# SCI

GLENDALE COMMUNITY COLLEGE

2019.07.23 | 100% SCHEMATIC DESIGN

# ACKNOWLEDGEMENTS


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**SCHEMATIC DESIGN APPROVAL NOTE**

APPROVAL OF THE SCHEMATIC DESIGN PHASE DELIVERABLES IS FOR THE ESTABLISHMENT OF THE GENERAL SCOPE, SPACE PROGRAM, CONCEPTUAL DESIGN, AS WELL AS SCALE AND RELATIONSHIPS AMONG THE COMPONENTS OF THE DESIGN, INCLUDING THE BUILDING SYSTEMS. THE PRIMARY OBJECTIVE IS TO ARRIVE AT A CLEARLY DEFINED, FEASIBLE CONCEPT AND PRESENT IT IN A FORM THAT ACHIEVES CLIENT UNDERSTANDING AND ACCEPTANCE. THE SECONDARY OBJECTIVE IS TO CLARIFY THE PROJECT PROGRAM, EXPLORE THE MOST PROMISING DESIGN SOLUTIONS, AND PROVIDE A REASONABLE BASIS FOR ANALYZING THE COST OF THE PROJECT.

WHILE THE INTENT OF SCHEMATIC DESIGN IS TO ESTABLISH THE DESIGN CONCEPT AND INTENT IT IS RECOGNIZED THAT FURTHER REFINEMENT AND COORDINATION OF THE BUILDING DESIGN WILL CONTINUE DURING THE DESIGN DEVELOPMENT PHASE. MINOR MODIFICATIONS TO THE DESIGN, INCLUDING, BUT NOT NECESSARILY LIMITED TO; PLAN REVISIONS, EXTERIOR AESTHETICS/MATERIALS, BUILDING SYSTEMS, SITE DESIGN, LANDSCAPE DESIGN, AND INTERIOR FINISHES ARE EXPECTED AND ARE CONSIDERED TO BE PART OF THE DESIGN DEVELOPMENT PROCESS.

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# SECTION ONE

## INTRODUCTION

/ EXECUTIVE SUMMARY

/ PROGRAMMING MATRIX

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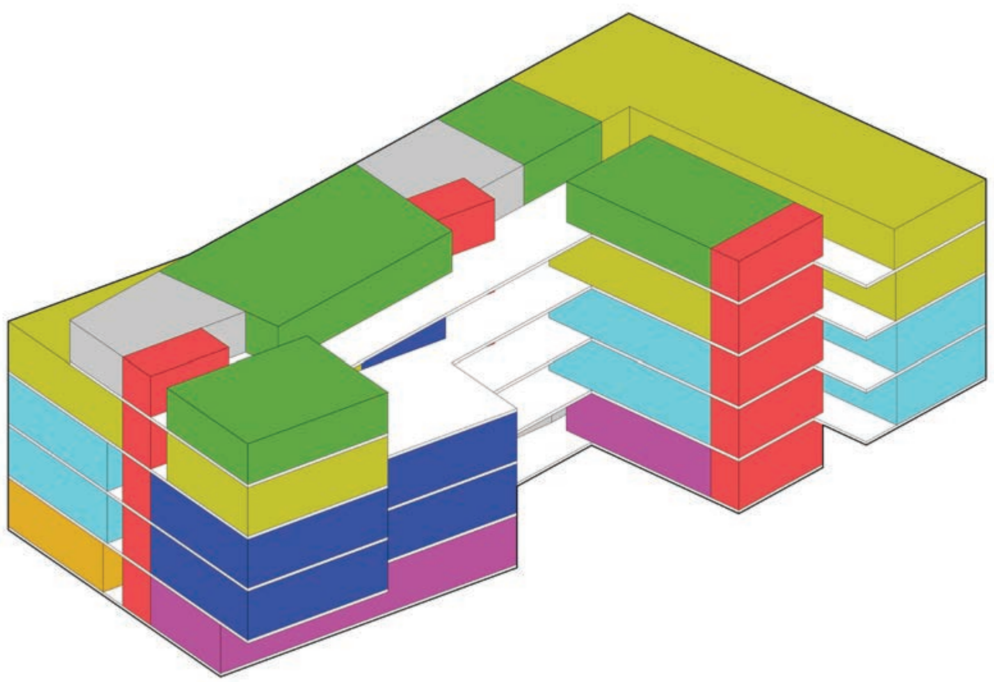
Glendale Community College is projected to face an increased enrolment of students and supporting faculty in the next decade. Amongst the most impacted programs will be the Sciences. In order to better accommodate and provide the best academic and social environment for the campus community, a new Science Center is needed.

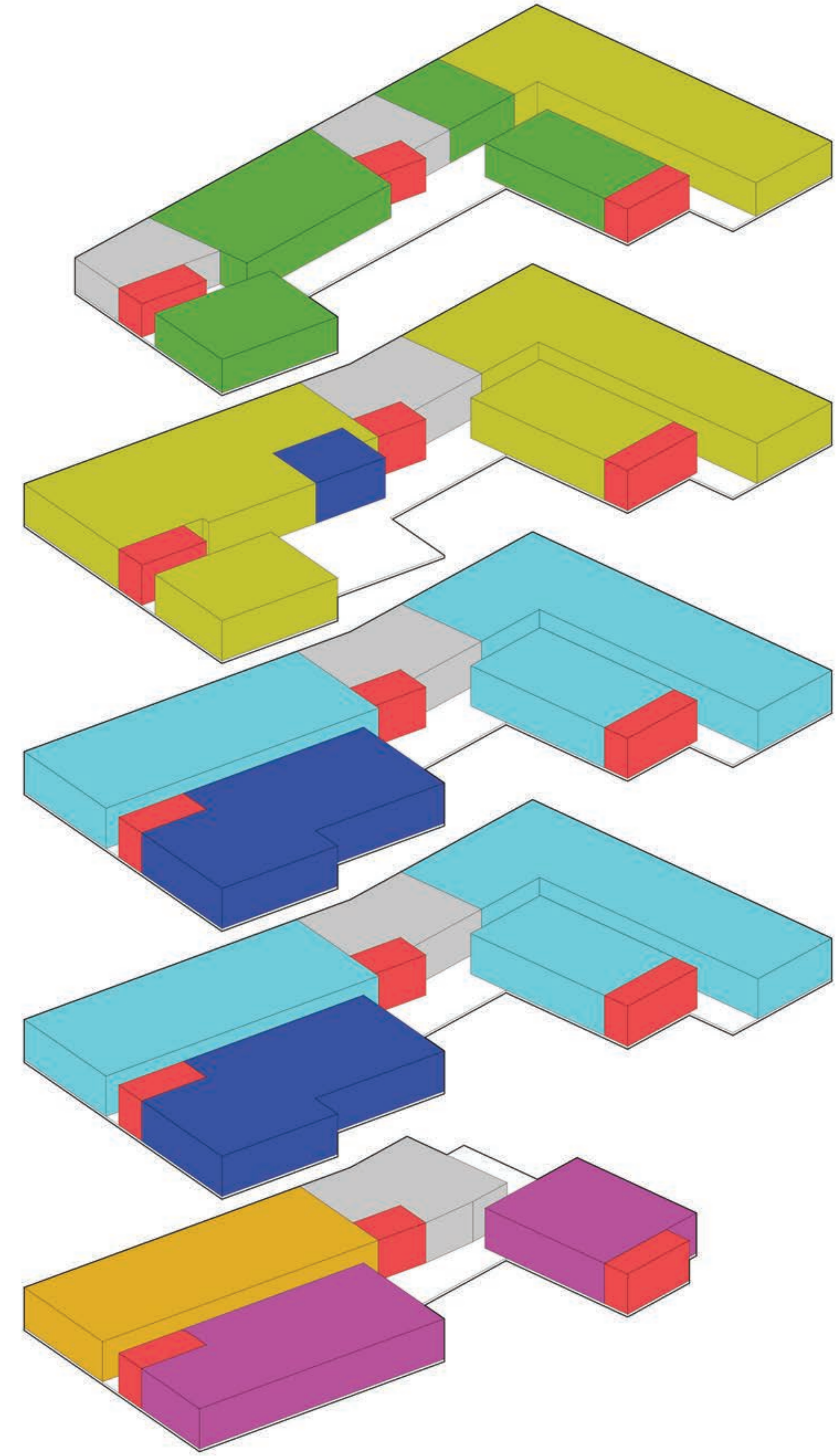
The new Science Center will be located at the North end of the campus on the corner of Verdugo Road and Campus Way. The project will be a 21st century cornerstone for the sciences and campus-community while serving as an anchor and campus edge for the community-at large.

The building is approximately 97,000 GSF that consists of:

- 31 Science Laboratories - including Earth Science, Biology, Chemistry, and Physics
- Dedicated laboratory support spaces
- 3,000SF Science Academy – a student centric resource for flexible studying, collaboration and tutoring
- 100 - Seat Stepped Lecture Hall
- 30 Faculty Offices and 2 Department Chair Offices
- Student Centric "collaboration" spaces in a variety of forms and sizes across all five levels.
- Open lounge spaces to foster student activity and curiosity, social interaction and Collaborative learning, both inside and outside the building.

The "U" shape design of the new science building embraces the terminus of an existing campus pedestrian axis, off the main quad. The building site has a 36ft topographic height difference across its length, which the building takes advantage of by creating "ground floor" entrances on two levels. The fluidity of exterior and interior is emphasized by creating a highly flexible and interactive atmosphere. Through thoughtful placement of multistory space volumes and integrated seating lounges in the common spaces to engage students and peak their curiosity. Challenging site and climate difficulties were perceived as opportunities to design architectural features that allow the new home for the sciences to become a truly enjoyable experience and resource for academic and social activities.





# EXECUTIVE **SUMMARY**

## PROGRAMMING CHALLENGES AND OPPORTUNITIES

The programming phase resulted in a space program matrix that provided the spatial requirements for the building and its organization. The program matrix is only the first of many superimposed layers of information that begin to shape a building layout and mass. Each required space is carefully studied and explored to find the best configuration that respects its critical adjacencies and begins to respond to the other superimposed layers like building systems, cost effectiveness, and overall building efficiency.

This project encounters a unique set of circumstances given the nature of the site and the architectural style of the campus. The traditional sloped tile roofs that sit atop every building on campus allow for a unique opportunity to screen what would otherwise be roof top equipment (and given a science building typology, that equipment is extensive). The sloped roof indirectly creates a penthouse, or mechanical attic, that can be taken advantage of instead of being left as dead space.

Similarly, the site on which the building will sit on covers a 36 foot grade difference across 250 feet. A grade difference that must be addressed by the building and its structural system. In collaboration with the Structural and Geotech engineers, the design team concluded that a permanent shoring system is the most effective way to retain soil around the building. As a result of this more efficient retaining system, there is a newly available 4,000SF of space on the ground floor that can be taken advantage of in lieu of leaving as dead space. Though the space does not have access to any direct daylight, it can serve as miscellaneous storage space.

Given the technical requirements of labs, science buildings typically have a lower efficiency percentage than other typologies. This can be attributed to a couple factors including, safety spatial requirements within labs, more restrictive mechanical systems (resulting in larger shafts), and more support space to run and maintain the specialty equipment. With a total assignable square footage (ASF) of **60,145 ASF**, and a gross square footage (GSF) of **93,600 GSF**, this science building is currently tracking at **64% efficiency**, on target for science buildings, and an accomplishment in particular considering the site challenges this project faces.

| Programmed Space | # of Rooms | Programed ASF | Provided ASF | Delta | Comments |
|---|---|---|---|---|---|
| | | | | | |
| **SCIENCE LABS** | | | | | |
| | | | | | |
| **BIOLOGY** | | | | | |
| General Biology | 6 | 7,662 | 7,551 | (111) | |
| Microbiology | 2 | 2,554 | 2,476 | (78) | |
| Anatomy | 4 | 5,108 | 5,130 | 22 | |
| Independent Research | 1 | 300 | 322 | 22 | |
| | | | | | |
| **CHEMISTRY** | | | | | |
| General Chemistry | 4 | 6,452 | 6,325 | (127) | |
| Active Learning | 2 | 1,200 | 1,274 | 74 | |
| Organic Chemistry | 3 | 4,503 | 4,535 | 32 | |
| Chemistry Research | 1 | 967 | 1,183 | 216 | |
| | | | | | |
| **EARTH** | | | | | |
| Oceanography | 1 | 1,277 | 1,311 | 34 | |
| Geology | 1 | 1,277 | 1,280 | 3 | |
| | | | | | |
| **PHYSICS** | | | | | |
| Physics Lab | 3 | 3,831 | 3,824 | (7) | |
| Computer Lab | 1 | 1,160 | 1,315 | 155 | |
| | | | | | |
| TOTAL ASF | | | 36,526 | | |


# PROGRAMMING MATRIX

SCIENCE BUILDING | GLENDALE COMMUNITY COLLEGE

| Programmed Space | # of Rooms | Programed ASF | Provided ASF | Delta | Comments |
|---|---|---|---|---|---|
| **SCIENCE LAB SUPPORT SPACE** | | | | | |
| **BIOLOGY** | | | | | |
| General Biology Support | **6** | **960** | **981** | 21 | |
| Microbiology Support | 2 | **320** | **304** | (16) | |
| Anatomy Support | 4 | **640** | **674** | 34 | |
| Vivarium | 1 | 549 | 613 | 64 | |
| Cadaver Room | 1 | 321 | 350 | 29 | |
| Specimen Storage | 1 | 641 | 218 | (423) | Divided into "Preserved" & "Dissection" storage rooms on 2nd and 3rd floors respectively |
| Prep & Storage | 1 | 920 | 922 | 2 | |
| Lab Tech Room | 1 | 107 | 168 | 61 | Additional office provided do to split levels |
| Autoclave | 1 | 185 | 546 | 361 | Includes remaining "Specimen Storage" sf |
| Chemical Storage | 1 | 96 | 128 | 32 | |
| **CHEMISTRY** | | | | | |
| Stock Room | 1 | 1,857 | 1,511 | (346) | Room SC-504 added to 5th floor to serve split chemistry program. Cart sized dumbwaiter provided to facilitate transportation to and fro main stock room. |
| Lab Tech Room | 1 | 107 | 81 | (26) | |
| Organic Chemical Storage | 1 | 267 | 391 | 124 | |
| Acid/Corrosive Storage | 1 | 334 | 603 | 269 | |
| Instrument Room | 1 | 321 | 324 | 3 | |
| **EARTH** | | | | | |
| Stock Room | 1 | 855 | 1,070 | 215 | |
| Lab Tech Room | 1 | 107 | 77 | (30) | |
| **PHYSICS** | | | | | |
| Stock Room | 1 | 1,130 | 1,143 | 13 | |
| Lab Tech Room | 1 | 153 | 157 | 4 | |
| **SHARED** | | | | | |
| Waste Storage | 1 | 214 | 220 | 6 | |
| Field Equipment Storage | 1 | 481 | 467 | (14) | |
| TOTAL ASF | | | 10,948 | | |
| **FACULTY & ADMIN** | | | | | |
| Large Meeting Room | 1 | 650 | 611 | (39) | |
| Medium Meeting Room | 2 | **800** | **694** | (106) | |
| Division Chair Office | 2 | **200** | **204** | 4 | |
| Faculty Office | 30 | **2,700** | **2,810** | 110 | |
| Group Adjunct Office | 2 | 400 | 280 | (120) | Reduced by half from originally programmed 800sf per Dr. Michael Ritterbrown. Can accommodate 8-10 workspaces split between 2 floors |
| Division Admin Support | 2 | **400** | **402** | 2 | |
| Group Study/Flex Room | 3 | 150 | 600 | 450 | Distributed through out building on all levels |
| TOTAL ASF | | | 5,601 | | |

| Programmed Space | # of Rooms | Programed ASF | Provided ASF | Delta | Comments |
|---|---|---|---|---|---|
| **MISC SPACES** | | | | | |
| Science Academy | 1 | 3,000 | 3,225 | 225 | |
| Large Lecture Hall (100 Seat) | 1 | 2,600 | 2,003 | (597) | |
| Baja Office | 1 | 350 | 342 | (8) | |
| Student Gathering | 1 | 800 | 1,500 | 700 | Distributed through out building on all levels |
| Outdoor Collaboration Space | 1 | - | 1,537 | | Not included in ASF |
| TOTAL ASF | | | 7,070 | | |
| | | TOTAL BUILDING ASF | 60,145 | | |
| **BUILDING SUPPORT** | | | | | |
| Restrooms: Men | 5 | - | 924 | | |
| Restrooms: Women | 5 | - | 951 | | |
| Restrooms: Unisex | 4 | - | 206 | | |
| Lactation Room | 1 | - | 44 | | |
| Custodial Room | 5 | - | 331 | | |
| Emergency Electrical | 1 | - | 115 | | |
| Main Electrical | 1 | - | 337 | | |
| Electrical Room | 4 | - | 488 | | |
| MDF | 1 | - | 185 | | |
| IDF | 4 | - | 285 | | |
| Mechanical Room | 2 | - | 1,425 | | |
| Outdoor Mechanical | 1 | - | 1,180 | | |
| TOTAL | | | 18,971 | | |
| Penthouse (Attic) | 1 | - | **12,500** | | Penthouse designation as a result of sloped tile roof |
| Potential Storage Space | 1 | | **4,150** | | Available space made available through permanent shoring approach |

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# SECTION TWO

## ARCHITECTURAL DESIGN

/ EXISTING SITE CONDITIONS

/ CONCEPT

/ OPPORTUNITIES & CONSTRAINTS

/ MASSING & PARTI

/ FLOOR PLANS

/ SUSTAINABILITY

/ ELEVATIONS & SECTIONS

/ EXTERIOR MATERIALS

/ RENDERINGS

S//02

The new science building is the physical embodiment of highly technical and scientific programmatic requirements; further enhanced by the mission of Glendale Community College, which is to educate a highly diverse student body by providing diverse learning environments.

This new landmark is located at the North edge of the campus, at the intersection of Verdugo Road and Campus Way.  The location will allow the building to maintains a traditional homogeneity, seamlessly integrating with the existing campus architecture along Verdugo. The building will help create a sense of place and identity to an edge of the campus that had been forgotten. The site is a terminus for a main pedestrian axis off the main quad.

The existing site currently houses the Arroyo Seco and Santa Anita Bldgs, aswell as Lots F and G. While Santa Anita will be demolished in Phase I to allow for construction, Arroyo Seco will be demolished in Phase II, once the new science building is open.


# GCC **CAMPUS**

SCIENCE BUILDING | GLENDALE COMMUNITY COLLEGE

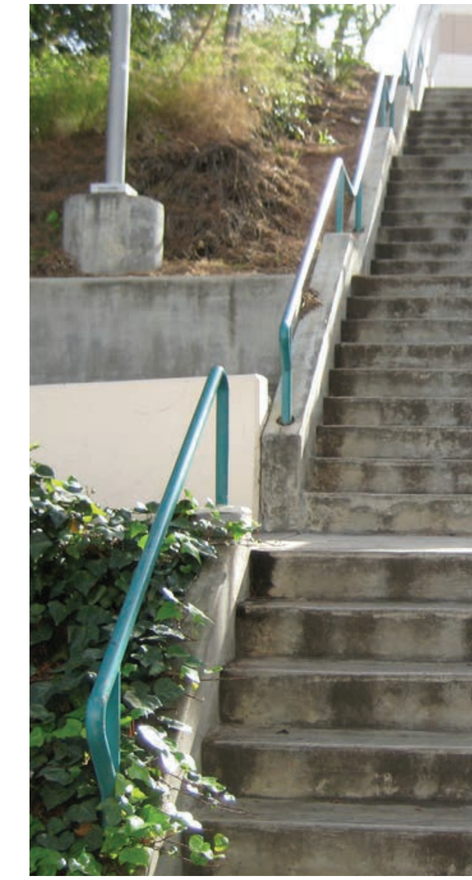


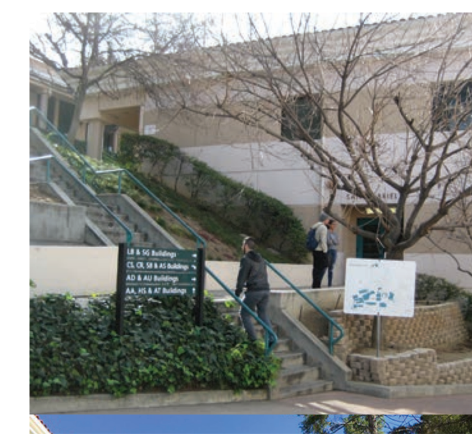
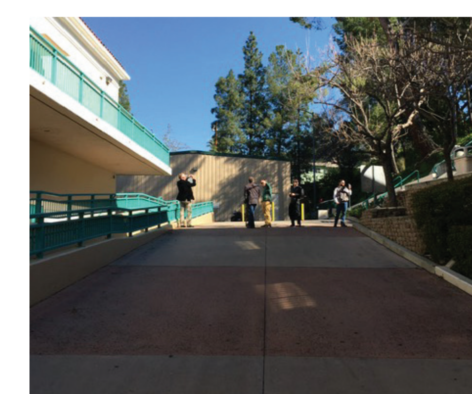


# EXISTING SITE







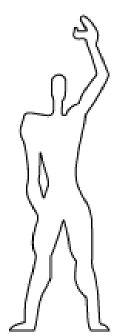



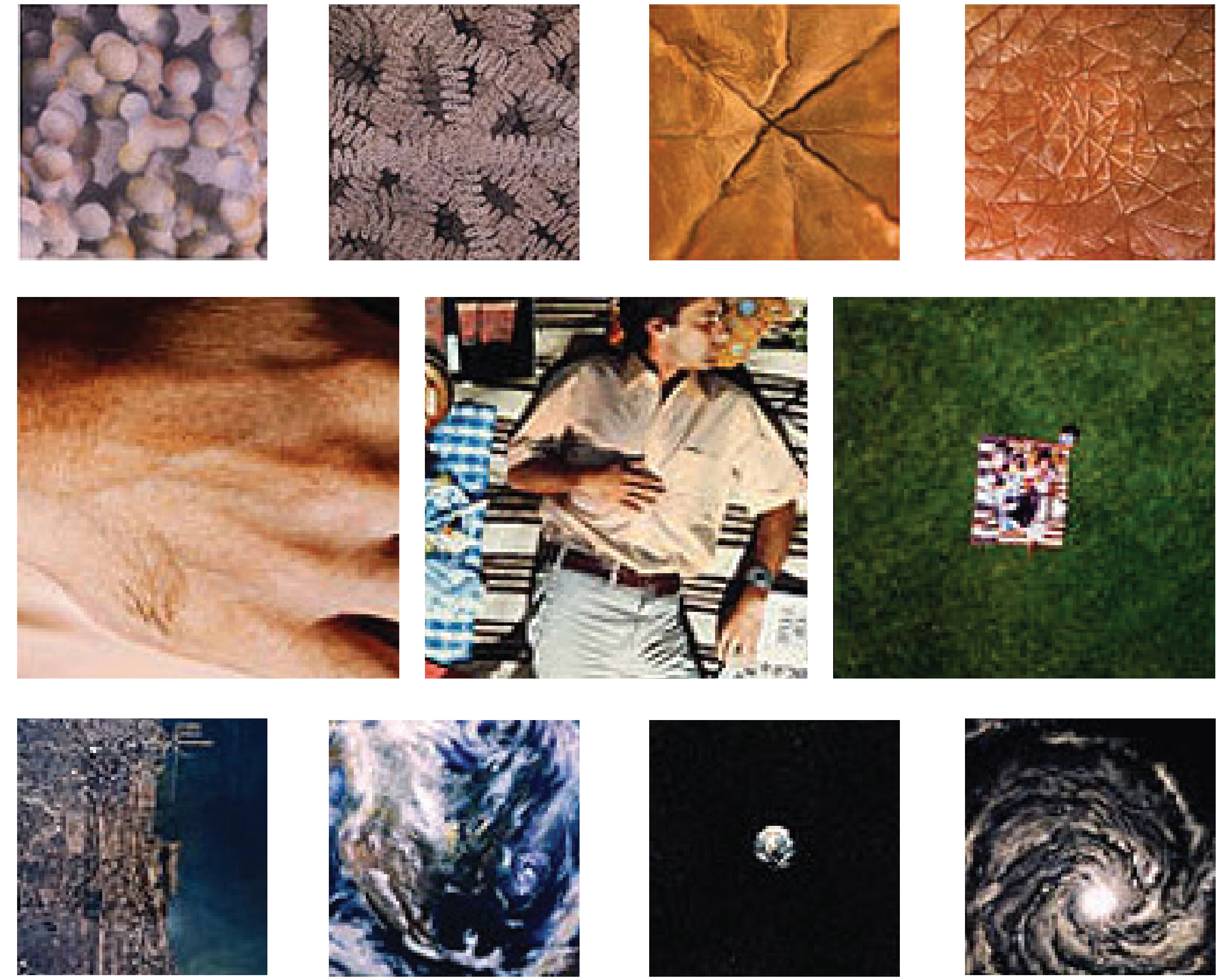
"the effects of adding another **zero**"

In 1977, Charles and Ray Eames released a short film titles Powers of Ten. The film employed the system of exponential powers to visualize the importance of scale, size, proportions, and perspective.

Powers of Ten illustrates the universe as an arena of both continuity and change, of everyday picnics and cosmic mysteries. The film begins with a close-up shot of a man, sleeping on a picnic blanket near a lakeside in Chicago. The camera steadily begins to zoom out, benchmarking every 10x, until it reaches the edge of the known universe. Then, the camera begins to zoom in, back towards the sleeping man in Chicago, continuing into his hand, at a rate of 10-x, eventually reaching the level of a carbon atom.

**CELEBRATING THE ZERO POINT**





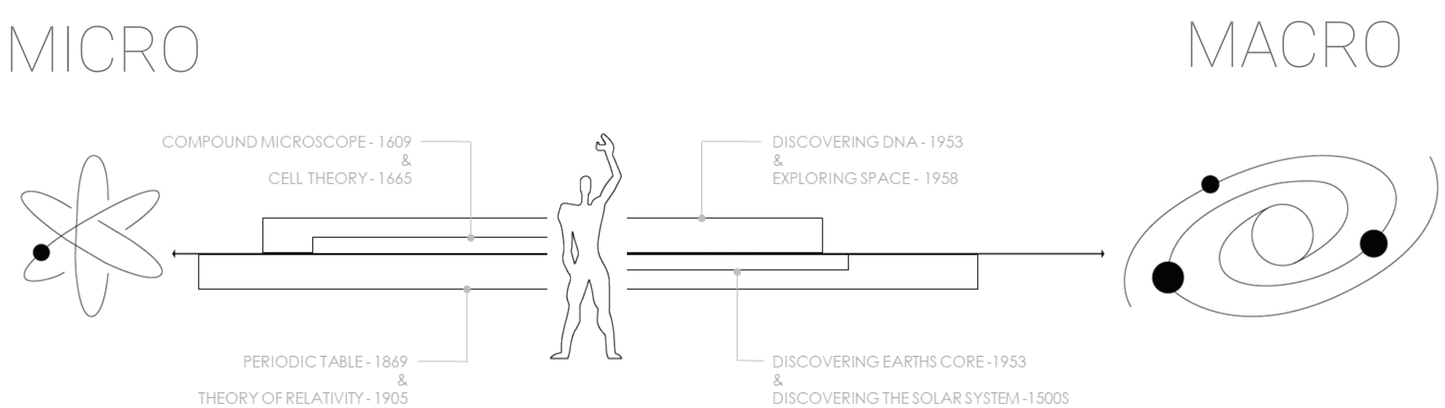
# POWERS OF **TEN**

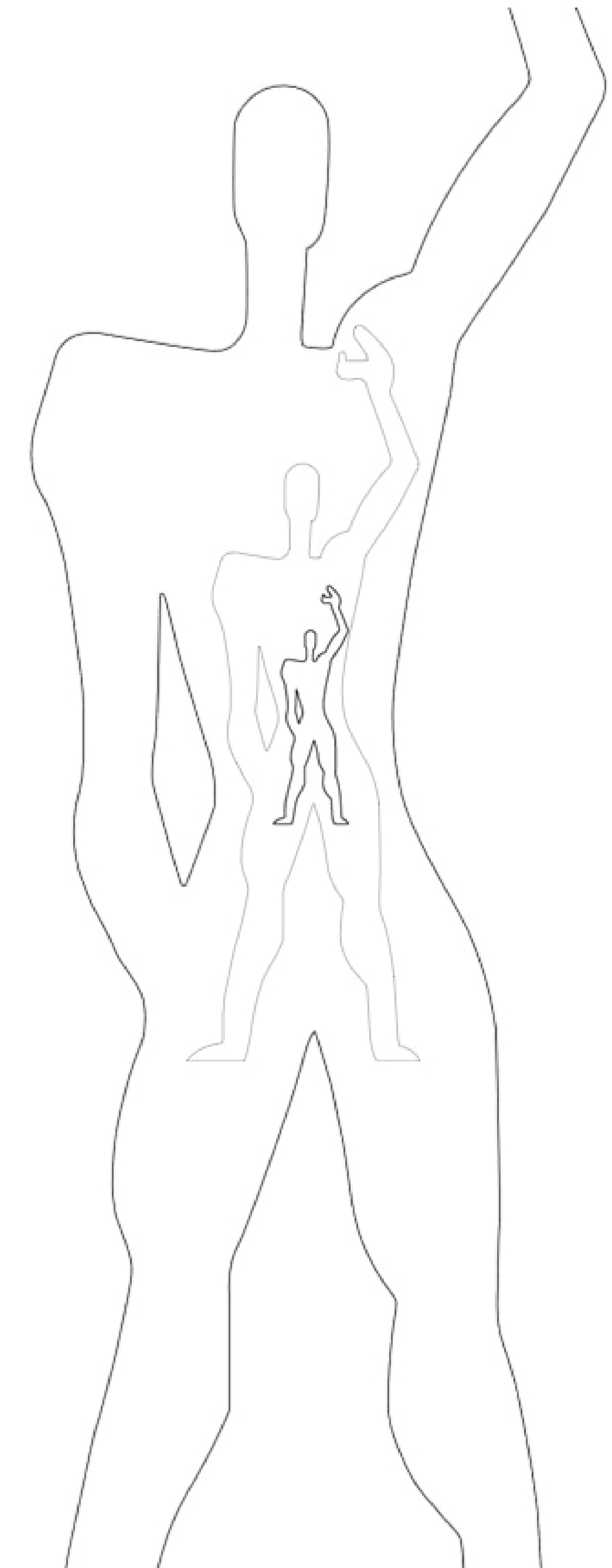
**Curiosity**

Through the Powers of Ten, we glean the importance of the zero point - humans - as innate curious beings, and the effects we can have on our surroundings, both on a **micro** or **macro** scale. It is our curiosity that drives major advancements and discoveries. It is our curiosity that makes us ask questions and seek solutions. It is our curiosity that makes us want to experience and explore. All things along a continuum that can be tracked but not defined.

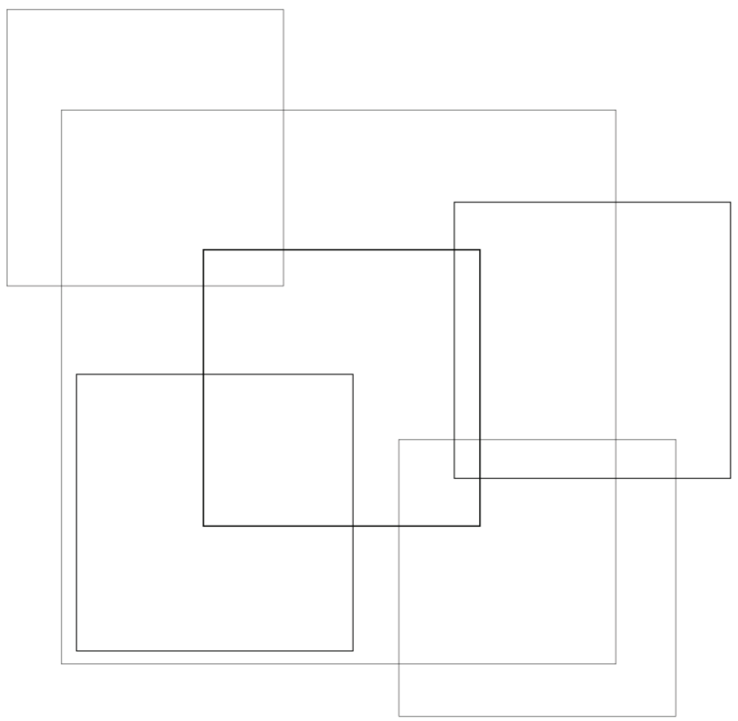
As a direct parallel, Powers of Ten explores themes of science to get its message across. Themes that derive their foundation from a knowledge based curriculum like that of a science program at a community college. However, one notable aspect of the film is its seamless integration and overlap of the "sciences". The sciences are treated similarly along a continuous spectrum. There is no start and stop, just flow. The sciences don't operate independent of each other, there is a natural overlap that exists. Similarly, there aren't defined borders we must adhere to when exploring our curiosity. We don't work in isolation of each other, and we don't learn in isolation of each other. Because at the end of the day, whatever major discovery or milestone we reach, its for a collective betterment. It makes us better humans, which in turn, sparks more curiosity.

The manifestation of this concept in relation to a community college science program is diagrammed to the right. There is a static, **knowledge** based curriculum taught in classrooms, there is student **curiosity** that inherently overlaps across subjects, and there are individual **non-linear paths** each student takes to satisfy their own curiosity to grow and learn. The celebration of curiosity, becomes the driving force, in designing for the human experience.



# WE ARE **HERE**



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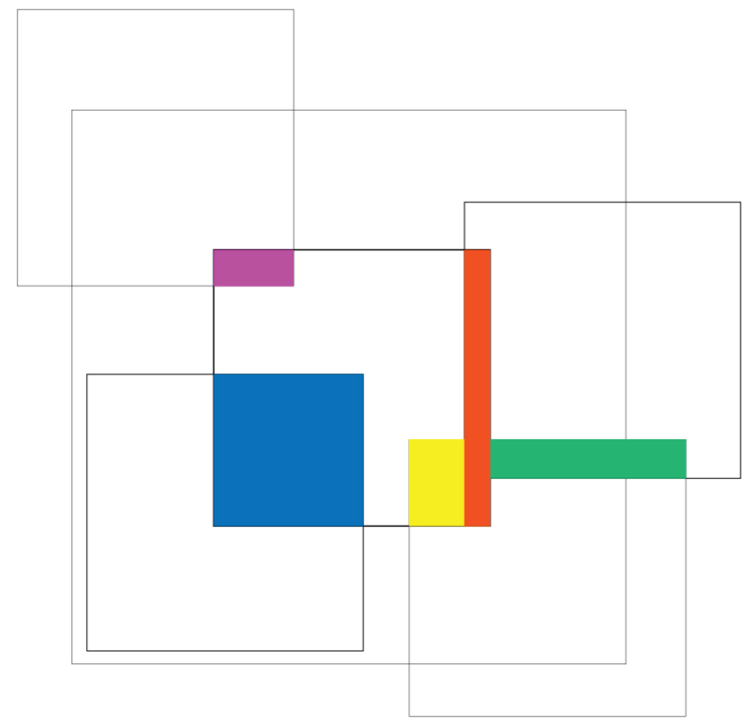
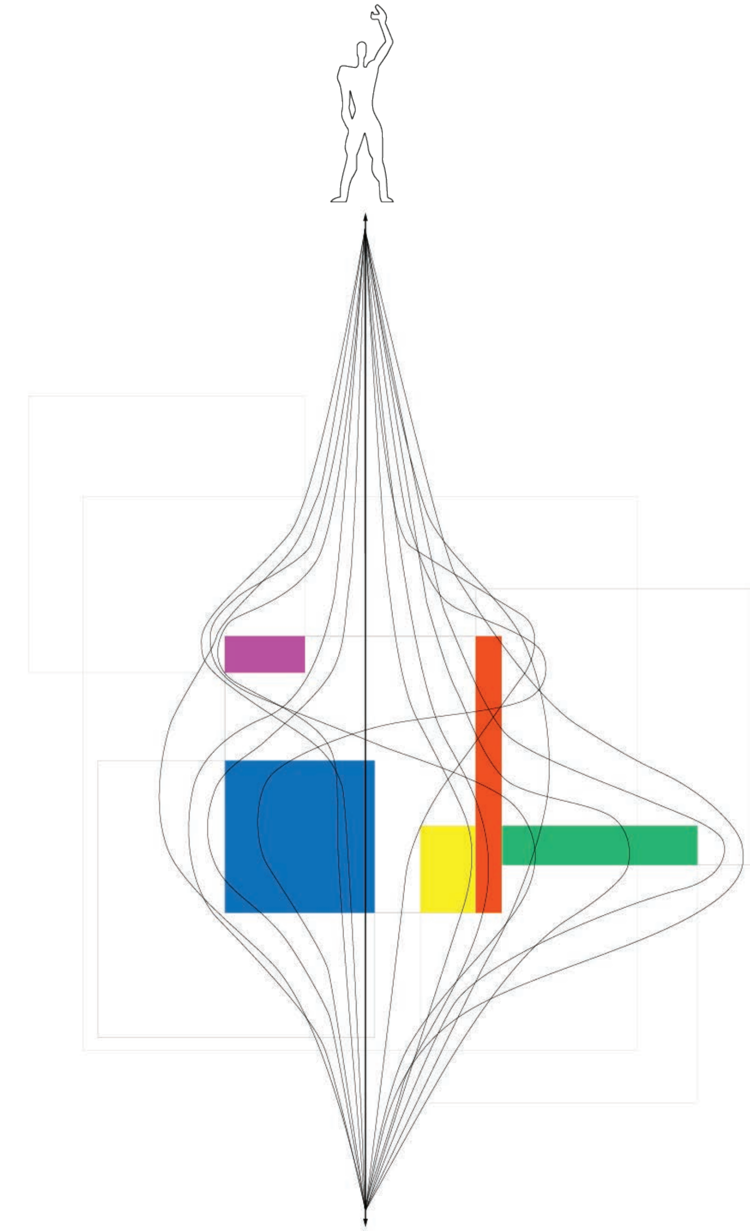


CURIOSITY



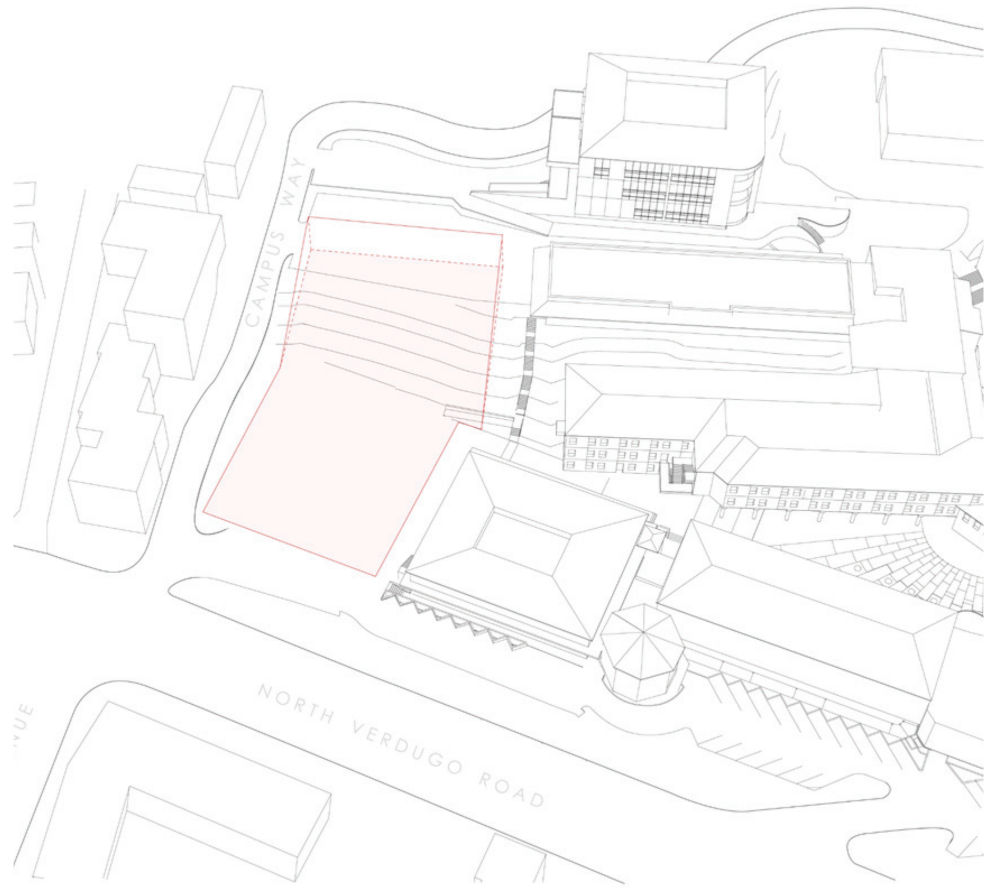
NON-LINEAR PATHS

# THE **ZERO** POINT

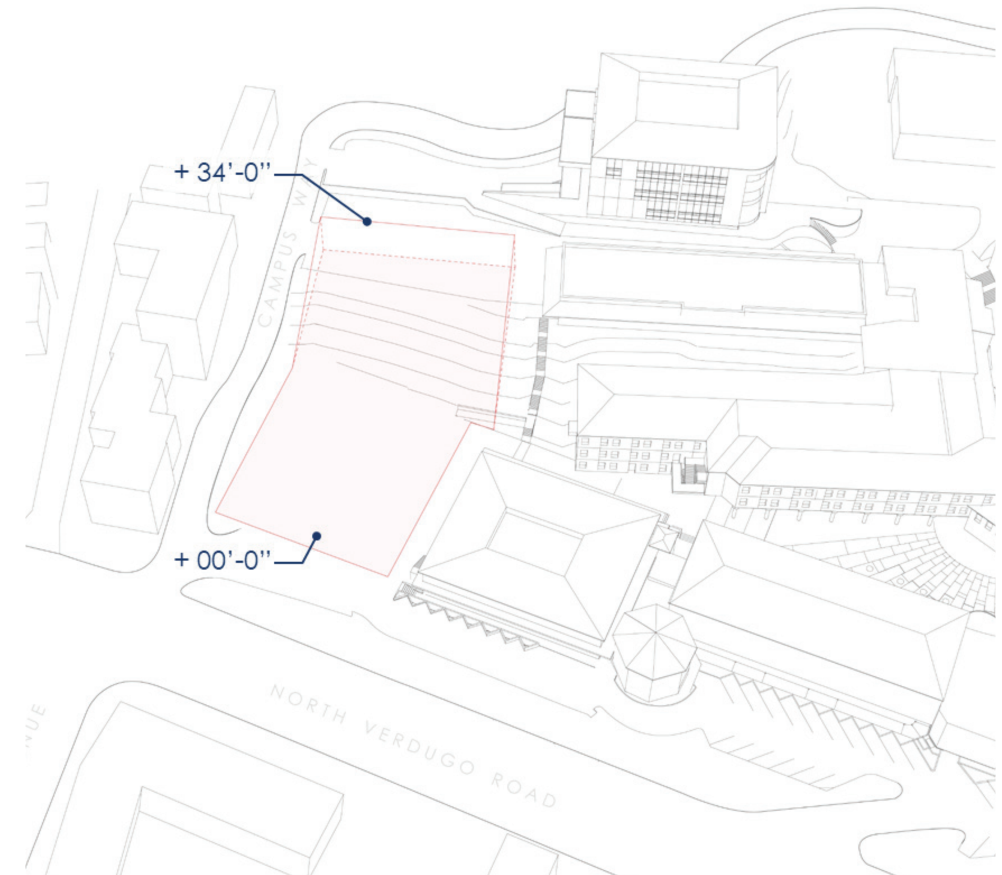
The existing site currently houses the Arroyo Seco and Santa Anita Bldgs, as well as Lots F and G. While Santa Anita will be demolished in Phase I to allow for construction, Arroyo Seco will be demolished in Phase II, once the new science building is open.
There are a couple influencing factors that the design team took into consideration in its initial site study:

- Project Phasing
- New Building Program Size
- Existing Fire Lanes & Required Setbacks
- Parking and Drop-Off
- 36ft grade difference across length of site
- Traditional urban planning objectives
- Pedestrian Axis Terminus
- Site Edge/Anchor

All factors considered, the resulting area allowed for a 22kSF building footprint, where 100kSF of building was needed. The only direction the building could expand was up.
At five occupied stories, this building will be the tallest on campus. Yet, due to the campus terrain, the buildings on the south edge of the campus (Sierra Vista/ Parking Structure) sit at a higher elevation and will look over the traditional tiled roof of this science building.

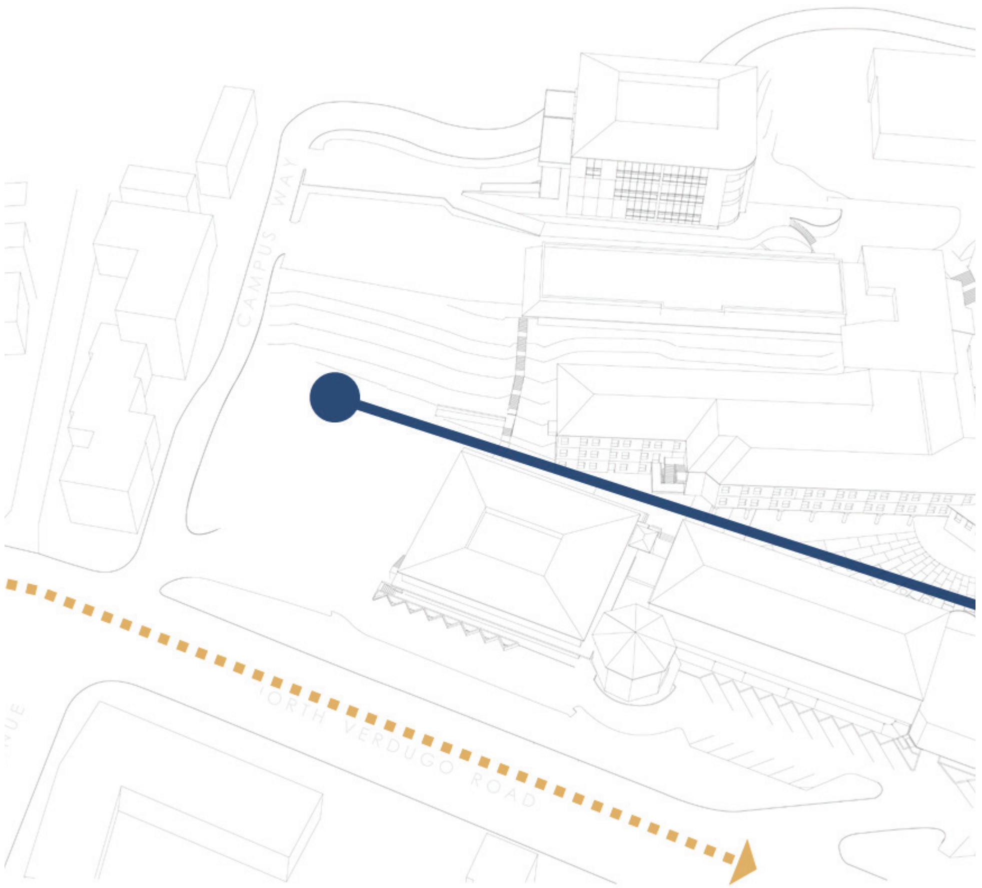



BASE SITE

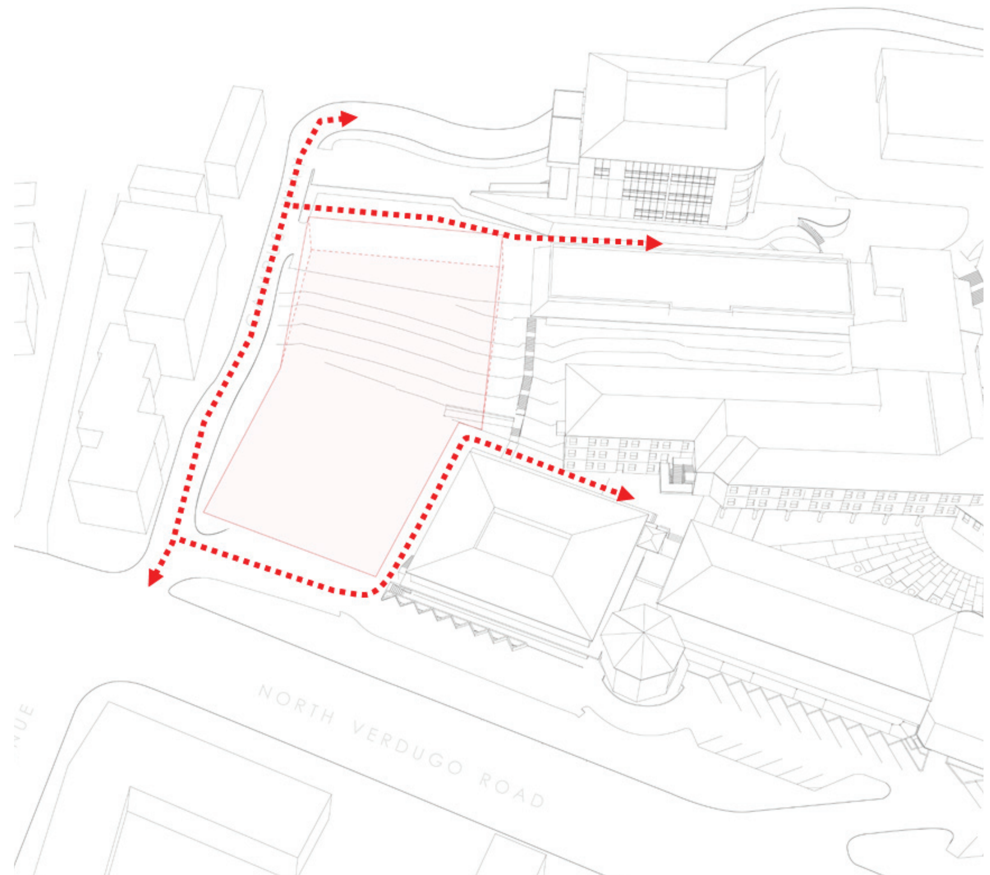



TOPOGRAPHIC CHALLENGES

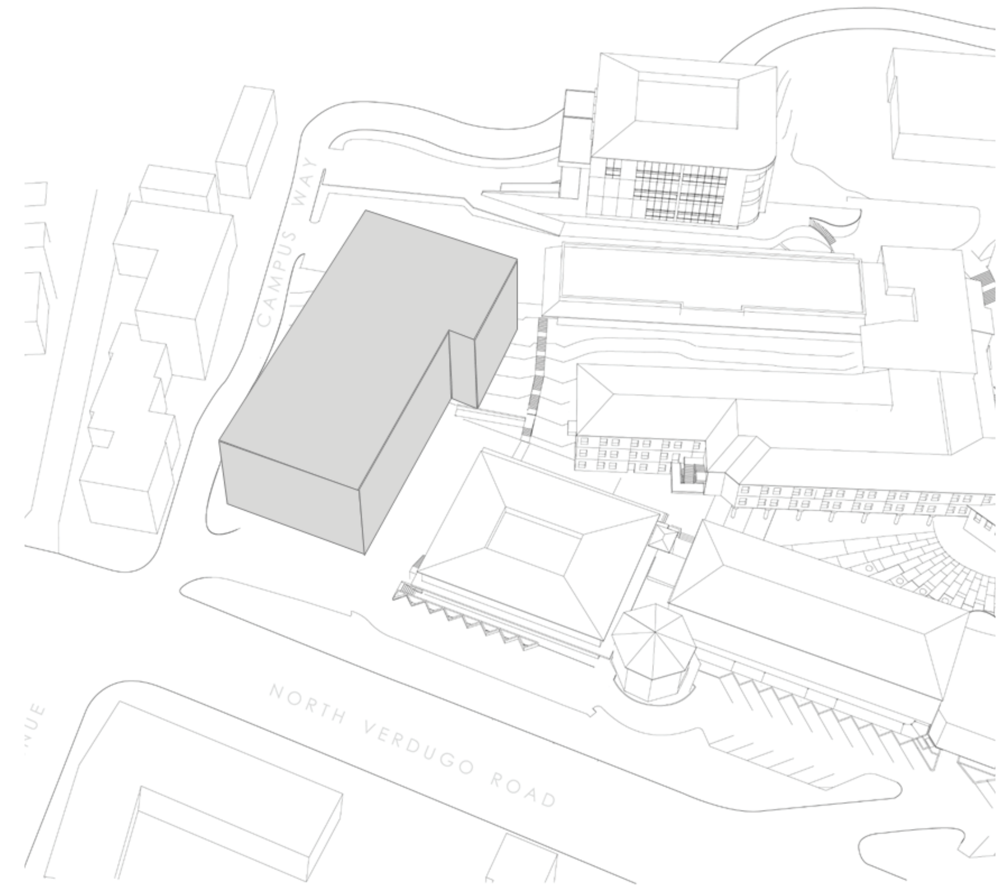
# OPPORTUNITIES & CONSTRAINTS



AXIS & EDGE OPPORTUNITIES




SETBACKS & FIRE ACCESS



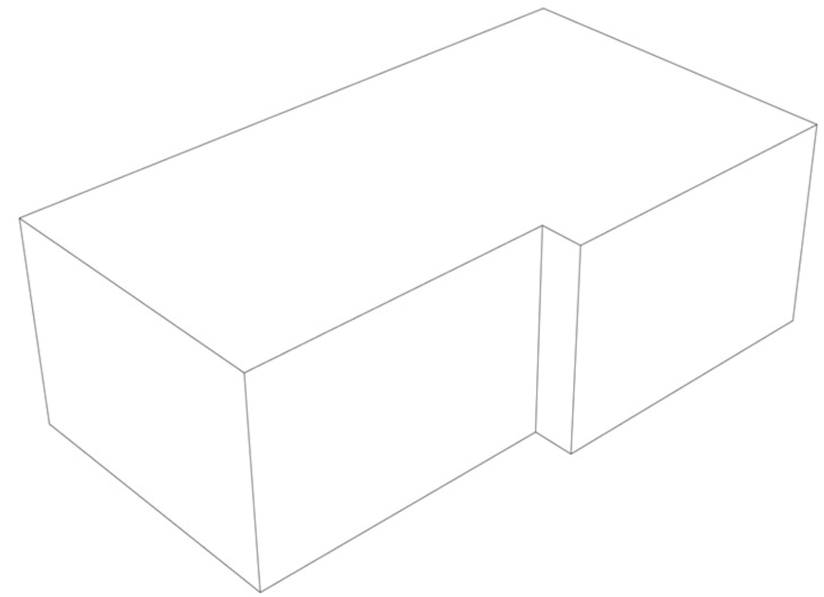

ALLOWABLE BUILDING ENVELOPE

**Step One**

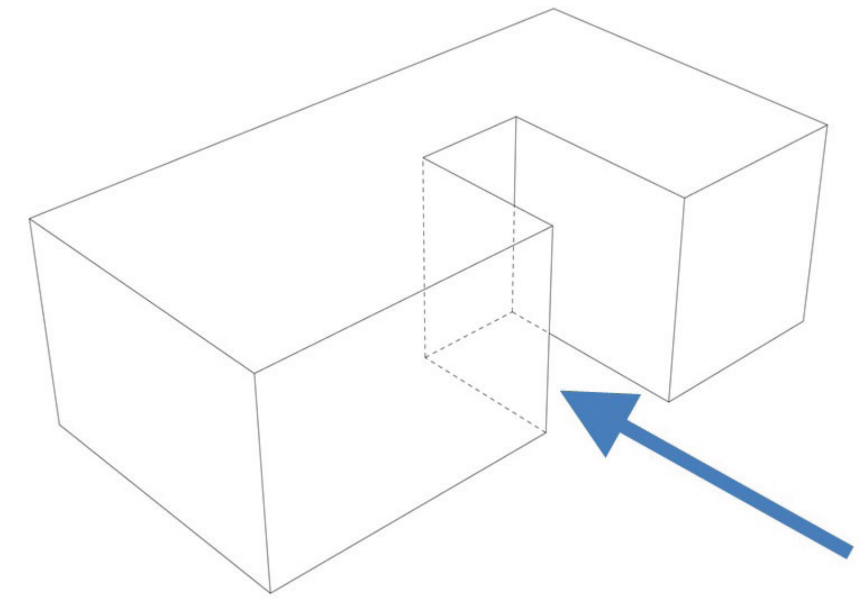
The resulting volume from the site analysis becomes our starting point as we begin manipulating a mass. The objective is to find the best massing solution that appropriately responds to known site and programmatic constraints.

Through the site analysis, we establish that the building will sit on the edge of the campus and at the end of a prominent pedestrian axis. This allows us to understand where the "front," or most public and visible, part of the building will and how that may start to visually distinguish itself from the rest of the building.

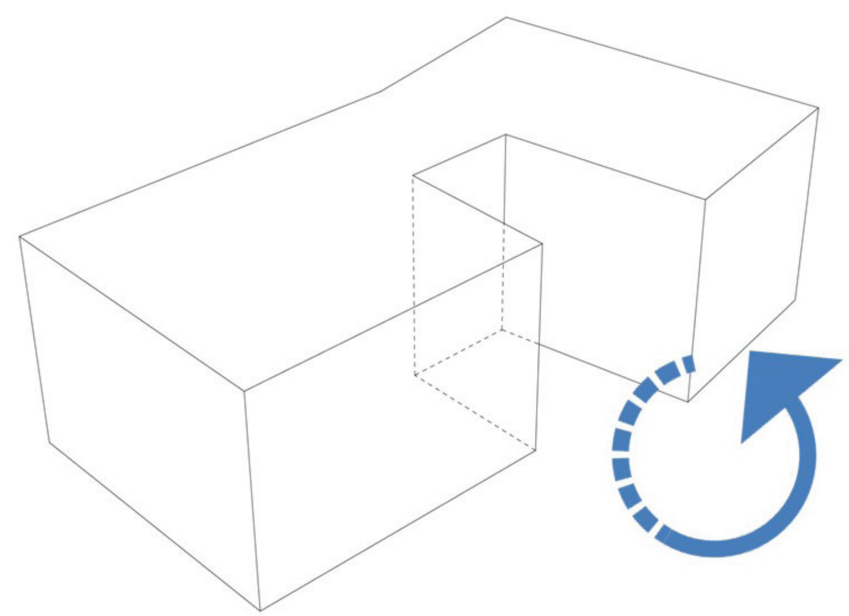
By cutting into the mass at the end of the pedestrian axis, the building itself, becomes the terminus for this end of the campus. Slightly rotating the shorter leg of the mass to follow site lines also begins to open up the "front door" of the building, allowing for more visibility and a more welcoming feel. Lastly, the mass needs to respond to the grade change to establish how much of the building will ultimately be buried underground, and how much (if any) is unusable space for.



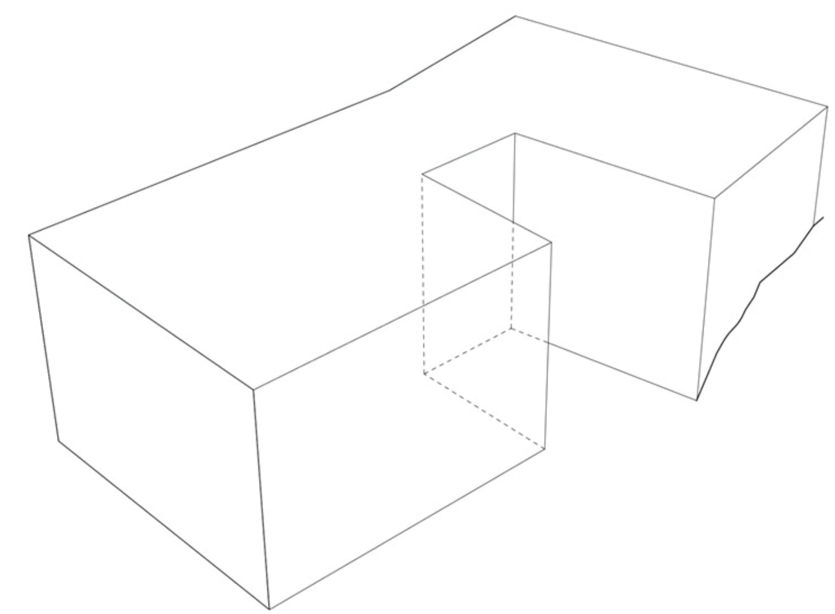
1. STARTING POINT MAXIMUM ENVELOPE



2. TERMINUS FOR PEDESTRIAN AXIS



3. RESPONDING TO SITE CONDITIONS



4. RESPONDING TO SITE TOPOGRAPHY

# MASSING

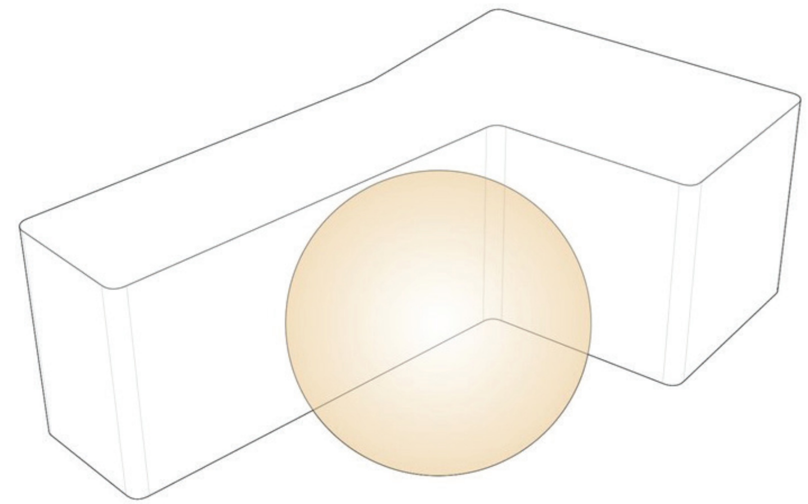
**Step Two**

The introduction of the parti to the mass begins to blend mass and concept together. It adds another level of articulation to the mass, derived from the main concept, curiosity; as the mass begins its transformation into a building, into architecture.

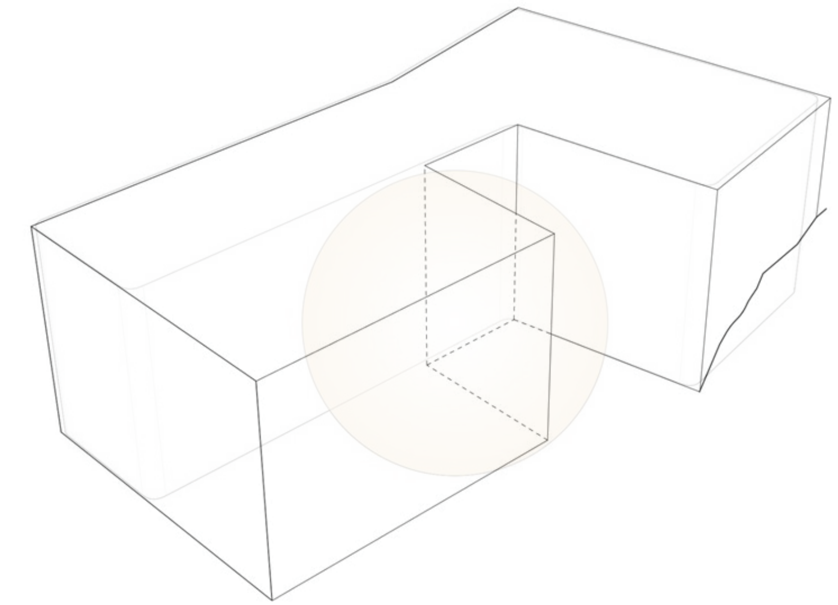
As applied to a mass, the concept manifests into a **sphere of curiosity.** Like the diagrams previously established for **knowledge, curiosity, and non-linear paths,** this building has labs and classrooms for knowledge based learning. Efficiency can begin to line the perimeter of the mass, while the more curious and individual aspects of learning, are centralized for everyone to experience.

Like the interdisciplinary nature of science, the building too must allow for engagement and collaboration across floors and departments. Introducing curiosity driven spaces, which manifest themselves in different ways, shapes and sizes, encourages collaboration and exploration. It allows for transparency and opportunity. It encourages the non-linear paths students are already on.

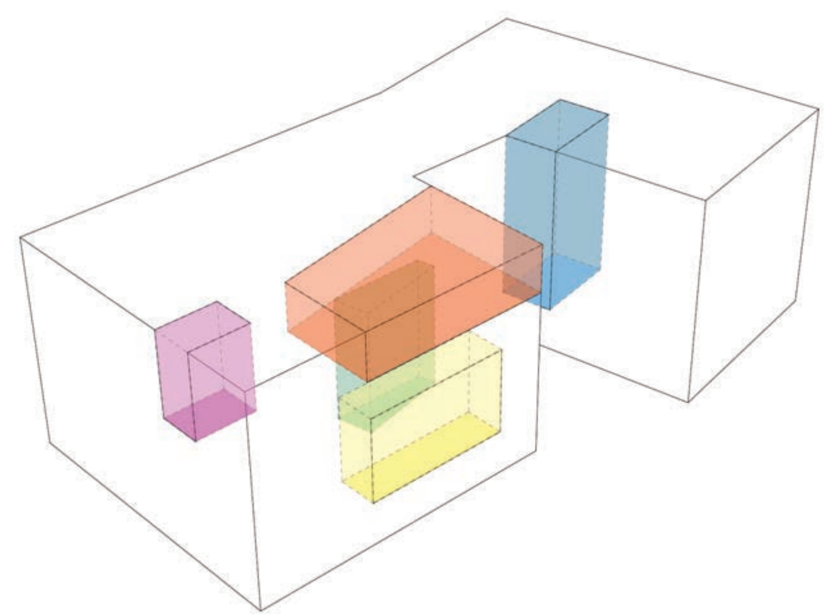
The resulting building mass begins to define two-dimensional parameters we can work with to start floor planning and designing.



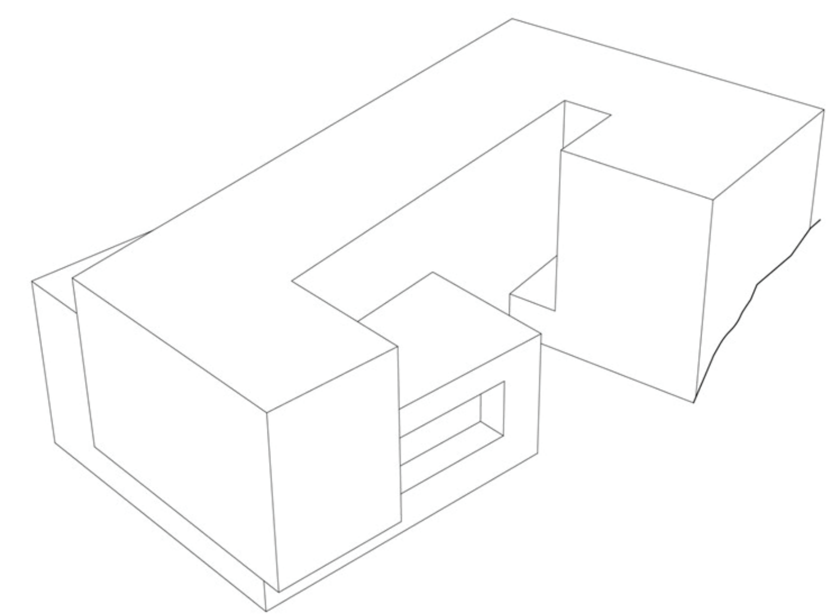
1. CONCEPT: SPHERE OF CURIOSITY



2. CONCEPT OVERLAID WITH BLDG MASS



3. ARTICULATED SPACES TO ENCOURAGE CURIOSITY



4. NEW STARTING POINT ARTICULATED BUILDING MASS

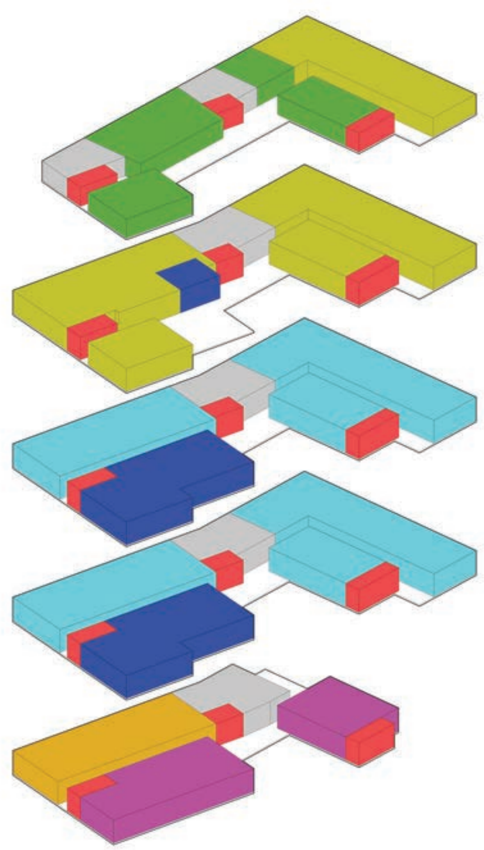
# PARTI

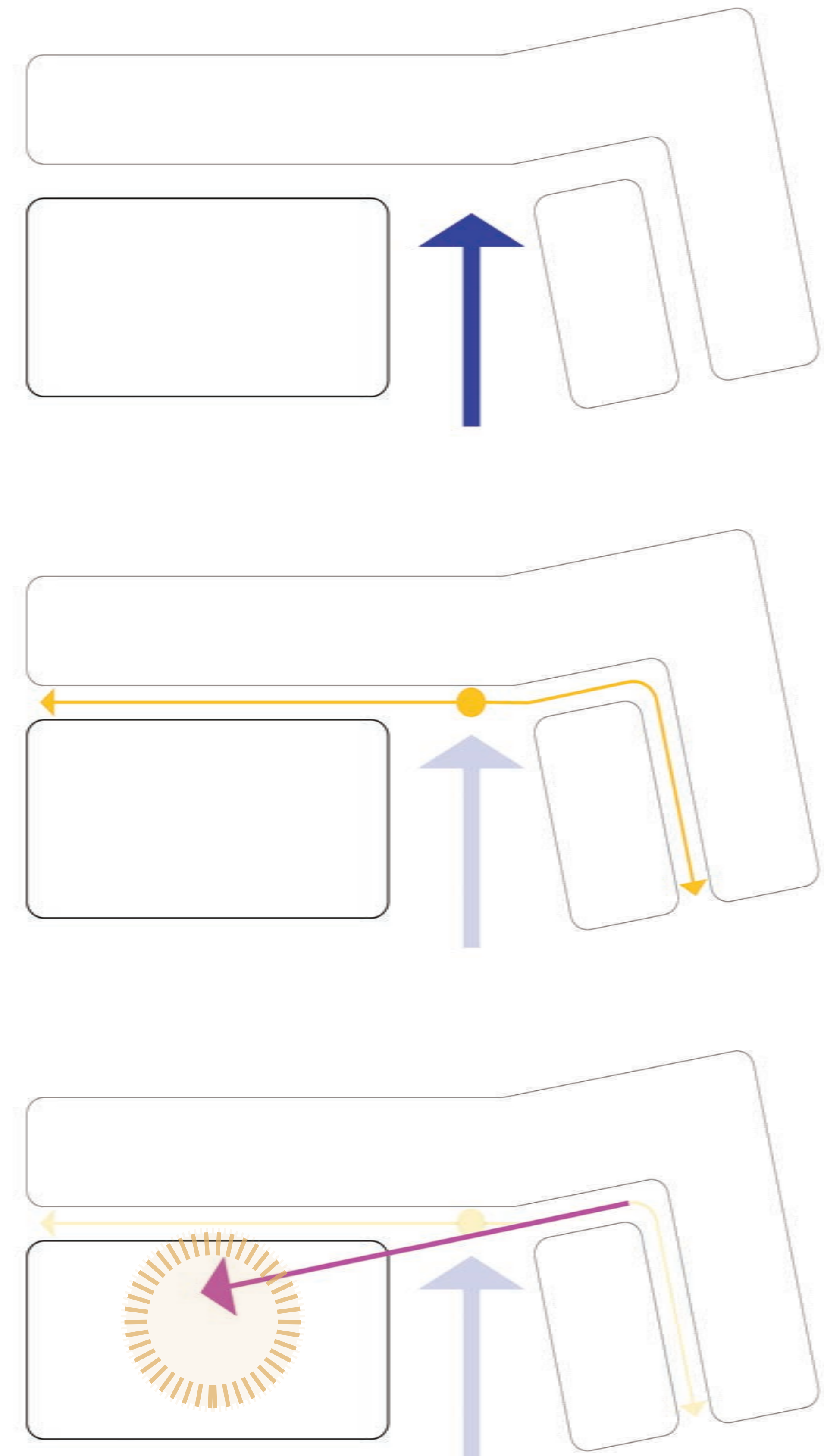
**Step Three**

Having rough parameters to work off of, we can begin the floor planning process which in balance with the overall massing, will start giving way to the design of the building.

The building is laid out as a highly efficient double-loaded corridor. In the diagrams to the right, the double loaded corridor is self evident and is only intersected by the exterior welcoming courtyard, resulting in a u-shape floor plate. This pinch point becomes the core of the building. Being central in its location to both ends of the building, it houses support spaces like elevators, restrooms, and building electrical and mechanical rooms. It is also off of the core, that the sphere of curiosity is superimposed. The design of the floor plan in this particular area takes advantage of more flexible spaces, more student centric spaces such as the science academy on the first floor and faculty offices on the second and third. On any given floor, the layout of the floor plan encourages students to collaborate, explore, and learn. Through the use of open collaboration space (indoor and outdoor), glazing for transparency, and double high spaces - students are afforded opportunities to learn beyond the classroom and outside their own discipline.

Given programmatic requirements, such as adjacencies and lab modules, the vertical stacking of the building becomes critical. Its allows for efficiencies in building system and way-finding, which translates in saved money down the road.
The diagram below illustrates how the building stacks neatly, yielding a more efficient building.





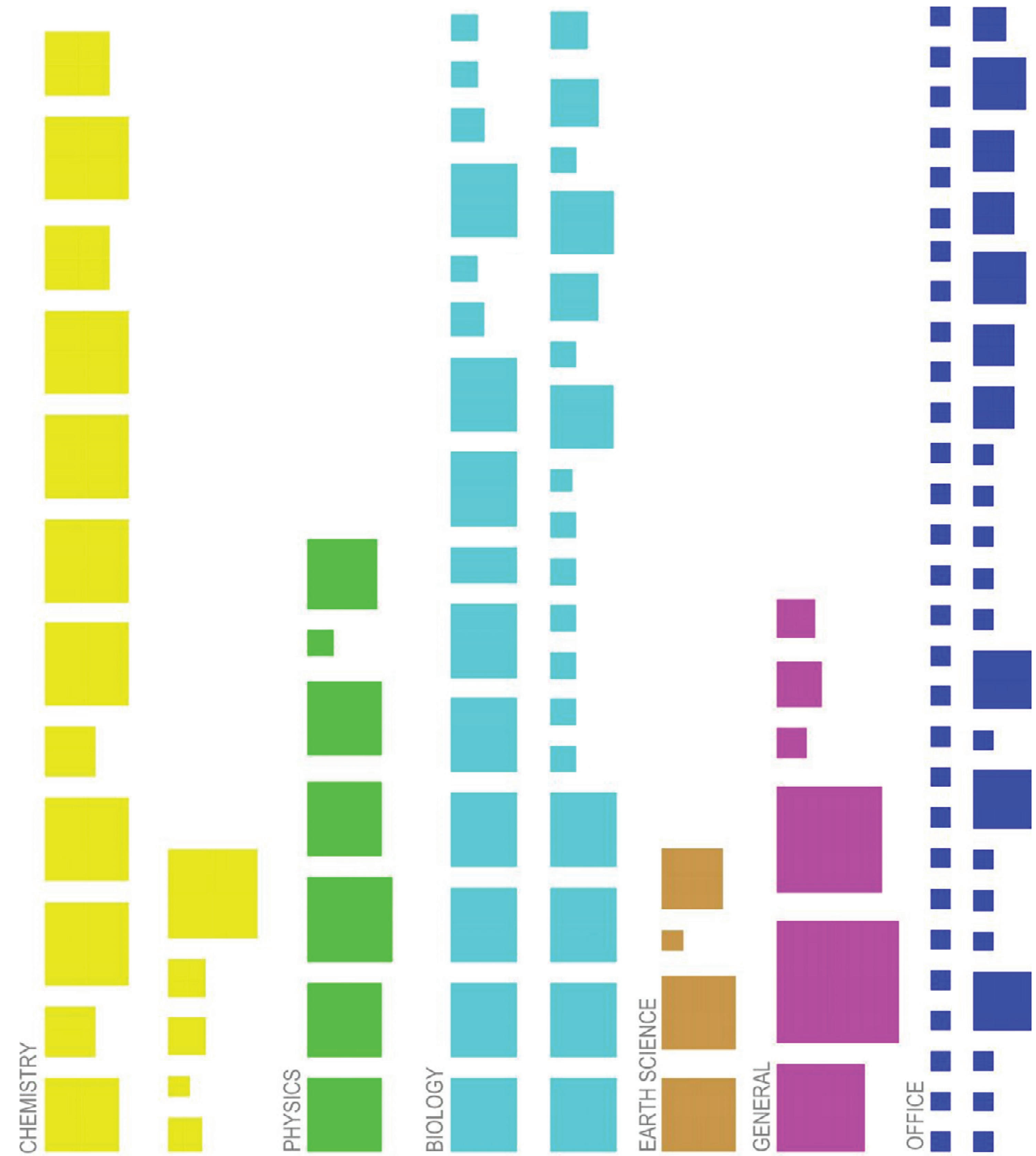
# FLOOR **PLANNING**

SCIENCE BUILDING | GLENDALE COMMUNITY COLLEGE


# SITE PLAN

# 60k ASF

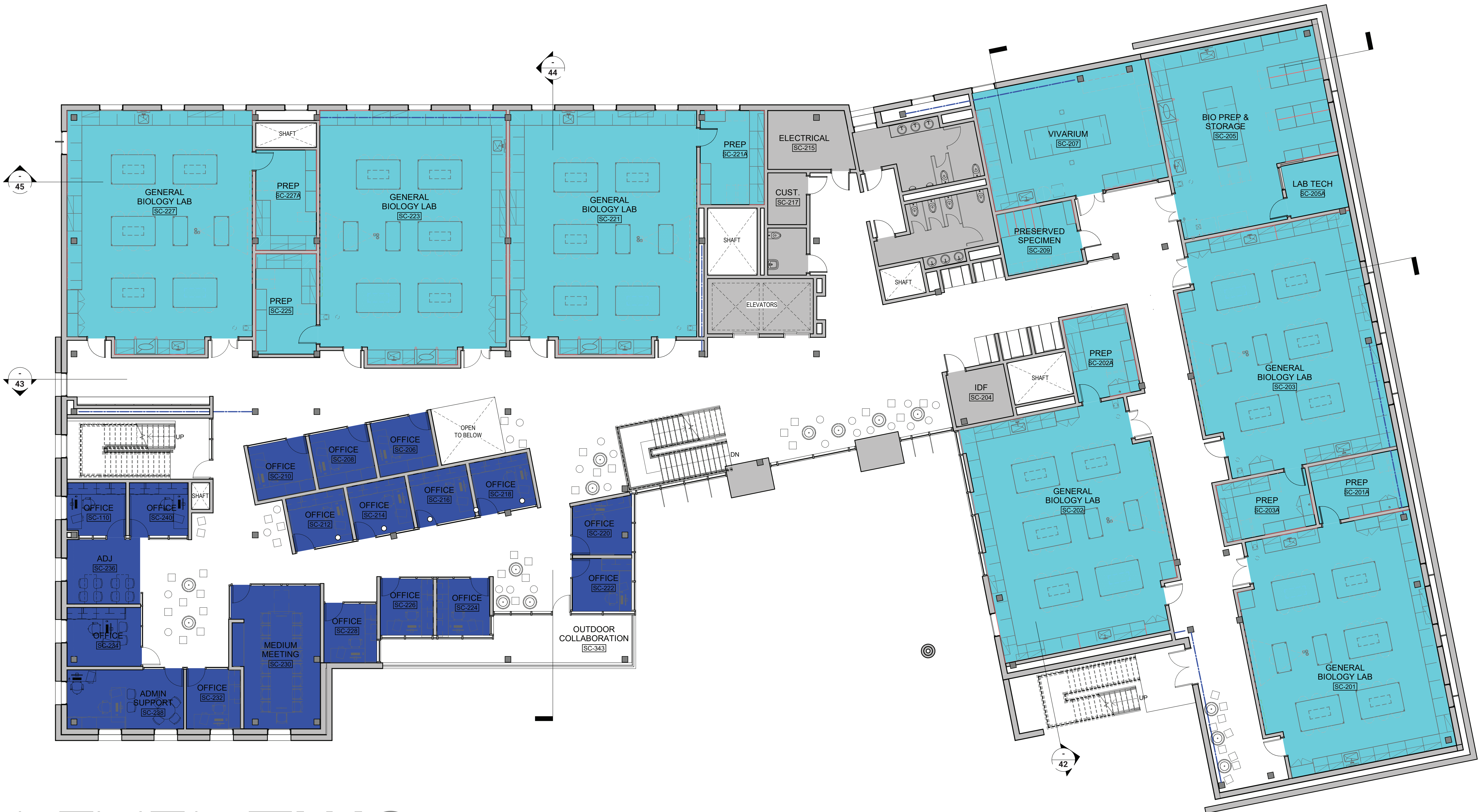
31 SCIENCE LABS
SCIENCE ACADEMY
100 SEAT LECTURE
32 FACULTY OFFICES




# PROGRAM BLOCKS

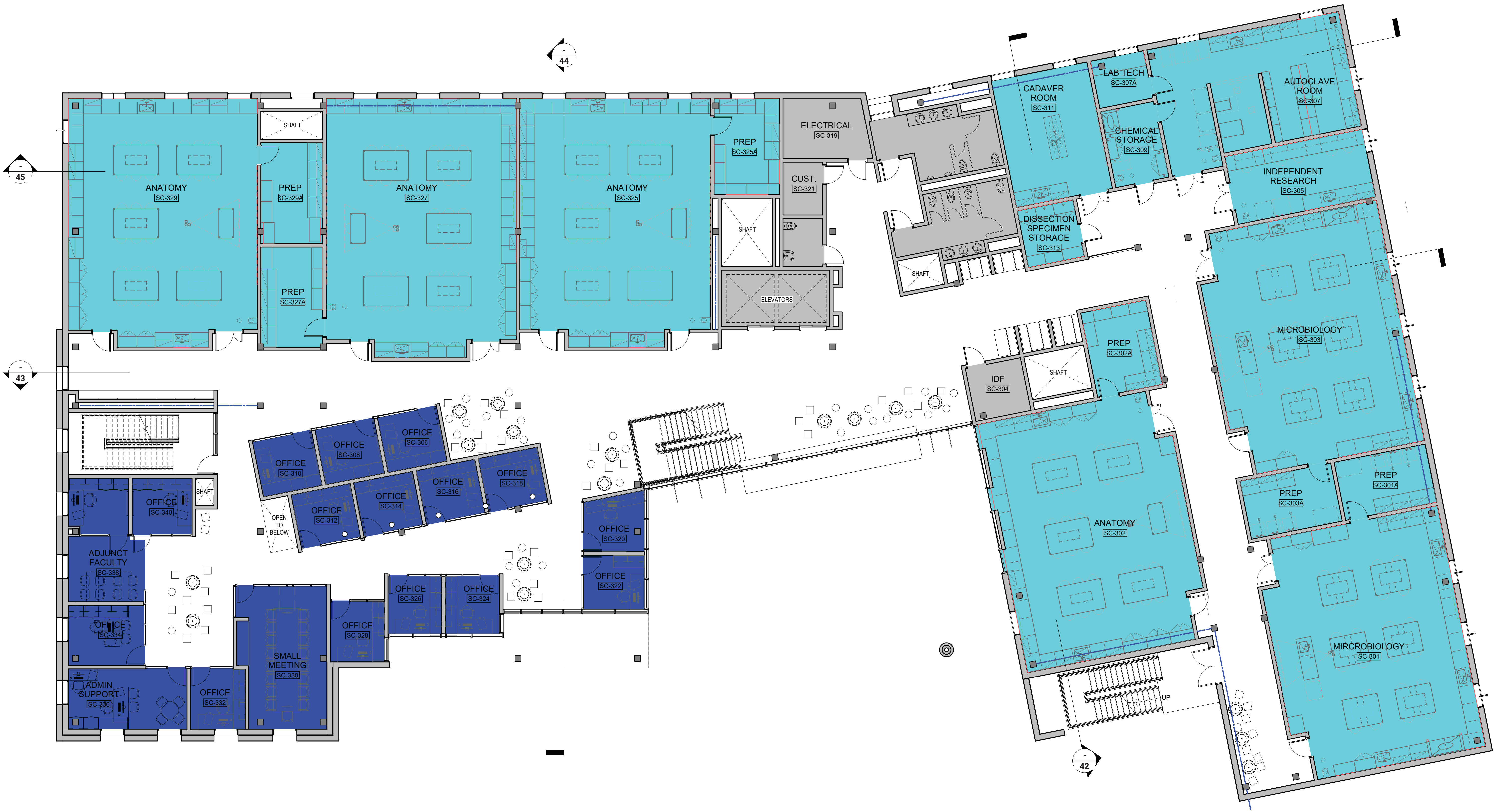

GEOLOGY LAB
SC-123
LAB TECH
SC-119A
LAB SUPPORT
SC-119
OCEANOGRAPHY
SC-117
MAIN ELECTRICAL
SC-113
EMERGENCY ELEC
SC-111
ELEVATORS
LACT RM
SC-105
MDF
SC-103
Outdoor Mechanical
SC-114
BAJA
SC-121
SHARED WASTE
SC-108
UP
MECHANICAL
SC-106
SHARED STORAGE
SC-104
SCIENCE ACADEMY
SC-102
AVAILABLE STORAGE AREA
SC-112
45
44
43
42
0
8'
16'
32'
N

# LEVEL ONE

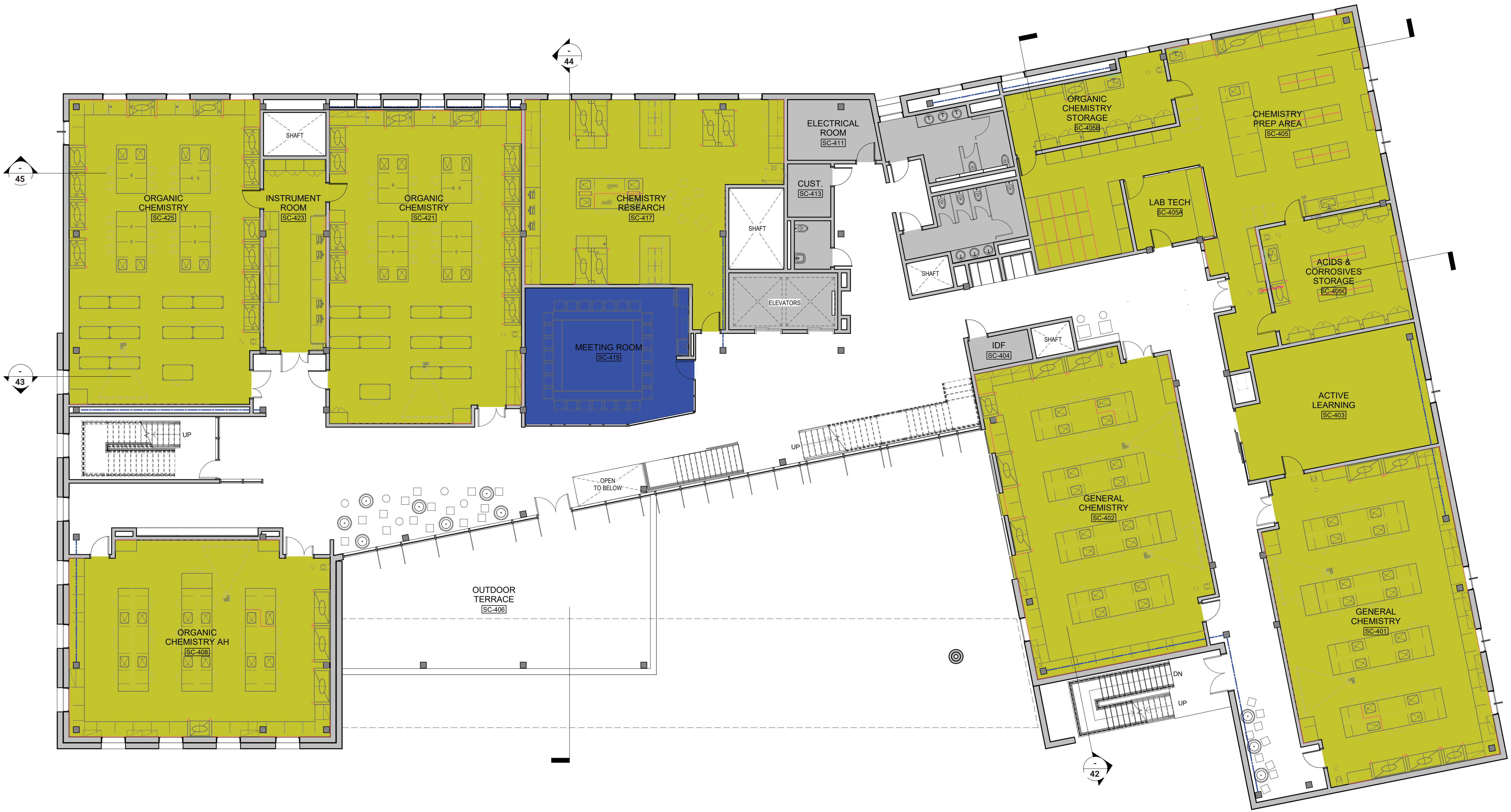



# LEVEL **TWO**

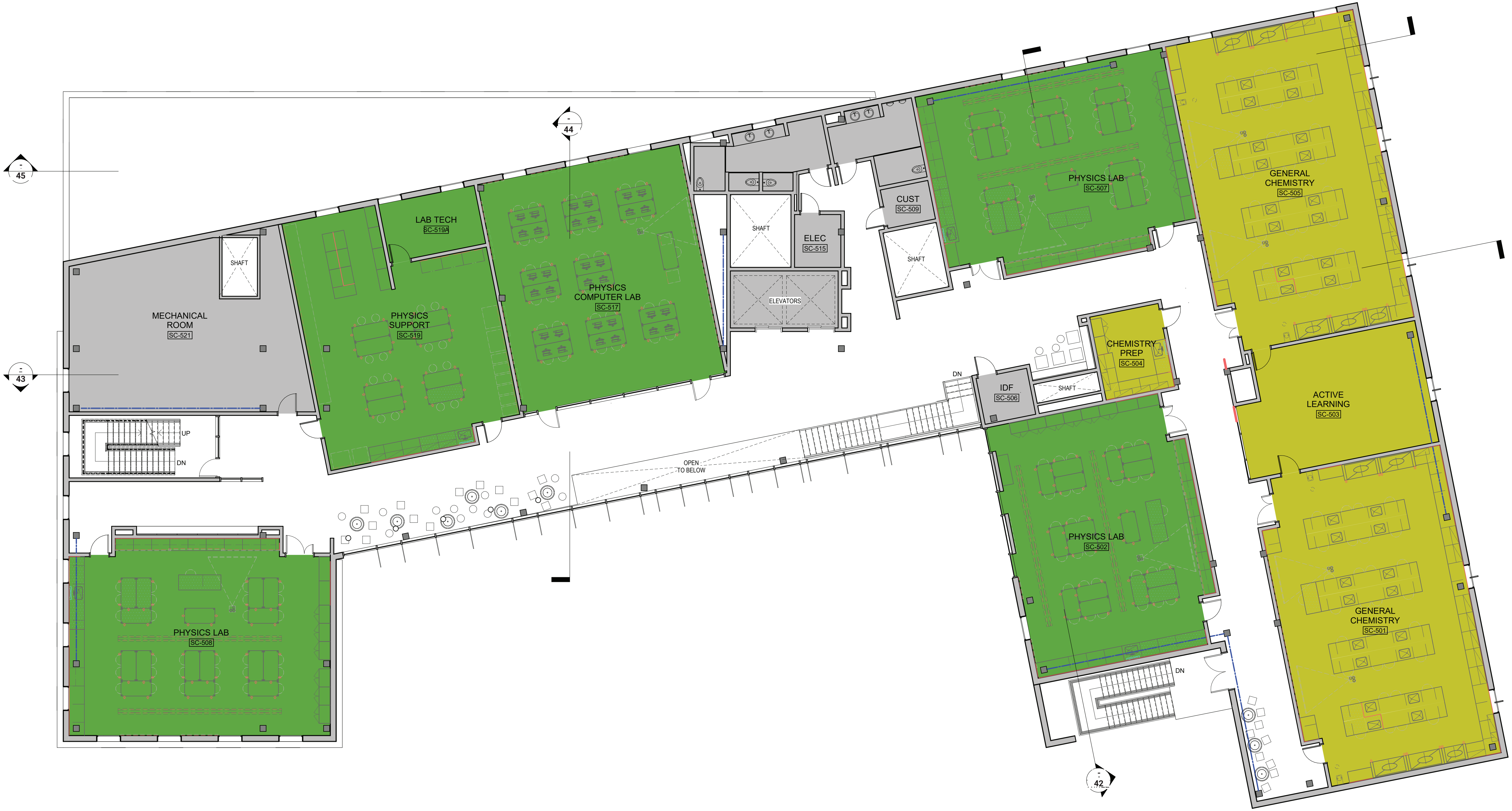
SCIENCE BUILDING | GLENDALE COMMUNITY COLLEGE


ANATOMY
SC-329
PREP
SC-329A
PREP
SC-327A
SHAFT
ANATOMY
SC-327
ANATOMY
SC-325
PREP
SC-325A
ELECTRICAL
SC-319
CUST.
SC-321
SHAFT
ELEVATORS
SHAFT
CADAVER ROOM
SC-311
LAB TECH
SC-307A
CHEMICAL STORAGE
SC-309
AUTOCLAVE ROOM
SC-307
INDEPENDENT RESEARCH
SC-305
DISSECTION SPECIMEN STORAGE
SC-313
MICROBIOLOGY
SC-303
PREP
SC-302A
IDF
SC-304
SHAFT
ANATOMY
SC-302
PREP
SC-303A
PREP
SC-301A
MIRCROBIOLOGY
SC-301
UP
OFFICE
SC-306
OFFICE
SC-308
OFFICE
SC-310
OFFICE
SC-312
OFFICE
SC-314
OFFICE
SC-316
OFFICE
SC-318
OPEN TO BELOW
OFFICE
SC-320
OFFICE
SC-322
OFFICE
SC-324
OFFICE
SC-326
OFFICE
SC-328
SMALL MEETING
SC-330
OFFICE
SC-332
ADMIN SUPPORT
SC-336
OFFICE
SC-334
ADJUNCT FACULTY
SC-338
OFFICE
SC-340
SHAFT
45
44
43
42
0
8'
16'
32'
N

# LEVEL THREE


ORGANIC CHEMISTRY SC-425
SHAFT
INSTRUMENT ROOM SC-423
ORGANIC CHEMISTRY SC-421
CHEMISTRY RESEARCH SC-417
MEETING ROOM SC-419
ELECTRICAL ROOM SC-411
CUST. SC-413
SHAFT
ELEVATORS
SHAFT
ORGANIC CHEMISTRY STORAGE SC-405B
CHEMISTRY PREP AREA SC-405
LAB TECH SC-405A
ACIDS & CORROSIVES STORAGE SC-405C
IDF SC-404
SHAFT
ACTIVE LEARNING SC-403
GENERAL CHEMISTRY SC-402
GENERAL CHEMISTRY SC-401
UP
OPEN TO BELOW
UP
ORGANIC CHEMISTRY AH SC-408
OUTDOOR TERRACE SC-406
DN
UP
45
44
43
42
0
8'
16'
32'
N

# LEVEL **FOUR**



MECHANICAL ROOM SC-521
SHAFT
PHYSICS SUPPORT SC-519
LAB TECH SC-519A
PHYSICS COMPUTER LAB SC-517
SHAFT
ELEC SC-515
ELEVATORS
CUST SC-509
SHAFT
PHYSICS LAB SC-507
GENERAL CHEMISTRY SC-505
CHEMISTRY PREP SC-504
IDF SC-506
SHAFT
DN
ACTIVE LEARNING SC-503
PHYSICS LAB SC-502
GENERAL CHEMISTRY SC-501
OPEN TO BELOW
UP
DN
PHYSICS LAB SC-508
DN
45
43
44
42
0
8'
16'
32'
N

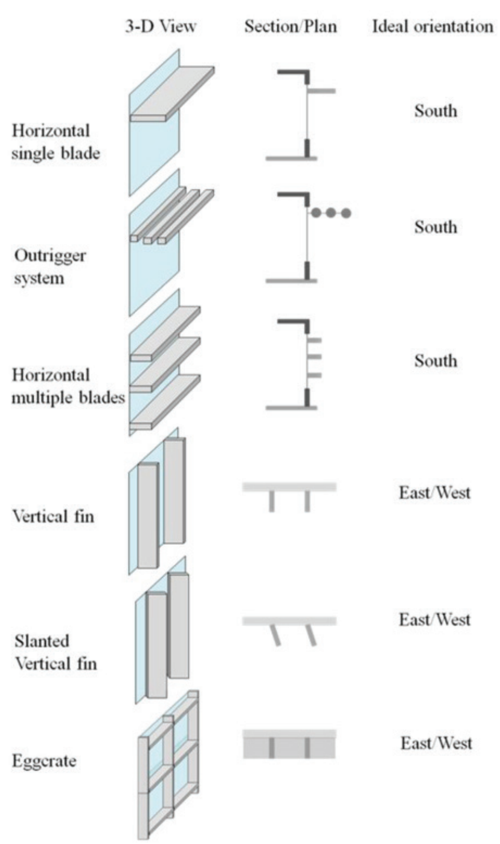

# LEVEL **FIVE**

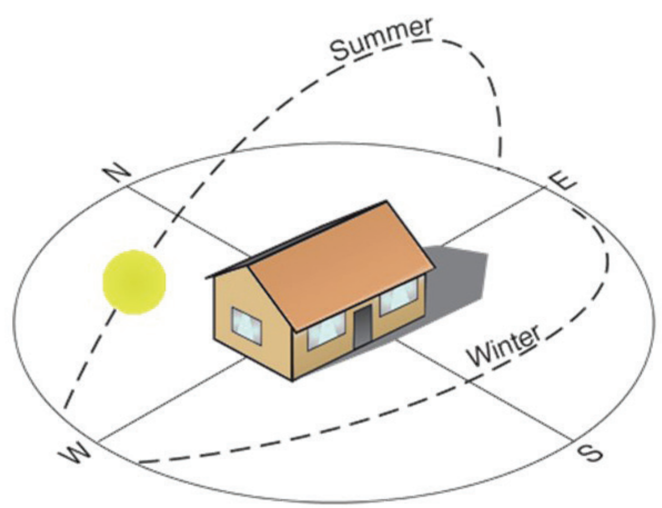
**Sustainable Strategies**

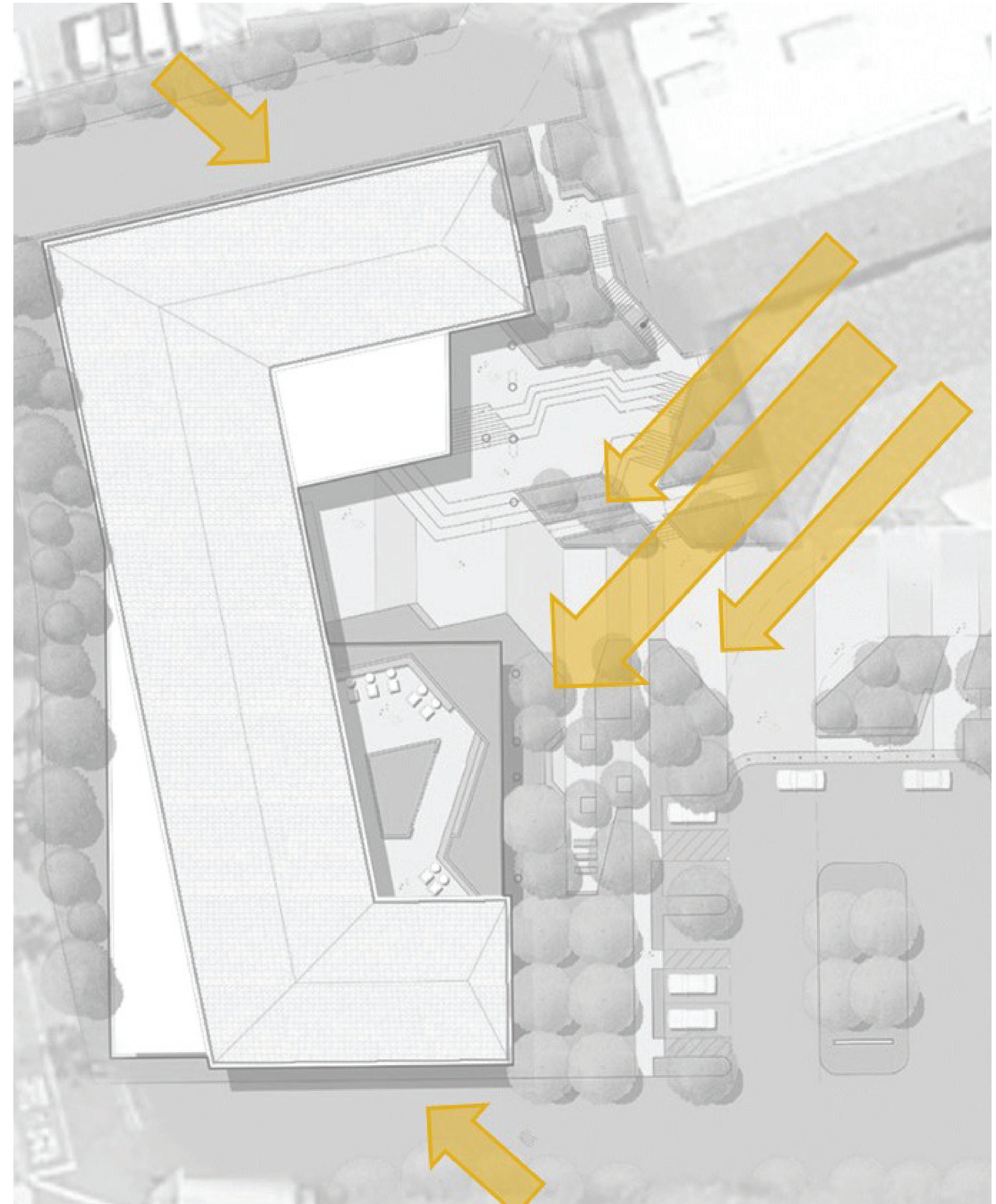
Through environmental analysis, we are able to establish areas of opportunity and any areas of concern from an environmental stand point. The orientation of the building within the site informs us of how the fenestration can begin to manifest itself.

Do to the direction of North, we can establish that our long building elevation, that faces Campus Way, can take full advantage of as much glazing as possible. The South/West/East elevations don't have that luxury. In order to mitigate potential heat gain and glare coming from these direction several approaches have been studies. Windows to the west will be deep set, minimum of 12inches to allow for the building itself to shade them. Glazing to East and South will employ the use of vertical fins, minimum 2 feet in depth, strategically placed to help mitigate unwanted heat gain and glare.

Knowing the direction of prevailing winds through a wind rose diagram can inform ideal locations for public outdoor spaces as well as the large lab exhaust stacks that sit atop the building.



# SUSTAINABILITY

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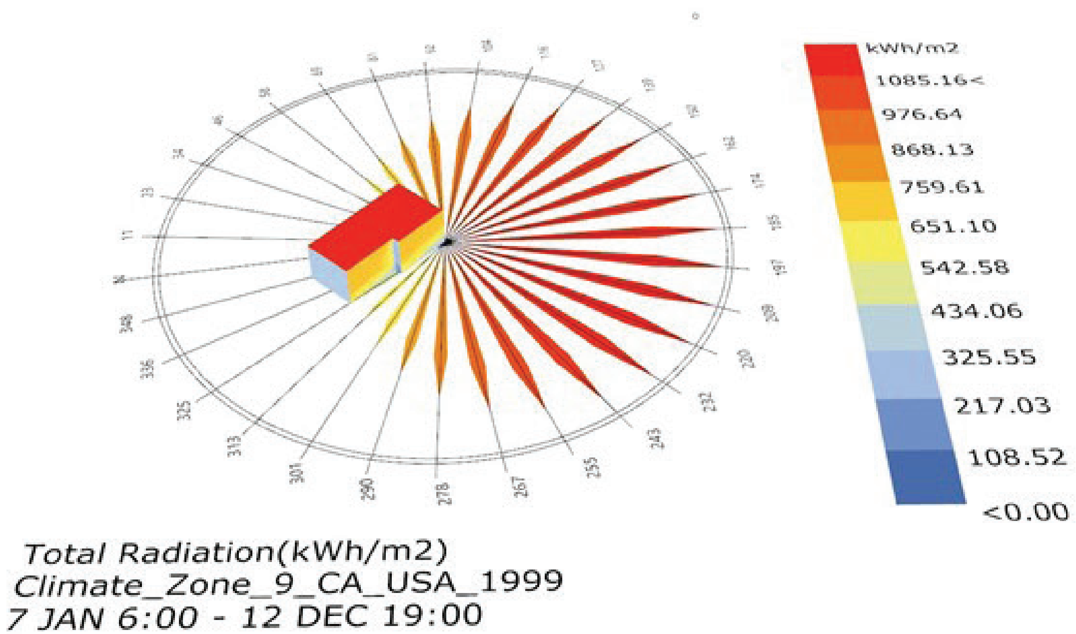
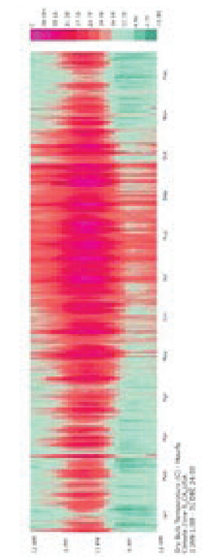
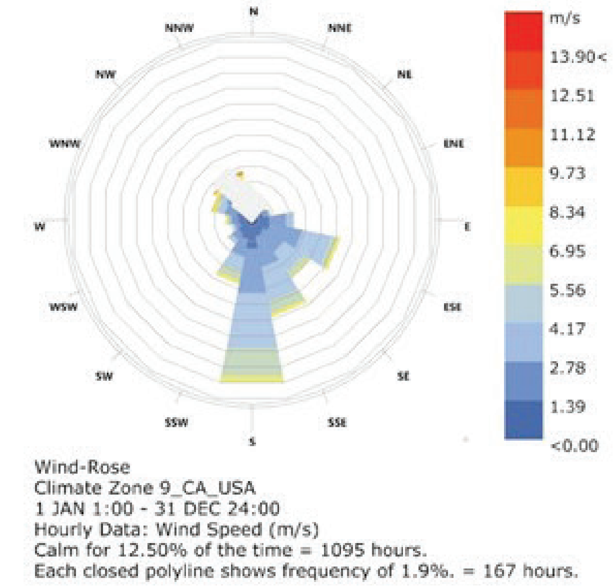
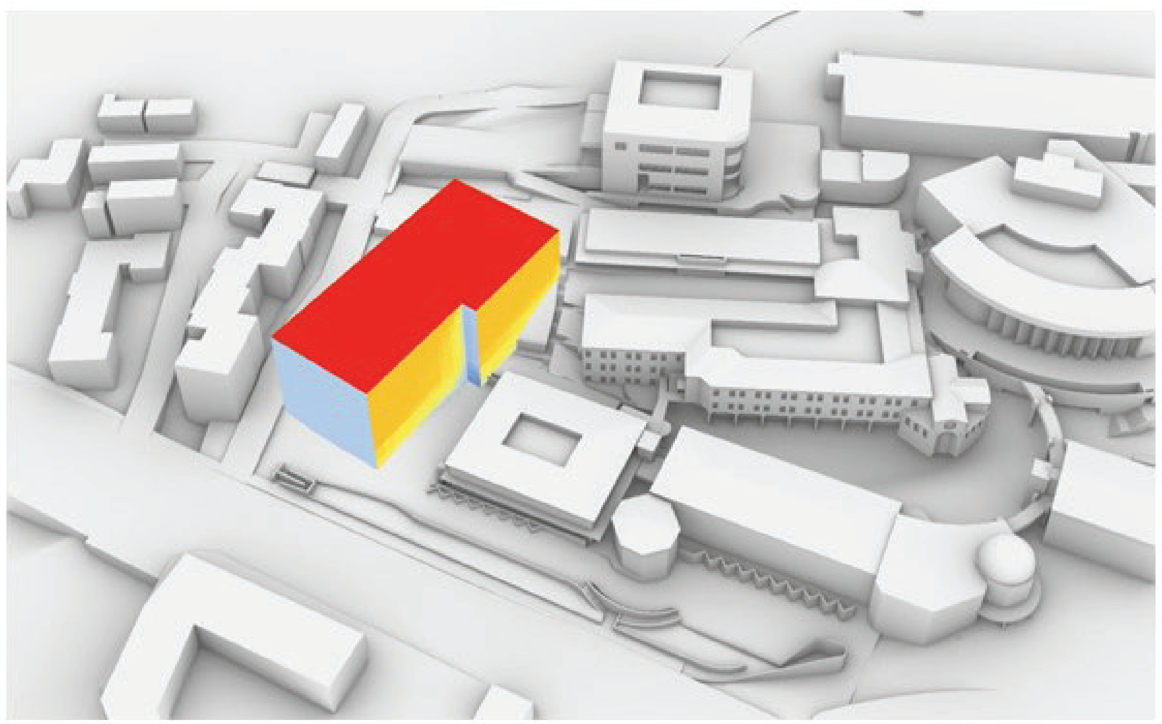
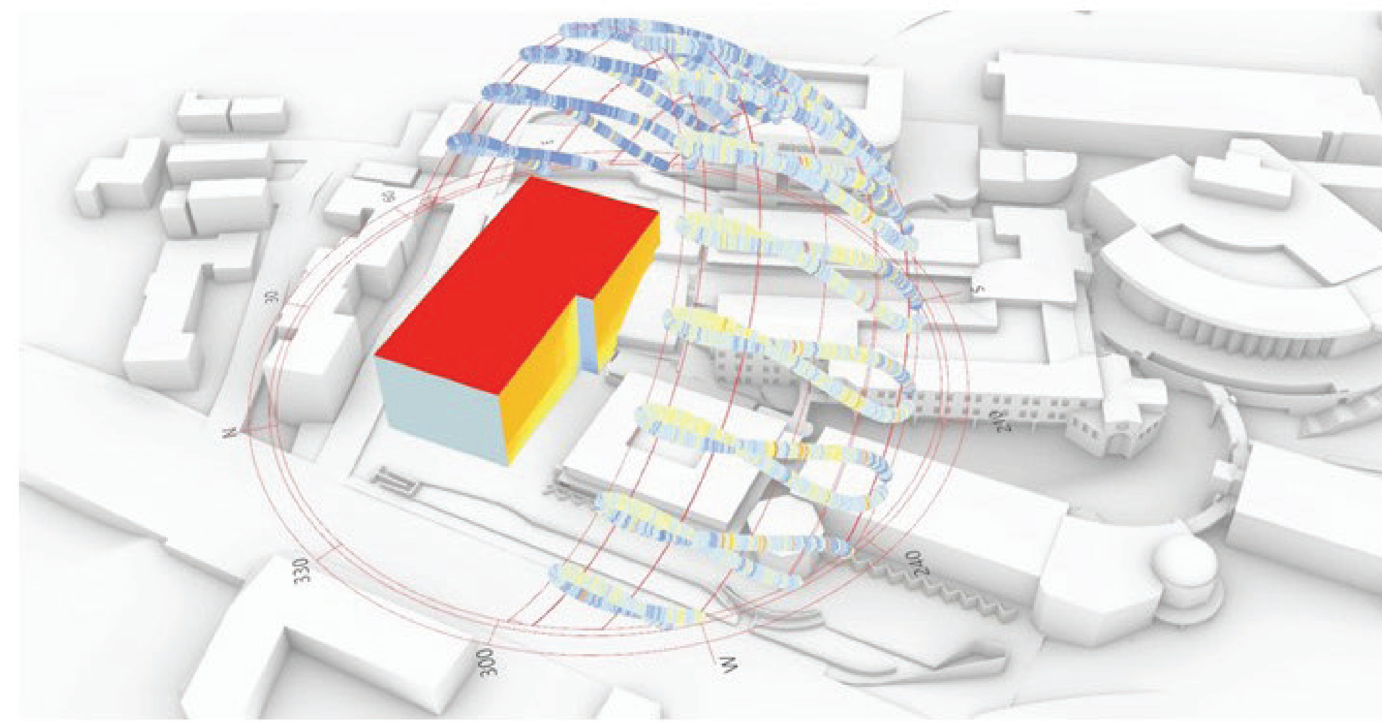




ILLUSTRATES AMOUNT OF RADIATION EXPOSURE ON BUILDING ENVELOPE



ILLUSTRATES DIRECTION OF PREVAILING WINDS

**Blending It All Together**

The exterior concept of the new building centers around four key factors:

Tradition | Identity | Science | Curiosity

In balance, these four factors maintain homogeneity throughout the campus while allowing for a 21st century science building to function and cater to its ever changing and constantly curious users, in the most optimal way.

There is an established architectural style that exists through the Glendale College Campus. Beginning with the original administration building, all subsequent buildings that have followed have employed **traditional** characteristics from the original building. Similarly, this new science building gracefully balances an existing architectural style with programmatic opportunities of a science building.

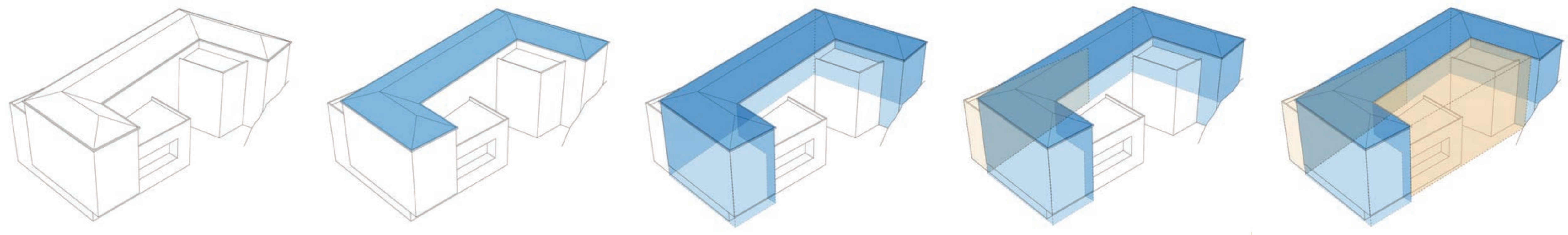
To the outside community, the campus as a whole represents a single entity and that **identity** is largely attributed to the consistent palette used throughout. Especially because the site is on the campus edge, the building will be highly visible and will add to the identity of school. It is critical that the community instinctively associates the new building with Glendale College.

The new building will be a state of art **Science** building. It is no secret that since the original building was constructed (non-science building) many changes have occurred including to teaching/learning paradigms. A science building is about the now, the next, and the future. Limiting spaces by means of antiquated architectural styling can lessen the effectiveness of that space.

Students embarking on a college level learning experience are prime for **curiosity**. While trying to figure themselves out on a personal level, they also need to be able to explore as many paths a college can offer. Designing a building that physically encourages student engagement, collaboration and exploration, can have a big impact in other aspects of their lives.

To achieve a healthy balance of all four factors, prominent features are highlighted in the diagram to the right. To maintain tradition and a homogeneous identity, a sloped tile roof is employed. Furthermore, a similar architectural style makes-up the most public portions of the building (punched openings, color palette) highlighted in blue. To give the building an identity of its own glimpses of the interior program make their way to the exterior through extensive use of glazing. And the conceptual sphere of curiosity of externalized at the welcome courtyard to peak interest and exploration of all students.

# EXTERIOR **CONCEPT**



TRADITION IDENTITY SCIENCE CURIOSITY

# EXTERIOR **MATERIALITY**

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**Palette**

Exterior material palette is derived from existing campus materials and the introduction of new materials used to highlight key aspects of the building and program. Most of the building uses exterior limestone plaster, with an integral color. The arch that denotes the main entry is limestone cmu. The use of composite metal panel is in contrast to the traditional plaster used through out, and gives identity to a new science building on campus. Curtain Wall and storefront systems make up all the glass walls and punched openings that help saturate the interior spaces with natural daylight Red roof tiles cover the sloped roof to keep consistency especially from a southern approach like the parking structure atop the hill.

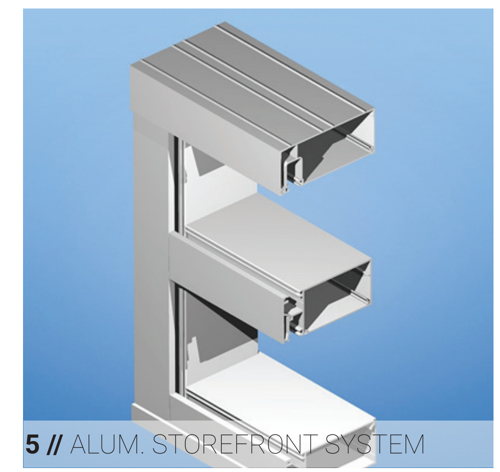
| # | MATERIAL & BASIS OF DESIGN |
|---|---|
| **1A** | LIMESTONE PLASTER - INTEGRATED COLOR A \| MFR: THERMOCROMEX |
| **1B** | LIMESTONE PLASTER - INTEGRATED COLOR B \| MFR: THERMOCROMEX |
| 2 | LIMESTONE CMU \| MFR: ARRISCRAFT |
| 3 | COMPOSITE METAL PANEL \| MFR: ALPOLIC |
| 4 | ALUMINUM CURTAIN WALL SYSTEM \| MFR: ARCADIA WINDOWS |
| 5 | ALUMINUM STOREFRONT SYSTEM \| MFR: ARCADIA WINDOWS |
| 6 | INSULATED GLASS UNIT \| MFR: SOLARBAN 70XL |
| 7 | IGU SPANDREL / CUSTOM FRIT \| MFR: SOLARBAN 70XL |
| 8 | 1" LAMINATED GLASS WITH CUSTOM FRIT \| MFR: GLASSPRO |
| 9 | ROOF TILE \| MFR:  BORAL ROOF |


**1 //** LIMESTONE PLASTER

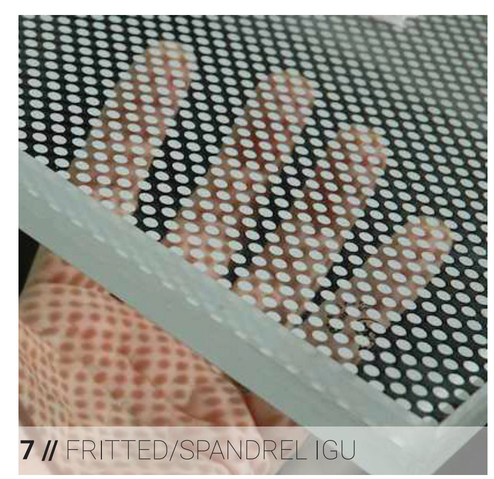

**2 //** LIMESTONE CMU

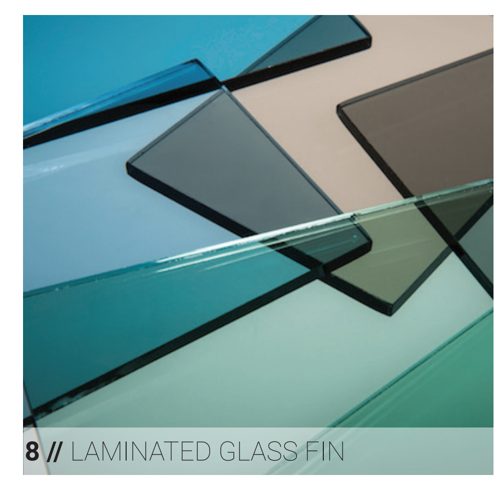

**3 //** COMPOSITE METAL PANEL


**4 //** ALUM. CURTAIN WALL SYSTEM


**5 //** ALUM. STOREFRONT SYSTEM


**6 //** INSULATED GLASS UNIT


**7 //** FRITTED/SPANDREL IGU


**8 //** LAMINATED GLASS FIN


**9 //** TERRACOTA ROOF TILE


# WEST **ELEVATION**

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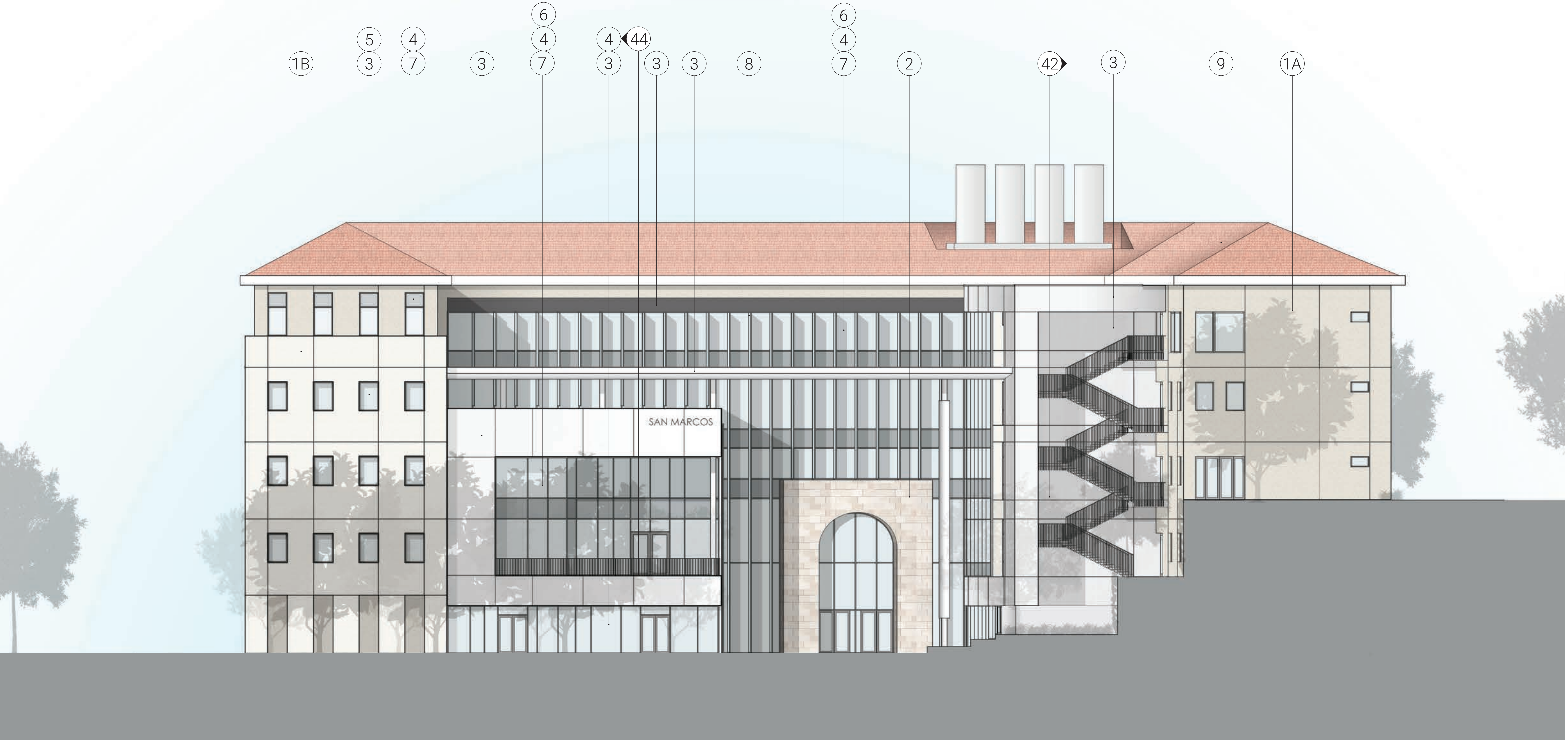
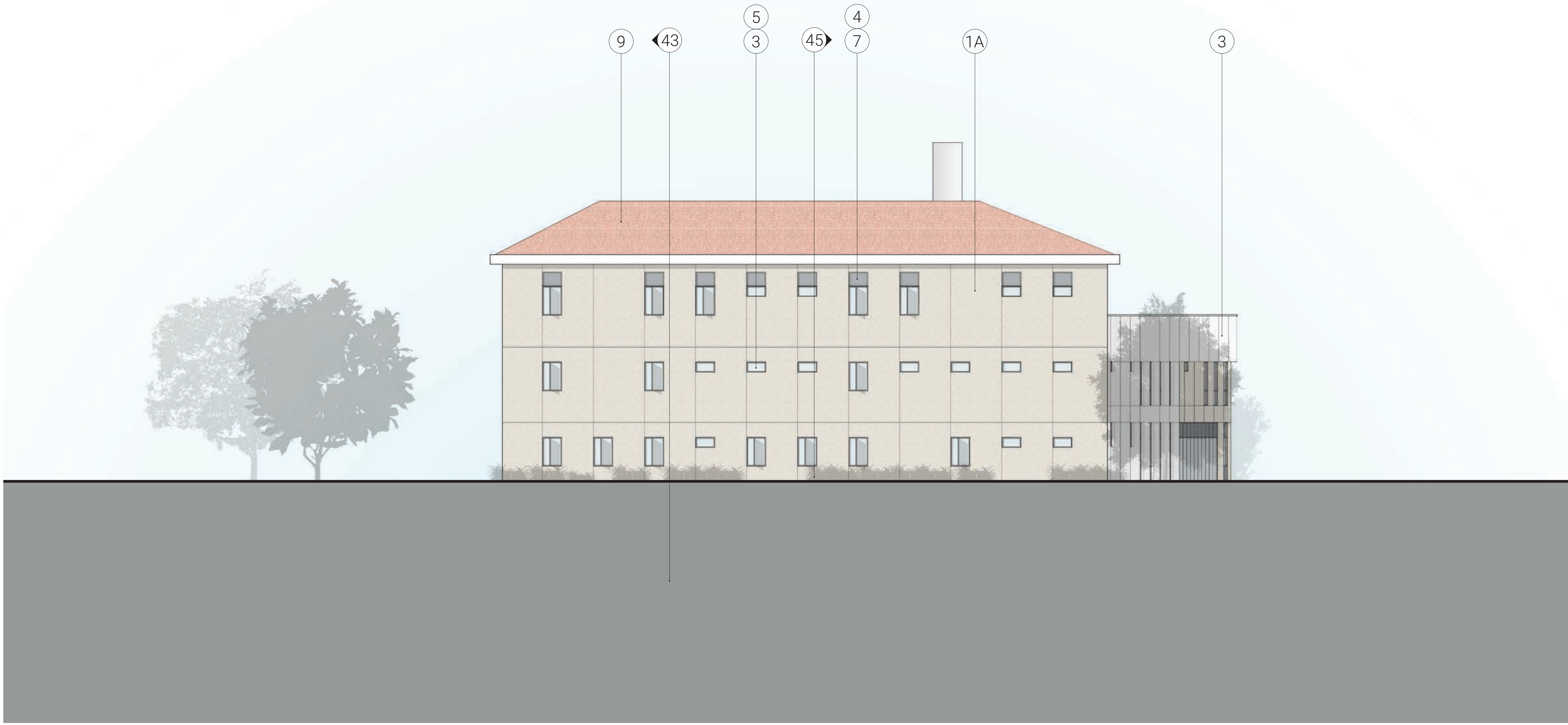
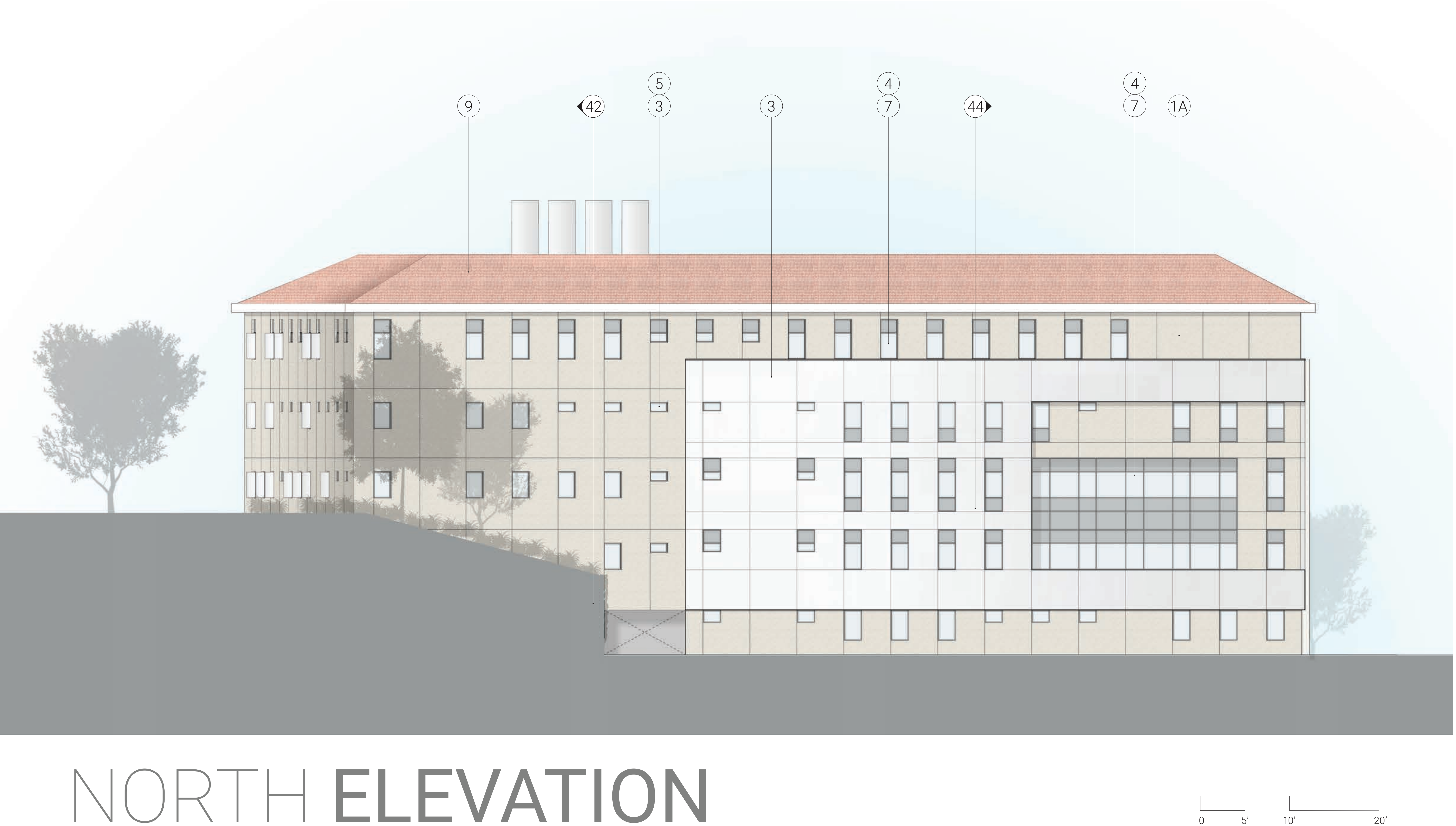



# SOUTH ELEVATION




# EAST **ELEVATION**

SCIENCE BUILDING | GLENDALE COMMUNITY COLLEGE




# NORTH **ELEVATION**


# BUILDING **SECTION**

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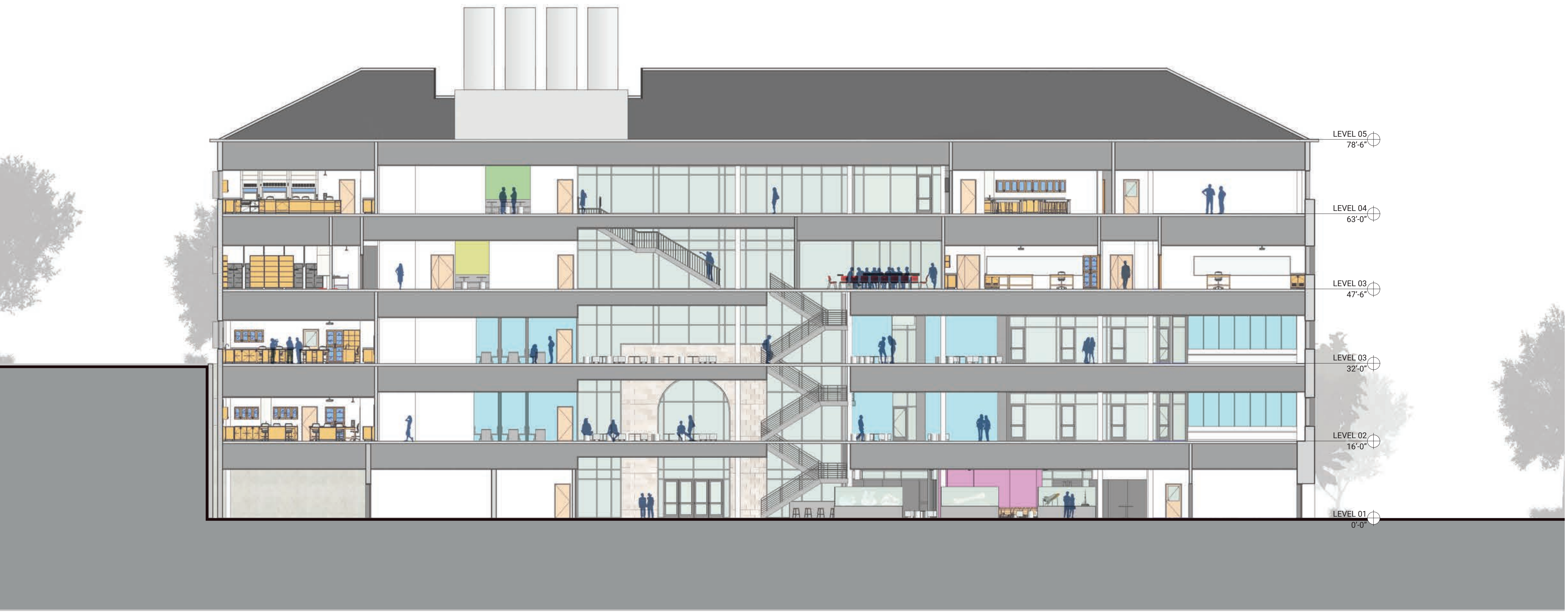
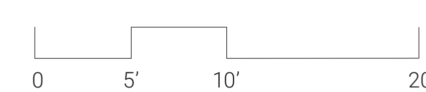


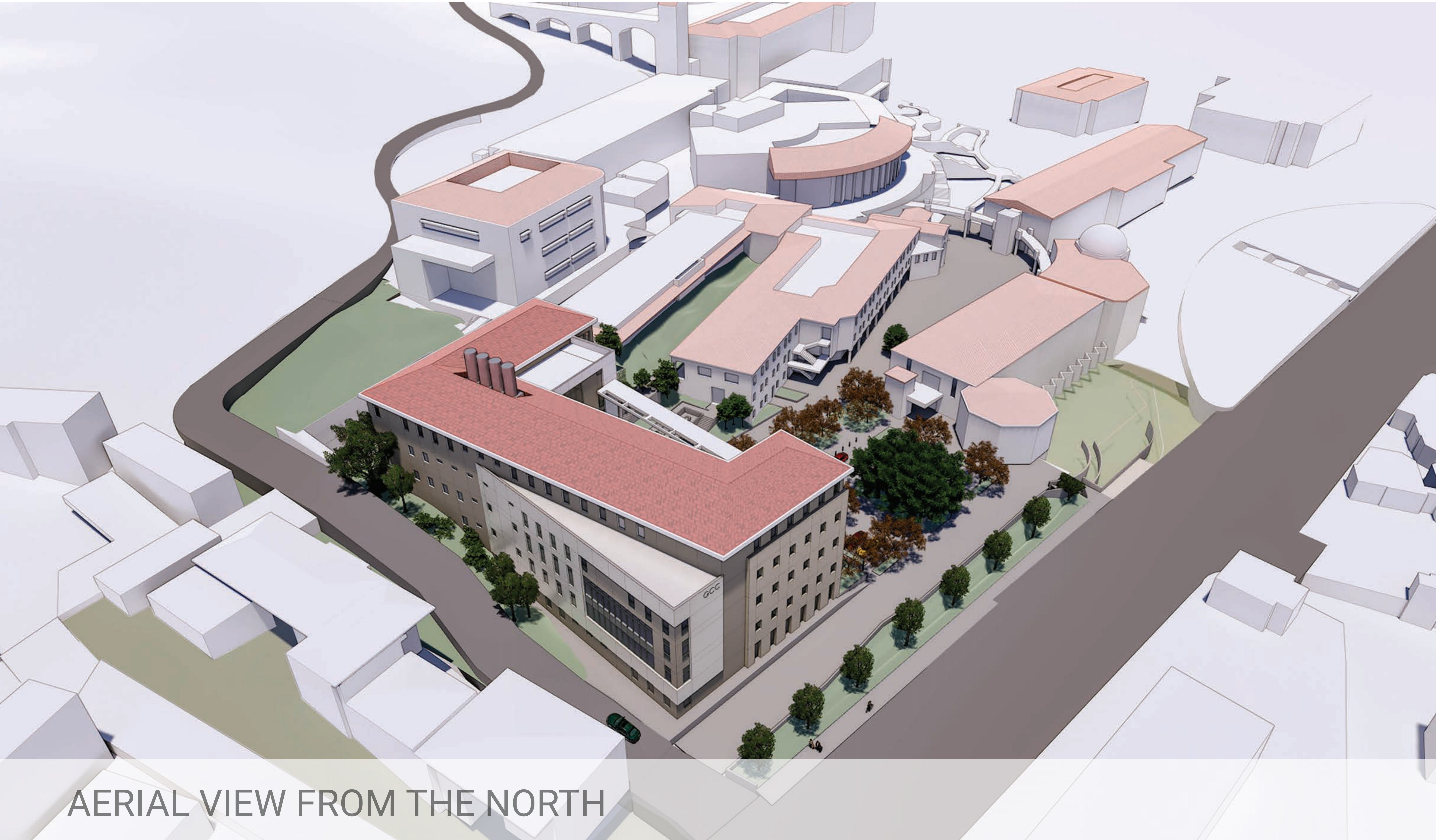

# BUILDING **SECTION**



# BUILDING **SECTION**

SCIENCE BUILDING | GLENDALE COMMUNITY COLLEGE


# BUILDING **SECTION**



AERIAL VIEW FROM THE NORTH


VIEW FROM CORNER OF VERDUGO RD & CAMPUS WAY

AERIAL VIEW FROM THE WEST


VIEW FROM CAMINO REAL BLDG


VIEW FROM SOUTH APPROACH

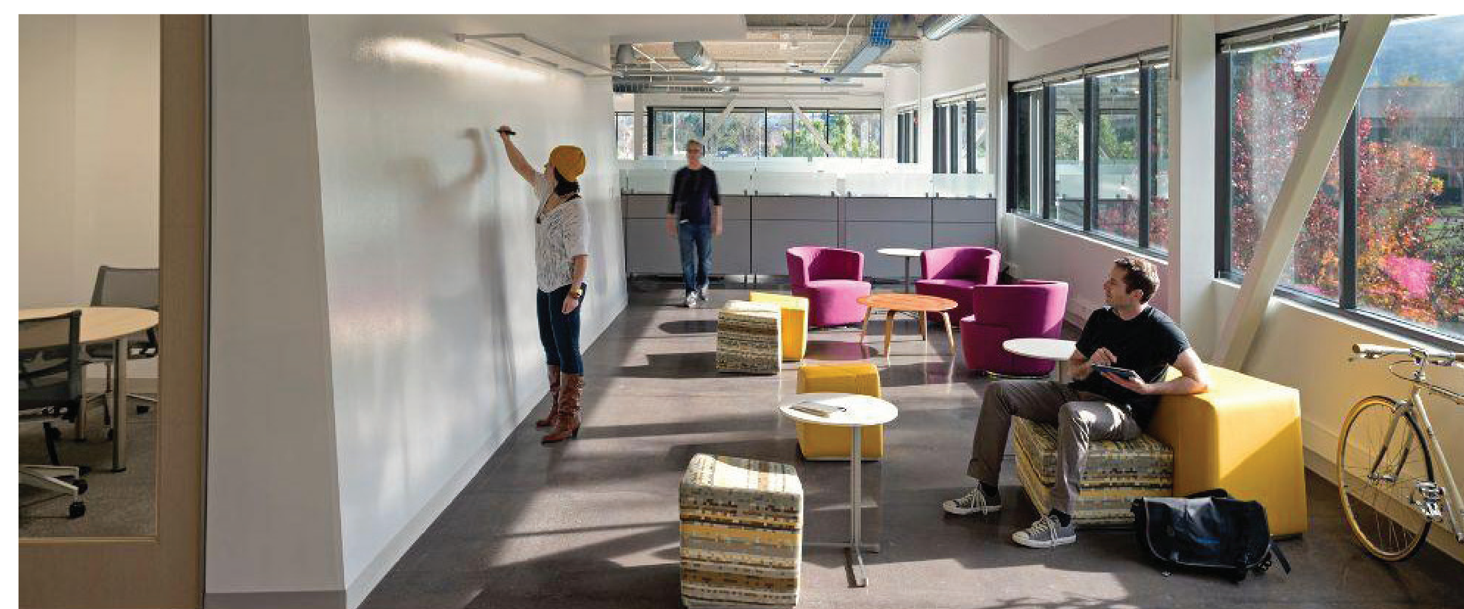

VIEW FROM SOUTH APPROACH @ NIGHT

**Primer**

The interior of the building is the actualized manifestation of this state-of-the art facility. The concept of science on display perfectly marries with the overall building concept of curiosity. Allowing students the opportunity to engage with, collaborate with, explore things they are exposed to inside the building is the goal. To achieve so much transparency, glazing will be used in strategic places to optimize visibility and interaction. Double-story spaces will intersect departments and encourage cross collaboration and exploration. More design opportunities will lie within the more flexible public spaces, where pops of color will be heavily used, across all surface. The use of color will also peak interest from the exterior as most of these public spaces are highly visible from the exterior.

# INTERIORS


CO-LAB



VIEW OF COLLLABORATION SPACE &TERRACE @ LVL FOUR

VIEW OF ELEVATOR LOBBY @ LVL TWO

# INTERIORS PRIMER

SCIENCE BUILDING | GLENDALE COMMUNITY COLLEGE

VIEW OF COLLABORATION SPACE @ LVL TWO

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# SECTION THREE

## BUILDING SYSTEMS

/ CIVIL

/ LANDSCAPE

/ LAB PLANNING

/ STRUCTURAL

/ MECHANICAL

/ ELECTRICAL

/ PLUMBING

/ FIRE PROTECTION

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# CIVIL ENGINEERING

### 9.1.1 Overview

The address of the project is 1500 N Verdugo Rd, Glendale, California 91208 and is approximately 53.37 acres. 1.6 acres of the site will be disturbed for the new site improvements. The community college is bounded by Campus Way on the north, Verdugo Road on the northwest, East Mountain Street on the south and Glendale Freeway and Campus Way on the east. The approximate location is Longitude: 34°10'08" N and Latitude: 118°13' 39" W. The civil scope for the Glendale Community College includes the demolition of existing building adjacent to the existing parking lot, hardscape/landscape areas, and wet utilities (see Appendix I for CD-1.0 to CD-2.2). Grading for drainage and accessibility for the new improvements at the site. Wet utility disconnections and re-connections and new connections for sanitary sewer, potable and fire water. Provide storm water management for Low Impact Development (LID) and Stormwater Pollution Prevention Plan (SWPPP).

### 9.1.2 Codes and Standards

All portions of the project will comply with all applicable codes and regulations. Codes cited herein are the minimum requirements. Design shall comply with the following standards:

Codes:
Department of the State Architect (DSA) Title 24
Applicable Sections of the City of Glendale Municipal Codes which include but are not limited to the following:

Regulations:
City of Glendale Fire Department Regulations
Los Angeles County Low Impact Development (LID) Best Management Practice (BMP) Standards Manual
Americans with Disabilities Act of 1990, as a public accommodation, as implemented in 28 CFR 35, department of Justice regulations relating to State and local governments, including ADAAG including requirements in the 2010 ADA Standards as adopted by the Department of Justice.

Governmental Requirements:
NPDES General Permit for Storm Water Discharges Associated with Construction Activity Water Quality Order 99-08-DWQ for project sites one or more acres.

Established Industry Standards:
Standard Specifications for Public Works Construction (SSPWC), latest edition
Standard Plans for Public Works Construction,
Latest edition Applicable ASTM Standards
Applicable AWWA Standards
Applicable ANSI Standards
Underwriters Laboratory

**City of Glendale Public Works**

### 9.1.3 Civil Design Considerations

#### 9.1.3.1 Site Improvements

The scope of the project is provided within the project limit of work shown on the architectural sketch, civil sketches and other documents. Site improvements include the design and construction of a new five-story Science Center Building, landscaping, paved/concrete walkways, new driveways, asphalt parking areas, fire lane access, and curb and gutter. The project site will provide approximately 20 on-site parking spaces for the school's use. The parking design shall comply with the 2010 ADA Standards for Accessible Design.

#### 9.1.3.2 Grading and Drainage

Per ADA requirements, grading design shall have no directional slopes greater than 5% without a landing, no cross-slope greater than 2.08%, and a maximum 8.33% for a ramp slope. To allow for construction margin of error, the design shall use a maximum of 4.8% directional slope, maximum of 1.8% cross-slope, and maximum 8% ramp slope. It should also allow stormwater runoff to flow into existing or new catch basins that encompass the storm drain network. Slope walks, stairways, ramps and other surfaces away from buildings.

Grading design for different types and functions of pavement are as follows: 1% minimum slope within AC pavement area, and 0.5% minimum within PCC pavement. Concentrated flow within AC pavement less than 1% will require concrete V-gutter with 0.5% minimum slope.

Earthwork, and over-excavation construction will be as recommended by the Geotechnical Report. Excavation bottom must be observed and approved by the Geotechnical Engineer to placing of and compacting fill.

Grading design will meet the adjacent existing condition to remain or provide transition as required per site condition. Grading should be provided per the overall site improvement plan and with the phases of construction. ADA path of travel will fit to the phasing of construction and ultimately for the finish complete package for the redevelopment of the entire proposed project. Storm drainage to be designed in such a way that the existing condition and new completed area are being served.

**9.1.3.3 Utilities**

Trenching and backfilling (on and offsite) shall be provided for installment of all utilities as required by utility companies or as necessary to bring complete utility services to the site / building.

Site utilities within the civil scope include domestic water, fire water, stormwater, and sanitary sewer service. The landscape architect will be responsible for the site irrigation service. All off-site utilities shall be designed per the City of Glendale Public Works. All on-site utilities shall be designed per DSA requirements. Utilities will connect to adjacent street beyond the public right of way.

Sanitary Sewer Infrastructure
The contractor shall verify all, but not limited to, existing information for what is actually on site. All on-site sanitary sewer lines beyond the proposed building will be constructed of approved materials per the Department of State Architect (DSA). The on-site sanitary sewer system will be reviewed and approved by DSA. The depths of sanitary sewer lines below finished grade shall be not less than 12 inches and not less than 6 feet at property lines. (Use greater depth if service to future buildings should require it.)

There currently exists a 10" sewer line running North on N. Verdugo Rd owned by the City of Glendale.

The existing 10" sewer line will remain in place. An easement will need to be provided per City of Glendale requirements along the existing 10" sewer line.

Water Infrastructure
The system shall provide adequate water supply for operation of the building's domestic requirements, irrigation demands, and fire hydrant requirements plus for sprinkler system demands. The new system shall comply with the District standard and specification, project demand, code and regulation. Water supply and distribution designed plans and calculations will be subject to review by the Fire Department, and Agency Having Jurisdiction (AHJ).

There currently exists a 16" water line running along the Campus Way with two fire hydrants located on the north and north-east of the site. On N Verdugo Rd, there exists a 12" water line with 2 backflow preventers.
The existing 16" water line will remain in place. An easement will need to be provided per City of Glendale requirements along the existing 16" water line.

Storm Drain Infrastructure
The site will be designed for maximum detention of storm water run-off, within the general limits established by the Los Angeles County Department of Public Works current Low Impact Development (LID) Standard Manual. Surface drainage will be used to the maximum extent reasonable.

Notes to consider and include in the storm drainage design.

- Project will be required to reduce post-construction storm water discharge to pre-construction levels using detention methodologies including detention basins and increasing permeable surfaces.
- Drainage structures and piping systems shall be designed based on hydrologic and hydraulic calculations, to transport a minimum flow velocity of 3 feet per second.
- With less than 1' – 0" of cover over top of pipe in vehicular traffic areas and in asphalt paved areas, encase pipe in concrete, reinforced as necessary to support imposed loads.
- Install cleanout at maximum spacing of 100 feet in straight runs and at each aggregate change of direction exceeding 135 degrees. A catch basin may substitute. Install cleanouts in yard boxes.
- Where transition is made from round pipe to rectangular pipe, provide cleanout hand hole or manhole for maintenance purposes.

**9.1.4 STORM WATER MANAGEMENT**

Storm water management is required for compliance with the Federal Clean Water Act National Pollutant Discharge Elimination System (NPDES) program. Plans are required for the construction phase and post construction storm water management.

Construction phase storm water management must comply with the State of California Water Resources Control Board Construction General Permit 2009-009-DWQ. A Storm Water Pollution Prevention Plan (SWPPP) must be prepared for the project (project disturbed area is greater than 1 acre, using the statewide template and guidance documents prepared by the California Storm Water Quality Association (CASQA).
The SWPPP must include a plan to address erosion control, non-storm water discharge, temporary sediment control, waste management and material pollution control, wind erosion control, equipment tracking control, and post construction BMP's.
The SWPPP must be prepared by a Qualified SWPPP Developer (QSD), certified by the State of California. The SWPPP will be submitted to the Regional Water Quality Control Board (RWQCB) for review and approval. A Notice of Intent (NOI) is required to be filed through the California Regional Water Control Board's SMARTS system. A Legally Responsible Person (LRP) of the district will need to be selected to file the NOI.

During construction a Qualified SWPPP Practitioner (QSP) is required to implement the site specific SWPPP. The QSP will oversee the installation, regular reporting, maintenance, and possible replacement of the temporary construction BMP's; and will be responsible for the storm water quality for the site.

The post construction storm water management design will be per the County of Los Angeles LID Guidelines.

## DEMOLITION PLAN NOTES:

### REMOVAL NOTES:

(1) REMOVE EXISTING AC PAVEMENT AND BASE MATERIAL, FULL DEPTH.
(2) REMOVE EXISTING CONCRETE PAVEMENT AND BASE MATERIAL, FULL DEPTH.
(3) REMOVE EXISTING BUILDING, FOOTINGS, AND ALL APPURTENANCES IN ITS ENTIRETY.
(4) REMOVE EXISTING STEPS/STAIRS, FOOTINGS AND HANDRAILS IN ITS ENTIRETY.
(5) CLEAR, GRUB AND REMOVE EXISTING TURF/PLANTER/ EXPOSED SUBGRADE AREA. REMOVE EXISTING SHRUBS AND ROOTS.
(6) REMOVE EXISTING CURB IN ITS ENTIRETY.
(7) REMOVE EXISTING WALL IN ITS ENTIRETY.
(8) REMOVE EXISTING WHEEL STOP.
(9) REMOVE EXISTING COLUMN.
(10) REMOVE EXISTING TRUNCATED DOMES.
(11) REMOVE EXISTING STORM DRAIN MANHOLES.
(12) REMOVE EXISTING UTILITY PANEL/PULL BOX.
(13) REMOVE EXISTING ELECTRICAL BOX.
(14) REMOVE EXISTING IRRIGATION CONTROL VALVE.
(15) REMOVE EXISTING LIGHT POST.
(16) REMOVE EXISTING SIGN.
(17) REMOVE EXISTING PARKING METER.
(18) REMOVE EXISTING BACKFLOW PREVENTER.
(19) REMOVE EXISTING TREES.
(20) REMOVE EXISTING BIKE RACK.
(21) REMOVE EXISTING RAMP FULL DEPTH. REFER TO OFFSITE IMPROVEMENTS.
(22) REMOVE EXISTING WATER FOUNTAIN.

### PROTECT-IN-PLACE NOTES:

[30] PROTECT IN PLACE EXISTING AC PAVEMENT.
[31] PROTECT IN PLACE EXISTING UTILTIY VALVE, CLEANOUT, MANHOLE. ADJUST TO NEW DESIGN GRADE AS REQUIREMENTS.
[32] PROTECT IN PLACE STREET SIGN.
[33] PROTECT IN PLACE EXISTING FIRE HYDRANT. ADJUST TO NEW DESIGN GRADE AS REQUIREMENTS.
[34] PROTECT IN PLACE EXISTING UTILTY PANEL BOX/VAULT.
[35] PROTECT IN PLACE EXISTING LIGHT POST.
[36] PROTECT IN PLACE EXISTING BOLLARD.
[37] PROTECT IN PLACE EXISTING DOWNSPOUT. ADJUST TO NEW DESIGN GRADE AS REQUIREMENTS.
[38] PROTECT IN PLACE EXISTING TREES.
[39] PROTECT IN PLACE EXISTING CURB.
[40] PROTECT IN PLACE EXISTING WALL.
[41] PROTECT IN PLACE EXISTING BACKFLOW PREVENTOR.

## UTILITY DEMOLITION PLAN NOTES:

### REMOVAL NOTES:

(1) REMOVE EXISTING WATER LINE AND APPURTENANCES IN ITS ENTIRETY. CAP AND PLUG BOTH END AS REQUIRED
(2) REMOVE EXISTING SEWER LINE AND APPURTENANCES IN ITS ENTIRETY.
(3) REMOVE EXISTING STORM DRAIN LINE AND APPURTENANCES IN ITS ENTIRETY.
(4) REMOVE EXISTING GAS LINE AND APPURTENANCES IN ITS ENTIRETY.

## UTILITY DEMOLITION PLAN NOTES:

### REMOVAL NOTES (CONT.):

(5) REMOVE EXISTING ELECTRICAL/STREET LIGHT LINE AND APPURTENANCES IN ITS ENTIRETY.
(6) REMOVE EXISTING TELECOMMUNICATIONS LINE AND APPURTENANCES IN ITS ENTIRETY.
(7) REMOVE AND RELOCATE EXISTING FIRE HYDRANT IN ITS ENTIRETY. ADJUST TO NEW DESIGN GRADE AS REQUIRED.
(8) REMOVE AND RELOCATE EXISTING STREET LIGHT/LAMP IN ITS ENTIRETY. ADJUST TO NEW DESIGN GRADE AS REQUIRED.
(9) REMOVE EXISTING UTILITY PULL BOX, MANHOLE, WATER VALVE, AND CLEANOUTS. ADJUST TO NEW DESIGN GRADES AS REQUIRED.
(10) REMOVE EXISTING CATCH BASIN/DRAIN INLET AND STORM DRAIN CLEANOUTS. ADJUST TO NEW DESIGN GRADES AS REQUIRED.

### PROTECT-IN-PLACE NOTES:

[20] PROTECT IN PLACE FIRE HYDRANT. ADJUST TO NEW DESIGN GRADES AS REQUIRED.
[21] PROTECT IN PLACE EXISTING UTILITY PULL BOX, MANHOLE, WATER VALVE, AND CLEANOUTS. ADJUST TO NEW DESIGN GRADES AS REQUIRED.
[22] PROTECT IN PLACE EXISTING UNDERGROUND GAS LINE.
[23] PROTECT IN PLACE EXISTING UNDERGROUND ELECTRICAL/ STREET LIGHT LINE/ STREET LIGHT.
[24] PROTECT IN PLACE TELECOMMUNICATIONS LINE.
[25] PROTECT IN PLACE EXISTING UNDERGROUND STORM DRAIN LINE.

C-1.0

## SITE PLAN NOTES:

### CONSTRUCTION NOTES:

(1) CONSTRUCT THICK CONCRETE PAVEMENT OVER (CAB) BASE COURSE.
(2) CONSTRUCT THICK AC SURFACING OVER THICK CRUSHED AGGREGATE BASE (CAB).
(3) CONSTRUCT CURB RAMP PER SSPWC CASE A TYPE 1 DETAIL 111–5.
(4) CONSTRUCT CURB RAMP PER SSPWC CASE B TYPE 1 DETAIL 111–5.
(5) CONSTRUCT RAMP PER ARCHITECTURAL DRAWINGS.
(6) NEW STRIPING PER ARCHITECTURAL DRAWINGS.
(7) PLANTER AREA PER ARCHITECTURAL AND LANDSCAPE DRAWINGS.
(8) CONSTRUCT CONCRETE CURB.
(9) CONSTRUCT STAIRS WITH HANDRAILS PER ARCHITECTURAL DRAWINGS.
(10) CONSTRUCT WALL PER ARCHITECTURAL DRAWINGS.
(11) CONSTRUCT SEAT WALL PER ARCHITECTURAL DRAWINGS.
(12) NEW BUILDING PER ARCHITECTURAL DRAWINGS.
(13) CONSTRUCT BOLLARDS PER ARCHITECTURAL DRAWINGS.
(14) DECOMPOSED GRANITE PER ARCHITECTURAL DRAWINGS.
(15) GENERATOR PER ARCHITECTURAL DRAWINGS.
(16) SAWCUT FULL DEPTH AND JOIN TO MATCH EXISTING.

## UTILITY PLAN NOTES:

### STORM DRAIN:

(1) INSTALL STORM DRAIN LINE, SEE PLAN FOR SIZES.
(2) CONNECT TO BUILDING DOWNSPOUT. COORDINATE AND MATCH LOCATION WITH THE BUILDING PLUMBING DRAWINGS. PROVIDE REDUCING FITTINGS AS APPLICABLE
(3) CONSTRUCT CATCH BASIN.
(4) INSTALL STORM DRAIN CLEANOUT.
(5) INSTALL JENSEN PRECAST DETENTION TANK.
(6) DETENTION TANK OVERFLOW.
(7) INSTALL JDS PRETREATMENT DEVICE.
(8) INSTALL MODULAR WETLAND SYSTEM PER MANUFACTURER DETAILS.
(9) MODULAR WETLAND SYSTEM OVERFLOW.
(10) CONSTRUCT CURB DRAIN.
(11) CONSTRUCT AREA DRAIN.
(12) INSTALL PARKWAY DRAIN PER SPPWC STD PLAN 151–2.

### SANITARY SEWER:

(20) INSTALL ABS SANITARY SEWER LINE.
(21) CONNECT TO BUILDING SANITARY SEWER AND LAB WASTE CONNECTION. PROVIDE REDUCING FITTINGS AND COUPLINGS AS NEEDED. FOR CONTINUATION SEE PLUMBING PLANS.
(22) CONNECT TO EXISTING SANITARY SEWER MAIN. VERIFY SIZE IN FIELD AND PROVIDE REDUCING FITTINGS AND COUPLINGS AS NEEDED. VERIFY LOCATION IN FIELD PRIOR TO CONSTRUCTION/ INSTALLATION OF SANITARY SEWER SYSTEM.
(23) INSTALL SEWER CLEANOUT.
(24) NEUTRALIZING TANK AND SAMPLING BASIN PER PLUMBING DRAWINGS.

### DOMESTIC WATER:

(30) CONNECT TO EXISTING WATER LINE. VERIFY SIZE IN FIELD AND PROVIDE REDUCING FITTINGS AND COUPLINGS AS NEEDED. VERIFY LOCATION IN FIELD PRIOR TO CONSTRUCTION/INSTALLATION OF NEW DOMESTIC WATER SYSTEM.
(31) CONNECT TO BUILDING DOMESTIC WATER CONNECTION. PROVIDE REDUCING FITTINGS AND COUPLINGS AS NEEDED. FOR CONTINUATION SEE PLUMBING PLANS.
(32) INSTALL 4" COPPER PIPE TYPE L TUBING FOR DOMESTIC WATER LINE.
(33) INSTALL CONCRETE THRUST BLOCK AND TIES FOR WATERLINE.

### GAS:

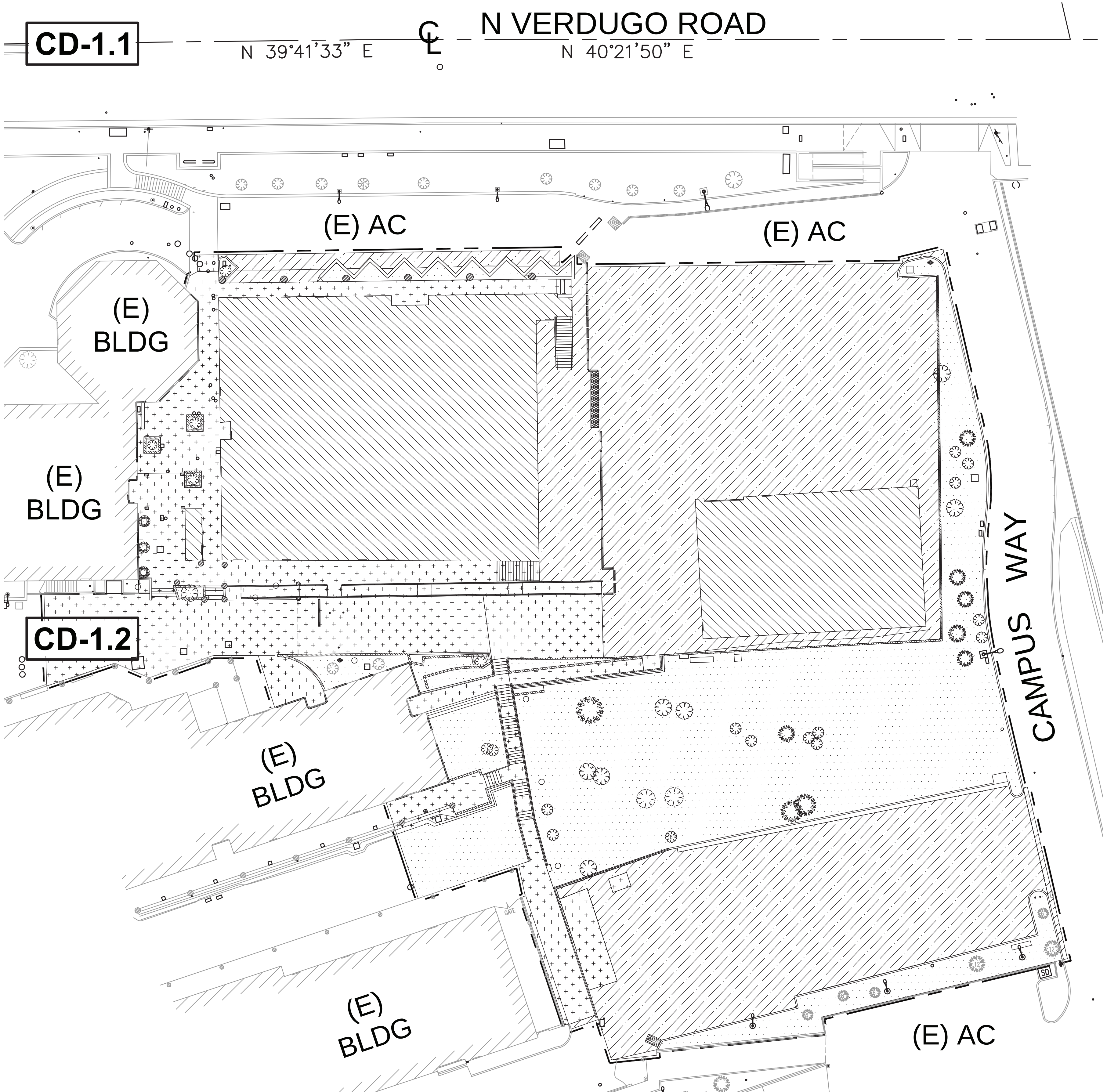
(40) INSTALL GAS EARTHQUAKE SHUT OFF VALVE PER PLUMBING DRAWINGS.

### FIRE WATER:

(50) CONNECT TO EXISTING WATER LINE. VERIFY SIZE IN FIELD AND PROVIDE REDUCING FITTINGS AND COUPLINGS AS NEEDED. VERIFY LOCATION IN FIELD PRIOR TO CONSTRUCTION/INSTALLATION OF NEW DOMESTIC WATER SYSTEM.
(51) CONNECT TO BUILDING FIRE WATER CONNECTION. PROVIDE REDUCING FITTINGS AND COUPLINGS AS NEEDED. FOR CONTINUATION SEE PLUMBING PLANS.
(52) INSTALL AWWA C900 PVC PRESSURE CLASS 200 (DR 14).
(53) INSTALL CONCRETE THRUST BLOCK AND TIES FOR WATERLINE.
(54) RELOCATE FIRE HYDRANT.

C-1.1

# CIVIL DESIGN DRAWINGS

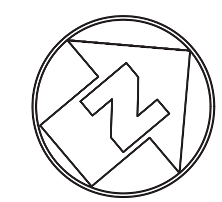



## REMOVAL LEGEND:

- REMOVE EXISTING AC PAVEMENT AND BASE MATERIAL, FULL DEPTH.
- REMOVE EXISTING CONCRETE PAVEMENT AND BASE MATERIAL, FULL DEPTH.
- REMOVE EXISTING WALL
- REMOVE EXISTING BLDG
- REMOVE EXISTING TRUNCATED DOMES
- CLEAR, GRUB AND REMOVE EXISTING TURF/PLANTER/SHRUBS/EXPOSED SUBGRADE AREA.REMOVE EXISTING SHRUBS AND ROOTS IN THEIR ENTIRETY.

## SHEET NOTES:

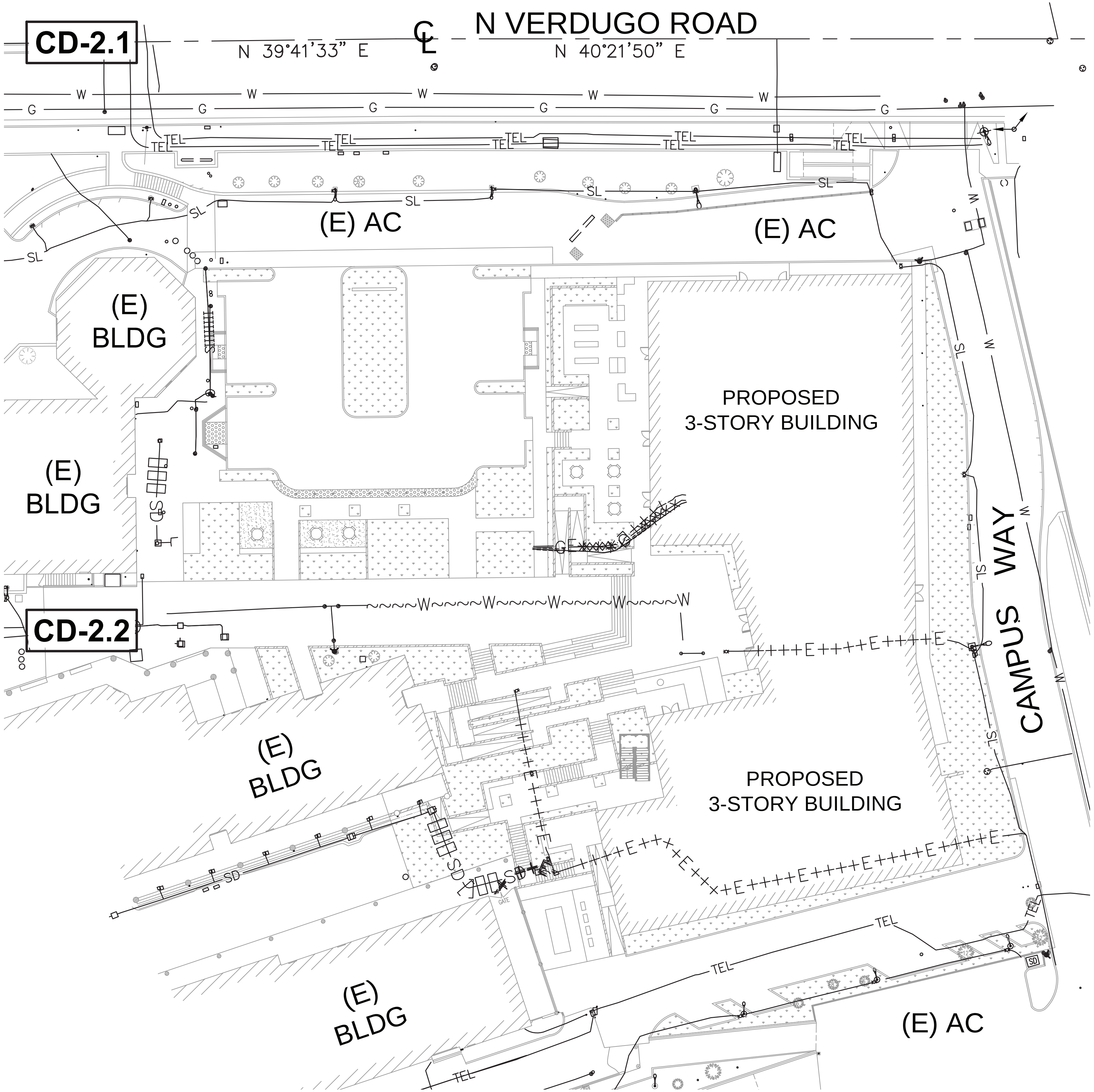
1. FOR REMOVAL NOTES, SEE SHEET C–1.0.



## COMPOSITE SITE DEMOLITION PLAN


SCALE: 1" = 40'

CD-1.0




## REMOVAL LEGEND:

| | |
|---|---|
| ~~~~W~~~~W | REMOVE EXISTING UNDERGROUND WATER LINE. |
| S S | REMOVE EXISTING UNDERGROUND SEWER LINE. |
| SD SD | REMOVE EXISTING UNDERGROUND STORMDRAIN LINE. |
| G G | REMOVE EXISTING UNDERGROUND GAS LINE. |
| ++++E++++E | REMOVE EXISTING UNDERGROUND ELECTRICAL LINE. |
| ====T====T | REMOVE EXISTING UNDERGROUND TELEPHONE LINE. |

## SHEET NOTES:

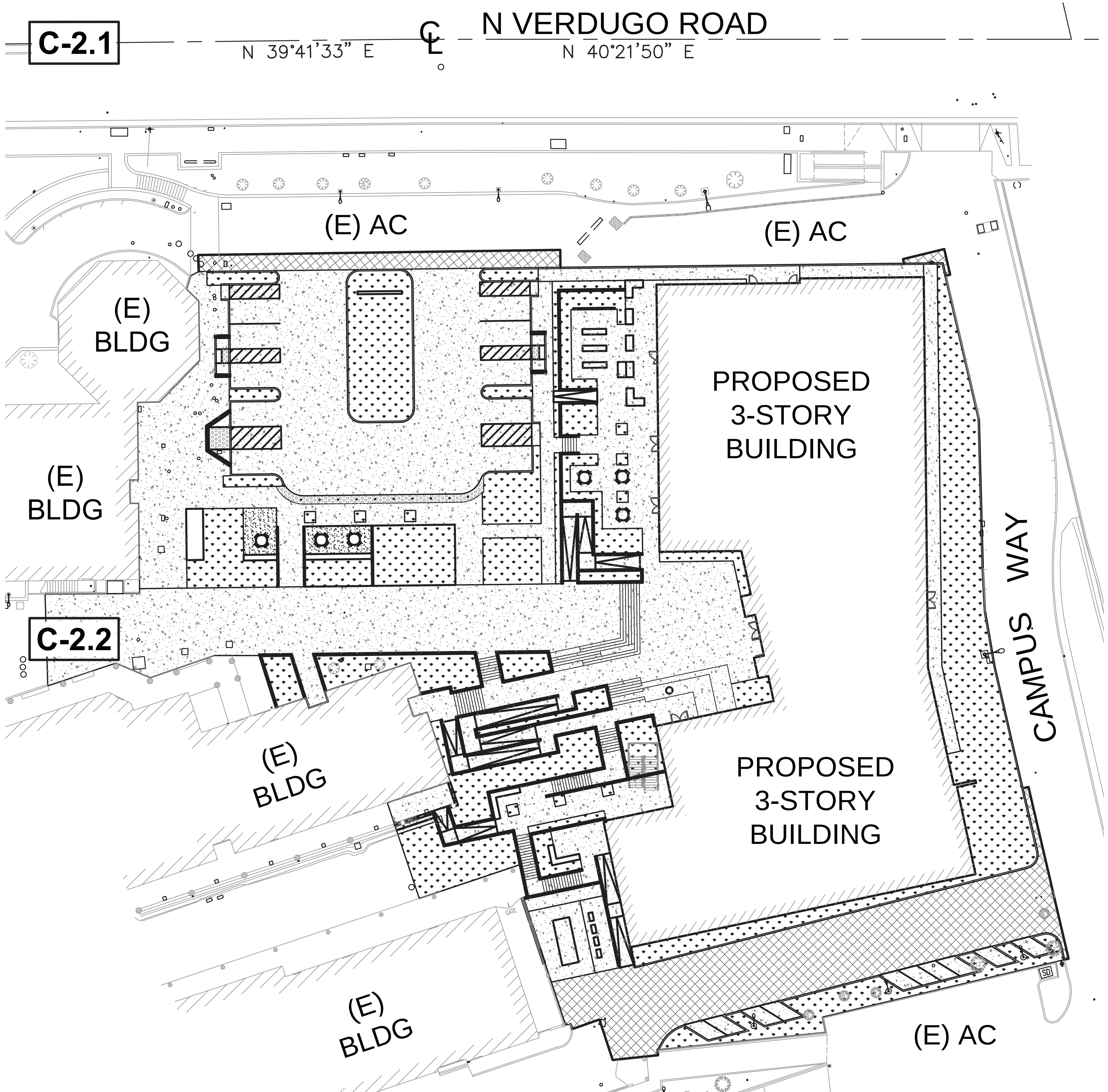
1. FOR REMOVAL NOTES, SEE SHEET C–1.0.

## COMPOSITE UTILITY DEMOLITION PLAN

40 20 0 40 80

SCALE: 1" = 40'

CD-2.0




## LEGEND:

- AC PAVEMENT
- CONCRETE PAVEMENT
- PLANTER AREA
- WALL
- TRUNCATED DOMES

## SHEET NOTES:

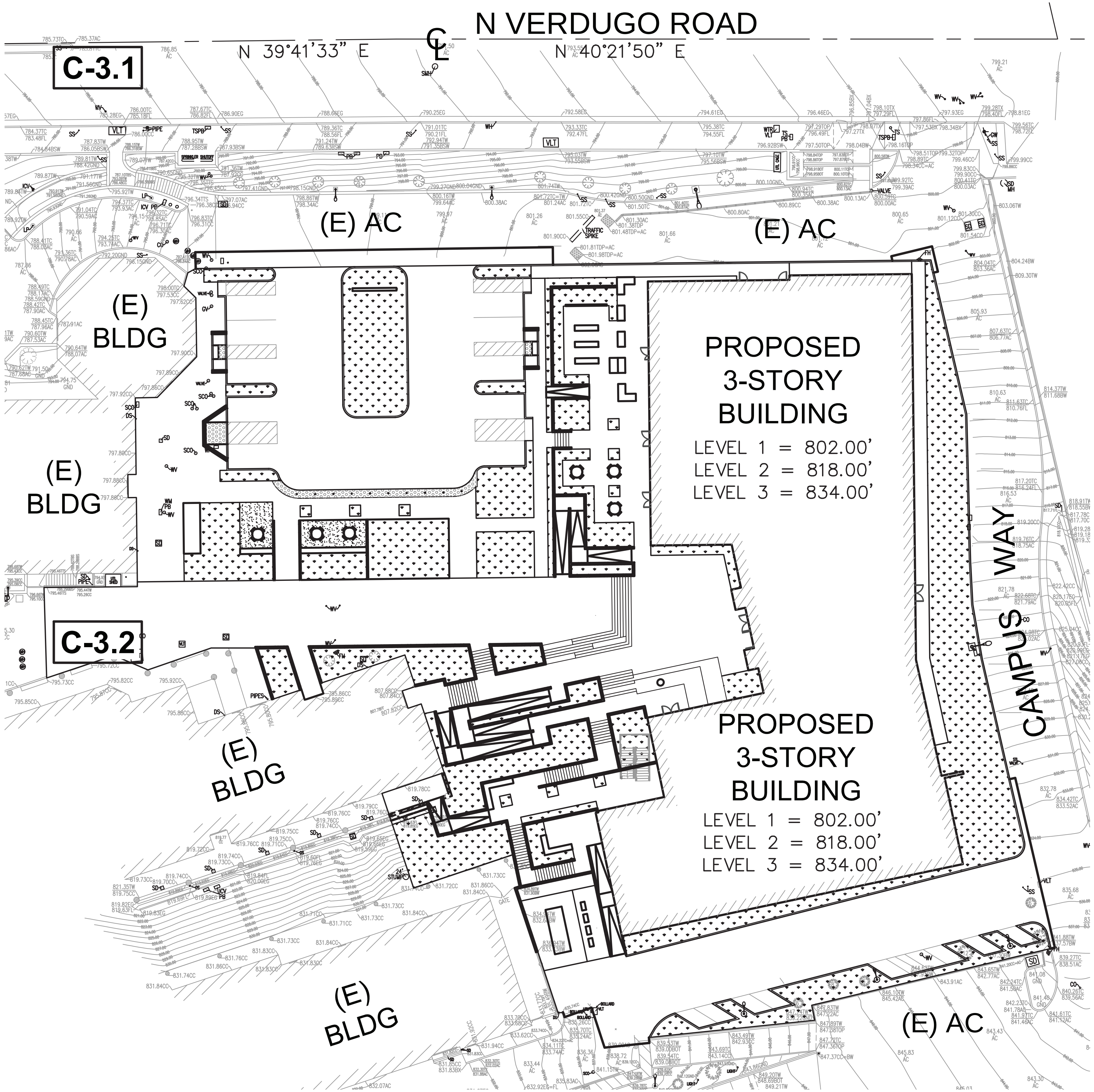
1. FOR CONSTRUCTION NOTES, SEE SHEET C–1.1.
2. REFER TO ARCHITECTURAL DRAWINGS FOR OTHER SITE DIMENSIONS AND IMPROVEMENTS NOT SHOWN ON THIS DRAWING.

## COMPOSITE SITE CONTROL PLAN

40 20 0 40 80

SCALE: 1" = 40'

C-2.0

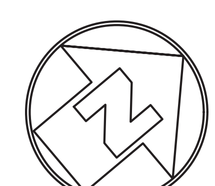



## ESTIMATED EARTHWORK

CUT VOLUME: 13.400 CYDS
FILL VOLUME: 300 CYDS

NET VOLUME: 13,100 CYDS (CUT)

1. THE ESTIMATED QUANTITIES PROVIDED ABOVE ARE FOR REFERENCE ONLY TO BE USED FOR ROUGH GRADE PLANNING.
2. ESTIMATED EARTHWORK ABOVE IS BASED ON DESIGN FINISH GRADES TO EXISTING GRADES IN SURVEY. THE ESTIMATED EARTHWORK DOES NOT CONSIDER THE THICKNESS OF PROPOSED PAVEMENT MATERIAL SECTIONS, FOUNDATION AND SLAB ON GRADE VOLUMES, THE REMOVAL OF ANY UNSUITABLE MATERIAL, AND TOP SOIL OR VEGETATION FROM CLEARING AND GRUBBING.
3. THE ESTIMATED EARTHWORK QUANTITIES DO NOT INCLUDE SHRINKAGE FACTORS DUE TO COMPACTION OR ANY OVER EXCAVATION QUANTITIES.
4. THE CONTRACTOR SHALL CALCULATE HIS OWN EARTHWORK QUANTITIES NECESSARY FOR HIS BID AND WORK. VCA IS NOT RESPONSIBLE AND LIABLE FOR THE CONTRACTOR'S EARTHWORK CALCULATIONS.
5. ESTIMATED EARTHWORK QUANTITIES ABOVE ASSUME THAT ALL ON-SITE MATERIALS ARE SUITABLE FOR BACKFILLING. HOWEVER, ACTUAL EXISTING ON-SITE MATERIALS AND IMPORTED MATERIALS MUST FIRST BE APPROVED BY THE GEOTECHNICAL ENGINEER PRIOR TO INSTALLATION, REMOVAL, OR REPLACEMENT.
6. THE ESTIMATED EARTHWORK QUANTITIES DO NOT INCLUDE OVEREXCAVATION.

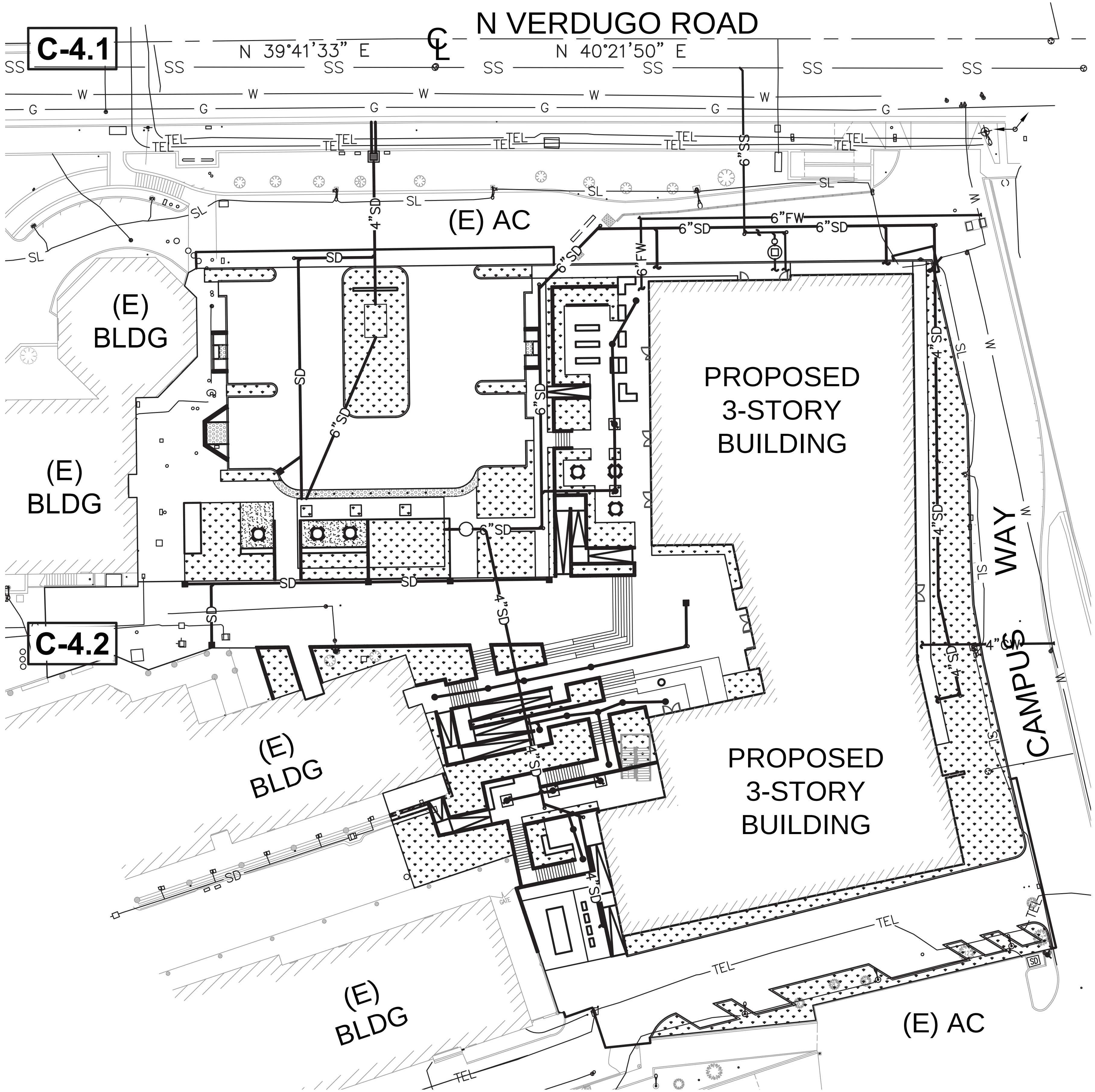


## COMPOSITE SITE GRADING PLAN

40 20 0 40 80

SCALE: 1" = 40'

C-3.0




## LEGEND:

| | |
|---|---|
| SD | PROPOSED STORMDRAIN LINE |
| 6"SS | PROPOSED SANITARY SEWER LINE |
| 4"CW | PROPOSED DOMESTIC WATER LINE |
| 6"FW | PROPOSED FIRE WATER LINE |

## SHEET NOTES:

1. FOR CONSTRUCTION NOTES, SEE SHEET C–1.1.

## COMPOSITE SITE UTILITY PLAN

40 20 0 40 80

SCALE: 1" = 40'

C-4.0

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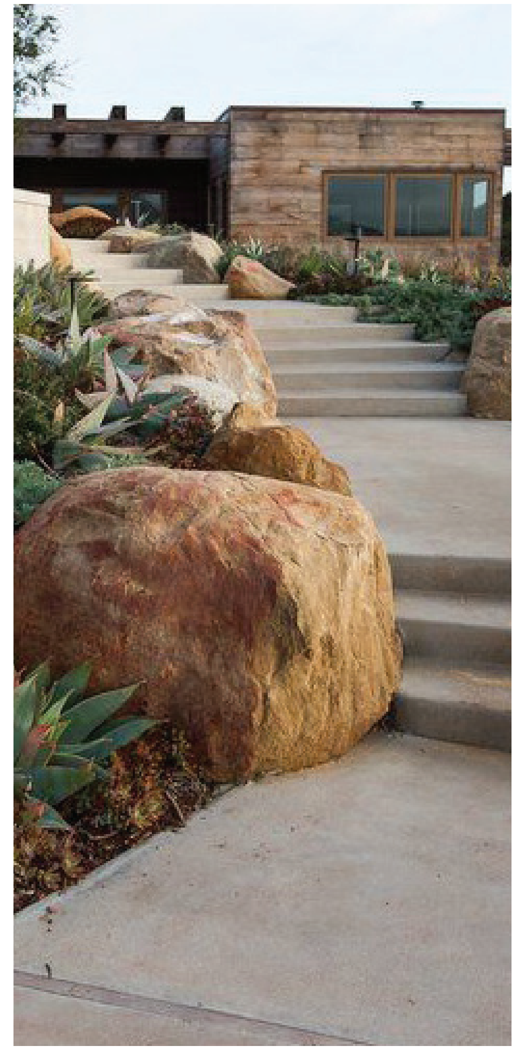
S//03

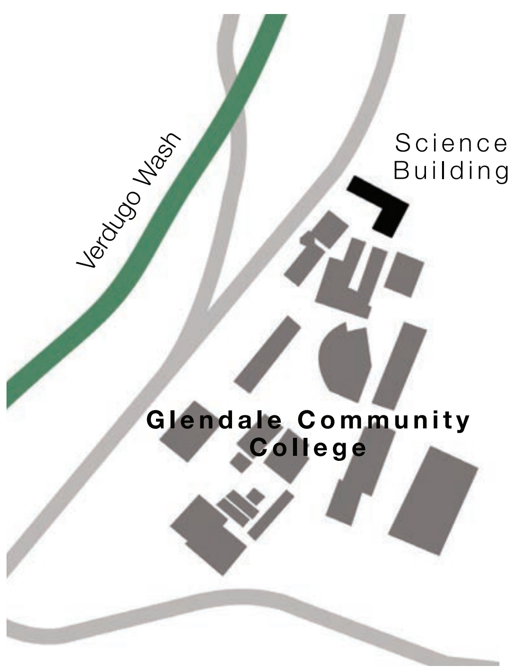
# LANDSCAPE

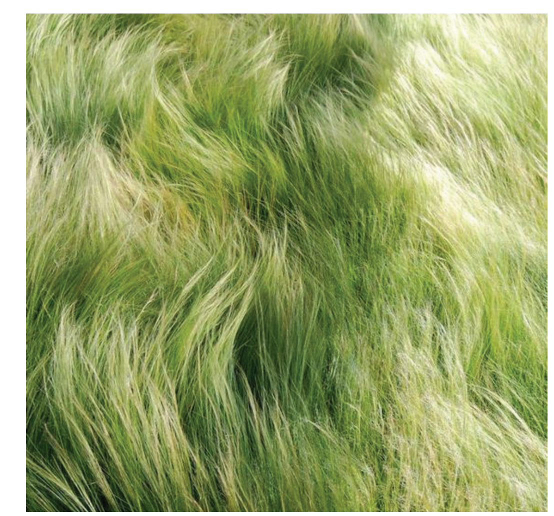
Situated between the Verdugo Mountains to the west and the San Rafael Hills to the east, the new Glendale Community College Science Building sits in a small valley adjacent to the Verdugo Wash. Beginning in the Crescenta Valley, the Verdugo Wash curves around the Verdugo Mountains as it makes its roughly nine mile journey to the Los Angeles River. Once a natural streambed collecting the seasonal flows from the surrounding ravines, the wash was channelized and encased in concrete in the early 1930's.

The site design for the new Science Building seeks to connect to the Verdugo Wash's original form and natural setting, anchoring the site to the campus's regional context. The dramatic grade change on site becomes and opportunity to echo the cascading and riparian feel of the Verdugo Wash as it tumbled over boulders and stone, through forest and chaparral.

The following images are examples of how this concept may manifest itself in the landscape. Boulders line the sequence of stairs that flow down from the upper to lower levels. A series of terraced planters manages the grade change on the south side of the new building, with understory planting hanging down the walls and softening the concrete This concept, of revealing the natural environment, continues through the site as it moves down the grand staircase to the arrival court and through out the student gathering spaces and seating areas.





# LANDSCAPE NARRATIVE

SCIENCE BUILDING | GLENDALE COMMUNITY COLLEGE

The plan to the right divides the site into six programming areas each with a defined purpose and use. The arrival court is the location of the student drop off area with group seating and canopy trees to provide students with a place to meet and make their way onto the campus.

Adjacent to the building, in the southwest corner, is the outdoor classroom. This area, defined by an outdoor chalkboard and group seating, provides opportunities for outdoor classes and study space.

Leading into the main entry to the Science Building is the promenade, creating a sense of arrival and connecting the science building to the central campus.

Situated between the Science Building and the Advanced technology center is the grand staircase. A sequence of steps and ramps connect the varying levels and entries of the two buildings. While boulders and hanging plants softened the space and connect to the historic landscape.

The upper terrace becomes and extension of the interior space and offers students a place to study and provides an area for outdoor classes.

The thin strip running along the northern face of the building is defined by large screening trees and shrubs to create a vegetated buffer between the building and the adjacent residential community.

The following images give an idea of the look and feel of each of these zones.

**Legend**

**Arrival Court**
Allée of Trees
Communal Seating
Student Drop Off

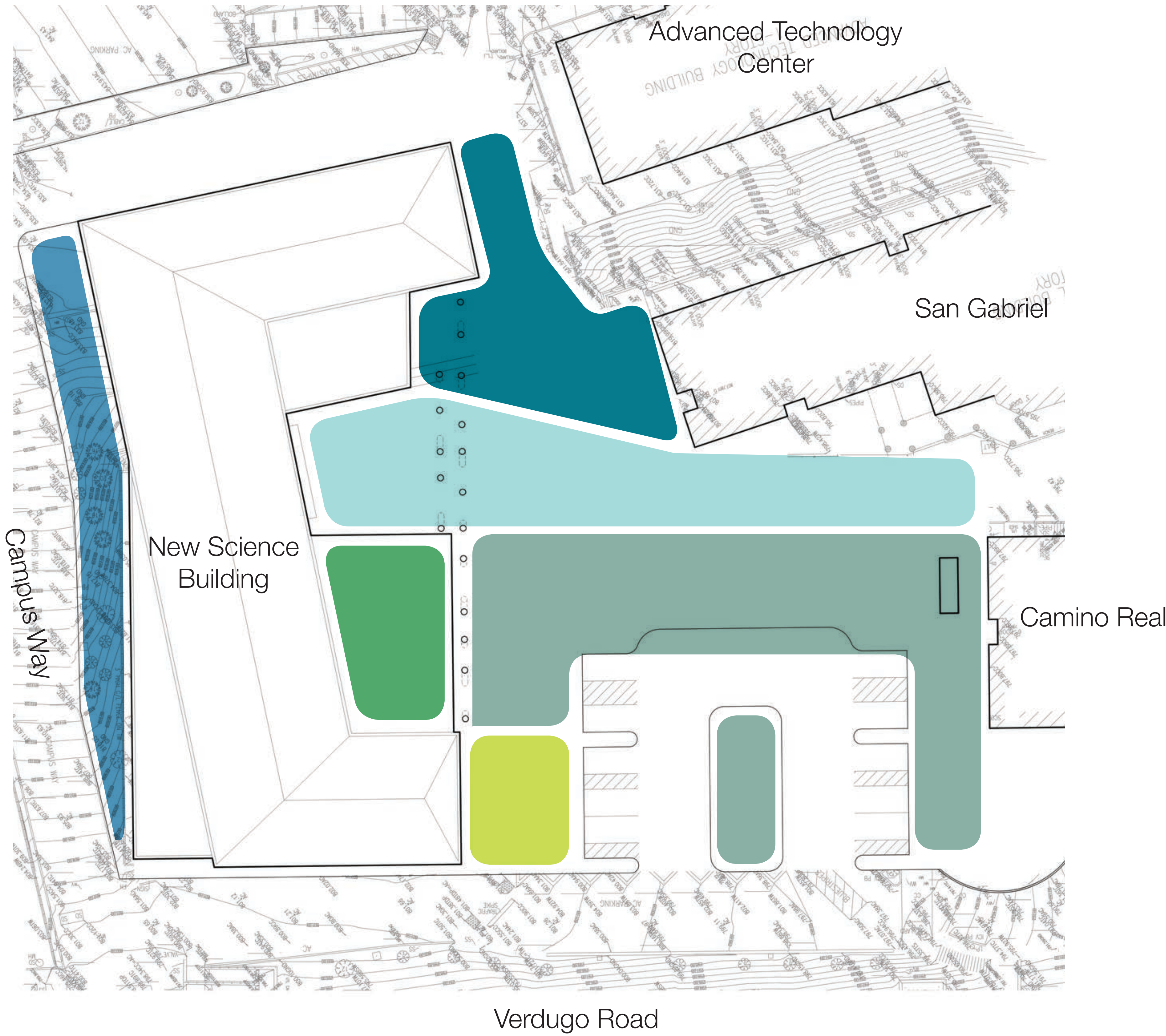
**Outdoor Classroom**
Outdoor Chalkboard
Group Seating
Canopy Trees

**Promenade**
Transitional Paving
Sense of Arrival
Building Entry

**Grand Staircase**
Seat Walls
Tiered Seating
Terrace Planting

**Upper Terrace**
Study Space
Outdoor Classroom
Group Seating

**North Buffer**
Dense Planting



**Arrival Court**

Allee of Trees
Communal Seating
Student Drop Off



**Outdoor Classroom**

Outdoor Chalkboard
Group Seating
Canopy Trees



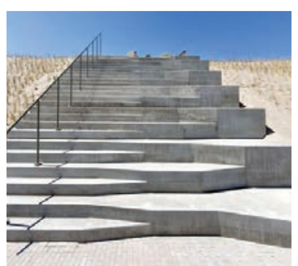
**Promenade**

Transitional Paving
Sense of Arrival
Building Entry



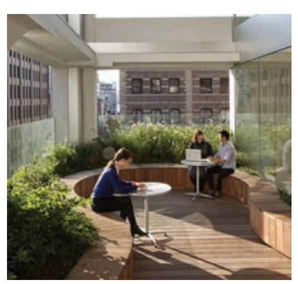
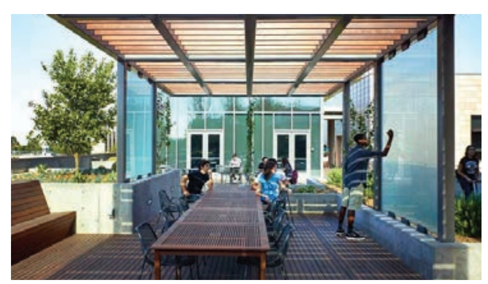

**Grand Staircase**

Seat Walls
Tiered Seating
Terrace Planting




**Upper Terrace**

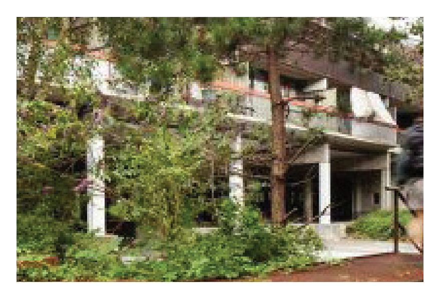
Study Space
Outdoor Classroom
Group Seating

**North Buffer**

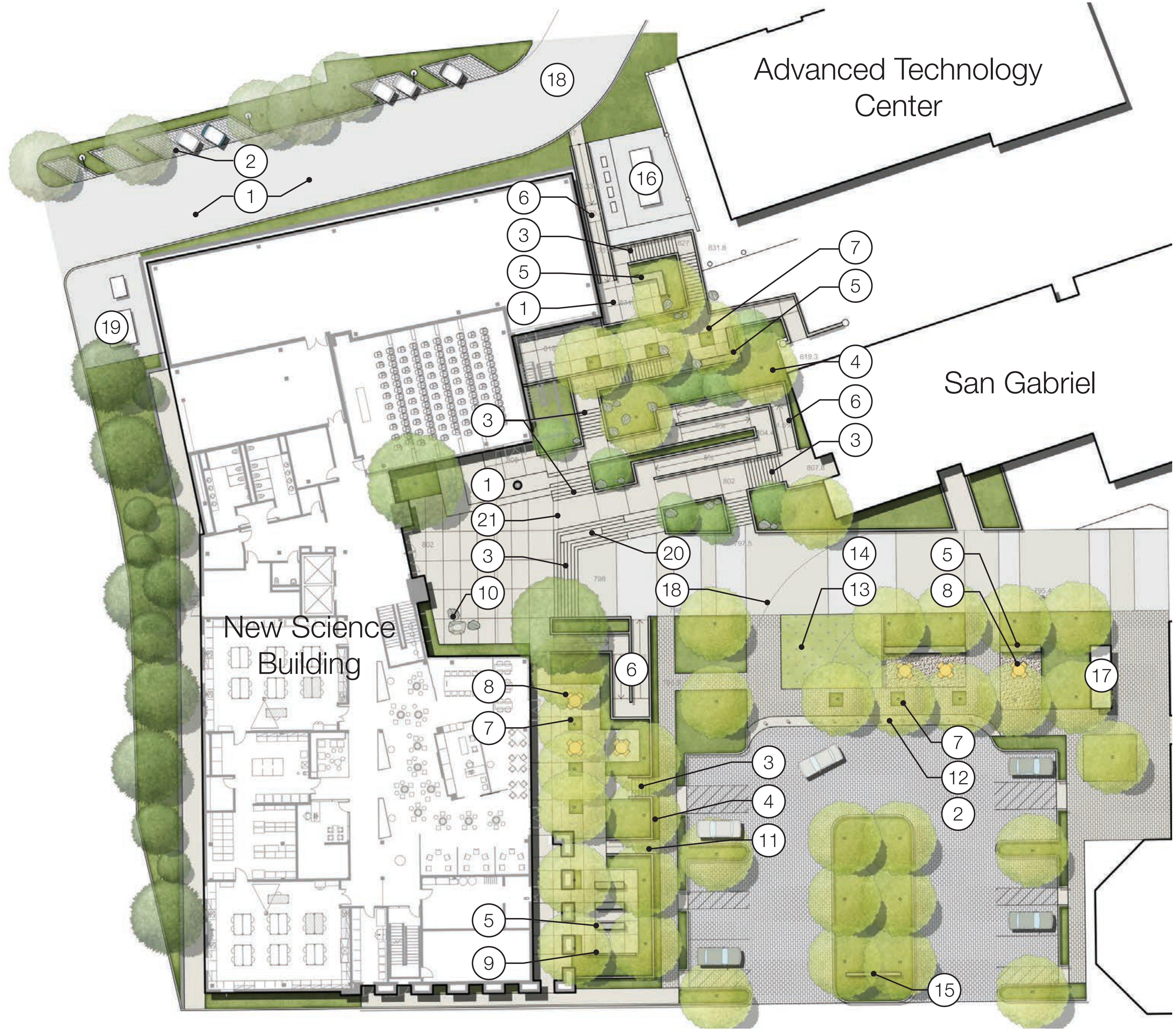
Dense Planting





**Legend**

1. Concrete Paving
2. Permeable Concrete Pavers- Vehicular
3. Concrete Steps
4. Concrete Planter Wall
5. Seat Wall
6. ADA Ramp
7. Tree Grate
8. Group Seating
9. Chalkboard Wall
10. Decorative Boulders
11. Maintenance Access Ramp
12. Bollards @ Zero Curb
13. Turf Block
14. Entry Promenade with Concrete Banded Paving
15. Entry Sign
16. Generator
17. Existing Elevator to Remain
18. Fire Access Lane
19. Transformer
20. Integrated Seat Walls in Steps
21. Canopy Edge Above



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S//03

# LAB PLANNING

**APPLICABLE CODE COMMENTARY**

**California Building Standards Code**

**Occupancy:** Because the laboratory areas are educational spaces above the 12th grade, as allowed by paragraph 304.1, the laboratory areas should be classified as Business Group B occupancy except where not allowed as described below.

**Hazardous Materials:** Control Areas in Group B occupancies may contain up to the maximum quantity of the exempt amounts of hazardous materials as listed in Tables 307.7 (1) and (2), including allowable increases for buildings provided with automatic fire suppression and approved storage cabinets. A Control Area can be made up of several laboratories, an entire floor, or an entire building; a multi-story Control Area is allowed. The floor area of a Control Area is not limited. The number of Control Areas per floor and the percentage of the maximum allowable quantities of hazardous materials per floor are listed in Table 414.2.2. Control Areas containing hazardous materials exceeding the exempt amounts must be classified as Group H occupancies as indicated in the tables and constructed as required.

**Fire Resistance Rating Requirements:** Control Areas shall be separated by fire barriers of fire-resistance ratings listed in Table 414.2.2. The floor assembly of Control Areas and the construction supporting the floors of the Control Areas shall have a minimum 2-hour fire resistance rating. A 1-hour fire resistance rating is allowed in buildings of Types IIA, IIIA, and VA construction provided the building is equipped with an automatic sprinkler system and is three stories or less above the grade plane.

**Exits:** Spaces in Group B with more than 50 occupants shall have two or more exits or exit access doorways.

**OTHER STANDARDS**

While the following provisions from other standards are not specifically referenced by the building code, they provide specific laboratory design recommendations.

**NFPA 45: Fire Protection for Laboratories Using Chemicals**

**Means of Egress:** The means of egress for laboratory units and laboratory work areas should comply with NFPA 101.

**Access to Exits:** A second means of access to an exit shall be provided from a laboratory work area if any of the following situations exist:

- A laboratory work area contains an explosion hazard so located that an incident would block escape from or access to the laboratory work area.
- A Class A laboratory work area which exceeds 500 SF or a Class B, C, or D laboratory work area which exceeds 1,000 SF.
- A fume hood in a laboratory work area is located adjacent to the primary means of exit access.
- A compressed gas cylinder in use which is larger than lecture bottle size or a cryogenic container in use, and contains a gas which is flammable or has a hazard rating of 3 or 4 and would prevent safe egress in event of accidental release of cylinder contents.

The required exit doors of all laboratory work areas within Class A or Class B laboratory units shall swing in the direction of exit travel.

**Furniture and Equipment:** Furniture and equipment in laboratory work areas shall be arranged so that means of access to an exit may be reached easily from any point.

**Explosion Hazard:** Explosion hazard is considered to exist if reactivity rating 4 materials are stored or used, or if highly exothermic reactions or procedures without established properties are planned, or if high pressure reactions are planned.

**NFPA 30 - Flammable and Combustible Liquids Code**

**Liquid Classification**

Combustible liquids have a flash point at or above 100° F (37.8°C) and are classified as follows:

- Class II: Liquids with a flash point at or above 100°F (37.8°C) and below 140°F (60°C)
- Class III A: Liquids with a flash point at or above 140°F (60°C) and below 200°F (93°C)
- Class III B: Liquids with a flash point at or above 200°F (93°C)

Flammable liquids have a flash point below 100°F (37.8°C) and a vapor pressure not greater than 40 lbs per square inch (absolute) (2,068 mm Hg) at 100°F (37.8°C). Flammable liquids are classified as follows:

- Class I A: Liquids with flash point below 73°F (22.8°C) and a boiling point below 100°F (37.8°C).
- Class I B: Liquids with flash point below 73°F (22.8°C) and a boiling point at or above 100°F (37.8°C).
- Class I C: Liquids with flash points at or above 73°F (22.8°C) and below 100°F (37.8°C).

**Storage Cabinets:** Not more than 120 gallons (454 L) of Class I, Class II, and Class III A liquid may be stored in a storage cabinet. The total aggregate volume of Class I, Class II, and Class IIIA liquids in a group of storage cabinets shall not exceed the maximum allowable quantity of flammable and combustible liquids per control area based on the occupancy where the cabinets are located. Storage cabinets shall meet the requirements set forth in 9.5.3.

**ANSI/AIHA Z9.5 Laboratory Ventilation**

**Air Recirculation**

Non-laboratory air. Air from building areas adjacent to the laboratory may be used as part of the supply air to the laboratory if its quality is adequate.

General room exhaust. Air exhausted from the general laboratory space (as distinguished from exhaust hoods) shall not be recirculated unless one of the following sets of criteria is met:

1. Criteria A
   a. There are no extremely dangerous or life-threatening materials used in the laboratory.
   b. The concentration of air contaminants generated by the maximum credible accident will be lower than short-term exposure limits;
   c. The system serving the exhaust hoods is provided with installed spares, emergency power, and other reliability features as necessary.
2. Criteria B
   a. Recirculated air is treated to reduce contaminant concentrations to those specified in 4.3;
   b. Recirculated air is monitored continuously for contaminant concentrations or provided with a secondary backup air cleaning device that also serves as a monitor (i.e., a HEPA filter in a series with a less efficient filter, for particulate contamination only);
   c. Provision of 100% outside air, whenever continuous monitoring indicates an alarm condition.

In addition to the above standards it will be necessary during the design phases of the project to work closely with the representatives of Glendale College. The project team may need to incorporate additional requirements as laboratory and support spaces are more definitively developed.

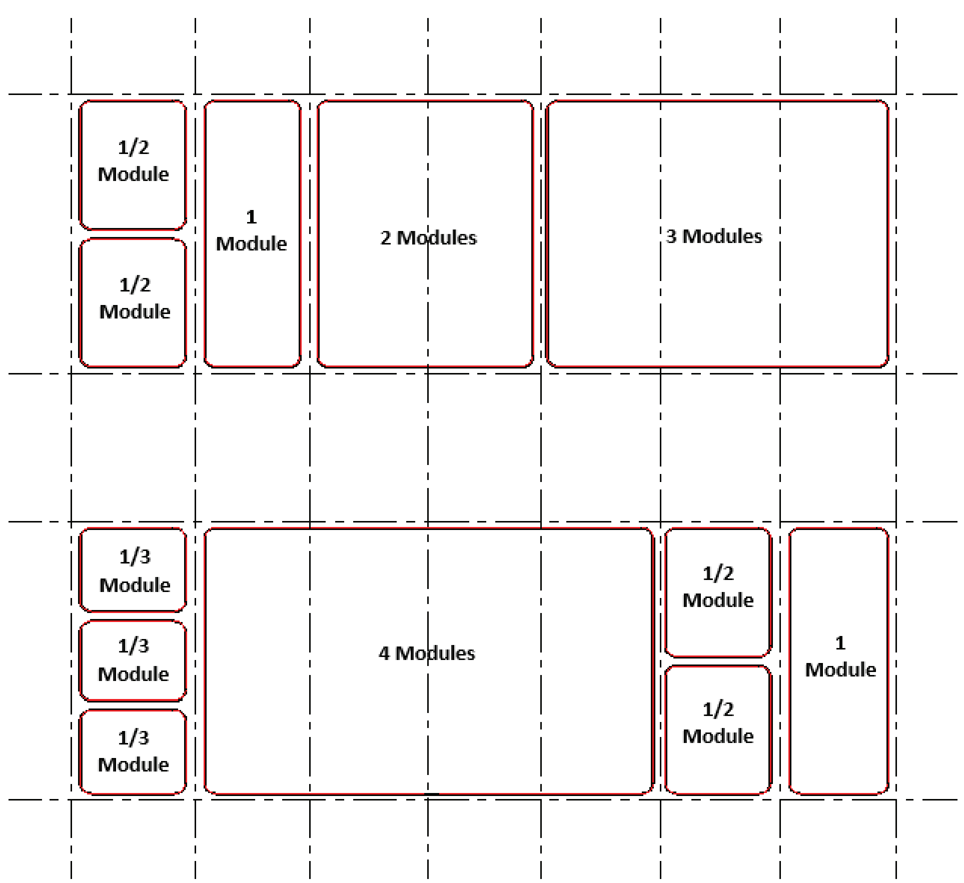
# LAB-CODE COMMENTARY

**MODULAR PLANNING & FLEXIBILITY**

Laboratories should be organized around modular planning principles so they are constructed with standardized units or dimensions for flexibility and a variety of uses. Modular planning is used as an organizational tool to allocate space within a building. The module establishes a grid by which walls and partitions are located. As modifications are required because of changes in laboratory use, instrumentation, or departmental organization, partitions can be relocated, doors moved, and laboratories expanded into larger laboratory units or contracted into smaller laboratory units without requiring reconstruction of structural or mechanical building elements.

The planning modules may be combined to produce large, open laboratories or subdivided to produce small instrument or special-use laboratories.

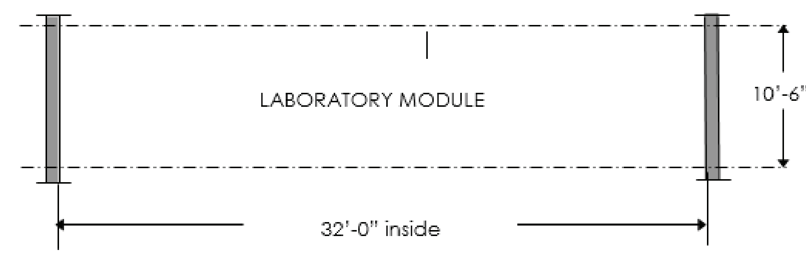
The above description of the planning module also includes the organized and systematic delivery of laboratory piped services, HVAC, fume hood exhaust ducts, power and signal cables. If these services are delivered to each laboratory unit in a consistent manner, then changes in laboratory use requiring addition or deletion of services will be easy to accomplish because of the constant nature of the infrastructure.




**MODULAR PLANNING & FLEXIBILITY**

The laboratory planning module dimensions should result from analyzing the laboratory bench space, equipment and circulation space.

- The bench dimensions should accommodate technical work stations, instruments, and procedures.
- The space between benches is designed to allow people to work back-to-back at adjacent benches, allowing accessibility for disabled and movement of people and laboratory carts in the aisle.
- The module should provide adequate bench space for floor standing equipment. Based on the above requirements and anticipated occupant loads the laboratory planning module for the New Science Complex is recommended to be 10'-6" wide by 32'-0" as shown below.




Island benches which are generally 5'-0" deep for double-sided use and wall benches 2'-6" deep are anticipated to accommodate the types of activities and instruments to be used in the New Science Complex.  In all cases the dimensions and configurations of the cabinets below the benches must be carefully coordinated with clearances needed for installing plumbing and electrical equipment and services.

A 5'-0" minimum aisle between benches will minimize circulation conflicts and reduce potential safety hazards and should be provided wherever possible.  It is critical in all laboratory spaces that students and instructors are able to maneuver without conflict in all aisles.

**CIRCULATION**

The design of the New Science Complex should assure effective external circulation for people accessing the building, delivery of materials and equipment and the removal of the laboratory waste on periodic basis.

Internal building circulation should provide safe pedestrian egress from each individual laboratory and laboratory support space through an uncomplicated path of egress to the building exterior at grade. The circulation system should accommodate the preferred adjacencies identified for the relationships between laboratories and laboratory support spaces and between laboratories and offices.

At least one door into each laboratory space should ideally have a minimum 52" wide clear opening. This can be accomplished using doors with 3'-0" active leaf and one 1'-6" inactive leaf.

Equipment lists should be carefully reviewed to verify that individual pieces of equipment can be transported and maneuvered between spaces. Future equipment should be anticipated.

Main interior circulation corridors are recommended to be a minimum 8'-0" width

Doorways accessing corridors should open into recessed alcoves serving the corridor. The doors should swing out from laboratories, in the direction of exit.

Circulation and fume hood locations within laboratory spaces should be coordinated to preclude primary exiting in front of the fume hoods.

**INTERACTION**

The design of the New Science Complex should develop concepts that would directly support interaction at different levels. Interaction areas should be linked to the circulation schemes.  Interaction spaces can be developed within laboratories, between laboratories and other spaces, on each floor and in public areas.

Informal interaction spaces can include:

- Casual meeting/interaction spaces for short duration interaction.
- Outdoor gathering spaces should be highly visible and inviting.
- Display/announcement boards serves as gathering places for informal contact.
- Connections to other campus facilities will facilitate interaction with faculty and staff in nearby buildings.

**ACCESSIBILITY**

The New Science Complex must conform to applicable local, state and federal regulations for providing accessibility to persons with disabilities. Early considerations should be given to the following accessibility aspects:

- All parts of the building shall be accessible by persons with disabilities (subject to certain limited exceptions in the Standards).
- All faculty lecture or demonstration positions should be accessible to persons with disabilities.
- All staff preparation areas should provide a path of travel accessible by persons with disabilities.
- Accessible work stations, sinks, fittings and fume hoods for employees should be provided in the laboratories, faculty demo areas, and staff prep areas based on the Americans with Disabilities Act Guidelines (ADAAG), college requirements, and any applicable state regulations.
    - o ADAAG does not dictate the quantity of such accessible employee work stations but requires reasonable accommodation in the workplace and encourages provision of such features during design to avoid expensive renovations in the future.
    - o The California Division of the State Architect (DSA) has indicated that all community college prep spaces and the like are considered common use spaces and must therefore include accessible work stations, sinks, fittings, and fume hoods.
- Accessible student work stations including associated sinks, fittings, and storage should be provided in the instructional laboratories for a minimum of 5% of the student stations (rounded up). A minimum of one fume hood, one general purpose laboratory sink, and each type of general use storage in each instructional laboratory should also be accessible.
- Location of accessible work stations should be in close proximity to eyewash and safety showers whenever possible.
- 18” clearance on the pull side and 12” clearance on the push side (when both a closer and latch are present) of the strike side of doors is required for interior doors.

General criteria and guidelines for accessible work stations in laboratories are as follows:

- Work surfaces 30” - 34” above floor with 27” minimum vertical wheelchair clearance below. Adjustable work surfaces can provide a range of possible height adjustments.
- Laboratory service controls and equipment controls should be placed within easy reach for persons with limited mobility and in compliance with codes and standards. Controls should have single-action levers or blade handles for easy operation.
- Aisle widths and clearances adequate for maneuvers of wheelchair bound individuals. Aisles 5’-0” wide are recommended with turnaround areas.

**NOISE CONTROL**

Noise control requires specific attention to design and construction details. The following sound sources should be addressed in the future detailed design of the mechanical and electrical systems:

- Fan noise transmitted to spaces through the duct system or through the building structure. This noise is characterized by a low-frequency rumble and often includes annoying pure tones.
- Noise generated by the excitation of duct wall resonance produced by fan noise, by pressure fluctuations caused by fan instability, and by high turbulence caused by discontinuance in the duct system.
- Noise generated by air flowing past dampers, turning vanes, terminal device louvers, and comprising mid-to-high frequency energy.
- Water circulation system noise caused by high velocities or abrupt pressure changes and is generally transmitted through structural connections.
- Noise and vibration caused by out-of-balance forces generated by the operation of fans, pumps, compressors, etc.
- Magnetostrictive hum associated with the operation of fluorescent lighting ballasts, transformers, or electric motors.
- Elevator equipment noise from motor generators, hoist gear, and counterweight movement; or from hydraulic pump systems.

Other design precautions could include where applicable:

- Conduits should not directly link noise-sensitive spaces, nor should they mechanically bridge vibrationally-isolated building elements using a rigid connection.
- Flexible conduit should be used for connections to isolated floor slabs, walls, and vibrationally isolated mechanical/electrical devices.
- Duct silencers should be considered when duct distance is not sufficient to provide adequate acoustical separation.

Generally, laboratory spaces should satisfy the following preliminary requirements unless more stringent requirements apply:

| Space | Noise Criterion Target Minimum |
|---|---|
| Teaching Laboratories | NC 35 |
| Laboratory Support Room | NC 35 |

These values assume fume sashes are closed and a VAV exhaust systems, and do not take into account adjacencies that may be incompatible and specialized laboratory spaces with large machinery; the design will be evaluated for incompatibilities, and additional mitigation provided, as required.

Noise levels should be less than NC 50 at a distance of 36 inches from fume hoods.

**VIBRATIONS/STRUCTURAL CONSIDERATIONS**

The common sources of vibration in the New Science Complex are the adjacent road traffic, footfall traffic on supported floor and mechanical equipment. Minimizing vibration from these sources should be implemented by structural and mechanical design. Special structural consideration maybe required for specific areas of the building.

Uniform live load shall not be less than minimum uniformly distributed loads required by structural code. For vibration considerations, laboratory areas should ideally be designed for 100 psf uniform live load for new construction. Concentrated loads may produce a greater load effect.

Human activities and operating machines are the most significant sources of vibration at above-grade building levels.

Footfall-induced vibrations and steady-state operating machine vibrations should be alleviated by:

- Increasing the stiffness of the floor by combinations of floor mass and depth.
- Confining heavily traveled areas to regions near column lines.
- Placing sensitive equipment near columns.
- Placing the equipment away from heavily traveled areas.
- Minimizing the length of spans.
- Cast-in-place concrete floor solutions.

Building mechanical systems are major source of vibration. Air handling equipment and ductwork should be selected and installed to minimize vibration. Equipment should be isolated from supporting structure with resilient mounts. Vibration isolators should be selected based on floor stiffness, span extension, equipment power and operating speed.

Vibration criteria for areas intended to accommodate sensitive equipment are based on rms Velocity Level as measured in one-third octave bands of frequency over the range of 8-100 Hz. Generic Vibration Criterion (VC) curves have been developed for different types of equipment. The results are shown in the table below.

Criterion curves VC-A through VC-E are applicable to science and engineering facilities. International Standards Organization (ISO) criteria for human exposure to vibration are also shown.

It is recommended that for long term optimum laboratory use and function, the design of the structural floor system should meet the VC-A criterion (2,000 µin/s) or, if that is cost prohibitive, one category lower (4,000 µin/s). The design should follow the AISC Guidelines of Design for Sensitive Equipment.

**Design Criteria for Sensitive Instrumentation and Equipment not otherwise Vibration-Isolated**

| Criterion Curve | $V_{rms}$ Velocity Level | | Detail Size (µm) | Description of Use |
|---|---|---|---|---|
| | (µin/s) | (dB) Ref:1µin/s | | |
| Workshop (ISO) | 32,000 | 90 | N/A | Distinctly felt vibration. Appropriate to workshops and non-sensitive areas. |
| Office (ISO) | 16,000 | 84 | N/A | Felt vibration. Appropriate to offices and non-sensitive areas. |
| Residential Day (ISO) | 8,000 | 78 | 75 | Barely felt vibration. Sleep areas in most instances. Probably adequate for computer equipment, probe test equipment and low-power microscopes (to 20X). |
| **Op.Theatre (ISO)** | **4,000** | **72** | **25** | **Vibration not felt. Suitable for sensitive sleeping areas. Suitable in most instances for microscopes to I00X and for other equipment of low sensitivity.** |
| **VC-A** | **2,000** | **66** | **8** | **Adequate in most instances for optical microscopes to 400X, microbalances, optical balances, proximity and projection aligners, etc.** |
| VC-B | 1,000 | 60 | 3 | Optical microscopes to I000x, inspection and lithography equipment (including steppers) to 3 micron-meter line widths. |
| VC-C | 500 | 54 | 1 | A good standard for most inspection equipment and lithography to 1 micron micron-meter detail size. |
| VC-D | 250 | 48 | 0.3 | Suitable in most instances for the most demanding equipment including electron microscopes (TEMs, SEMs, AFMs) and E-Beam systems, operation to the limits of their capacity. |
| VC-E | 125 | 42 | 0.1 | A difficult criterion to achieve in most instances. Assumed to be adequate for the most demanding of sensitive systems including long path, laser-based, small target systems and other systems. |

Note: Detail Size represents the minimum width of fabrication details or size of research particles that could be handled at a specific criterion value.

## HVAC/SAFETY

The laboratory HVAC system should promote the safe operation of the building, health and comfort of the occupants and safe outside environment. The laboratory environment must be free of hazardous substances. Harmful vapors, gases, particulates or biological agents must be contained at the source and continuously removed from the any laboratory in which they are present.

The HVAC design should be based on regulatory requirements and guidelines along with good engineering practices. Code requirements are a minimum standard.

## PRIMARY CONTAINMENT

The primary containment in laboratory ventilation consists of Laboratory Fume Hoods which operate under negative pressurization with respect to the laboratory, preventing the personnel exposure to hazardous materials.

### Laboratory Fume Hoods

Laboratory fume hoods will be factory certified. Field certification "As Installed" will also be required prior to fume hood use in the laboratory.

Hood sash movement may be vertical, horizontal or a combination of both.

Laboratory fume hoods shall be designed to maintain an average face velocity of 100 feet per minute ±10%. For energy saving considerations, the design sash position should be 60% of maximum hood opening. Vertical sash stops shall be provided at design sash position. The location shall be labeled. The sash should be fully open only during set-up or take-down operations.

The constant volume fume hoods will develop face velocities below 100 feet per minute when the sash is raised above the design operating position of 18". Under no circumstances shall face velocities drop below 60 fpm. Variable air volume fume hoods maintain constant face velocities by controlling the exhaust flow relative to the sash position.

Consideration can be given to "low flow" or "low face velocity" fume hoods operating at face velocities less than 100 feet per minute. However, the safe use of these hoods often requires special training and procedures potentially making them inappropriate for novice lower division students, and Cal/OSHA prohibits their use under normal circumstances.

Each fume hood shall be equipped with a flow-measuring device and should be monitored locally to allow convenient confirmation of adequate hood performance. All laboratory fume hoods must be equipped with visual and audible alarms warning of unsafe airflow. The fume hoods should be located away from interfering drafts, airflow disturbances, supply air openings and pressure differentials created by the swing of doors.

### Other Exhaust Equipment

Canopy Hoods - Hoods over work areas or equipment used to capture heat or steam. The recommended design flow rate is 75 cfm per linear foot of open perimeter.

Vented Cabinets - Cabinets used to store hazardous, corrosive, toxic and other health hazard substances. Cabinets for storage of non-flammable substances are typically vented by connection to the laboratory exhaust system, providing a negative pressurization of the enclosure. Per NFPA 30, Flammable and Combustible Liquids Code, venting of flammable liquid storage cabinets has not been demonstrated to be necessary for fire protection purposes. However, it may be desirable for health or other purposes in which case the recommended method of ventilation should be followed.

Snorkels – Small capturing cones attached to an adjustable exhaust arm, suspended from the wall or ceiling, used to capture heat or fumes from equipment or processes.

## SECONDARY CONTAINMENT

Secondary containment is provided by the negative pressurization of the laboratory space relative to corridors and adjacent spaces where required. Negative pressurization is achieved by controlling the ratio of exhaust to supply air at minimum 110%. Walls surrounding laboratories should extent to structure or a solid ceiling should be provided to ensure proper pressurization is maintained.

Some laboratory spaces may require positive or neutral pressurization.

Doors to laboratories should generally be equipped with closers and should not be held open.

Laboratory spaces serving chemistry and biological purposes in most cases should be continuously ventilated 24 hours per day.

Air from spaces identified as using hazardous materials shall be exhausted outdoors and not recirculated.

Air from offices and laboratories that do not generate odors, chemical, biological or other type of hazard may be recirculated.

Supply air should be effectively distributed into all portions of the laboratory space. Supply air distribution should not create drafts in front of laboratory hoods. The maximum supply air velocity 6 feet above the floor, in front of fume hoods shall be less than 50% of the fume hood face velocity.

## EMERGENCY AND STANDBY POWER CONSIDERATIONS

Measures involving emergency and standby power should be approved by the Authority Having Jurisdiction.

Emergency power supply should be implemented if a definite potential for catastrophe such as explosion, fire, violent ejection of chemicals or other life-threatening situations is present. Fire detection and alarm systems, elevators, fire pumps, public safety, communication and monitoring systems and processes where current interruption would produce serious life safety or health hazard should be on emergency power.

Standby power is recommended to serve loads such as heating, ventilating and refrigerating systems, smoke removal, sewage disposal systems, lighting systems, data processing, communication systems, and processes that, when stopped, could create a hazard, discomfort, significant or costly interruption or damage to product or process.

It is generally recommended that standby power should be provided to exhaust fans of the manifolded system serving laboratory areas.

Momentary or extended losses of power shall not change or affect any of the control system setpoints, calibration settings, or emergency status.

## HVAC/ADAPTABILITY

Laboratory ventilation systems should be designed to be adaptable to changes of teaching protocols and building operation.

Modularity is the key concept to an adaptable laboratory HVAC system. The laboratory module may support various functions over the life of the building.

If possible, the laboratory HVAC system should be designed as an assembly of repetitive modules. Each laboratory planning module will have supply air diffusers, exhaust grilles, terminal air flow control device, with capability for individual temperature control based on zoning.

The laboratory ventilation system should be flexible, allowing timely and cost effective changes over time without affecting the performance and operation of the building HVAC system.

The HVAC system should be flexible and provide spare capacity to accommodate changes of the laboratory space allocation or laboratory designation.

The HVAC system design should have the capability of supporting additional future fume hoods.

Some laboratory spaces that exceed the average air flow requirements may need special HVAC considerations.

**HVAC/DESIGN CRITERIA**

**FILTRATION**

It is recommended that laboratory air handling units shall be provided with pre-filters and final filters. Pre-filters should be minimum, 30-35% ASHRAE efficiency. Final filters should be minimum 80-95% ASHRAE efficiency.

Laboratory supply and exhaust systems should be design for adequate static pressure for maintaining air flow capacity with fully loaded filters.

**VENTILATION RATES**

The air flow rate for each laboratory space should result from the uppermost of the following criteria:

- Minimum air changes per hour.
- Laboratory heat gain.
- Exhaust requirements from fume hoods and other exhaust equipment.

Minimum Air Changes per Hour

Minimum outdoor air in laboratory facility spaces shall comply with ASHRAE Standard 62.1-2007 requirements or local code, whichever is stricter.

Laboratories generating odors or chemical, biological or other type of hazard shall be 100% exhausted to the outdoors. Air from offices and laboratories that do not present any risk of hazard may be recirculated. Supply air could consequently be 100% outdoor air or mixture of outdoor and recirculated air.

In laboratories exhausting 100% air to the outside, minimum air changes shall comply with OSHA 29 CFR Part 1910, p. 3332, 4. (f) OSHA 1990b), which recommends 4 to 12 air changes per hour if local exhaust hoods are used as the primary method of control. The exhaust air and the minimum design air exchange rates are recommended in Table H2.

**Table-H2 Exhaust Ratios and Minimum Air Changes**

| Space | Exhaust Air | | Minimum Air Changes per Hour | |
|---|---|---|---|---|
| | Minimum | Maximum | Occupied | Unoccupied |
| Laboratory | 100% | 100% | 6 | 4 |
| Laboratory Support | 100% | 100% | 6 | 4 |

***Note: Some laboratory spaces require higher air exchange rates. Refer to Detailed Space Requirements exhibits.***

**Heat Gain from Laboratory Equipment**

Heat gain depends on the type and specifics of the laboratory. Detailed heat gain from laboratory equipment will be provided during the design development phase for each laboratory space. Preliminary heat gain estimated as an average per net laboratory area is as follows:

- Laboratory Equipment: 20 BTUH/ft2 , 6 W/ft2
- Laboratory Support Space Equipment: 35 BTUH/ft2 , 10 W/ft2

**Exhaust Equipment Requirements**

The design exhaust flow from typical laboratory equipment is shown in Table H3. A complete schedule of exhaust equipment will be issued during the design development phase.

**Table H3 - Typical Exhaust Equipment Flow rates**

| Equipment | Design Flow (cfm) | |
|---|---|---|
| **Laboratory Fume Hoods** | **Bench type hood** | **Floor mounted hood** |
| 4' Laboratory Fume Hood | 500 | 850 |
| 5' Laboratory Fume Hood | 650 | 1,150 |
| 6' Laboratory Fume Hood | 800 | 1,400 |
| 8' Laboratory Fume Hood | 1,100 | 1,950 |
| **Biological Safety Cabinets** | **Class II Type A2** | **Class II Type B2** |
| 4' BSC | 400 | 800 |
| 6' BSC | 600 | 1,200 |
| **Canopy hoods** | 75 per linear foot of open perimeter | |
| **Equipment vent/Snorkels** | 60 (min) | 200 (max) |

**MINIMUM LABORATORY HVAC REQUIREMENTS**

The laboratory HVAC system should be controlled to ensure operational safety, regulatory compliance and satisfy process constraints as well as occupant comfort. The designed HVAC control system should provide flexibility and minimize the operational cost of the building.

A typical control system is recommended to provide the following minimal safety requirements in response to abnormal situations:

- Annunciate the equipment failure to a monitoring center and turn on the existing standby equipment.
- Maintain relative levels of pressurization in the laboratories.
- De-energize the supply air handling unit serving laboratory areas, in case of fire or smoke detection. The exhaust fans should continue to operate at a level that facilitates a safe evacuation of the building through doors between pressurized spaces. Reducing the level of exhau st to a desired pressurization could be obtained by ramping down the exhaust fans or by activation of bypass dampers on exhaust plenum. Capability of operating doors under fire alarm conditions must be tested and documented as part of the commissioning process.
- It is recommended that HVAC control systems shall be direct digital control with pneumatic actuation.
- The supply and exhaust air flow regulators must be within ± 5% accuracy of design flow, specifically designed for laboratory use and must be pressure independent. The products must have a minimum of five years of installed field operating history. Commercial components are not acceptable.

**SELECTION OF LABORATORY BUILDING AIR FLOW CONTROL SYSTEM**

Laboratory buildings are complex facilities comprising a variety of spaces and equipment subject to diversified programs. The most versatile air flow control is the variable air volume system (VAV), capable of responding to changes of conditions in the space.

However, teaching laboratory cooling loads vary considerably between occupied and non-occupied periods. The equipment component of cooling load is usually not significant. The air flow driver may be minimum air changes. In such scenario, a two-position constant volume system (CAV) may be appropriate.

Fume hoods in teaching laboratories, are recommended to be VAV, providing stable operation of the hood at constant face velocity. In some situations of low fume hood density, it may be suitable to operate the hood at constant volume, providing the minimum air changes per hour required for the space.

A laboratory VAV control system should perform the following functions:

- Control the hood volumetric flow rate to maintain the constant face velocity,
- Monitor room temperature to provide adequate air flow for removing the room heat gain.
- Monitor room occupancy to provide 100% of operational supply air when space is occupied.
- Reduce the air flow at scheduled level for unoccupied mode of operation,
- Control the fume hood exhaust, the general exhaust and the supply airflow to maintain the laboratory pressurization.
- Provide time delay in changing room air supply and exhaust flow to unoccupied mode based on room occupancy sensor.
- Provide time delay in changing the fume hood flow to standby mode based on fume hood motion sensor.

**HVAC/DUCTWORK AND FANS**

**SUPPLY AIR DUCTWORK**

Supply air duct system should be galvanized steel of minimum 4 inch water gauge pressure class for mains. Branch ducts should be minimum 2 inch class. Sealing, reinforcing and supporting should be according to SMACNA standards.

Lining the supply duct in laboratory spaces is not recommended.

**EXHAUST AIR DUCTWORK**

Fume exhaust ducts, if present, should be constructed of materials compatible with chemicals to be carried in the air stream. Typical selection of exhaust ductwork materials, based on effectiveness and cost criteria, is shown in Table H5.

**Table H5 Exhaust Ductwork Materials**

| Exhaust ductwork | First option | Second option |
|---|---|---|
| Fume hood branch | Stainless steel | PVC coated galvanized steel |
| Exhaust mains | Galvanized steel | |
| Laboratory general exhaust | Galvanized steel | |

Longitudinal sections of exhaust ducts should be continuous seamless tube or continuously welded formed sheet. Horizontal ducting from fume hoods should be sloped down towards the fume hood at 1/8 inch to the foot.

Sound absorbing interior lining or other sound absorbing devices should not be used in the exhaust ductwork.

Velocity in fume exhaust duct should range 1,600-2,000 feet per minute.

Fume hood exhaust ductwork within the building shall be under negative pressure.

Balancing and control dampers of the exhaust system shall fail open in event of failure.

Fire dampers should not be placed in manifolded fume exhaust ducts.

Exhaust air filtration is not generally required for manifolded exhaust systems.

Manifolding the Exhaust Systems

Exhaust ducts from chemical fume hoods and other special exhaust systems within the same laboratory unit may be combined into one common system. A manifold system has the advantage of diluting the effluents inside a combined exhaust system, improving the system flexibility and reducing the initial cost and operating cost. Compatibility of effluents, as defined in ANSI/AIHA Z9.5, should be considered in manifolding the fume hood exhaust. DSA IR M-1 must also be addressed regarding verifying that the manifolded system will not exceed 25% of the LFL (Lower Flammability Limit) per CMC 505.

**EXHAUST FANS**

Fume exhaust fans should be constructed of materials compatible with chemicals present in the exhausted air. They will be located in a separate space under negative pressure in respect to the surrounding spaces and will provide direct access to the outside for fan discharge ducts.

Air exhausted from chemical fume hoods and dedicated exhaust systems shall be discharged above the roof at a location, height, and velocity sufficient to prevent re-entry of chemicals and to prevent exposures to personnel.

**BUILDING EXHAUST STACKS AND AIR INTAKE**

The fume exhaust stacks must be above the highest point of the building, including mechanical penthouses and roof parapets. The height of the fume exhaust stacks will be determined in conjunction with local codes and regulations. The key parameters that affect stack design and location are:

- Stack height
- Discharge velocity
- Volumetric flow rate
- Intake locations

The height of the stacks and their location on the roof are critical to safe building operation and the safe of neighboring sites. Fume exhaust stacks must be minimum 10 feet above the adjacent roof line to avoid exposing the maintenance personnel to the direct upward blast of the fume exhaust.

The design discharge velocity from exhaust stacks generally should be 3,500 to 4,000 feet per minute to counteract any entrainment due to varying wind direction or area environmental features.

Volumetric flow rates of VAV systems should to maintain discharge velocity above a minimum level. This can be accomplished by sizing the stack for the minimum velocity at minimum exhaust flow or by inducing outdoor air into the exhaust stream prior or after the exhaust fan.
Exhaust stacks should not be located within enclosures or architectural screens. Architectural masking structures may be used as long as they do not create recirculating zones of the exhaust discharge and the stack extends at least one diameter above the masking structure.

Entrainment of the harmful fumes from exhaust stacks on the roof into the outside air intakes of building ventilation systems should be prevented. The location and height of the exhaust discharge relative to the building air intakes should be correlated with prevailing wind directions. Outside conditions, surrounding buildings, hills, trees, and other obstacles which can cause turbulent flow around the laboratory building should be considered.

It is recommended that building air intake be located on the lower one-third of the building and high enough above the ground to avoid dust or vehicle exhaust. If located on the roof, air intakes should not be placed near the edges of a wall or roof.

Manifolding the building exhaust system provides a high degree of dilution at stack discharge.

**LABORATORY PIPED SYSTEMS**

**SYSTEMS DESCRIPTION**

Laboratory piped systems distributed throughout the building include: industrial non-potable water, laboratory waste and vent, purified water, vacuum, and natural gas. Refer to the Drawings and Detailed Space Requirements worksheets for specific requirements for each laboratory and laboratory support space.

Laboratory piped systems should be flexible and adaptable to changes. The system design should consist of horizontal mains with points of connection to each laboratory. The systems should be distributed in corridors or other similar arrangements in double-ended horizontal loops through each floor of the building.

The location of the points of connection should be consistent throughout the building for simple identification. Each laboratory unit will have separate shut-off valves on all piping services. The points of connection valves should be fully accessible. All piping components subject to condensation, heat loss or freezing should be insulated and protected by fire-retardant jacket. The piping systems must be labeled for identification.

The design of the laboratory piping systems should include diversity and capacity allowance for future expansion. Laboratory piping is not subject to requirements of NFPA 99 Standard for Health Care Facilities.

**Water Supply Systems**

Industrial Cold Water and Hot Water (ICW, IHW)

Laboratories will be supplied with separate industrial cold and hot water systems protected by central backflow preventers. Industrial water is supplied to laboratory sinks and cupsinks, fume hoods, washing and sterilizing equipment, hose stations, laboratory ice machines, and laboratory equipment. All fixtures utilizing industrial water should have a sign stating "NON-POTABLE WATER, DO NOT DRINK". Maximum water pressure at service outlet should be limited to 80 psi. A minimum of 35 psi should be provided at the most hydraulically remote fixture or equipment. Industrial hot water should be recirculated and distributed at or below 120°F.

Tempered (Tepid) water system (TW)

Tempered (Tepid) water supplying drench hoses and safety shower/emergency eyewash fixtures is potable water at tempered temperature and distributed in a separate loop to each floor. The tempering mixing water valves should be located at the connection of potable water systems to the riser. Usually the tempered water is not recirculated. The frequent use of drench hoses and the scheduled testing of eye washing and safety shower equipment is anticipated to prevent tempered water stagnation.

Purified Water (PW)

A central purified water system should be designed to satisfy the present and future laboratory requirements. Initial cost, operating cost, environmental impact, minimization of chemical use, reliability, and constructability should be considered in selection of the system. The water treatment may include pre-treatment such as softening and carbon filtration, primary treatment of reverse osmosis, and secondary treatment such as deionization, UV filtration, and micron filtration. The level of purification is recommended to satisfy ASTM Type II specifications including minimum resistivity of 1 meg-ohm-cm. More stringent water purity requirements for specific needs, such as ASTM Type I, may be provided by local point-of-use polishing equipment connected to the central purified water system. Each floor should be provided with a piping distribution system independent of other floors. The distribution should be a continuous loop of undiminished pipe size routed to each service location. The branch connection to the service fixture should have a local isolation valve located to minimize the dead-leg.

**Laboratory Vacuum (LV)**

Laboratories should be provided with a centralized vacuum system. The system should be designed to provide 19 to 23 inch Hg negative pressure at the most remote location of vacuum service. The system should include duplex or triplex vacuum pumps, storage tank, controls, and distribution piping.

**Laboratory Natural Gas (LG)**

Natural gas should be supplied at low pressure of 4 to 7 inches of water. Propane may be used in remote locations where natural gas is not available. Each floor and laboratory space should have an isolation valve that is quickly accessible for emergency shutoff. Additional shutoff valves should be provided downstream of the point of connection in accessible locations for controlling the usage of natural gas in teaching laboratories.

**Laboratory Waste System (LW)**

The laboratories should be provided with chemical resistant waste and vent system. Laboratory waste and vent systems should be separate from the general use sanitary system. The two systems should be connected to the site sanitary waste system outside the building footprint.

The release of chemicals is strictly regulated by the Laboratory Protocols that do not permit discharging acids, bases or other chemicals into the laboratory waste system. As a result, the dilution of the effluents in the laboratory waste is significant. Combining laboratory waste with sanitary waste outside of the building provides further dilution. The expected concentration levels may be below the limits imposed by the Authority Having Jurisdiction, potentially making a neutralization tank system for the laboratory waste unnecessary. A sampling pit, in a designated location prior to discharging into the city sewer system, is a common approach for monitoring the concentration of chemicals. However, this proposed approach should be discussed with and approved by the Authority Having Jurisdiction.

Small quantities of chemicals from glass washing activities, accidental spills, or improper usage may be discharged through sinks or cupsinks prior to dilution. Therefore, the sinks, cupsinks and piping materials should be constructed of chemical resistant materials for these residual chemicals in the waste stream.

**PIPING MATERIALS**

The laboratory piping materials should be high quality, resistant to chemical or erosive effects of the conveying fluids. The materials recommended for piped services are shown in Table P2.

**Table P2 - Piping Materials**

| Piping system | Designation | Material and joints |
|---|---|---|
| Industrial Cold Water and Hot Water | ICW/IHW | Type L copper with soldered or brazed joints |
| Purified Water | PW | Unpigmented or homopolymer polypropylene (PP) pipe, valves and fittings with electro-fusion joints |
| Laboratory Vacuum | LV | Type L copper with soldered or brazed joints |
| Natural Gas | NG | Black steel with welded or threaded joints |
| Laboratory Waste and Vent System | LW, LWV | Flame retardant polypropylene pipe with mechanical joints above grade in accessible spaces. Thermally welded joints below grade, behind walls or inaccessible spaces |

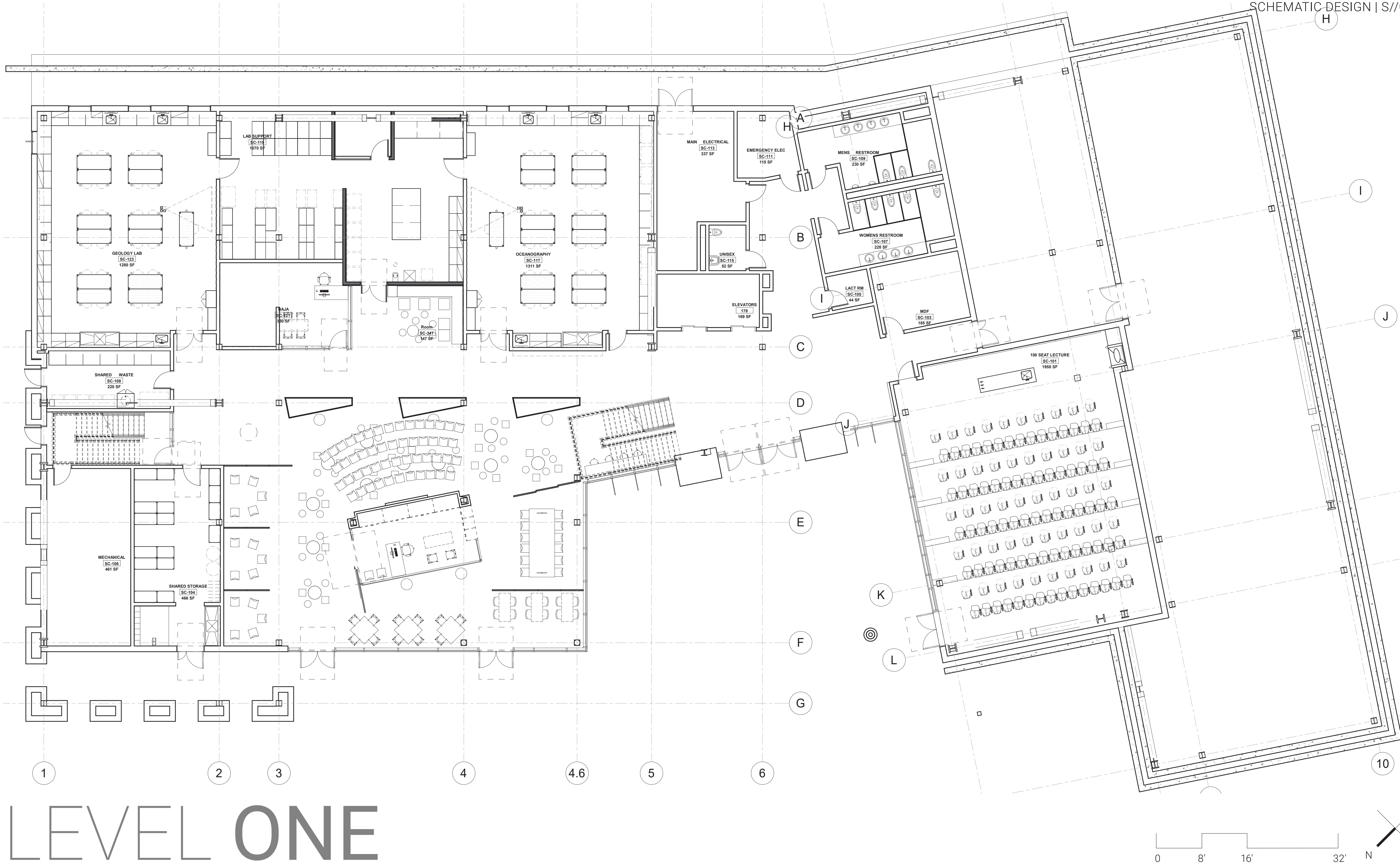
**ELECTRICAL SERVICE AND DISTRIBUTION**

Subject to campus and District standards, 208Y/120 volt power from secondary distribution switchboards should be distributed to laboratory spaces via dedicated panelboards (typical 42 pole), mounted outside individual laboratory spaces, with one panelboard per 2-4 laboratory modules. Panelboards serving laboratory areas should be sized with a 225-amp bus, served with a 225-amp feeder, and provided with a 150-amp main circuit breaker. A minimum of 20% spare capacity should be provided in laboratory panelboard space by floor.

Lighting and non-laboratory area electrical loads should be served by panelboards that do not supply laboratory loads. All non-laboratory electrical panelboards should be mounted in building electrical rooms on each floor, and should be supplied by feeders sized to match the panelboard bus.

## LABORATORY SYMBOLS LEGEND

| SYMBOL LEGEND | DESCRIPTION |
|---|---|
| | PIPE DROP ENCLOSURE |
| | DRYING RACK |
| | ADJUSTABLE WALL SHELVES (2 TIER U.O.N.) |
| | ADJUSTABLE ISLAND BENCH SHELVING (2 TIER U.O.N.) |
| | CYLINDER RESTRAINT |
| | OPEN INDUSTRIAL SHELVING UNIT |
| | SNORKEL FUME EXHAUST - SEE EXHAUST SCHEDULE |
| | OVERHEAD SERVICE CARRIER |
| | SAFETY SHOWER WITH EYEWASH UNIT |
| | WIRE SHELVING UNIT |
| | WATER PURIFIER - OWNER FURNISHED, OWNER INSTALLED |
| | PROJECTION SCREEN (SEE ARCHITECTURAL DOCUMENTS, SHOWN FOR COORDINATION ONLY) |
| | MARKER BOARD (SEE ARCHITECTURAL DOCUMENTS, SHOWN FOR COORDINATION ONLY) |
| | TACK BOARD (SEE ARCHITECTURAL DOCUMENTS, SHOWN FOR COORDINATION ONLY) |
| | COAT HOOKS - (REFER TO DIVISION __ OR SEE ARCHITECTURAL DRAWINGS - SHOWN FOR COORDINATION ONLY) |
| | WALL CABINET - SEE CASEWORK MENU |
| | TALL STORAGE CABINET - SEE CASEWORK MENU |
| | MOVABLE TABLE - SEE CASEWORK MENU |
| | LEG POST UNDER BENCH/TABLE TOP |
| | CHEMICAL FUME HOOD - SEE EXHAUST SCHEDULE |
| | FULL-VIEW CHEMICAL FUME HOOD - SEE EXHAUST SCHEDULE |
| | LAMINAR FLOW HOOD |
| | CONTROLLED ENVIRONMENTAL ROOM PANELS |
| | OWNER FURNISHED, OWNER INSTALLED EQUIPMENT |
| | EPOXY RESIN SINK - SEE SINK SCHEDULE |
| | STAINLESS STEEL SINK - SEE SINK SCHEDULE |
| | CUP SINK - SEE SINK SCHEDULE |
| | |


LAB SUPPORT
SC-119
1070 SF
GEOLOGY LAB
SC-123
1280 SF
OCEANOGRAPHY
SC-117
1311 SF
MAIN ELECTRICAL
SC-113
337 SF
EMERGENCY ELEC
SC-111
115 SF
MENS RESTROOM
SC-109
230 SF
WOMENS RESTROOM
SC-107
228 SF
UNISEX
SC-115
52 SF
ELEVATORS
178
169 SF
LACT RM
SC-105
44 SF
MDF
SC-103
185 SF
BAJA
SC-121
330 SF
Room
SC-341
147 SF
SHARED WASTE
SC-108
220 SF
100 SEAT LECTURE
SC-101
1958 SF
MECHANICAL
SC-106
461 SF
SHARED STORAGE
SC-104
466 SF
A
B
C
D
E
F
G
H
I
J
K
L
1
2
3
4
4.6
5
6
10
0
8'
16'
32'
N

# LEVEL **ONE**

# LEVEL **TWO**

SCIENCE BUILDING | GLENDALE COMMUNITY COLLEGE

ANATOMY SC-329 1258 SF
PREP SC-329A 172 SF
PREP SC-327A 172 SF
ANATOMY SC-327 1322 SF
ANATOMY SC-325 1272 SF
PREP SC-325A 173 SF
ELECTRICAL SC-319 139 SF
CUST. SC-321 58 SF
UNISEX SC-323 53 SF
ELEVATORS 178 169 SF
MENS RESTROOM SC-315 195 SF
WOMENS RESTROOM SC-317 177 SF
CADAVER ROOM SC-311 351 SF
DISSECTION SPECIMEN STORAGE SC-313 91 SF
LAB TECH SC-307A 71 SF
CHEMICAL STORAGE SC-309 116 SF
AUTOCLAVE ROOM SC-307 633 SF
INDEPENDENT RESEARCH SC-305 269 SF
MICROBIOLOGY SC-303 1239 SF
PREP SC-302A 157 SF
IDF SC-304 83 SF
PREP SC-303A 152 SF
PREP SC-301A 152 SF
ANATOMY SC-302 1278 SF
MIRCROBIOLOGY SC-301 1237 SF
OFFICE SC-310 94 SF
OFFICE SC-308 95 SF
OFFICE SC-306 95 SF
OFFICE SC-312 92 SF
OFFICE SC-314 92 SF
OFFICE SC-316 92 SF
OFFICE SC-318 92 SF
OFFICE SC-320 99 SF
OFFICE SC-322 99 SF
OFFICE SC-340 95 SF
ADJUNCT FACULTY SC-338 139 SF
OFFICE SC-334 126 SF
SMALL MEETING SC-330 339 SF
OFFICE SC-328 92 SF
ADMIN SUPPORT SC-336 200 SF
OFFICE SC-332 94 SF
A B C D E F G H I J K L
1 2 3 4 4.6 5 6 10
0 8' 16' 32'
N


# LEVEL THREE


# LEVEL **FOUR**

SCIENCE BUILDING | GLENDALE COMMUNITY COLLEGE

MECHANICAL ROOM
SC-521
964 SF
PHYSICS SUPPORT
SC-519
1143 SF
PHYSICS COMPUTER LAB
SC-517
1313 SF
WOMENS RESTROOM
SC-513
192 SF
MENS RESTROOM
SC-511
152 SF
CUST
SC-509
52 SF
ELEC
SC-515
66 SF
ELEVATORS
178
169 SF
PHYSICS LAB
SC-507
1265 SF
GENERAL CHEMISTRY
SC-505
1603 SF
CHEMISTRY PREP
SC-504
160 SF
IDF
SC-506
64 SF
ACTIVE LEARNING
SC-503
613 SF
PHYSICS LAB
SC-502
1278 SF
GENERAL CHEMISTRY
SC-501
1577 SF
PHYSICS LAB
SC-508
1350 SF
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C
D
J
E
F
G
K
L
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1
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3
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4.6
5
6
10
0
8'
16'
32'
N


# LEVEL FIVE

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S//03

# STRUCTURAL

**PROJECT DESCRIPTION**

The proposed Science Building is located in the Glendale Community College, Glendale, California. The proposed structure is a 5-story building. The structure consists of approximately 96,000 SF of framed area. Level 1 is on grade and houses a stepped lecture hall, Geology and Oceanography Labs, main electrical and mechanical rooms, MEP equipment etc. Level 2 houses General Biology Labs/Lab supports, offices etc. Anatomy and Microbiology labs and a few offices are located at Level 3. Level 4 houses the General and Organic Chemistry Labs. Physics and General Chemistry Labs are located at Level 5. Floor to floor heights of the structure are as follows:

Level 1 to Level 2: 16'-0"
Level 2 to Level 3: 16'-0"
Level 3 to Level 4: 15'-6"
Level 4 to Level 5: 15'-6"
Level 5 to Roof: 15'-6"

The building is located on a sloped site (sloped up from the west to the east). The existing ground elevation varies from EL. 802'-0" to EL. 838'-0". The soil on the East side and parts of North and South sides of the building will need to be retained as shown on Figure 2.

**GENERAL DESIGN CRITERIA**

**Governing Codes**
Governing Code Authority: Division of State Architects (DSA)

Code: 2019 California Building Code with any applicable local city and including the DSA amendments

**Reference Standards**
American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI)
ASCE 7-16: Minimum Design Loads for Buildings and Other Structures

American Institute of Steel Construction (AISC)
AISC 360-16: Specification for Structural Steel Buildings
AISC 341-16: Seismic Provisions for Structural Steel Buildings

American Concrete Institute (ACI)
ACI 318-14: Building Code Requirements for Structural Concrete
TMS 402-13 / ACI 530-13: Building Code Requirements for Masonry Structures

American Welding Society (AWS)
AWS D1.1-10: Structural Welding Code - Steel
AWS D1.8-09: Structural Welding Code - Seismic Supplement
AWS D1.4-17: Structural Welding Code – Reinforcing Steel

**DESIGN LOADS**

**Dead Loads**
Estimated weight of construction material, including self-weight of structural framing and super-imposed dead loads (e.g. ceiling, flooring, roofing, MEP).

**Superimposed Dead Loads:**

| Item # | Area | Gravity (psf) | Seismic (psf) |
|---|---|---|---|
| 1 | Typical floors | 11 | 35 |
| 2 | Exterior Areas (4" depression) | 61 | 85 |
| 3 | Exterior Areas (6" depression) | 86 | 110 |
| 4 | Restroom (2" depression) | 36 | 60 |

1) Exterior Skin Loads: 25 psf (except at the curtain wall areas). 20 psf for curtain wall.
2) PV Panels: 12 psf assumed over 50% of the roof area (6 psf over the entire roof area)
3) Stairs: 60 PSF

**Live Loads**

1) Lab/Lab Support — 100 psf, non-reducible
2) Classrooms/Offices — 80 psf, reducible
3) Corridors above Level-1 — 80 psf, reducible
4) Light Storage — 125 psf, non-reducible
5) Roof — 20 psf, reducible

**Seismic Load Parameters**

1) Risk Category — III
2) Occupancy Importance Factor — Ie = 1.25
3) Site Class — D (Geotechnical Report, Pg. 11)
4) Site Specific Seismic Ground Motion Values (Geotechnical Report, Pg. 12)
   SMS = 2.187g
   SM1 = 1.644g
   SDS = 1.458g
   SD1 = 1.096g
5) Long-Period Trans. Period TL = 8 sec
6) Seismic Design Category (SDC) — E
7) Response Modification Factor — R = 8.0 (Buckling Retrained Braced Frames)
8) Deflection Amplification Factor — Cd = 5
9) System Overstrength Factor — Ω0 = 2.5
10) Drift Limit — 0.02hsx (each Level)
11) Redundancy — Rho = 1.3 (both directions)

**Wind Design**

1) Basic Wind Speed — 105 mph
2) Exposure Category — C
3) Directionality Factor — Kd = 0.85
4) Topography Factor — Kzt = 1.00
5) Natural Frequency — Based on calculated natural frequency from elastic analysis n1 < 1 Hz each direction
6) Gust Effect Factor — Gx = 0.85
7) Enclosure Classification — Closed
8) Internal Pressure Coeff. — GCpi = ±0.18

**LOAD COMBINATIONS**

The following load combinations would be used for the design of the structural elements.

| **Ultimate Strength Design** | **Allowable Stress Design (with 1/3 increase)** |
|---|---|
| (1) 1.4D | D+L+H |
| (2) 1.2D + 1.6L + 1.6H + 0.5Lr | D+L+W+H |
| (3) 1.2D + 1.6 Lr + 1.6H + (f1L or 0.5W) | D+L+E/1.4+H |
| (4) 1.2D + 1.0E + f1L | 0.9D-E/1.4+H (*) |
| (5) 1.2D + 1.0W + 1.6H + f1L + 0.5Lr | |
| (6) 0.9D + 1.0W + 1.6H | |
| (7) 0.9D + 1.0E + 1.6H | |

f1= 1.0 for Public Assembly Area and 0.5 for all others.
D = Dead load
L = Live load
Lr= roof live load of 20 psf or less
W = Wind load
E = Earthquake load due to horizontal base shear
H = Load due to lateral earth pressure

Allowable Stress Design load combinations will be used for the deflections and sizing of foundations calculations. For all other cases, Ultimate Strength Design load combinations will be used.

Note(*): When using this alternative load combinations to evaluate sliding, overturning and soil bearing at the soil-structure interface, the reduction of foundation overturning from Section 12.13.4 in ASCE 7 shall not be used. When using these alternative basic load combinations for proportioning foundations for loadings which include seismic loads, the vertical seismic load effect, Ev, in Equation 12.4-4 of ASCE 7 is permitted to be taken equal to zero.

# DESIGN LOADS

**MATERIALS**

**Structural Steel**

| | |
|---|---|
| Steel Wide Flange Members | ASTM A992 Gr. 50, Fy = 50 ksi |
| Steel Channel, Angle, Plates | ASTM A36, Fy = 36 ksi (UNO) |
| Exception – SFRS Plates | ASTM A572 Gr. 50, Fy = 50 ksi |
| Pipes | ASTM A53 Grade B, Fy = 35 ksi |
| HSS (Round) | ASTM A500 Grade C, Fy = 46 ksi |
| HSS (Rectangular) | ASTM A500 Grade C, Fy = 50 ksi |
| Machine Bolts: | ASTM A307 (UNO) |
| Anchor Bolts: | ASTM F1554, Fy = 36 ksi (UNO) |
| High Strength Bolts | ASTM A325-N (UNO) |

**Concrete**

| | |
|---|---|
| Portland Cement: | ASTM C150, Type II |
| Normal Weight Concrete (145 pcf) | ASTM C33 Hard Rock Aggregate |
| Slab on Grade | 4,000 psi (Normal Weight) |
| BRBF Foundations | 5,000 psi (Normal Weight) |
| Grade Beams | 4,000 psi (Normal Weight) |
| All Other Concrete | 4,000 psi (Normal Weight) |
| Lightweight Concrete (110 pcf) | ASTM C330 Expanded Shale Aggregate |
| Concrete on Metal Deck | 3,000 psi |

**Reinforcing Steel**

| | |
|---|---|
| All Reinforcing except per below | ASTM A615, Grade 60 |
| Reinforcing to be welded | ASTM A706, Grade 60 |

**Metal Deck:**

| | |
|---|---|
| Deck and Accessories | ASTM A653-95, Grade 33 (Galvanized G-60) |

**Composite Studs:**

| | |
|---|---|
| Shear Studs ("Nelson" Studs) | ASTM A29, GRADES C1010 THROUGH C1020 |

STRUCTURAL SYSTEMS

Gravity-Load Resisting System:

Steel construction with concrete filled metal decks supported on steel beams is selected. 2nd to 5th levels as well as roof diaphragms will consist of 3 ¼" light-weight concrete over 3" metal deck. Steel wide flange beams and girders will be used.

Lateral-Load Resisting System:

Braced Frame is considered for the seismic bracing of the classroom building. Buckling Restraint Braced Frames (BRBF) are used in both directions. BRBF frames are evenly distributed throughout the building.

The steel framing – buckling restraint braced frame scheme was selected over others because it offered added values and opportunities that significantly enhanced the project. Benefits of the proposed structural scheme include:

- Provides a much more sustainable, lighter and a very high-performing structure.
- Buckling restraint braced frame is ideal for drift control due to their inherent stiffness. Strategic placement of the braced frames adjacent to stair and restroom walls or partition allows total flexibility for space planning.
- The building, as designed, is very stiff and will have significantly less inter-story drift than what the code permits.
- The smaller story drift will limit the building damage in an earthquake event and allow restoration of building functionality and occupancy much more expeditiously than would be possible with other more flexible lateral force resisting systems.
- This is no vertical discontinuity in the braced frames. This not only simplifies the construction but also yields a structure which is much more robust.
- The proposed structural system is very cost-effective and also minimizes the construction time.

SERVICEABILITY CRITERIA

Vertical Deflection Criteria

Steel: Non-Composite Beam Deflection Criteria (For bare metal deck, where occurs)

Live Load (Roof):
Interior Beams: L/360 or 1" Max
Perimeter Beams: L/360 or 0.75" Max (for Plaster finish)
L/360 or 0.50" Max (where Glazing occurs)

Dead + Live Load (Roof): Interior Beams: L/240
Perimeter Beams: L/240

Steel: Composite Deflection Criteria (Floor and Roof framing)

Initial Construction Dead Load (wet concrete)
- For both Exterior & Interior Beams: No limit

Post Composite Live Load:
- Perimeter Beams: L/360 of 0.50" Max ----- For Typical Metal Stud/ Curtain Wall
- Interior Beams: L/360 or 0.75" Max ---- For Typical Partitions

Post Composite Superimposed (DLsuper+LL):
- Perimeter Beams: L/360 ---- For Typical Metal Stud/Curtain Wall
- Interior Beams: L/240 ---- For Typical partitions

Total Deflection (Pre-Comp. DL + Post-Comp. Superimposed DL + Post-Comp. LL – Camber)
- For Interior Beams: L/240
- For Perimeter Beams: L/240
- Do not check the shored deflection criteria.

Beams & Girders Supporting Elevator Sheave Beams
- Total Deflection = L/1666 (Applies only to elevator static loads).

Floor Vibration Criteria

The floor framing of the building was designed stiff enough to meet or exceed the vibration performance requirement (for walking excitation) indicated below:

a. General Biology Labs, Vivarium (2nd Floor): 2000 mips (75 steps/min)
b. Anatomy and Microbiology Labs (3rd Floor): 2000 mips (75 steps/min)
c. Physics Lab (SC-508 only) at 5th Floor: 2000 mips (75 steps/min)

Camber
Camber 80% of pre-composite dead load deflection
Minimum camber = ¾"

STRUCTURAL IRREGULARITY CHECKS

| Table 12.3-1 (ASCE 7) Horizontal Structural Irregularities | | | | |
|---|---|---|---|---|
| **No.** | **Type of Irregularity** | **Present** | **Remarks** | **Design Effects** |
| 1a | Torsional Irregularity | Yes | --- | Sec12.3.3.4,12.7.3, 12.8.4.3,12.12.1, Table 12.6-1 & Sec 16.2.2 |
| 1b* | Extreme Torsional Irregularity | No | --- | - |
| 2 | Reentrant Corner Irregularity | Yes | --- | Sec 12.3.3.4 & Table 12.6-1 |
| 3 | Diaphragm Discontinuity Irregularity | No | By Inspection | Sec 12.3.3.4 & Table 12.6-1 |
| 4 | Out-of-Plane Offsets Irregularity | Yes | By Inspection | Sec12.3.3.3, 12.3.3.4,12.7.3, Table 12.6-1 & Sec 16.2.2 |
| 5 | Nonparallel Systems - Irregularity | Yes | By Inspection | Sec 12.5.3, 12.7.3, Table 12.6-1 & Sec 16.2.2 |

* *Shaded horizontal irregularities are prohibited for SDC D through F per ASCE 7, Section 12.3.3.*

| Table 12.3-2 (ASCE 7) Vertical Structural Irregularities | | | | |
|---|---|---|---|---|
| **No.** | **Type of Irregularity** | **Present** | **Remarks** | **Design Effects** |
| 1a | Stiffness-Soft Story Irregularity | No | By Inspection | None |
| 1b* | Stiffness-Extreme Soft Story Irregularity | No | By Inspection | - |
| 2 | Weight (Mass) Irregularity | No | --- | - |
| 3 | Vertical Geometric Irregularity | No | By Inspection | None |
| 4 | In-Plane Discontinuity in Vertical Lateral Force-Resisting Element Irregularity | No | By Inspection | None |
| 5a* | Discontinuity in Lateral Strength-Weak Story Irregularity | No | By Inspection | - |
| 5b* | Discontinuity in Lateral Strength-Extreme Weak Story Irregularity | No | By Inspection | - |

* *Shaded vertical irregularities are prohibited for SDC D through F per ASCE 7, Section 12.3.3.*

FOUNDATION SYSTEM:

A site specific draft geotechnical report has been prepared by Koury Engineering dated April 15, 2019. Based on the geotechnical consultant's recommendations, the structure of the proposed building may be supported on CIDH (Cast-in-Drilled Hole) piles. The other foundation system using mat is still being considered, pending further recommendation from the soil engineer.

**Preliminary CIDH Piles Axial Capacities (Excluding Boring 4 Area)**

| Diameter (in) | Design Pile Length (ft) | Allowable Static Capacity | | Allowable Seismic Capacity | |
|---|---|---|---|---|---|
| | | Compression | Uplift | Compression | Uplift |
| 30 | 55 | 250 | 125 | 280 | 140 |
| 30 | 65 | 290 | 145 | 330 | 165 |

**Preliminary CIDH Piles Axial Capacities (At Boring 4 Area)**

| Diameter (in) | Design Pile Length (ft) | Allowable Static Capacity | | Allowable Seismic Capacity | |
|---|---|---|---|---|---|
| | | Compression | Uplift | Compression | Uplift |
| 30 | 55 | 120 | 60 | 160 | 80 |
| 30 | 65 | 150 | 75 | 200 | 100 |

**Preliminary 30" CIDH Piles Lateral Capacities – Fixed Head Condition**

| | | |
|---|---|---|
| Pile top deflection | 1/4" | 1/2" |
| Allowable lateral load | 86 kips | 124 kips |
| Maximum negative moment | 419 k-ft | 653 k-ft |
| Maximum positive moment | 177 k-ft | 281 k-ft |
| Depth to max positive moment | 9.9 ft | 10.5 ft |
| Depth to max negative moment | 0 ft | 0 ft |

# STRUCTURAL SYSTEMS

SOIL RETENTION SYSTEM:

The building is located on a sloped site (sloped up from the west to the east). The existing ground elevation varies from EL. 802'-0" to EL. 838'-0". The soil on the East side and on parts of North and South sides of the building will need to be retained as shown on Figure 2. As the soil retaining height is significant, it is more cost effective to isolate the building and not rely on the building to provide the buttress to resist the lateral soil pressure. Two independent retaining systems are explored, one is the conventional concrete retaining wall with pile foundation and the second is the permanent shoring system with soil anchors. After careful evaluation, the permanent shoring option was selected.

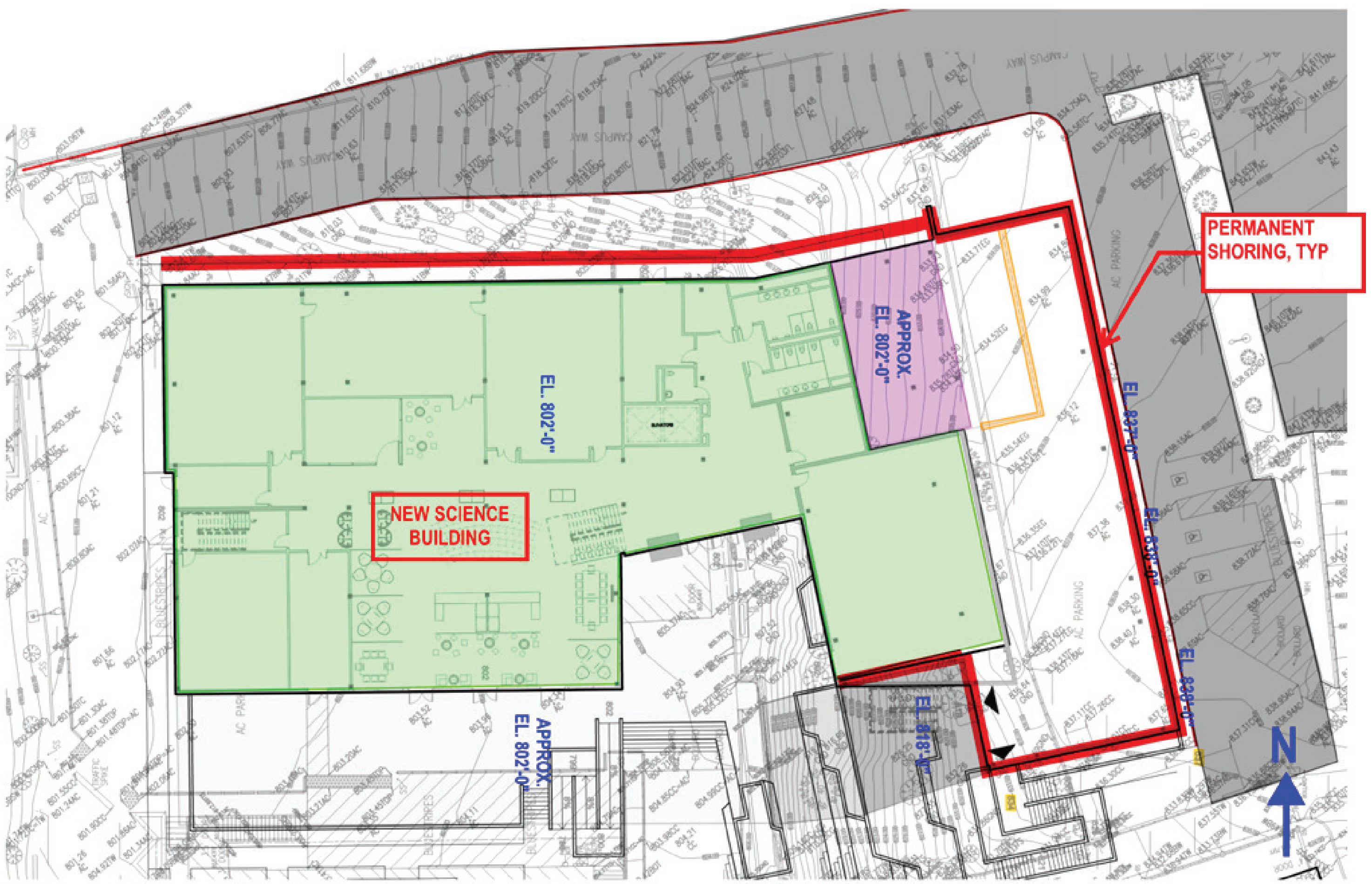
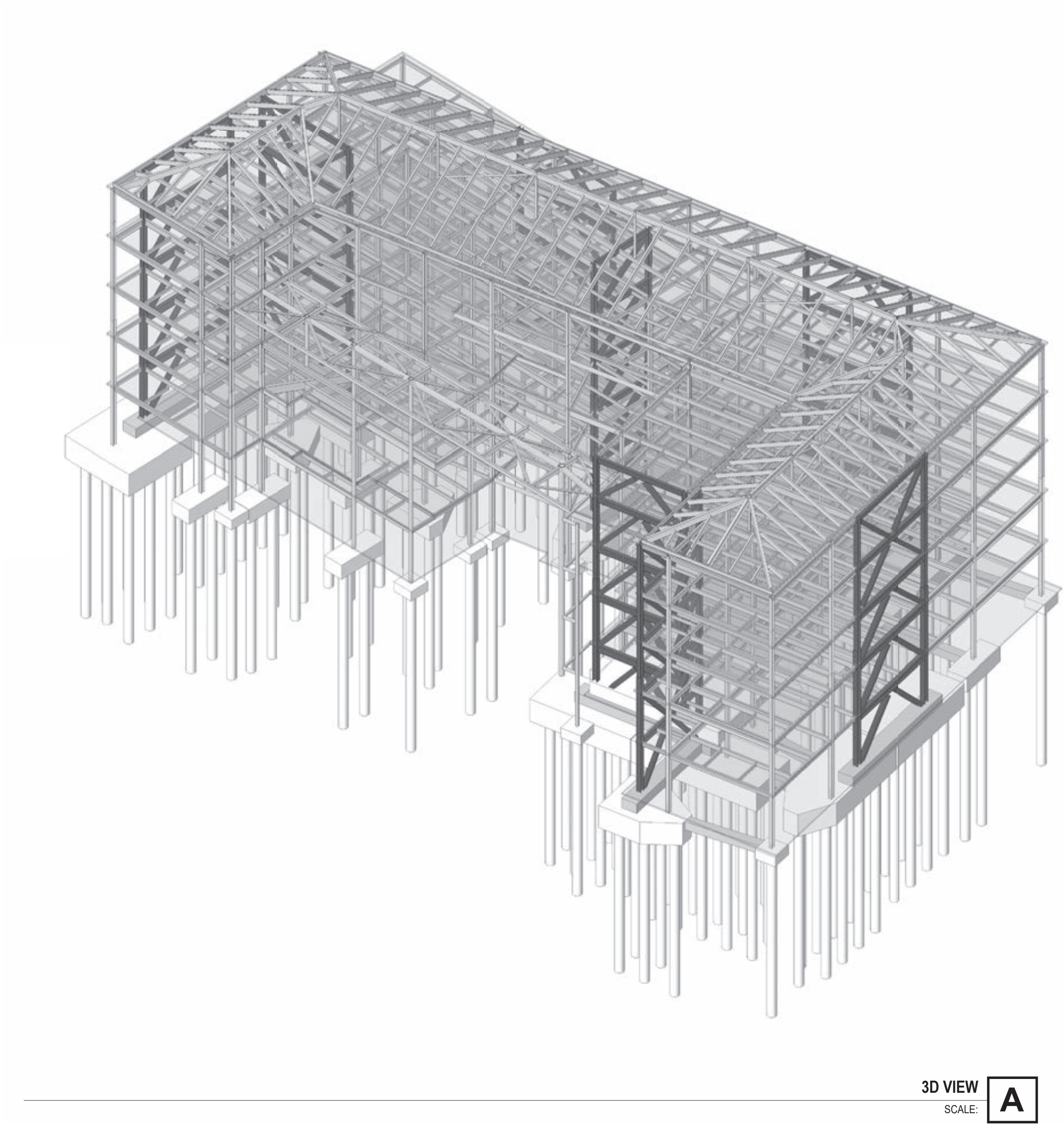
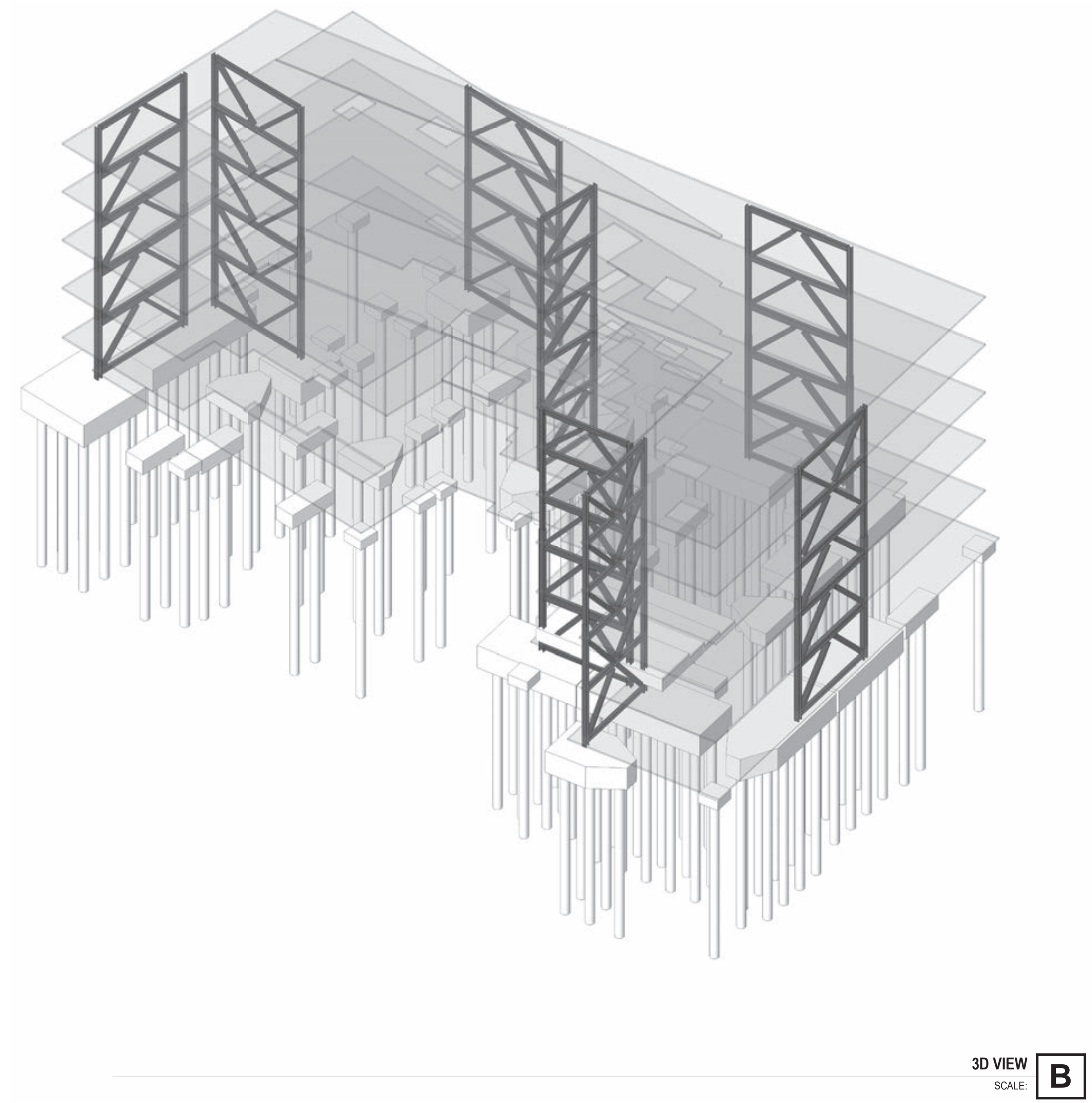
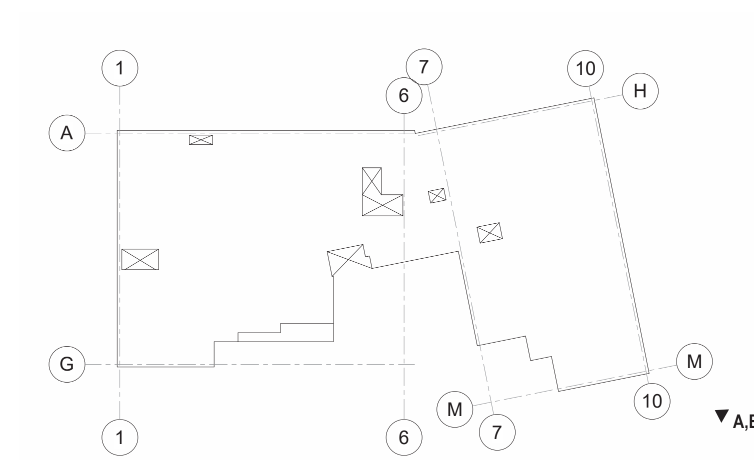



**FIGURE 2:** The Science Building and Permanent Shoring

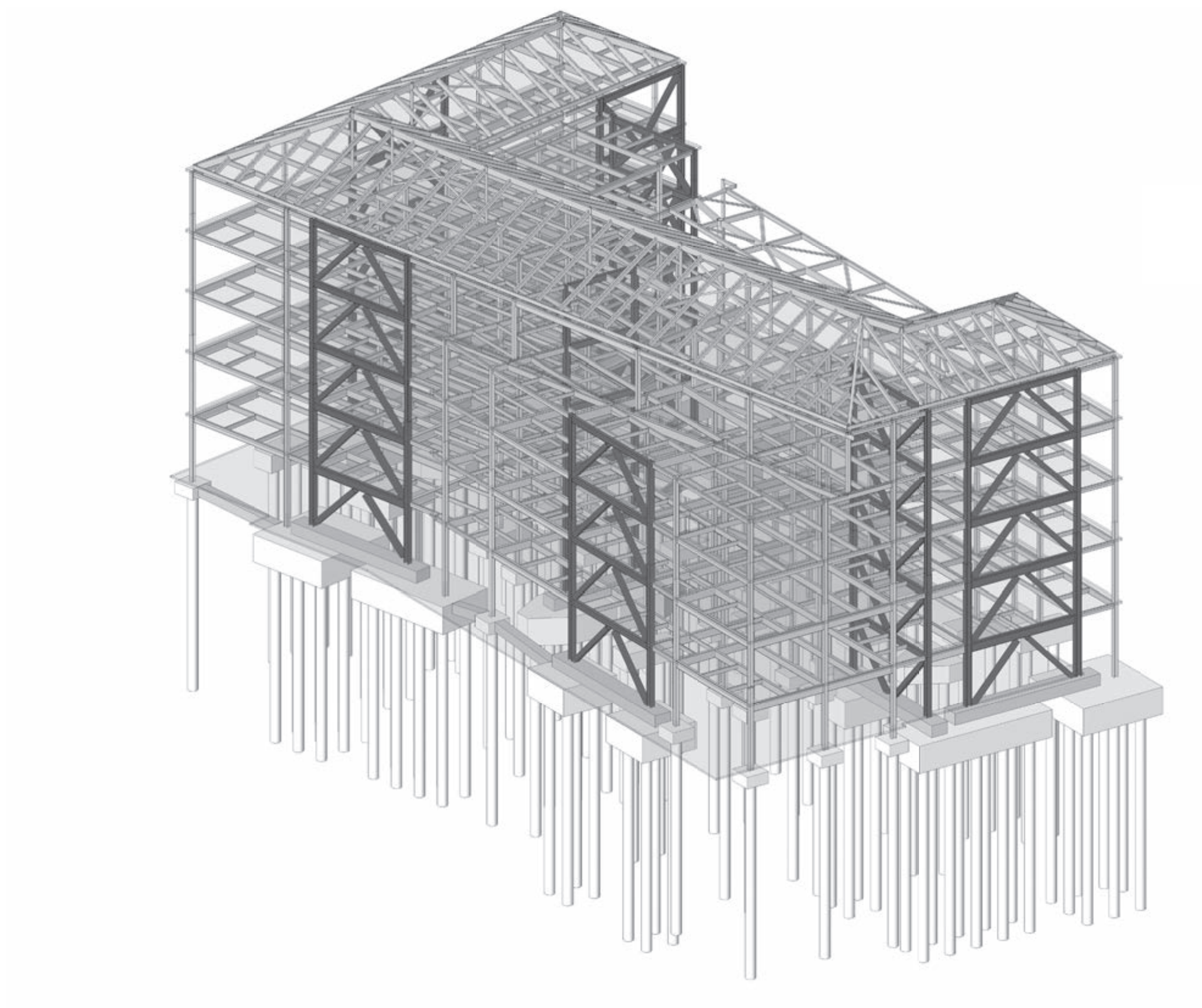


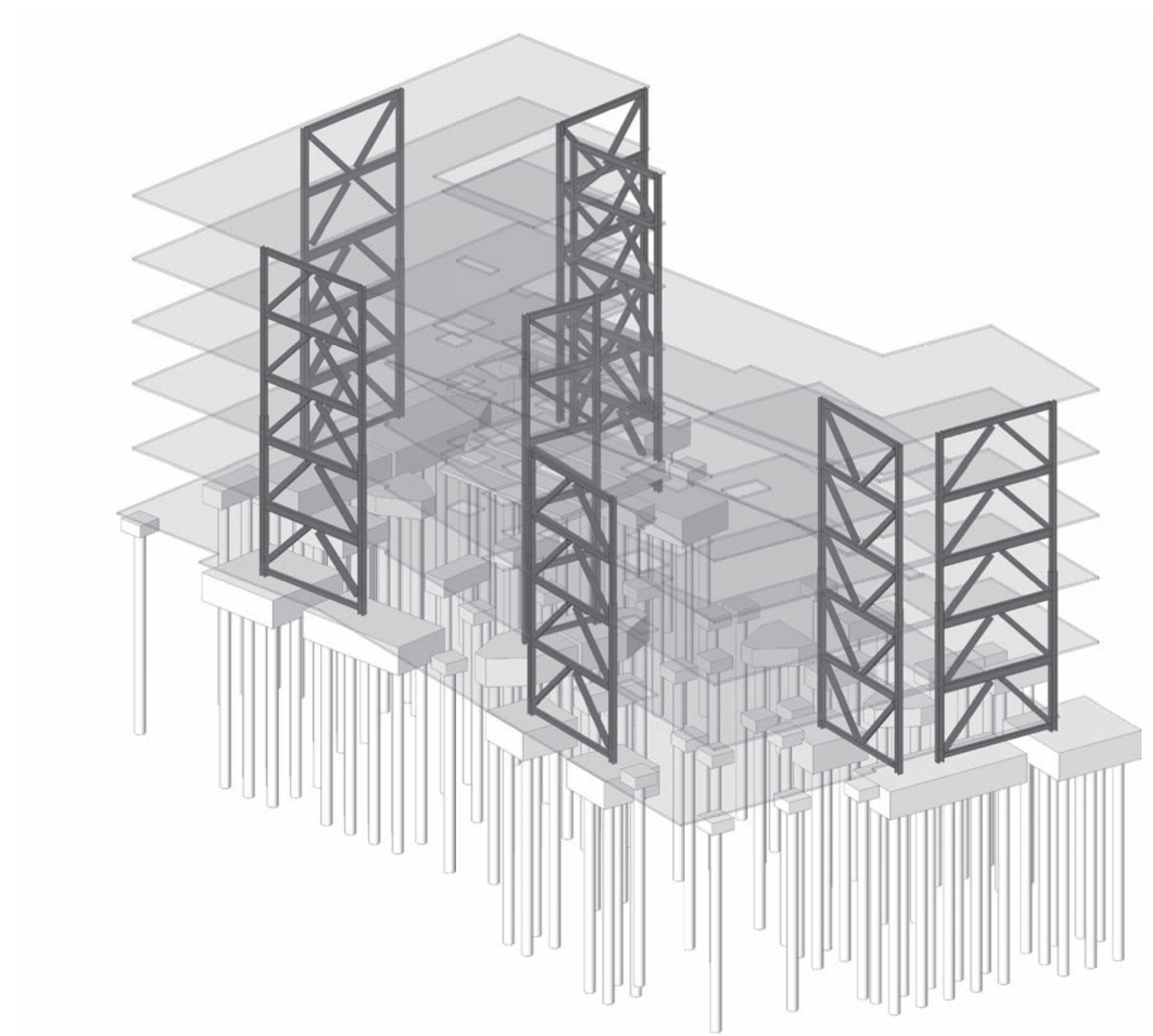




# 3D FRAMING DIAGRAM

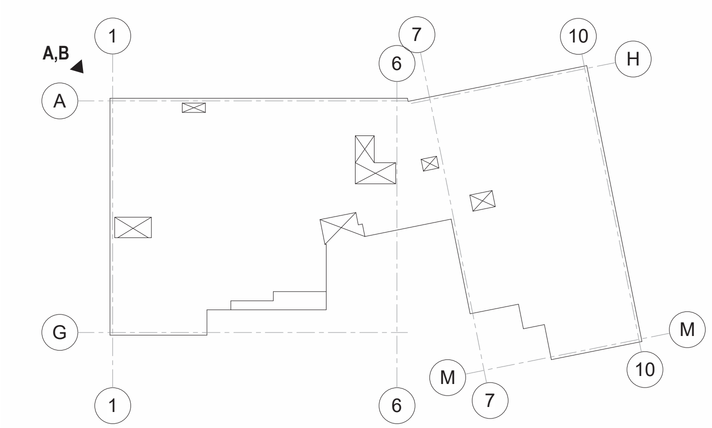
SCIENCE BUILDING | GLENDALE COMMUNITY COLLEGE



3D VIEW
SCALE:
A

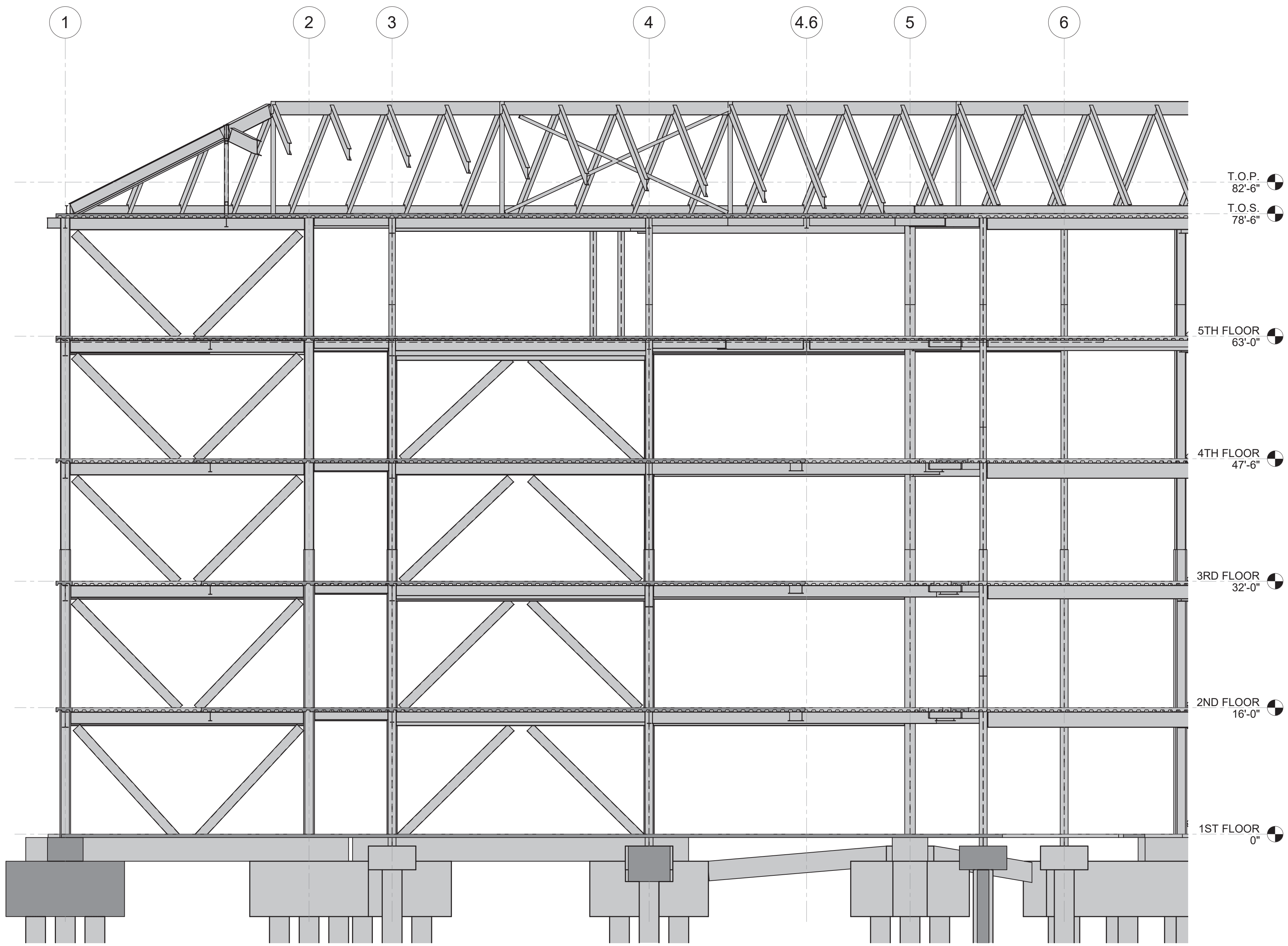


3D VIEW
SCALE:
B



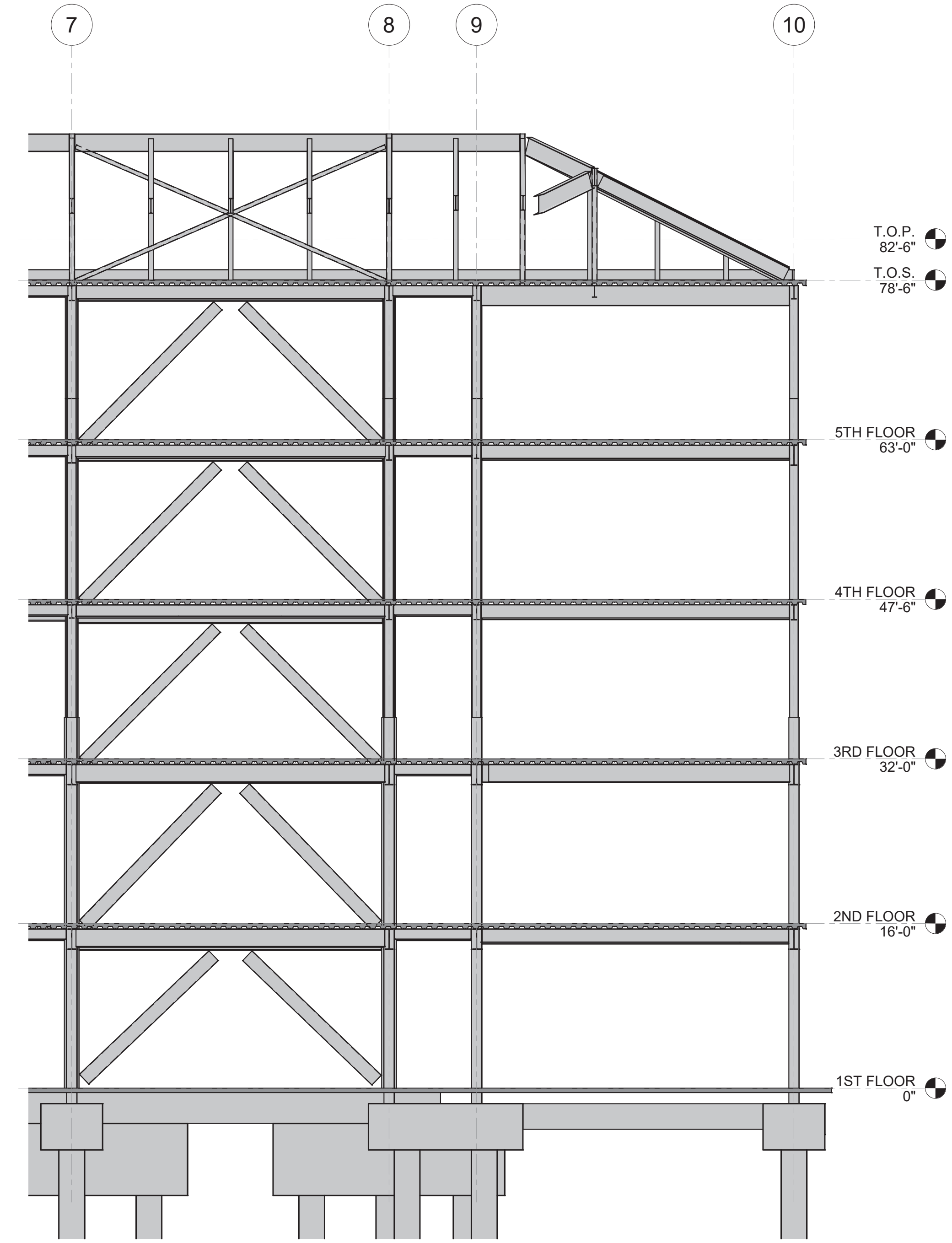

KEYPLAN

# 3D FRAMING DIAGRAM



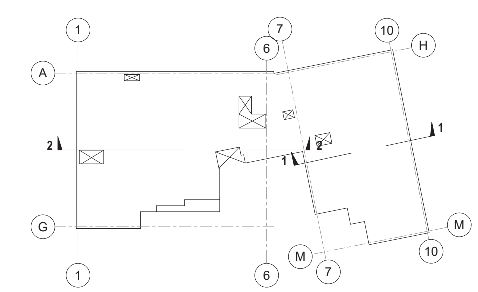

OVERALL BUILDING SECTION 2

SCALE: 1/8" = 1'-0"




OVERALL BUILDING SECTION 1

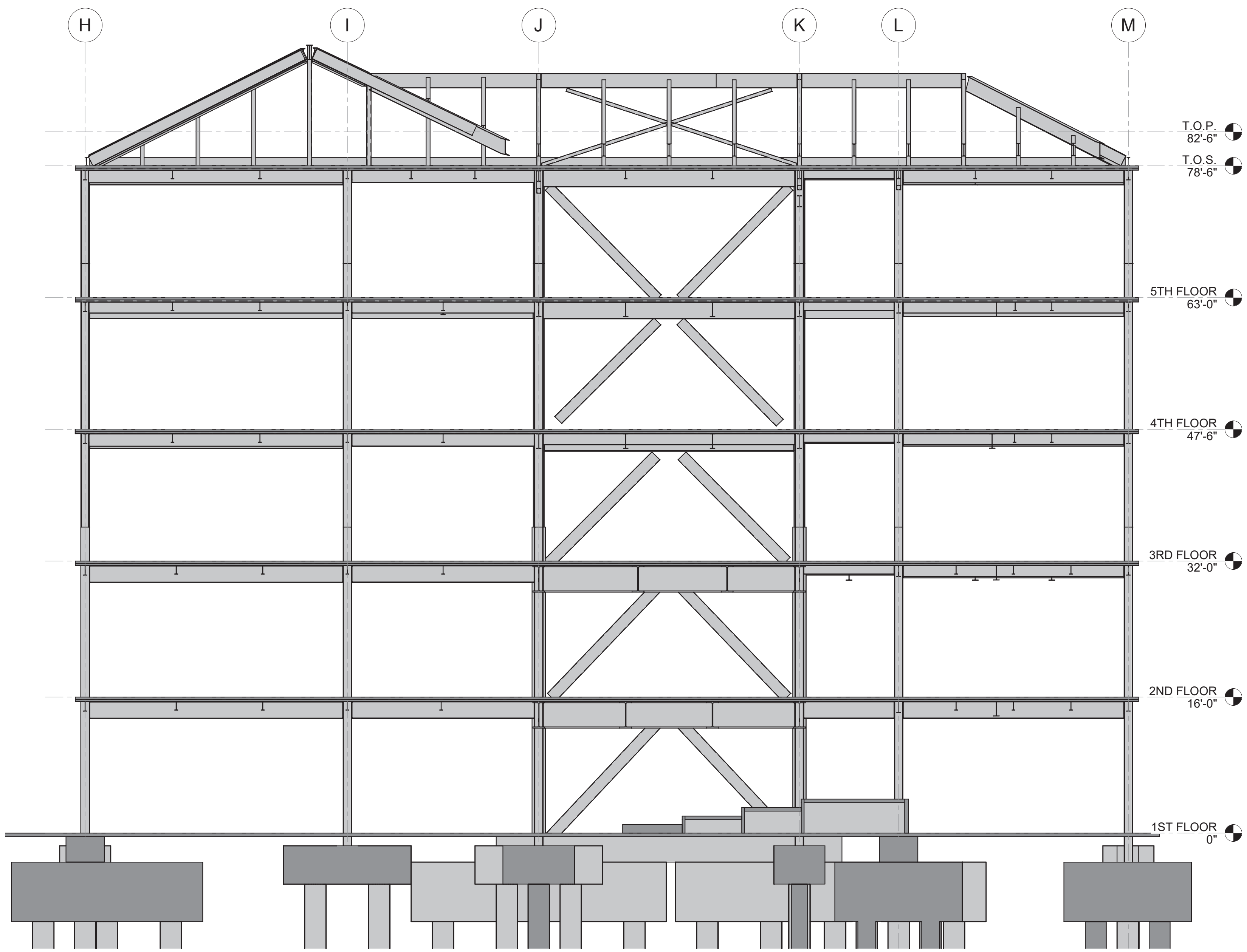
SCALE: 1/8" = 1'-0"



KEYPLAN

# FRAMING SECTIONS

SCIENCE BUILDING | GLENDALE COMMUNITY COLLEGE




**OVERALL BUILDING SECTIONS** 2

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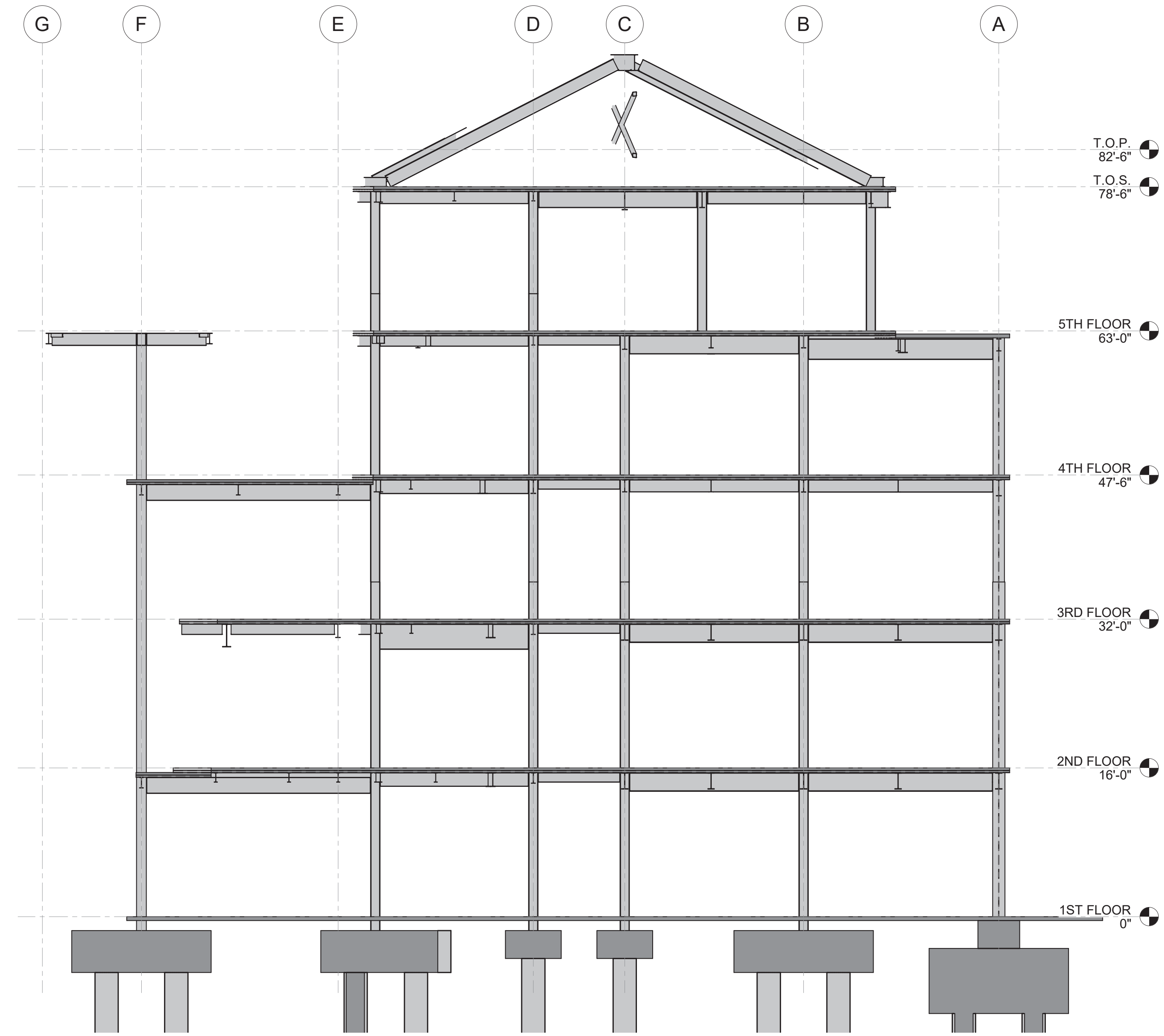
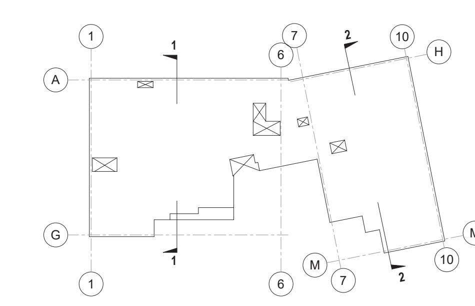


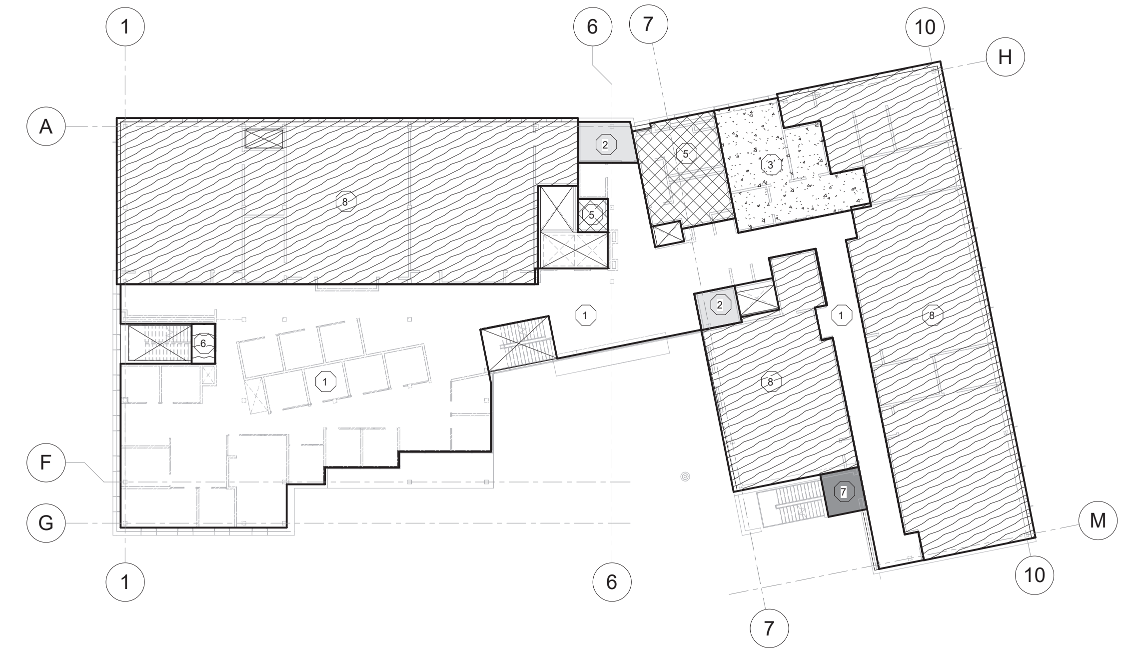

**OVERALL BUILDING SECTIONS** 1

SCALE: 1/8" = 1'-0"



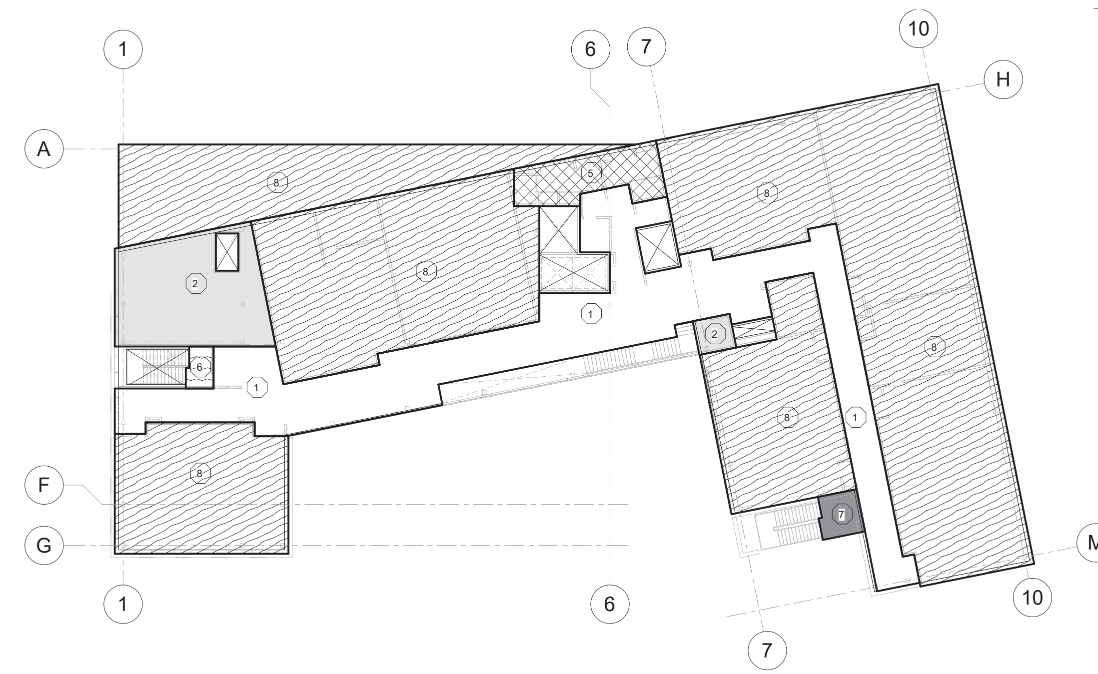

# FRAMING SECTIONS


**SECOND FLOOR - LOADING DIAGRAM** **1**
SCALE: NTS




**THIRD FLOOR - LOADING DIAGRAM** **2**
SCALE: NTS

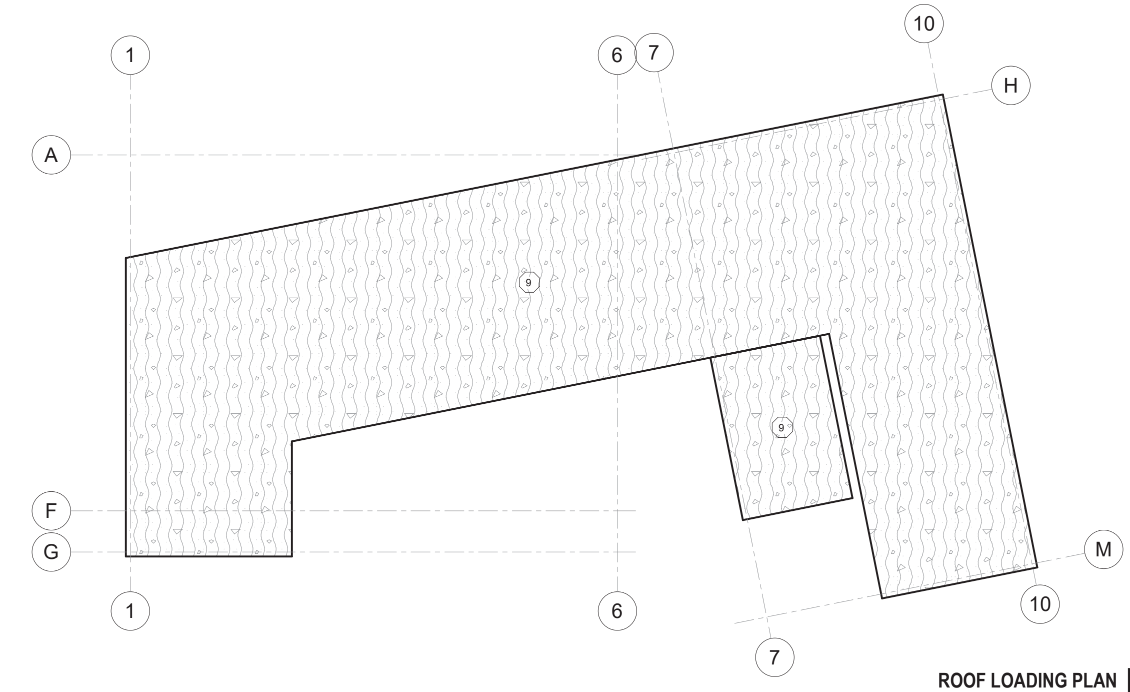

**FOURTH FLOOR - LOADING DIAGRAM** **3**
SCALE: NTS




**FIFTH FLOOR FRAMING PLAN** **4**
SCALE: NTS

# LOADING DIAGRAMS

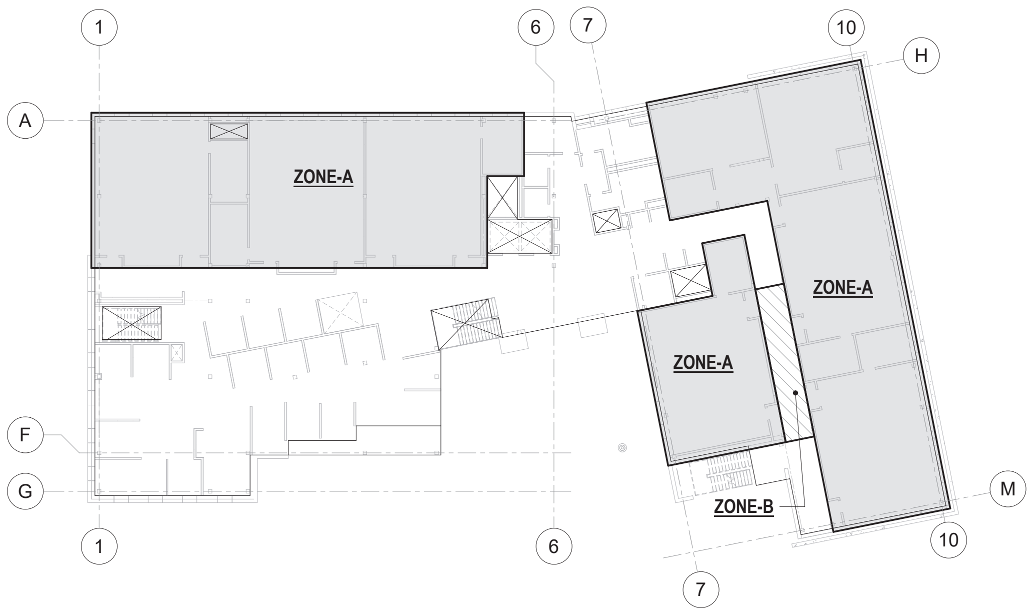
SCIENCE BUILDING | GLENDALE COMMUNITY COLLEGE



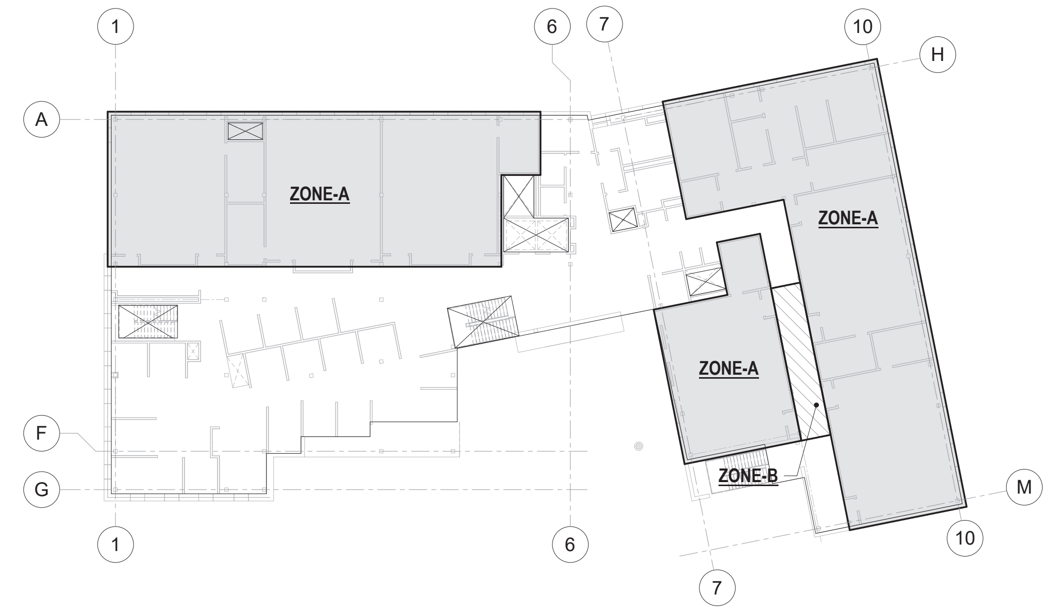

ROOF LOADING PLAN
SCALE: NTS
5

| LOADING DIAGRAM TABLE | | | | | | | |
|---|---|---|---|---|---|---|---|
| **AREA DESCRIPTION** | **LIVE LOAD** (FOR SLAB DESIGN) | **SUPERIMPOSED DEAD LOAD** (FOR SLAB DESIGN) | **MARK** | **AREA DESCRIPTION** | **LIVE LOAD** (FOR SLAB DESIGN) | **SUPERIMPOSED DEAD LOAD** (FOR SLAB DESIGN) | **MARK** |
| OFFICE -CLASSROOM CORRIDOR | 80 PSF REDUCIBLE | 11 PSF | 1 | LABORATORY | 100 PSF NON-REDUCIBLE | 11 PSF | 7 |
| MEP ROOM | 100 PSF NON-REDUCIBLE | 11 PSF | 2 | ROOF W/ 4" DEPRESSION | 20 PSF NON-REDUCIBLE | 71 PSF | 8 |
| STORAGE | 125 PSF NON-REDUCIBLE | 11 PSF | 3 | GABLE ROOF | 20 PSF REDUCIBLE | 26 PSF | 9 |
| TERRACE W/ 6" DEPRESSION | 100 PSF NON-REDUCIBLE | 80 PSF | 4 | - | - | - | 10 |
| RESTROOM W/ 2" DEPRESSION | 80 PSF NON-REDUCIBLE | 36 PSF | 5 | - | - | - | 11 |
| ASSEMBLY EXIT | 100 PSF NON-REDUCIBLE | 11 PSF | 6 | - | - | - | 12 |

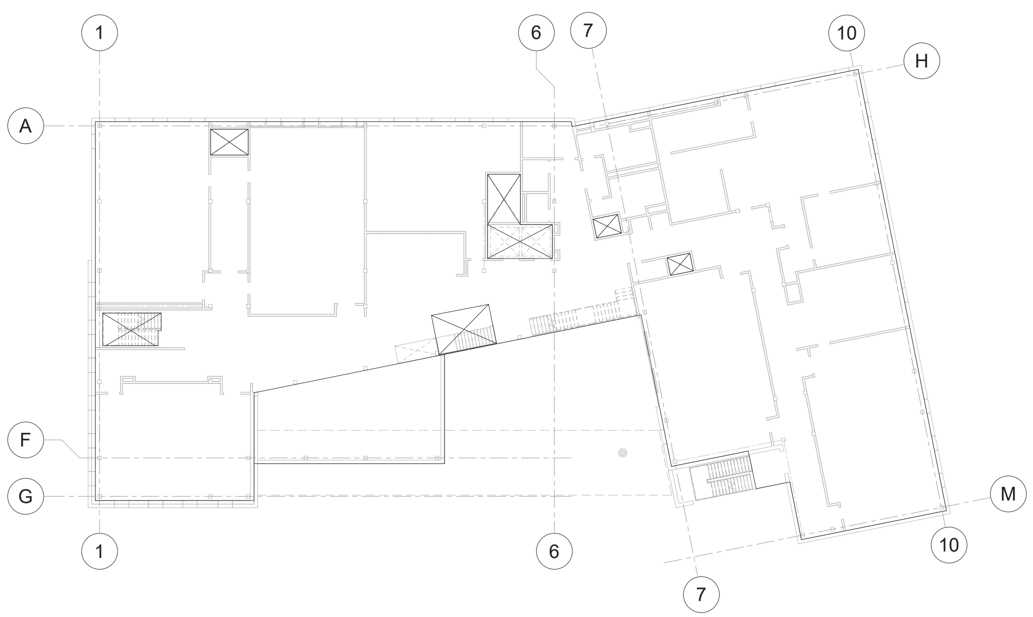
# **LOADING** DIAGRAMS



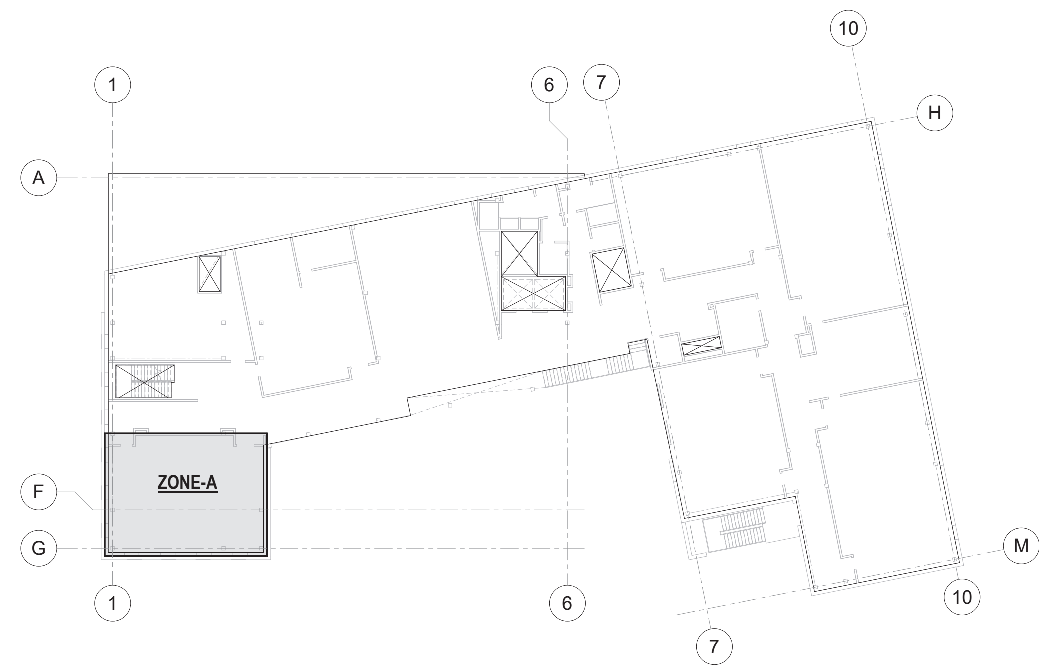

SECOND FLOOR - VIBRATION PLAN
SCALE: NTS
**1**




THIRD FLOOR - VIBRATION PLAN
SCALE: NTS
**2**



FOURTH FLOOR - VIBRATION PLAN
SCALE: NTS
**3**

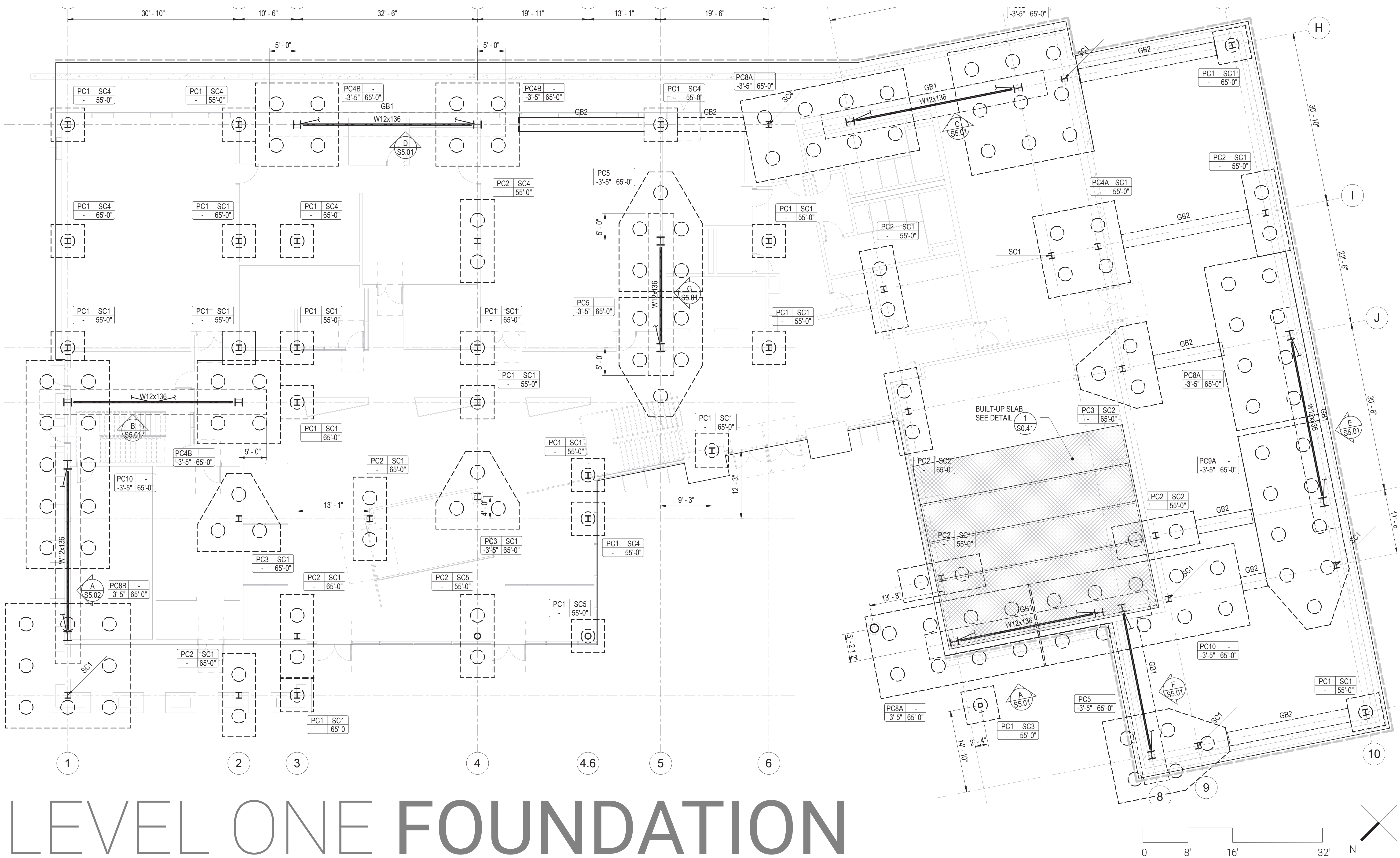



FIFTH FLOOR - VIBRATION PLAN
SCALE: NTS
**4**

| VIBRATION DIAGRAM TABLE | | |
|---|---|---|
| DESCRIPTION | VIBRATION CRITERIA | MARK |
| ZONE A | 2000 MIPS (75 STEPS/ MIN) | |
| ZONE B | 2000 MIPS (100 STEPS/ MIN) | |

# VIBRATION CRITERIA ZONES

SCIENCE BUILDING | GLENDALE COMMUNITY COLLEGE

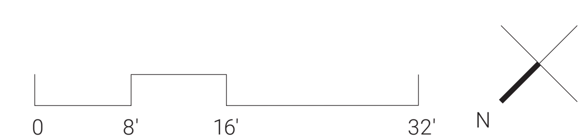


# LEVEL ONE **FOUNDATION**


# LEVEL TWO **FRAMING**

SCIENCE BUILDING | GLENDALE COMMUNITY COLLEGE


# LEVEL THREE **FRAMING**




# LEVEL FOUR **FRAMING**

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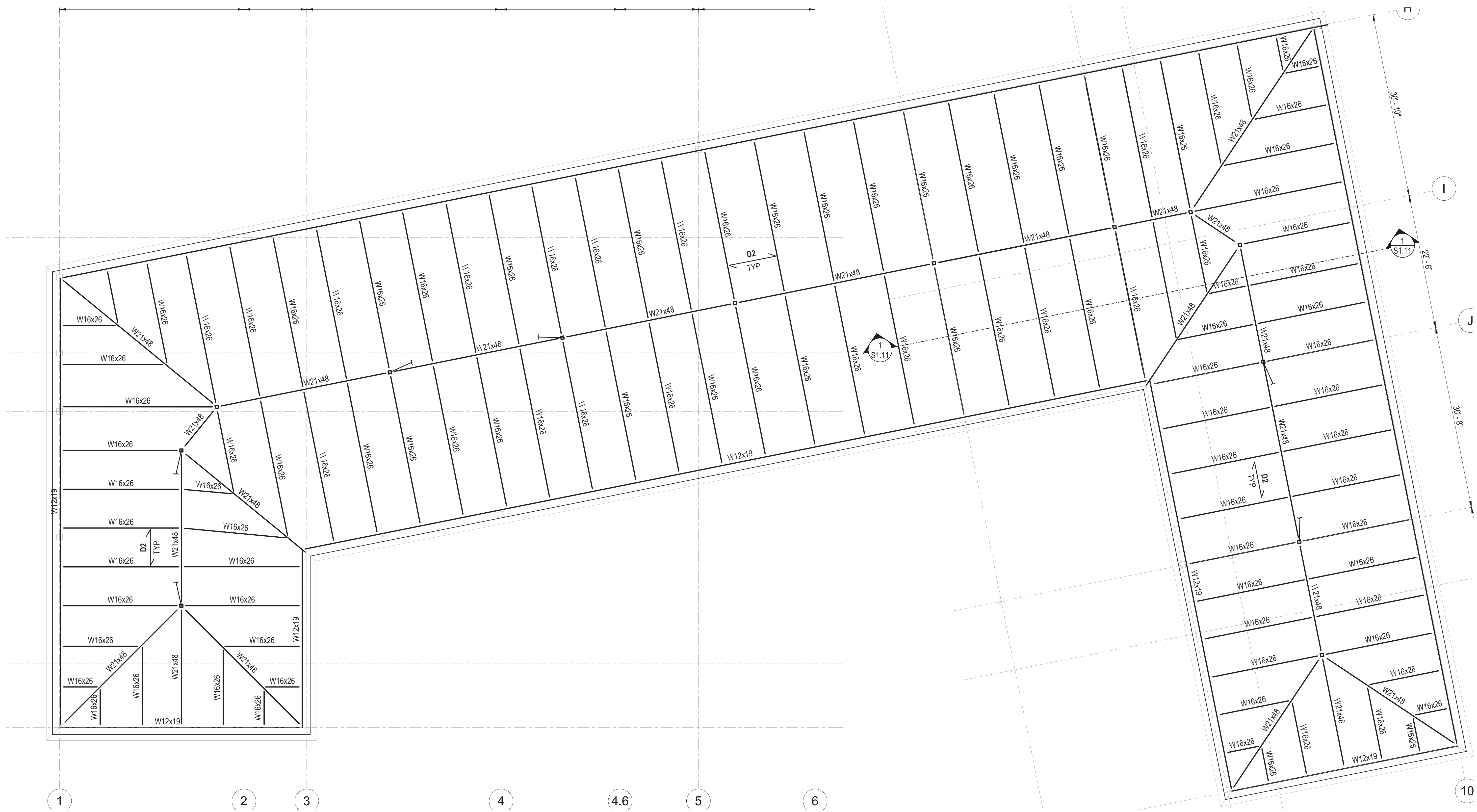
# LEVEL FIVE **FRAMING**

0 8' 16' 32'

N


# ROOF **FRAMING**

SCIENCE BUILDING | GLENDALE COMMUNITY COLLEGE



# GABLE ROOF **FRAMING**

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# S//03

# MECHANICAL

SECTION 3
**Mechanical Engineering (HVAC, Plumbing, Fire Protection)**

**DESIGN CRITERIA**
**CODE STANDARDS AND REFERENCE**

- 2019 Title 24 California Code of Regulations
- Part 2, California Building Code
- Part 3, California Electrical Code
- Part 4, California Mechanical Code
- Part 5, California Plumbing Code
- Part 6, California Energy Code
- Part 9, California Fire Code
- Part 11, California Green Building Standards Code
- Part 11, California Green Building Standards Code Supplement
- ASHRAE Standard 55-2013, Thermal Environmental Conditions, with provisions per LEED requirements
- ASHRAE Standard 62.1-2016, Ventilation for Acceptable Indoor Air Quality, with provisions per LEED requirements
- ASHRAE Standard 90.1-2013, Energy Standard for Buildings, with provisions per LEED requirements
- SMACNA
- NFPA

**Location**

- Glendale, CA
- CEC Zone 9

**Outside Design Conditions**
California Building Code energy requirements (Title 24) specifies design conditions that must be met. Conditions are based on CEC Title 24 Joint Appendix JA2 – Reference Weather Data, 0.1% summer condition, 0.2% winter conditions.
Design criteria for the project will be based on local context and climate, City of Glendale, CA

Summer: 101 °F DB / 70 °F MCWB
Winter: 35 °F DB

The design conditions may be exceeded for a number of hours per year (due to outside temperatures exceeding these design conditions). While designing to these conditions by definition indicates that design set points will be exceeded during peak periods, typical design often requires a minimal amount of over sizing so that control is always maintained. This results in small amounts of risk and results in significant first cost and operating cost savings.

**INTERIOR DESIGN CONDITIONS**

The indoor environmental conditions in a given space are normally controlled to satisfy the requirements of the Thermal Environmental Conditions for Human Occupancy Standard 55-2016 using the Predicted Mean Vote model, developed and published by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) and ANSI. Designing to meet that Standard produces a design with industry accepted comfort conditions. ASHRAE 55 specifies conditions in which a specified fraction of the occupants will find the environment thermally acceptable. It takes into account air temperature, radiant temperature, air movement, air moisture content, metabolic rate, and clothing level.
The "Adaptive Comfort" model also relates indoor design temperature ranges to outdoor climatological conditions, meaning that indoor temperatures can "float" warmer than normal when outdoor air temperatures are also warmer. Owner involvement in setting space temperature criteria is critical. The table shows proposed design temperatures and indicates where heating only spaces may be appropriate. Owner review and approval is critical.

| Space Type | Design Air Temperature Setpoint (°F) | |
|---|---|---|
| | Summer | Winter |
| Classroom/Office/Conference Room Area/IT/ LAB | 74 ±2 | 68 ±2 |
| Storage, Elec, etc. | 90 (max) | 68 ±2 |

***Figure 1: Space Temperature Setpoints***

- Electrical rooms will be ventilated to serve the equipment and maintain the room at or below 90 F or the lowest maximum temperature allowed from the manufacturer(s) of the equipment in that room.
- Telecommunication spaces will be air conditioned to maintain a maximum of 78 F with maximum allowable temperature of 80 F unless dictated otherwise by CCD.
- Elevator machine rooms shall be air conditioned to maintain a maximum of 85 F with maximum allowable temperature of 87 F.
- There are no areas in the building where humidity control is required to maintain humidity within any specific range

**Envelope Performance**

The table below illustrates the insulation values used for modeling the energy usage within the building for a 2019 Title 24 code building and a performance building of the same shape.

| Element | | Code | Recommended Building Performance |
|---|---|---|---|
| Wall | U-value | 0.062 | 0.033 |
| | R-value | R-16.2 | R-19 |
| Roof | U-value | 0.034 | 0.025 |
| | R-value | R-30 | R-40 |
| Floor | U-value | 0.269 | 0.269 |
| | R-value | R-3.7 | R-3.7 |
| Glazing (Curtainwall) | U-value | 0.41 | .036 |
| | SHGC | 0.26 | 0.24 |
| | VT | 0.46 | 0.63 |
| Window to wall ratio | % | 40% | <30% |

***Figure 2: Recommended Insulation Values***

# HVAC DESIGN CONDITIONS

**Lighting and Equipment Loads**

| Floor | Lighting Heat Gain (W/sf) | Power Equipment Heat (W/sf) |
|---|---|---|
| Offices | 0.9 | 1.0 |
| Classrooms/Labs | 1.0 | TBD |
| Restrooms | 0.5 | 0 |
| Corridor | 0.5 | 0.5 |
| Storage | 0.4 | 0 |
| Main Elec room | 0.4 | TBD |
| Telecommunication | 0.4 | 75 |

Mech Rooms: Heat load pending on equipment sizing

*Figure 3: Lighting and Equipment Heat gain Loads*

**People Loads**

| Room Type | Heat Gain (BTUH) Sensible / Latent | Occupant Density (sf/person) |
|---|---|---|
| Office | 250/200 | 100 |
| Classroom | 250/200 | 30 |
| Conference/ Lounge | 250/200 | 20 |
| LAB | 250/200 | 30 |

*Figure 4: Air Distribution Criteria*

## HVAC SYSTEM DESCRIPTION

### Ventilation Requirement

Airflow to mechanically ventilated spaces will be, at minimum, in compliance with ASHRAE Standard 62-2010, with a minimum of MERV 13 filtration the combined outside air supply and return air (if applicable).

| Room Type | Ventilation Rates (cfm/sf) | Occupant Density (sf/person) |
|---|---|---|
| Conference Rooms | 0.5 | 20 |
| Classroom | 0.3 | 30 |
| Corridor | 0.06 | 100 |
| Laboratories | 100% OSA | 40 |
| Lobby | 0.15 | 30 |
| Storage | 0.15 | 500 |
| IDF/MDF | N/A | No occupants |

*Figure 5: Ventilation Rates and Occupant Densities*

When the weather is mild but cooling is still needed due to internal loads and solar gains, cooler outside air can be used to condition the space. Recirculating air handling units shall be equipped with dry bulb economizers that can maximize the amount of outside air instead of recirculating a portion of the room air. Economizers are required per code for air handling units of this size and will contribute to the operational energy savings.
Air handling units serving laboratories and laboratory support will be 100% OSA and spaces fully exhausted.

### Exhaust System

Exhaust fans will be provided to serve the restrooms, janitor closets and science labs/ hoods. The restrooms and janitor closets, min. 10 air changes per hour (ACH) exhaust assuming 9'-0" effective ceiling height. Providing variable volume exhaust is an excellent energy saving strategy to reducing the total volume of building exhaust and 100% outside air make up for these spaces. Exhaust VAV valves will be provided on lab and fume hood exhaust to work in tandem with supply VAV to maintain space pressurization control.

### System Controls and Narrative Sequences of Operation

Monitoring of the HVAC and building energy systems is required to guarantee continuous, optimized operation. Highly accurate sensors for temperature, flow rate, pressure, etc., pay for themselves in the ability to maintain system operation at the most efficient conditions over time. Additionally, trending monitored points at one-minute intervals provides immediate feedback of system operation and diagnostics for equipment.

Concurrent with monitoring, simple and straightforward control strategies are required to maintain system operation over time. Complicated controls will often be overridden and unworkable. Therefore, the Direct Digital Control (DDC) building management system will be designed for straightforward operation and be able to optimize the operation of the system through transparent means. The DDC system will meet current campus building management system standards

All HVAC equipment will be connected to the control system to allow monitoring status, alarm, and scheduling operations remotely. Sensor may be shared with lighting occupancy control system.
The DDC system will integrate control and monitoring from zone level to central plant level. Energy flow and trending capability will be included and interconnectivity by utilizing BACNET, an open communications protocol.

Control, diagnostics and trending will be available through local operator workstations as well as through remote web access.

## DUCTWORK SYSTEM

### General

Duct systems shall be designed to obtain lowest cost-beneficial pressure loss by limiting certain duct velocities, avoiding dynamic loss components where possible and utilization of low dynamic loss components. High-loss fittings, such as mitered elbows, abrupt transitions, and takeoffs and internal obstructions must be avoided.
Distribution system pressure losses shall be determined by total pressure. The use of the "static regain" is encouraged as design methods. However, other methods are acceptable provided it can be demonstrated that the results are comparable to the above specific procedures.

Pressure distribution duct (between the AC unit and terminal device) shall be designed for pressure drop 0.08" WG or less. Long duct runs shall be designed with special consideration of pressure loss since the maximum loss for any run shall be imposed upon the entire fan system.
Horizontal duct distribution shall be routed to maximize long, straight runs without multiple penetrations through fire and / or smoke partitions. Multiple horizontal mains shall be of comparable length and configuration to equalize pressure losses. The overall object is to route ducts that will avoid or minimize architecturally and / or structurally induced dynamic losses.

Sheet metal gages will be minimum 22 gage and in accordance with CMC, not SMACNA. Construction of ductwork, except for gage thickness, will be in accordance with SMACNA 1995-second edition for the appropriate duct pressure classification. Variations in duct size, and additional duct fittings will be provided, as required to clear obstructions and maintain clearances.

Laboratory fume hood exhaust will be conveyed in stainless steel ductwork to connect to an exhaust fan plenum on the roof. Exhaust ducts will connect to a common manifold within each floor fire zone. Galvanized duct in lieu of stainless steel will be used once the dilution of fume concentration is below 10% of the lower flammability limit.

Fume exhaust duct shall be fully welded construction.

Provide drive slip or equivalent flat seams for ducts exposed in the conditioned space or where necessary due to space limitations. Longitudinal seams will use Pittsburgh lock. Button punch snap lock will not be used on the project. On ducts over 48 inches wide, provide standard reinforcing on inside of duct. Run-outs to grilles, registers or diffusers on exposed ductwork will be the same size as the flange outer perimeter on the grille, register, or diffuser.

Return air system will be ducted in shafts and non-conditioned spaces. Return air plenum will be used above non-acoustically sensitive conditioned spaces.

Painting inside of ducts behind grilles is not allowed.

### Friction Losses and Minimum Duct Sizes

Supply air ducts from cooling unit's discharge up to the terminal unit will be sized for friction losses of 0.08 inches WG/100 feet but not exceeding a velocity of 1200 fpm. Minimum size duct to terminal units or air valves will be eight inches in diameter but not less than terminal inlet size.

Supply air ducts downstream of terminal units or air valves; return air ducts, and general (e.g., toilet) exhaust ducts will be sized for friction losses of 0.08-inch WG/100 feet but not exceeding 1000 fpm.

### Ductwork Accessories

A manual volume damper in the upstream ductwork from a terminal unit will be provided. Duct silencers will be utilized to improve acoustical performance in the duct system.

### Grilles, Registers, and Diffusers

Supply, return and exhaust inlets and outlets shall be coordinate with the Architect and the Acoustician.
The face velocity at the diffusers shall not exceed 500 fpm, unless approved by Acoustical Consultant.
All inlets and outlets shall be selected at least 10 NC levels below the NC level of the room.
All supply outlets shall be provided with a minimum of 5 feet of flexible ductwork to reduce vibration transmission, provide sound attenuation and assist in locating the diffusers in the ceilings or walls. Flexible ductwork shall not exceed 7 feet.
Laminar flow diffusers will be provided near fume hoods to avoid disturbing air flow through the sash opening.

### Insulation

Supply air ductwork, return ductwork exposed to unconditioned spaces. The insulation thickness as a minimum shall be as listed in the CEC.

### Sound, Vibration, and Seismic Control

HVAC equipment and systems can generate vibration. Ductwork will be designed to minimize vibration, conducted noise, and transmitting airborne noise. Supply, return and/or exhaust air fans, pumps and the like should be located away from sensitive areas, and housed in mechanical rooms with walls designed to attenuate noise from the equipment.
The following equipment shall be provided with vibration isolation:

- Fans
- Condensers & Heat pumps (CU, HP)
- Fan Coil Units (all of FCU)
- Air Handlers (internally isolated)
- Pumps

Sound attenuators (duct silencers) shall be provided for AC supply, and return, and as indicated by acoustical consultant.
Specific areas requiring attention to control noise and vibration may include:

- Fan noise, transmitted either through the structure or through the duct system.
- Noise generated by air flowing past dampers, turning vanes and terminal device and louvers.
- Noise caused by excitation of duct wall resonance, produced by fan noise; by pressure fluctuations caused by fan instability; and by turbulence caused by discontinuance in the duct systems.
- Noise from the water circulation system, generally transmitted through the structural connections.
- Noise and vibration from out of balance forces from fans, pumps, compressors, etc.
- Air handling units may have built-in sound attenuators in lieu of duct silencers.
- Cross talk between acoustically isolated spaces.

Duct silencers shall only be considered when duct distance is not sufficient to provide adequate acoustical separation between rooms.
Vibrations generated by HVAC systems must be minimized: judicious equipment selection; limitation of fluid flow velocities; and isolation of key mechanical, piping and ducting systems is required.
Vibration isolation systems shall be provided on rotating mechanical equipment greater than 1/2 hp located within the critical area, greater than 5 hp elsewhere in the building, and greater than 10 hp outside the building within 200 feet of the building. Reciprocating equipment (other than emergency equipment) shall not be used.
Steel frames shall be used for air handling equipment. Flexible pipe connectors (e.g., twin-sphere connectors) shall be used on piping connecting to isolated equipment and where piping and ducting exit the mechanical room. Flexible duct connectors shall be used in a similar manner.
Special design consideration shall been given to the duct layout reducing noise transfer between rooms, especially noise generated by loud equipment or discussions in adjacent rooms.

Ducts of diameter less than 24 inches do not require isolation provided flow velocities do not exceed 1,200 feet per minute. (In the case of rectangular ducting, the effective diameter is defined as the square foot of the product of the two duct dimensions.)

# DUCTWORK SYSTEM

**ENERGY PERFORMANCE ANALYSIS**

The following memo has been prepared to provide the energy breakdown for the HVAC options analyzed for Glendale Community College.

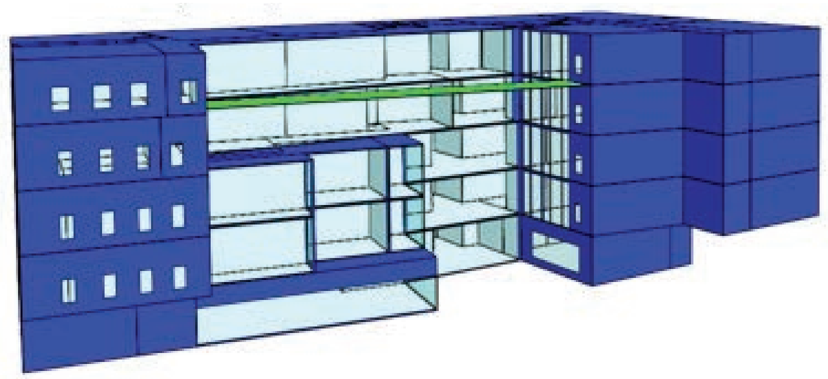

*Figure 6: Building IES Model*

IES-VE was used to create an energy model to simulate the energy break down for the current proposed design compared to two alternative HVAC options for corridors and office spaces. These two alternate systems were assigned to spaces with large window-to-wall ratio (WWR), such as the corridor spaces located on the 4th and 5th floor of the South façade where they are exposed to high solar radiation, thus affecting the thermal comfort in those areas. The alternative HVAC systems were analyzed to determine the best conditioning option for these spaces. The following list includes the current HVAC design and the two optioned that were analyzed.

- Early stage Design: VAV with reheat with chilled water cooling and hot water heating.
- Option1: Stacked Ventilation: double façade
- Option 2: Radiant heating and cooling

Option 1 is only applied to the 4th and 5th floor corridor spaces on the south facing façade, whereas, Option 2 is applied to all the corridor spaces on the south façade for all floors.

In order to get a clearer picture of the HVAC impact, the results of the analysis presented focuses on HVAC only end-uses such as, heating, cooling, pumps, fans, and heat rejection to generate an HVAC only EUI. Therefore, plug loads, lighting, and service hot water were excluded so that the incremental changes between the options could be seen more clearly. For example, plug loads have a big impact on the overall EUI of a lab building and would be constant between options, making the changes to the HVAC results less apparent.
As a result, the initial design generates an HVAC only energy use intensity (EUI) of 55 kBtu/sf-yr compared to Option 1 with an HVAC EUI of 53 kBtu/sf-yr and option 2 with an HVAC EUI of 45 kBtu/sf/yr, as shown in Figure 1 below. The energy break down for the HVAC components show that the heating energy drastically reduced for Option 2 by 34% compared to the initial design. Figure 2 shows the only major change in the HVAC energy was heating for option 2. Furthermore, the alternative HVAC analysis shows that Option 1 and Option 2 can help reduce the HVAC energy use intensity by 3% and 18%, respectively.

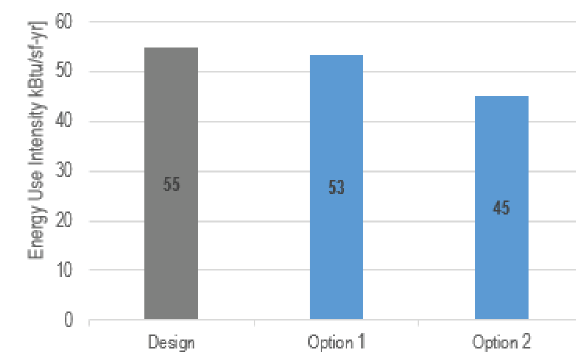


*Figure 6: Design and Alternative HVAC systems overall EUI*

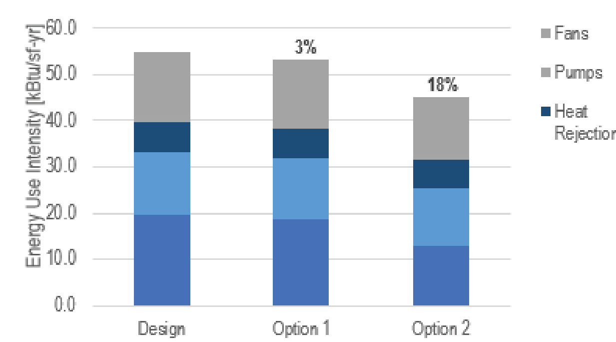


*Figure 7: Design and Alternative HVAC systems Energy Break Down EUI.*

The primary HVAC systems is roof-top, 4-pipe, VAV AHUs with hot water reheat at the zone level for non-lab spaces and with high occupancy level. Office spaces will be conditioned via air handling units ducted to zone active chilled beams. The active beams will also provide zone heating. Each three offices will be considered as a single zone with a changeover control valve between heating and cooling provided in each zone controlled via a room mounted thermostat. Ventilation will be controlled based on occupancy and Carbon Dioxide concentration on a room by room basis via a pressure independent control damper.
Active beams will be piped in a reverse return arrangement within each zone. Isolation ball valves will be provided at each beam. Each room will be provided with a pressure relief damper direct to corridors and partial air will be returned to the air handling units.
All dehumidification will be provided via the air handling unit which requires higher than code minimum.
Lab spaces will be provided 100% OSA AHUs and 100% exhaust with hot water reheat at the zone level. Heat is provided by four roof-top gas-fire heating hot water boilers.

Chilled water will be connected to the campus central plant near the building site and piped up through the building to the first floor mechanical room, welded, steel piping. The plant provide 44 degF supply / 58 degF return connections. There is approximately 700 tons of chilled water load.

All pumps will be variable volume with dual pumps sized at 50% each on both CHW and HHW.

Per energy analysis mentioned above in option 2, corridor Radiant In-Slab Heating and Cooling has been selected for corridors. Space heating and cooling to corridors will be provided primarily by an in-slab radiant system. In slab hydronic heating relies on radiative heat transfer and hot water as the heating medium, providing what many regard as the most comfortable and highest efficiency commercially viable approach to space heating. Humans perceive thermal comfort based on air temperature, air movement, relative humidity, and radiant temperature of their surroundings. It is important to note, however, that the resting human body transfers as much as 60% of its heat via radiative heat exchange. By controlling the mean radiant temperature of a space via radiant heating, the radiant slab achieves much higher levels of comfort than an all air heating system.

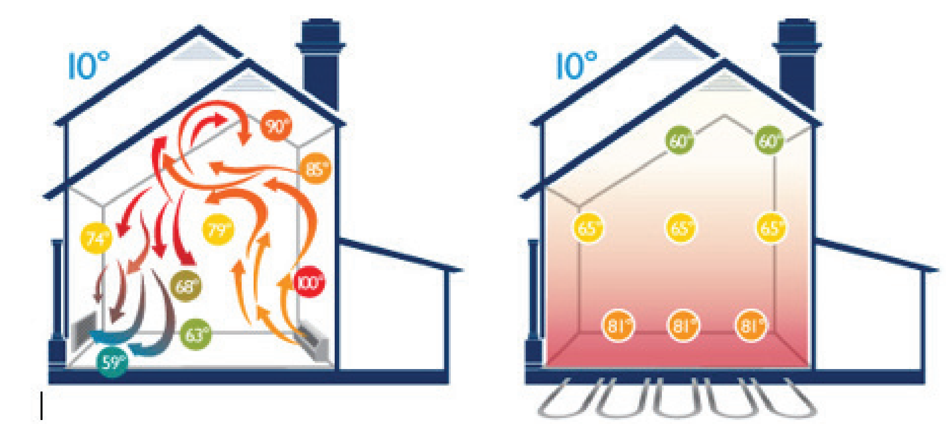


*Figure 8: Radiant Heating*

# ENERGY PERFORMANCE

Additionally, water has approximately 3500 times the heat capacity of air, so distributing hot water to the space for heating is substantially more energy efficient than pushing warm air to the space. Radiant tubing will be cast in a concrete topping slab. The radiant in-slab system will be separated into zones with manifolds.

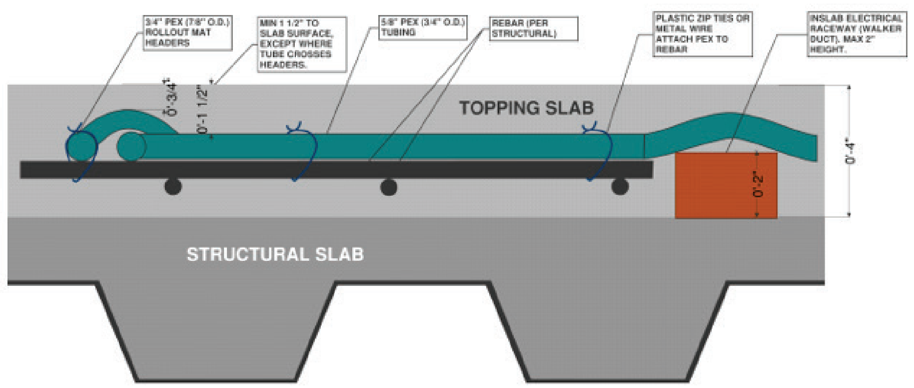


**Figure 9: Radiant Topping Slab Diagram**

**Equipment:**

- AHU-1, 59,500 CFM variable speed supply, 100% OSA
  - LABS, East wing, first, second, third and fourth floor
- AHU-2, 28,500 CFM variable speed supply, 100% OSA
  - LABS, West wing, first, second and third floor
- AHU-3, 14,200 CFM variable speed supply with economizer
  - Offices and Classrooms, first, second, third and fourth floor.
- AHU-4, 47,100 CFM variable speed supply with economizer
  - LABS, fourth and fifth floor.
- 4 – 47,000 CFM Laboratory Exhaust fans, variable speed (plenum and multiple fan stacks)
- 1 – 4,000 CFM General Exhaust fan with VFD for Restrooms
- 1 – 1,500 CFM Fume Exhaust fan, variable speed, Vivarium
- 4- 2,000 MBH HHW Boilers, >90% Condensing type, with integral primary pump
- 4 - HHW Pumps - 128 GPM, 50 ft TDH – VFD
- 2 - CHW Pumps -600 GPM, 50 ft TDH – VFD
- Split DX/FCU for telecom rooms (~1.5 tons ea)
- 1 – Electrical rooms Exhaust fan

All AHU equipment is designed with fully modulating economizer capable of providing 100% OSA.

Anticipated distribution of VAV zone boxes would be 1 VAV box per 1,500 SF, but not less than one per space type. Laboratory air controls provided (similar to Price controls and venture valves)
Electrical room, and IT rooms will be provided with cooling only split system fan coil units.

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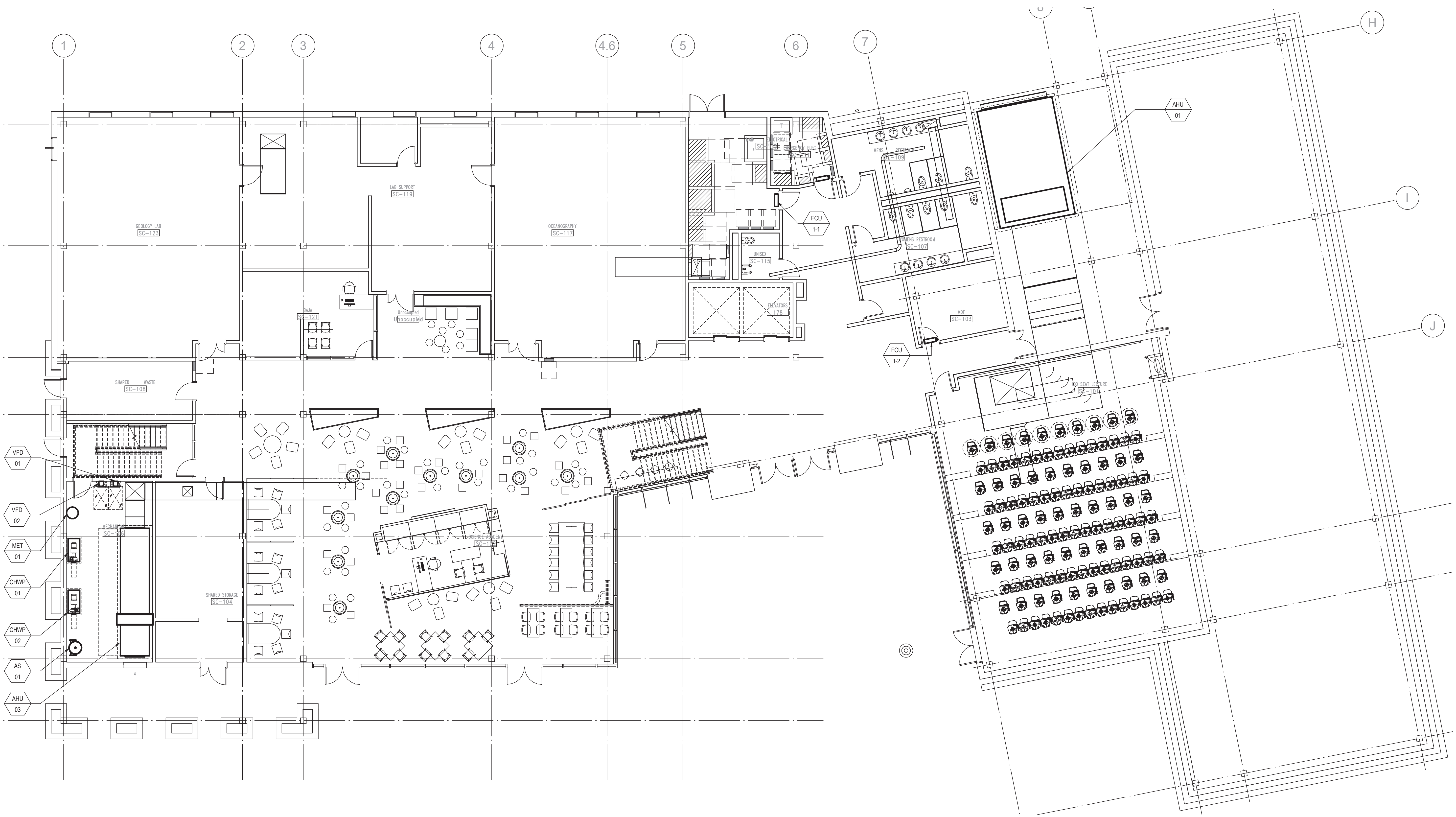
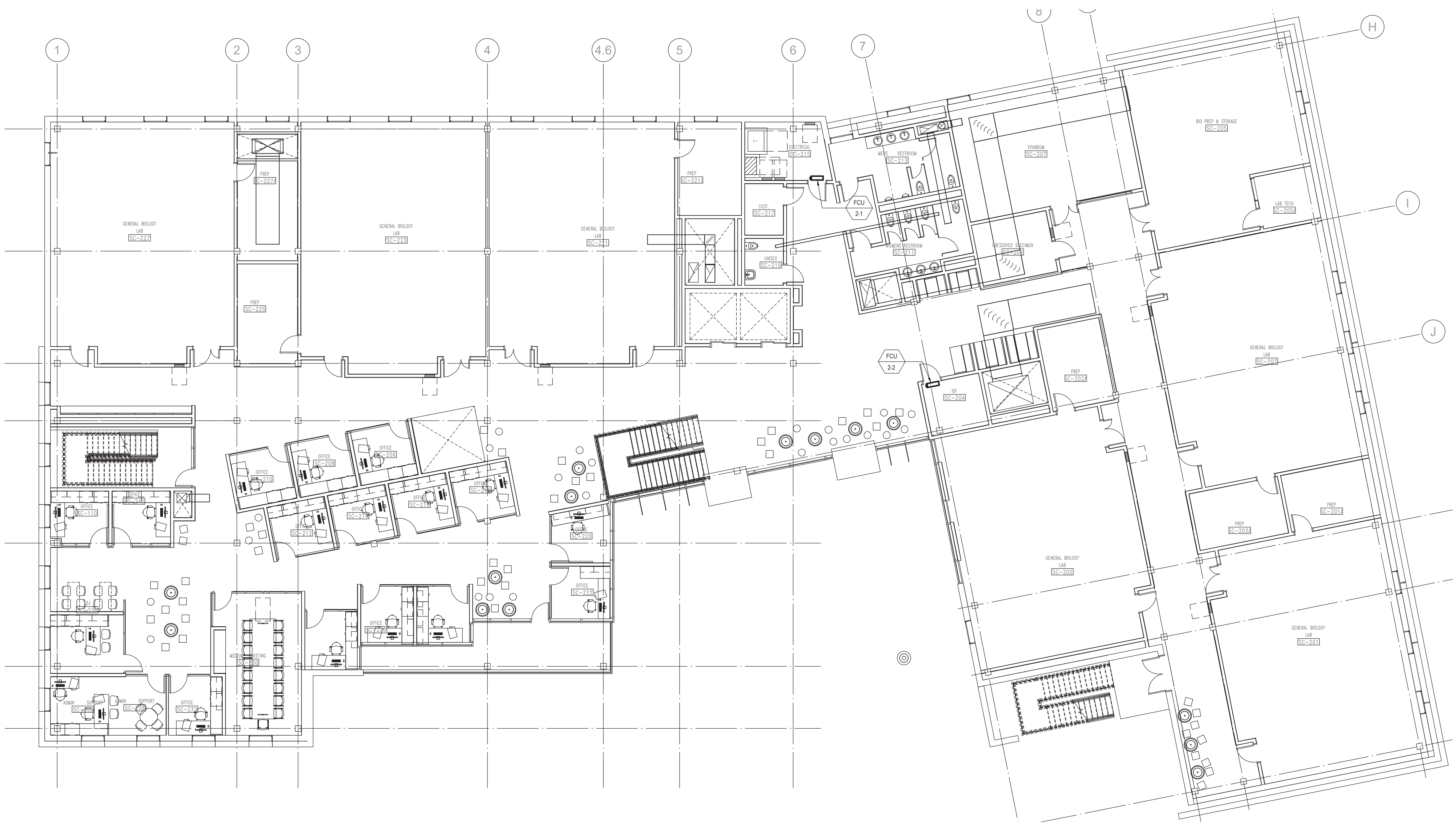



# LEVEL ONE **MECHANICAL**

SCIENCE BUILDING | GLENDALE COMMUNITY COLLEGE



# LEVEL TWO **MECHANICAL**

0 8' 16' 32'

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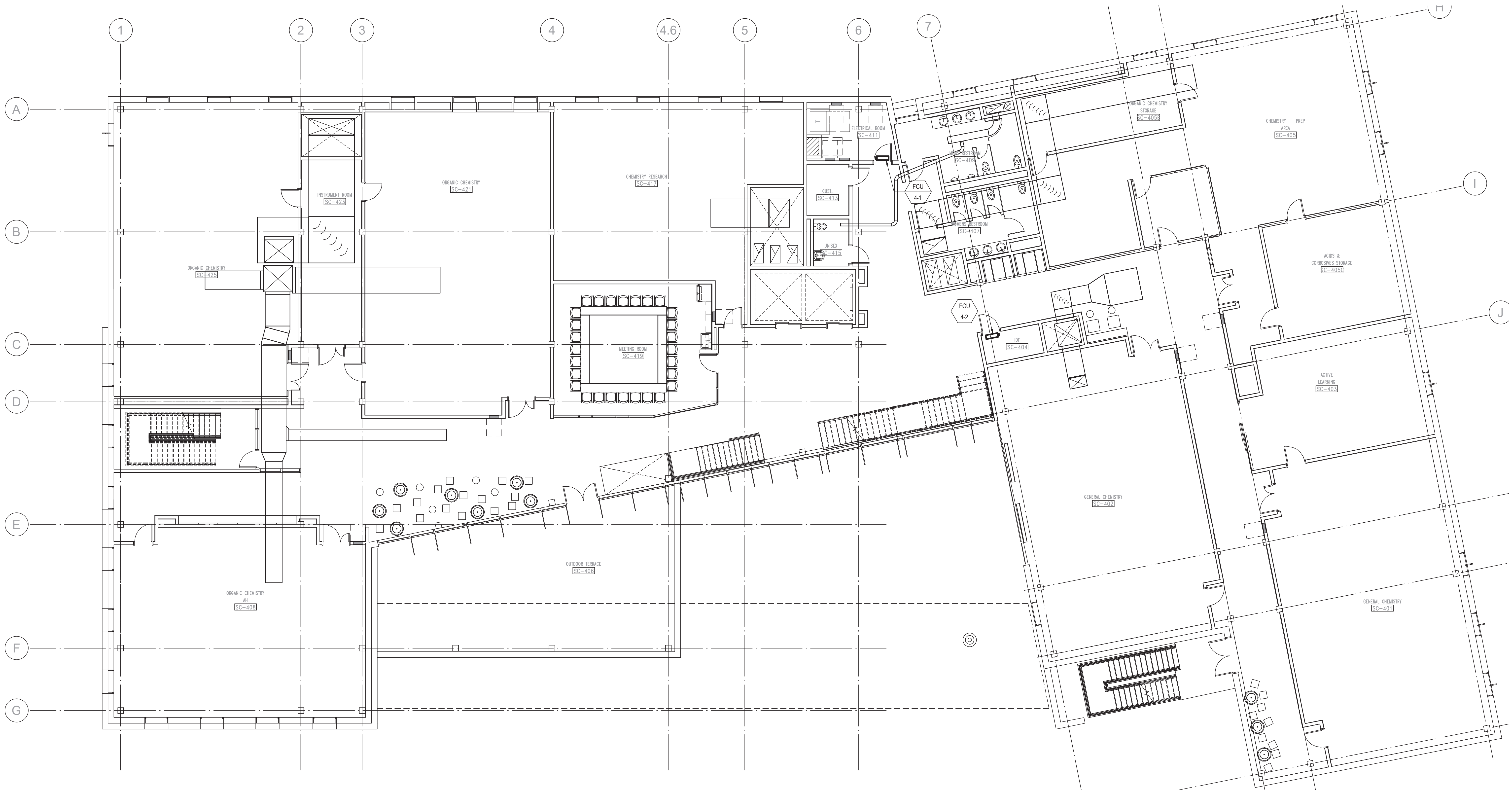
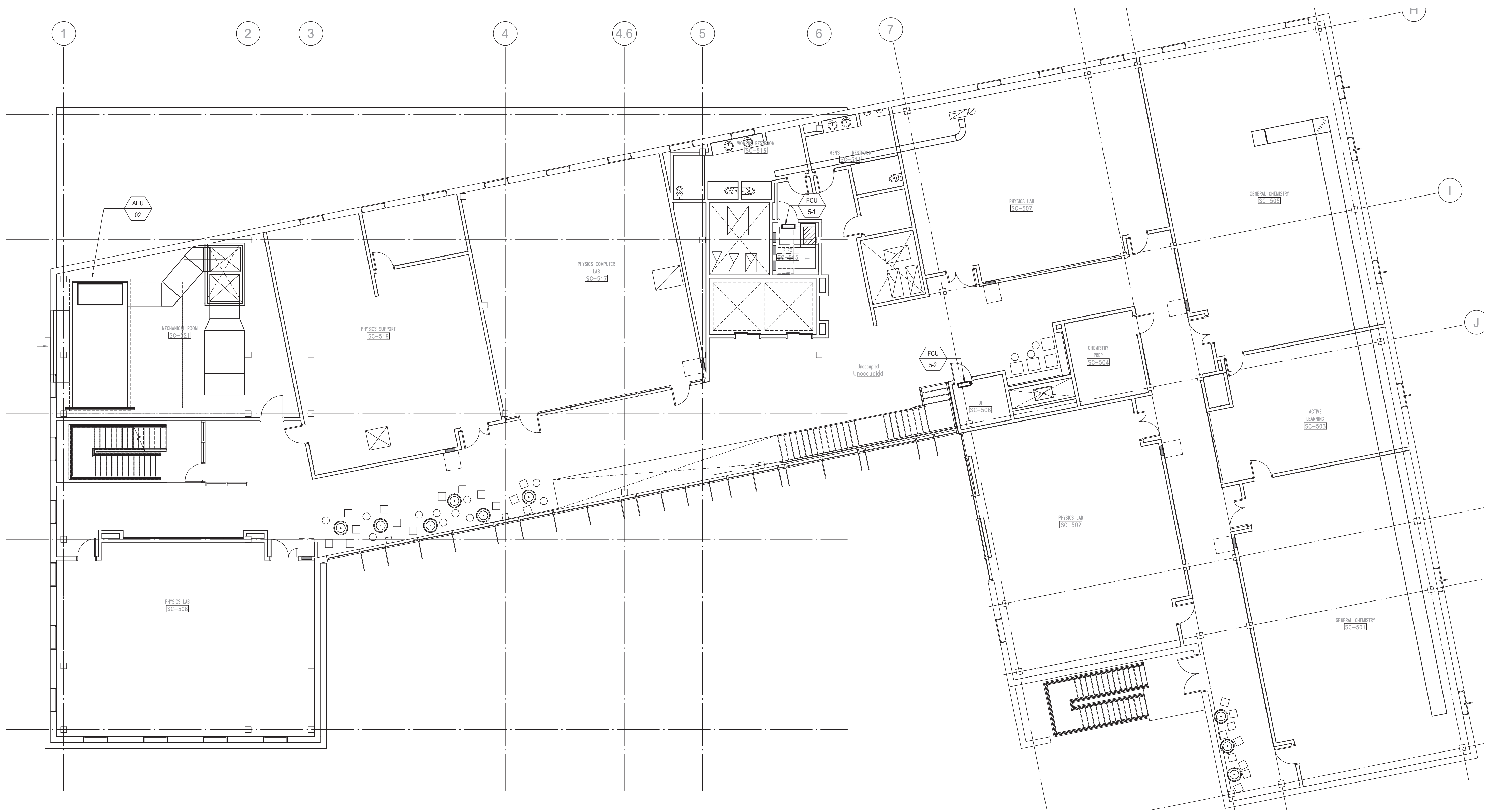
# LEVEL THREE **MECHANICAL**

SCIENCE BUILDING | GLENDALE COMMUNITY COLLEGE




# LEVEL FOUR **MECHANICAL**




# LEVEL FIVE **MECHANICAL**

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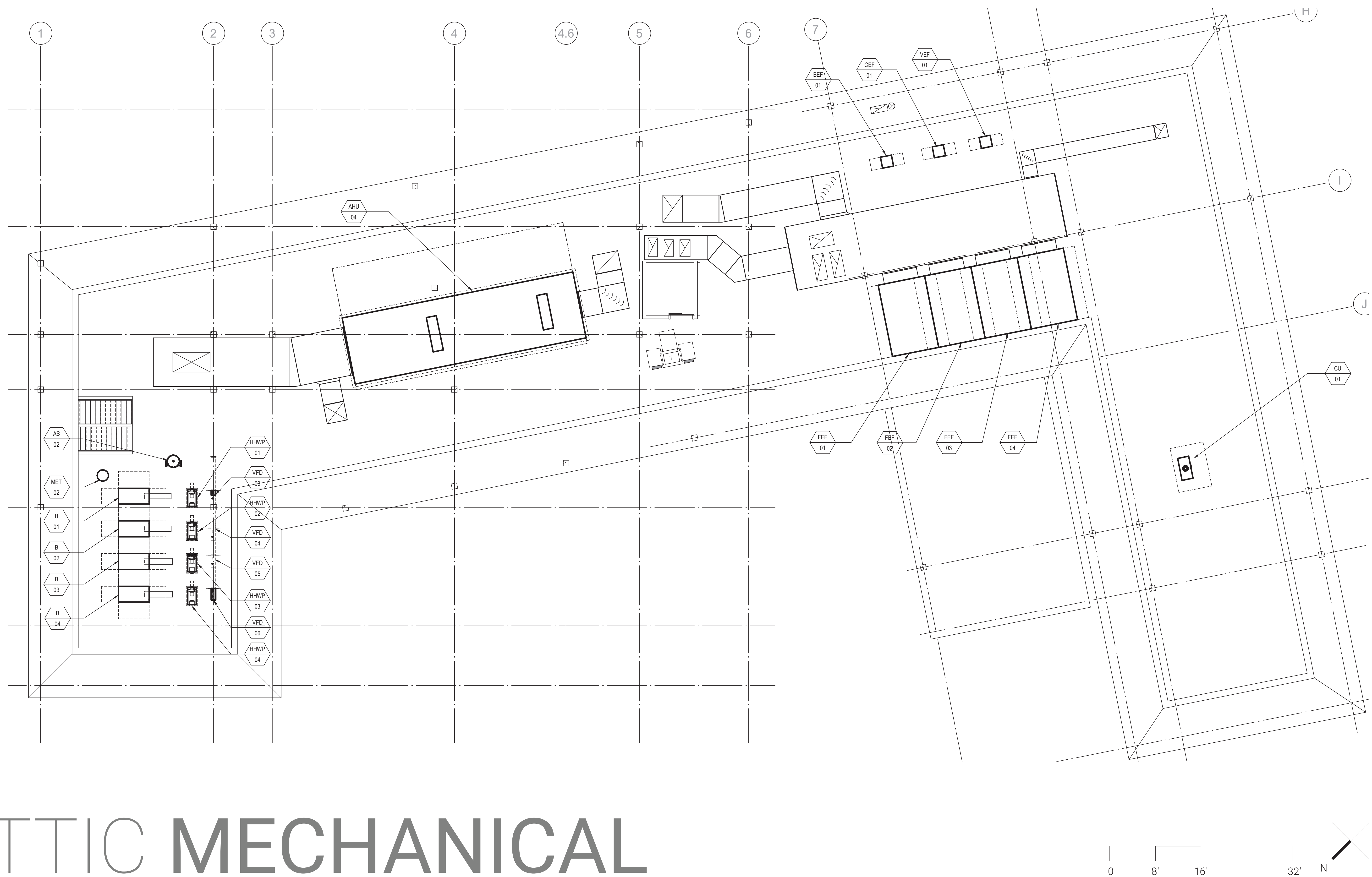


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# ELECTRICAL

SECTION 4
**Electrical Engineering**

## GOALS

The electrical design will strategically implement a sensible, sustainable system that provides ease of maintenance, flexibility, and capacity for future modifications.

Every effort shall be made to ensure that designs and equipment used on the new campus are replicable for deployment into future expansion or modification. This campus will serve as a notable example of feasible, sustainable design strategies.

## ELECTRICAL CODES AND STANDARDS

**Codes**

- 2019 California Administrative Code, Title 24 Part 1
- 2019 California Building Code (CBC), Title 24 Part 2
- 2019 California Electrical Code (CEC), Title 24 Part 3
- 2019 California Mechanical Code (CMC), Title 24 Part 4
- 2019 California Plumbing Code (CPC), Title 24 Part 5
- 2019 California Energy Code (CEC), Title 24 Part 6
- 2019 California Fire Code (CFC), Title 24 Part 9
- 2019 California Green Building Standards Code (CGBSC), Title 24 Part 11
- 2019 California Referenced Standards Code (CRSC), Title 24 Part 12
- 2019 NFPA 72 National Fire Alarm Code
- 2019 NFPA 110 Standards for Emergency and Standby Power Systems
- State of California Public Utilities Commission (CPUC)
- ADA Standards for Accessible Design- Code of Regulations
- Occupational Safety and Health Administration (OSHA)

**Standards**

- ADA Standards for Accessible Design – Code of Regulations (Including Amendments)
- American National Standards Institute ANSI
- American Society for Testing and Materials ASTM
- Association of Edison Illuminating Companies AEIC
- Certified Ballast Manufacturers CBM
- Electrical Testing Laboratories ETL
- Electronic Industries Association EIA
- IES DG-29-11
- Illuminating Engineering Society of North America IESNA
- Institute of Electrical and Electronics Engineers IEEE
- Insulated Power Cable Engineers Association IPCEA
- National Electrical Manufacturers Association NEMA
- International Electrical Testing Association NETA
- National Fire Protection Association NFPA
- Underwriters' Laboratories UL

## ELECTRICAL SERVICE

The new building will derive its normal power from the existing campus 5kv electrical infrastructure from Manhole "HVMH-8". From HVMH-8, provide new (2) 4"C-3#350kcmil (5kv, 1/C) and 1#4/0 ground to proposed pad mounted switch for the building. Based on preliminary load calculations, the building will require a 2500 Amp, 480/277V, 3P, 4W main switchboard with a 2500 Amp circuit breaker equipped with ground fault protection located in the Main electrical room on Level 1. The main switchboard will have Surge Protective Devices.

The main electrical room will also contain the main distribution equipment to feed process loads, lighting, mechanical and plumbing loads in each area. The room will require two means of egress located on opposite end of the room. One of the egress doors should be minimum of 72" wide for equipment removal and replacement. Exit doors shall be swinging outside and equipped with panic hardware.

Stacked satellite electrical rooms will be provided on each level of the building containing Distribution boards, panel boards feeding all the required loads, lighting and small mechanical loads. Designated Lab panels will be provided outside the lab rooms.

## BUILDING POWER DISTRIBUTION

All distribution panelboards, transformers and panels will be located in electrical rooms or closets.

- 225 amp 42 pole, 120/208V, 3 phase, 4 wire panel boards shall be provided throughout the electrical rooms for powering office equipment and general use receptacle outlets.
- 100 amp 42 pole, 480/277V, 3 phase 4 wire panelboards shall be provided throughout the electrical room for lighting for the interior and exterior of the building.
- 480/277V, 3PH, 4W and 480V, 3-PH, 3W electrical power shall be distributed through the building by feeders from the main electrical room to feed all Distribution Boards
- 208/120V, 3 phase, 4 wire power will be provided from shall be provided throughout the electrical rooms for powering small mechanical and plumbing loads
- 150 amp 42 pole, 120/208V, 3 phase, 4 wire panel boards shall be provided by the entrance to the laboratories.
- 208/120V, 3 phase, 4 wire power will be provided from 208/120V, 3 phase, 4 wire distribution panelboards via 480-208/120V, 3 phase, 4 wire distribution transformers.
- Energy efficient 480-120/208V transformers will be provided to energize the 208/120V distribution system.
- Space for the building automation control panels will be provided in mechanical rooms. The building automation system is described in other sections of this document.
- Space for the building life safety Fire Alarm Panels and Terminal Cabinet may be provided in electrical rooms. The fire alarm system is described in other sections of this document.

## LOAD DENSITIES: Lighting and Receptacles (Volt-Amperes/Sq. Ft.)

- General Offices: Lighting 1.0; Receptacles 5.0
- Classrooms: Lighting 1.2; Receptacles 5.0
- Meeting Rooms: Lighting 1.2; Receptacles 5.0
- Administrative Areas: Lighting 1.0; Receptacles 5.0
- Electrical and Communications Room: Lighting 0.6; Receptacles 3
- Mechanical and Equipment Rooms: Lighting 0.6; Receptacles 3
- Corridor, Restroom, Stair, Support : Lighting 0.6; Receptacles 1
- Laboratory: Lighting 3.0, Receptacles 25.0

## EQUIPMENT SIZING CRITERIA

| | |
|---|---|
| **Branch Circuit Load Calculations** | |
| Lighting | 100% of actual installed wattage |
| Receptacle | 180 VA per outlet |
| Special Outlets | Actual installed wattage of equipment |
| **Demand Factors** | |
| Lighting | 125% of total wattage |
| Receptacles, Convenience Outlets | 100% of first 10 kVA plus 50% of all over 10 KVA |
| Motors | 125% of wattage of largest motor plus 100% of wattage of all other motors |
| Fixed Equipment | 100% of total wattage |

Mechanical, lighting, and office receptacle loads, and general receptacle loads will be segregated by panel in order to measure and verify by load types.

Maximum voltage drop in each power feeder shall be no more than 3%, and the total drop including feeders and branch circuits shall be no more than 5% overall.

## SPARE CAPACITY, EQUIPMENT AND FEEDER SIZE

30% spare capacity will be provided for future growth for main service equipment.

20% spare capacity will be provided for future growth for distribution boards and panel boards.

# ELECTRICAL SERVICE

**ELECTRICAL DISTRIBUTION**

**Main Distribution**

The building power distribution will be at 480/277V and 208/120V via individual conductors in conduits.

The feeders from the utility transformer will feed a main 480/277V switchboard. The incoming service will have a Digital Metering Section for customer metering.

480V distribution will run horizontally from the main switchboard to distribution panels located in electrical rooms. From the distribution panels 480/277V branch raceway circuits will provide power for lighting, mechanical equipment, elevator and pumps. General receptacle outlets and office equipment power shall be 208/120 via dry type transformers.

**METHOD OF DISTRIBUTION**

- 480V, 3 phase 3 wire for all motor loads, 1/2 horsepower and larger.
- 277V, 1 phase for LED lighting fixtures.
- 120V for receptacle outlets and motors smaller than 1/2 horsepower.
- 120/208V, 1- and 3-phase for classrooms
- 120/208V, 1- and 3-phase for laboratories
- Separate wires in conduit will be provided for each of the following loads:

**HVAC and Plumbing Systems**
- 480V, 3 phase, 3 wire, 60 Hz; 208V, 3 phase, 3 wire, 60 Hz, and 120V, 1 phase, 2 wire, 60 Hz.

**Elevators**
- 480V, 3 phase, 3 wire, 60 Hz;

**Lighting and General Purpose Receptacles**
- 277V, 1 phase for LED lighting.
- 208Y/120V, 3 phase, 4 wire, 60 Hz for general purpose receptacles (via local dry type transformers).
- Lighting branch circuit design will be based upon a maximum of 2700 volt amperes per 20 ampere, 277V circuit.
- Receptacle branch circuit design will be based upon a maximum of 1200 volt amperes per 20 ampere, 120V circuit

**Low Voltage Switchboards**

The low voltage switchboards will be completely assembled, free standing, with copper bus bars, full neutral bus, and separate copper ground bus. Protective devices will be provided with approved barrier between sections and extended load terminals.

Protective devices will be single and multiple-pole circuit breakers. All devices will be fully rated for available fault plus 10%. Series rated devices and equipment are not acceptable for use on this project.
Circuit breakers that are 400A and larger will be molded case type, rated for application in their intended enclosure with solid state tripping, including adjustable long time, instantaneous, short time, and ground fault.

**Panelboards, & Dry-Type Transformers**
**Panelboards**
Individual panelboards shall have door-in-door construction and copper bussing, unless otherwise noted in single line diagram.

**Transformers**
Energy efficient transformers in compliance with the 2016 Department of Energy Efficiency Standards must be provided for this project.
Transformers shall be located in dedicated equipment rooms.

| RACEWAY APPLICATIONS | | |
|---|---|---|
| **ENVIRONMENT** | **RACEWAYS** | **BOXES, ENCLOSURES, AND CABINETS** |
| **Dry locations, concealed** | RMC, IMC, EMT, FMC, LFMC, LFNC, WW | SM, FS/FD, NEMA 1 |
| **Dry locations, exposed, subject to damage*** | RMC, IMC | SM, FS/FD, NEMA 1 |
| **Dry locations, exposed, not subject to damage*** | RMC, IMC, EMT, FMC, LFMC, LFNC, WW | SM, FS/FD, NEMA 1 |
| **Outdoor locations, underground**[9] | RMC, IMC, PVC | SCTE 77 |
| **Outdoor locations, submerged**[9] | RMC[3], IMC[3], PVC | NEMA 6, 6P |
| **Outdoor locations, embedded in concrete**[9] | RMC, IMC, EMT[4], PVC, ENT[4] | FS/FD |
| **Under concrete slab**[9] | RMC, IMC, EMT[4], PVC | N/A |
| **Underground, direct burial**[9] | RMC[3], IMC[3], EMT[3], PVC | SCTE 77 |
| **Legend:**<br>EMT Electrical metallic tubing<br>ENT Electrical nonmetallic tubing<br>FMC Flexible metal conduit<br>FS/FD Cast-metal box<br>IMC Intermediate metal conduit<br>LFMC Liquidtight flexible metal conduit<br>LFNC Liquidtight flexible nonmetallic conduit<br>N/A Not applicable<br>NEMA Refers to NEMA 250, type classification<br>PVC Rigid polyvinyl chloride conduit<br>RMC Rigid metal conduit | **Notes:**<br>1. Building finishes must provide a barrier with a 15-minute fire rating.<br>2. For buildings not more than three stories above grade.<br>3. Corrosion protection is required.<br>4. With fittings for purpose.<br>5. Enclosed and gasketed.<br>6. Dust-tight wireway only.<br>7. Raintight wireway only.<br>8. Nonincendive and intrinsically safe wiring are allowed in any wiring method permitted for unclassified locations.<br>9. Aluminum materials are permitted only with approved supplementary corrosion protection.<br>10. Schedule 80.<br>11. Only as specifically permitted under the environmental | |
| SM Sheet-metal box<br>WW Wireway | condition.<br>12. Subject to temperature limitations where exposed to sunlight.<br>* "Subject to damage" denotes environments where exposed raceways may be impacted by traffic, by cleaning or maintenance operations, or by similar influences. | |

**GROUNDING**

**Code compliant methodology shall be used.**

**Equipment Grounding System**

UFER ground shall be the primary grounding electrode for new buildings and ground rod(s) installed in ground test wells shall be the primary grounding electrode for existing buildings that do not have a UFER system.

All metallic objects that enclose electrical conductors or that might be energized by electrical currents including all metal equipment parts such as enclosures, raceways, building metal structure and equipment grounding conductors must be effectively bonded.

All earth grounding electrodes must be solidly joined together into a continuous electrically conductive system connected to the main grounding electrode system. Individual building grounding systems must be interconnected to the campus grounding system.

The neutral conductor of the main service and the secondary of all grounding transformers shall be bonded to the building ground system. The grounding of the neutral conductors will only be done once per voltage level to avoid creating grounding loops.

A separate green insulated wire will be run in each feeder conduit and each branch circuit conduit.

**Technical (isolated) grounding system**

Isolated grounding system circuits may be installed for the reduction of electrical noise (electromagnetic interference) on the technical grounding circuit.

A technical power system will be established for this project. The equipment connected to this system is sensitive to electromagnetic interference. In addition to the green equipment ground conductor a separate isolated green with yellow striped insulated wire will be installed in each feeder conduit and each branch circuit conduit connected to the technical power system.

A technical ground bus will be installed in all MDF and IDF rooms. The technical ground bus will include stain less steel mounting brackets, insulator and pre-drilled copper bus bar.

**EMERGENCY AND STAND-BY POWER**

The emergency power system will include a diesel generator with skid-base mounted diesel fuel tank. The generator will be housed in a sound attenuating enclosure to provide protection and controlled access to the generator. The generator will automatically supply power to designated emergency system upon loss on normal power. (3) automatic transfer switches are proposed to transfer electrical loads from normal to emergency power. The proposed electrical loads to transfer are as follows:

**Life Safety System**

The loads will transfer and be up and running within 10 seconds upon loss of normal power. Life Safety loads include but are not limited to the following:

- Building Fire Alarm System – including the fire detection system and combination fire/smoke dampers
- Emergency egress lighting along the designated path of egress. This path would include interior as well as exterior areas.
- Engine generator auxiliary systems power. These include the remote generator annunciator panel for generator and fuel status.

**Stand-by Emergency System- Required**

The required Stand-by Emergency System will include emergency loads required by code to be on emergency power The loads will automatically transfer to the generator within 60 seconds upon loss of normal power. These loads include but are not limited to the following:

- Fume hoods
- Elevator

**Stand-by Emergency System- Optional**

The Stand-by Emergency System will include emergency loads related to improved safety of the facility and loads that the owner requires for maintenance or operation of the facility. The loads will automatically transfer to the generator within 60 seconds upon loss of normal power. These loads include but are not limited to the following:

- Critical Lab Equipment
- Optional: Domestic booster pump

**RECEPTACLES**

General purpose receptacles will be spaced at maximum 50 feet on center along interior walls, including but not limited to, corridors, hallways, interior side of exterior walls, and open areas. Minimum one receptacle outlet will be located within all occupied spaces. Receptacles will be located within 25 feet of mechanical equipment and electrical service areas.
Ground fault interrupting receptacles will be provided for all 125-volt, single phase 15- and 20-ampere receptacles located in bathrooms, rooftops, outdoors, and within 6 ft of a sink.

Provide dedicated and special configuration receptacles for all office copy equipment and appliances. Weatherproof, in-use type outlet boxes shall be used at all exterior locations.

**Receptacle with Continuous Use, Weatherproof Cover**

**LIGHTING CONTROLS**

A distributed microprocessor based lighting control system will be provided to automatically control the entire building lighting systems. The system shall be scalable and provide local as well as central control of the lighting systems. Lighting control systems for the project will have the ability for granular control of fixture groups, device management, load monitoring, and Automatic Demand Response (ADR).

The lighting control head end shall have capability of control and monitoring of any space in a cluster by area or zone and set schedules/presets.

Each fixture or group of fixtures will be controlled by individually addressable ballast, sensor and controller and communicate its status (occupancy, daylight, temperature) to a gateway. Provide a lighting control system that can respond to available daylight by switching or dimming electric light to save energy and extend lamp life.

# EMERGENCY POWER

The lighting controls systems allow for automatic daylight harvesting which shall reduce electric lighting consumption by continuously dimming. The daylight harvesting system will utilize wireless photocells which will sense daylight levels in the space and will dim the lights to a low level or 5% light output. Below minimum light level, fixture power will be disconnected.

Enclosed stairs shall include occupancy sensor controls to reduce the lighting within the stair (by a minimum of 50%) when it is not occupied.

Toilet rooms shall include occupancy sensor controls to turn off all the non-night light fixtures when the room is not occupied. Occupancy sensor time delays shall be set at a minimum of 30 minutes.
Back of house rooms such as storage rooms, janitorial rooms, equipment rooms, locker rooms, etc shall be controlled by local occupancy sensors.

Exterior lighting fixtures shall be turned on by a photocell placed at an appropriate location on the exterior of the building. Light fixtures which are designated as essential for security shall be turned off by a photocell as well. Light fixtures which are designated as ornamental shall be turned off by the time clock function of the lighting control panel. Where required, exterior motion sensors will increase lighting levels when people are present and reduce to minimum 50% lighting levels when areas are vacant.

**PHOTOVOLTAIC SYSTEM**

Integral Group will provide provisions per Title 24 solar-ready requirements. Provisions for power conduits from roof-mounted PV arrays to locations of future PV inverter will be provided.

**OPTIONAL: ENERGY MONITORING & SUB-METERING**

Monitoring, metering and controls can all play a major role in realizing the projects objectives. Sub-meters can be provided for the building and at the distribution board level. Sub-meters shall be web-enabled and shall communicate to the EMCS, where the data shall be collected and stored.
Loads shall be segregated at the panel level as follows:

- HVAC/Plumbing
- IDF/Telecom
- Process/Plug Loads
- Lighting
- Elevator
- Comprehensive power, energy, and demand measurements shall be collected including:
- Voltage and current: per phase minimum, maximum, and average
- Power: kVA, Watts, kVAR, and Power Factor
- Demand: Forward, reverse, net, sum, load profile, and export.

**ELECTRICAL SYSTEM STUDIES**

**Coordination study**

The coordination study is an integral part of the building operation. It greatly reduces faulty circuit breaker tripping and thus enhancing user experience and minimizing maintenance calls.
Coordination study will be performed by the contractor using actual equipment curves. Study electrical distribution system from normal and alternative power sources throughout electrical distribution system for project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

Coordination study shall be conducted using CAPTOR software from SKM Systems Analysis Inc.

**Arc-flash study**

The Arc Flash study will calculate the incident energy and arc flash boundary for each location in a power system. The study shall determine the trip times from the protective device settings and arcing fault current values. Incident energy and arc flash boundaries should be calculated following the NFPA 70E and IEEE 1584 standards. Clothing requirements shall be specified from for each piece of equipment. Initial study will be provided on construction documents using generic equipment and assumed utility fault levels. Final coordination study shall be performed by contractor using actual equipment, feeder types and lengths.

Coordination study shall be conducted using Arc Flash software from SKM Systems Analysis Inc.

**Short circuit study**

The short circuit study shall include three-phase analysis including rigorous load flow and voltage drop calculations, impact motor starting, traditional fault analysis, demand and design load analysis, feeder, raceway and transformer sizing, and panel, MCC, and switchboard schedule specification. Initial study will be provided on construction documents using generic equipment and assumed utility fault levels. Final coordination study shall be performed by contractor using actual equipment, feeder types and lengths.

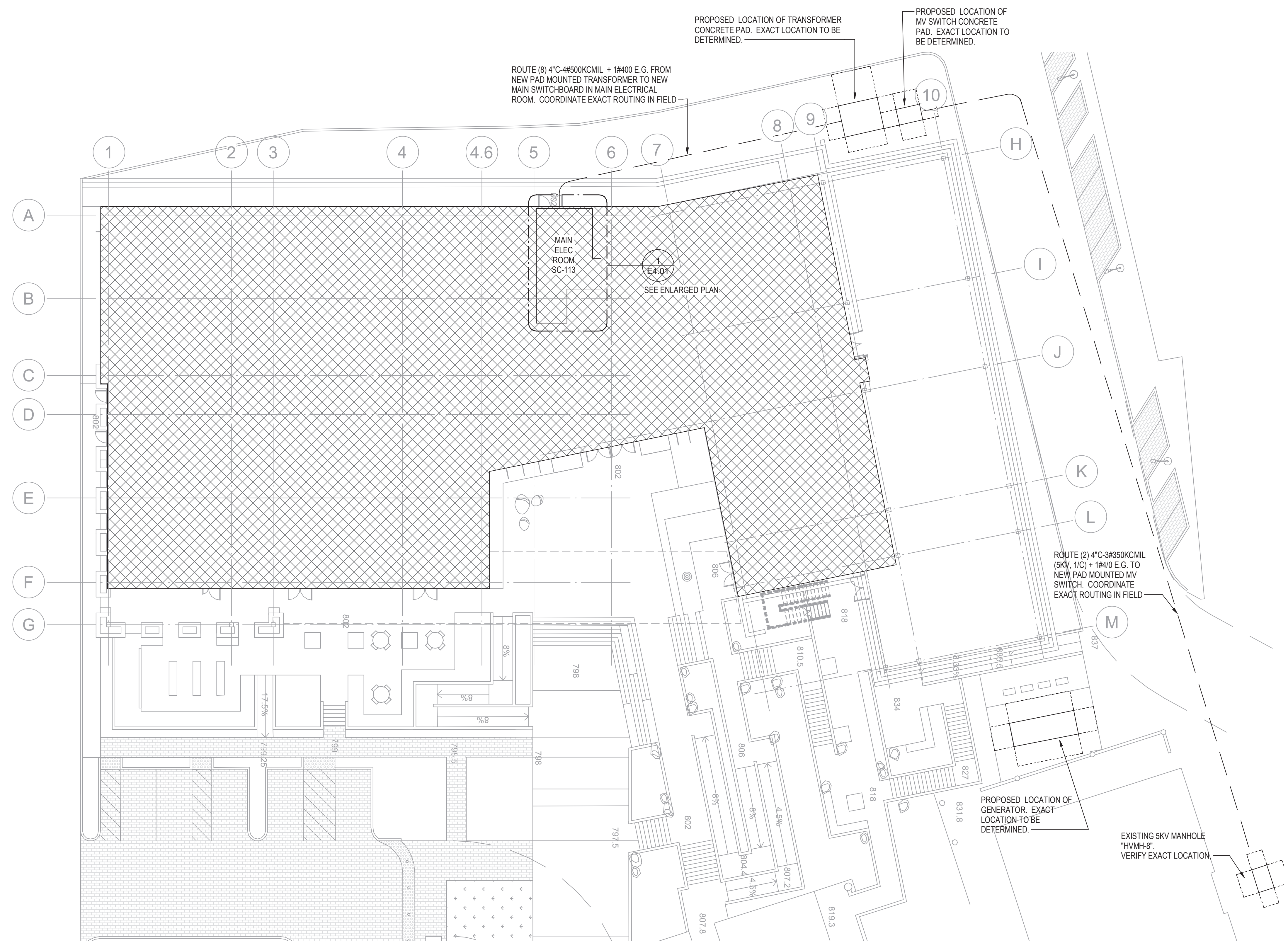
Short circuit study shall be conducted using DAPPER software from SKM Systems Analysis Inc.

**FIRE ALARM**

Fire alarm system shall meet local Fire Marshall requirements and shall include full smoke/heat coverage for the building, as well as strobe, horn, and horn/strobe coverage in all areas as required. All initiating and annunciating devices shall be addressable. A remote annunciator with a full graphical layout of the entire building shall be provided at main entrance to building. Addressable monitor and relay modules shall be used to interface with required items, such as fire sprinkler valves and air handling units requiring automated shutdown. Performance of the horns and strobes shall be per acceptance of the AHJ.

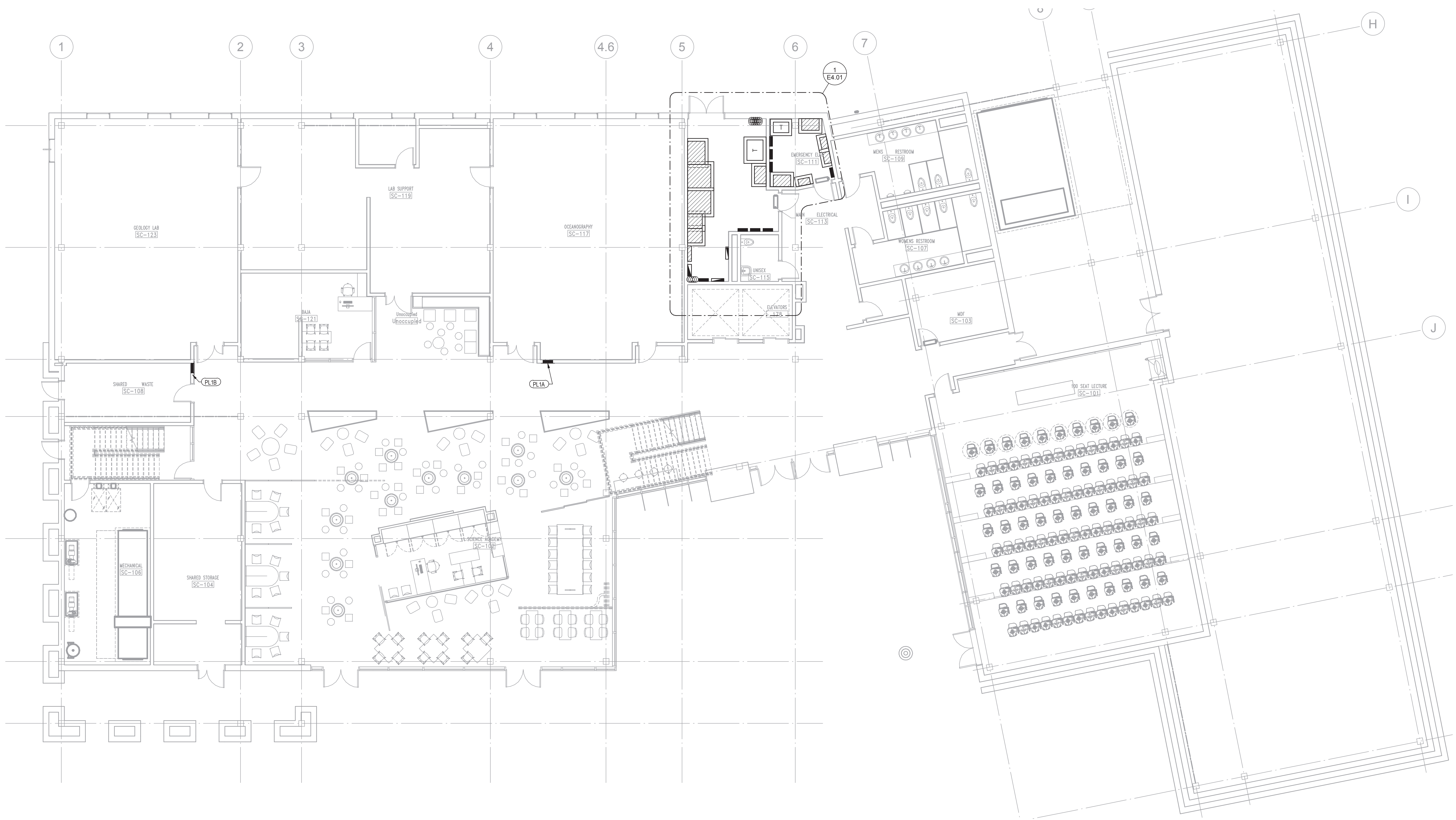
All fire smoke dampers (FSD's) shall be connected to 120V power though an interposing relay controlled by the fire alarm system to automatically close the damper. Automatic door holds shall be provided at each stairwell door and shall be automatically closed by the fire alarm system.
Contractor is responsible for providing a complete turn-key system.

# SYSTEM STUDIES

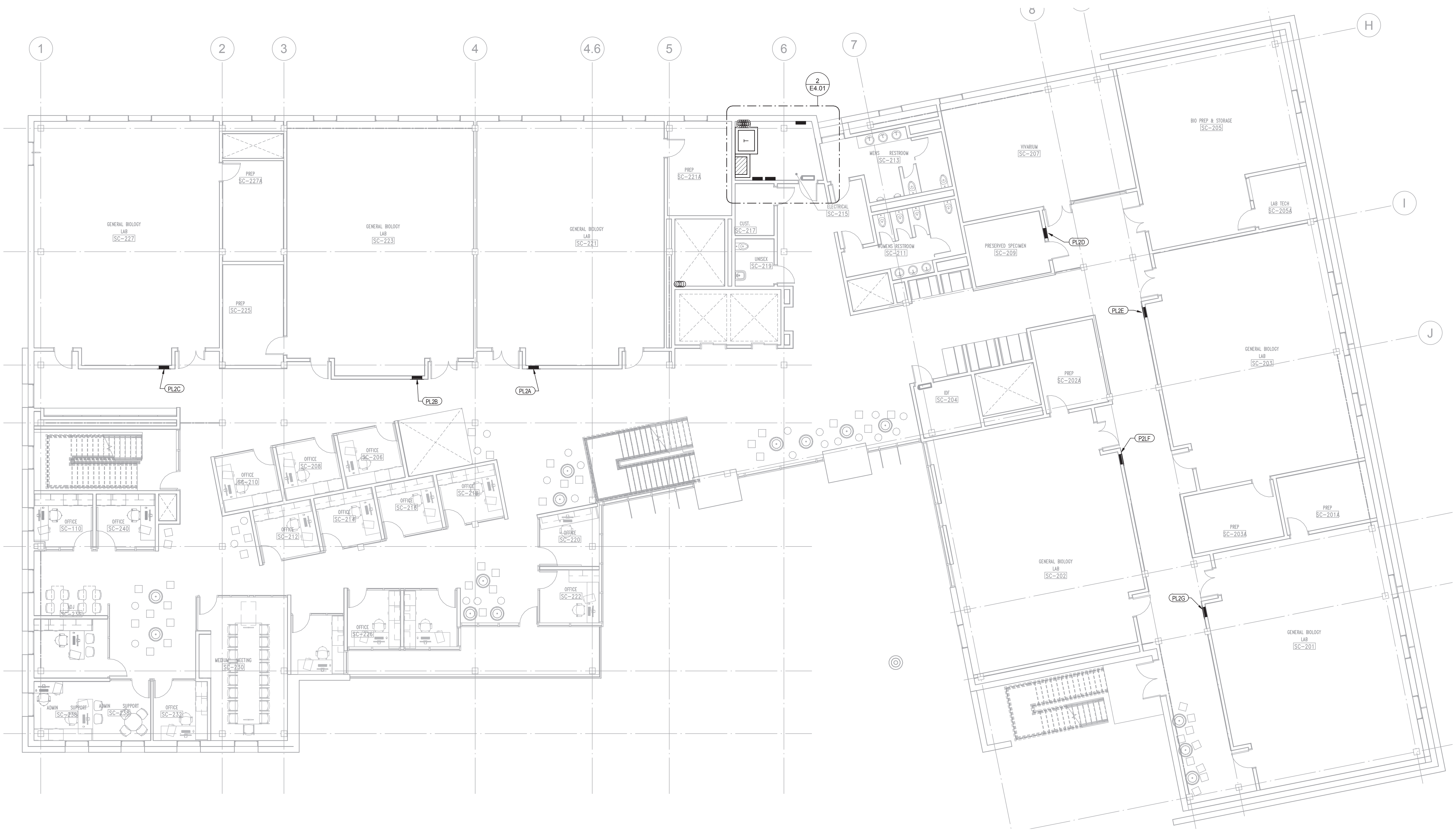



# ELECTRICAL SITE PLAN

SCIENCE BUILDING | GLENDALE COMMUNITY COLLEGE

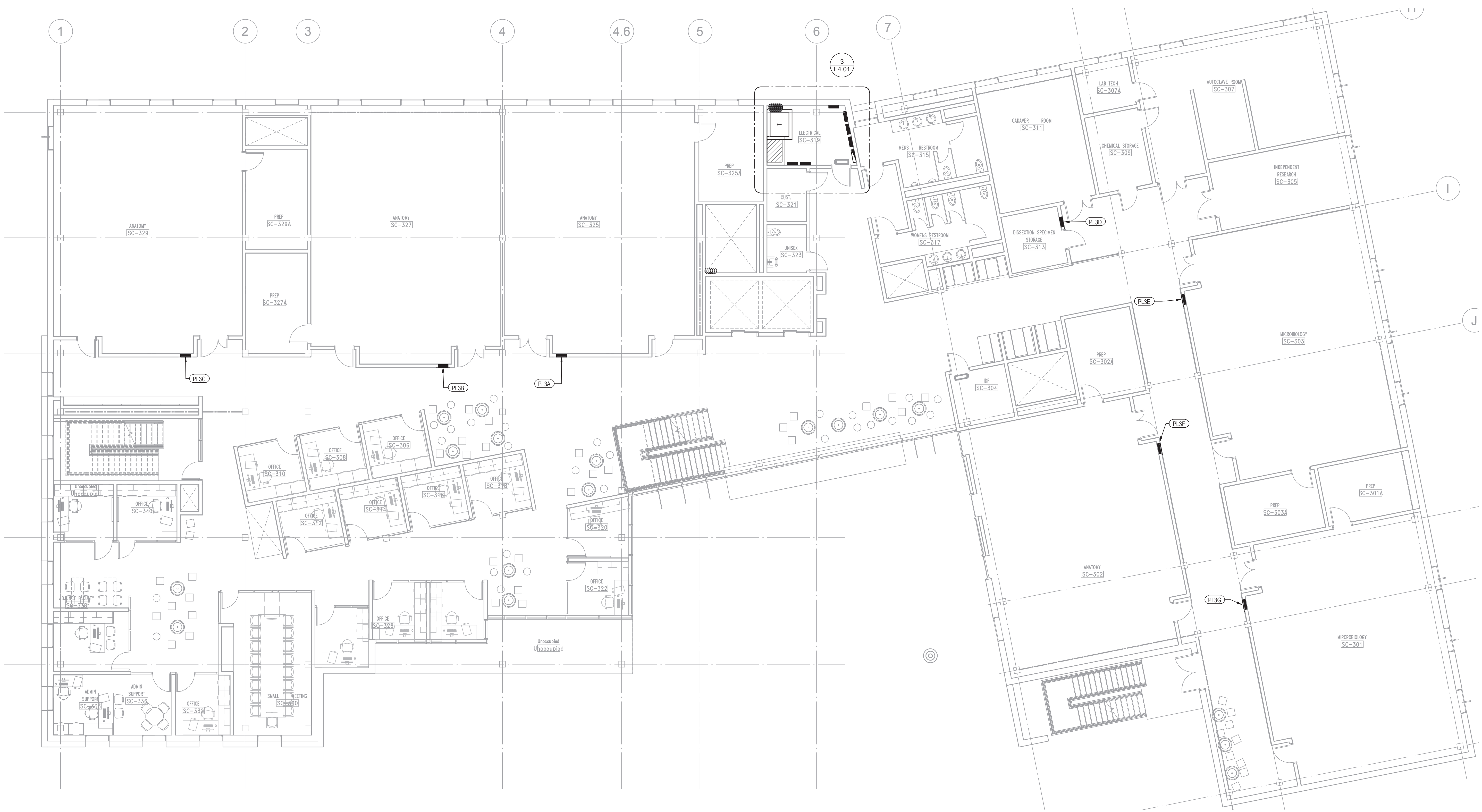



# LEVEL ONE **ELECTRICAL**




# LEVEL TWO **ELECTRICAL**

SCIENCE BUILDING | GLENDALE COMMUNITY COLLEGE



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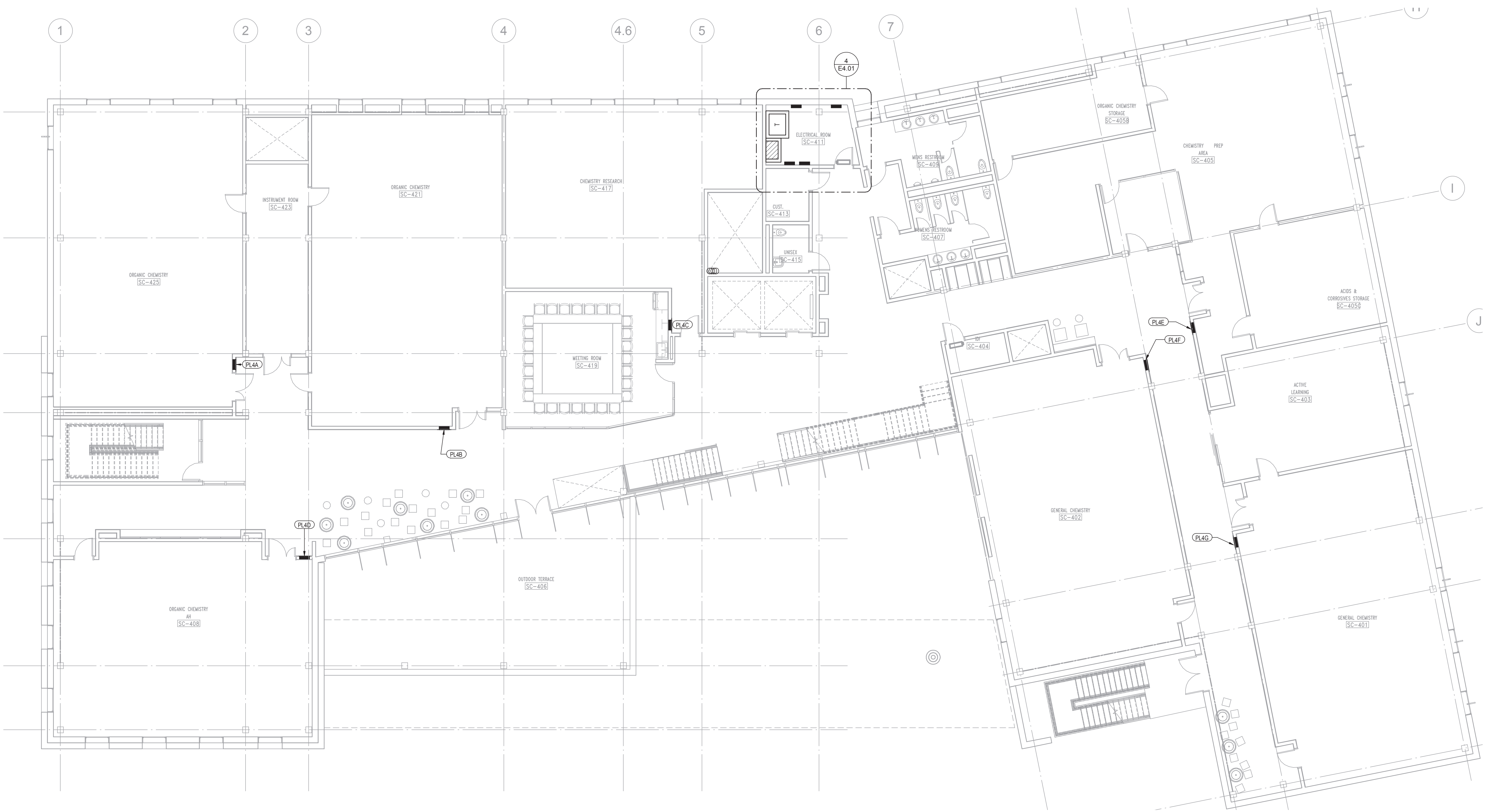
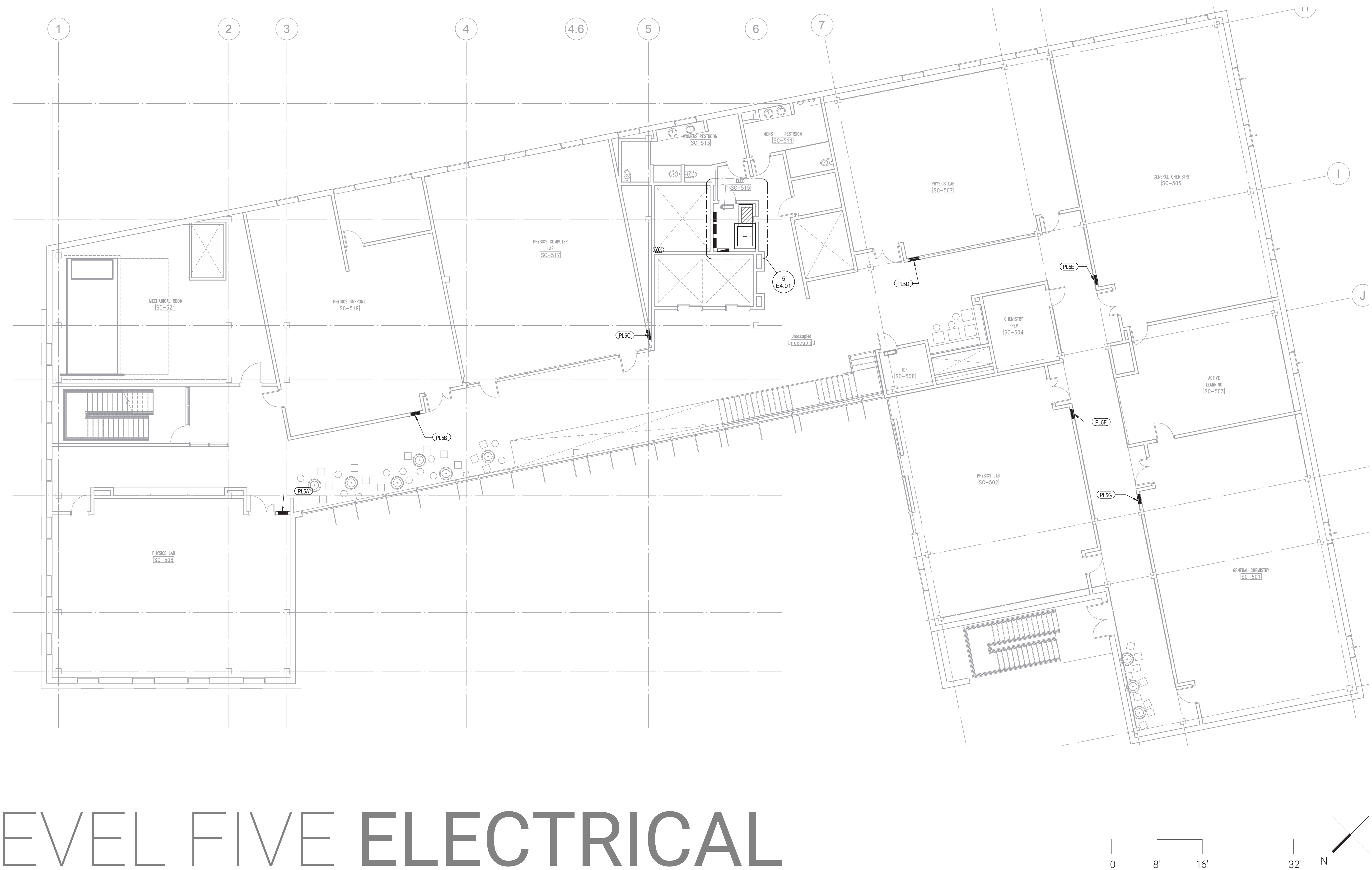
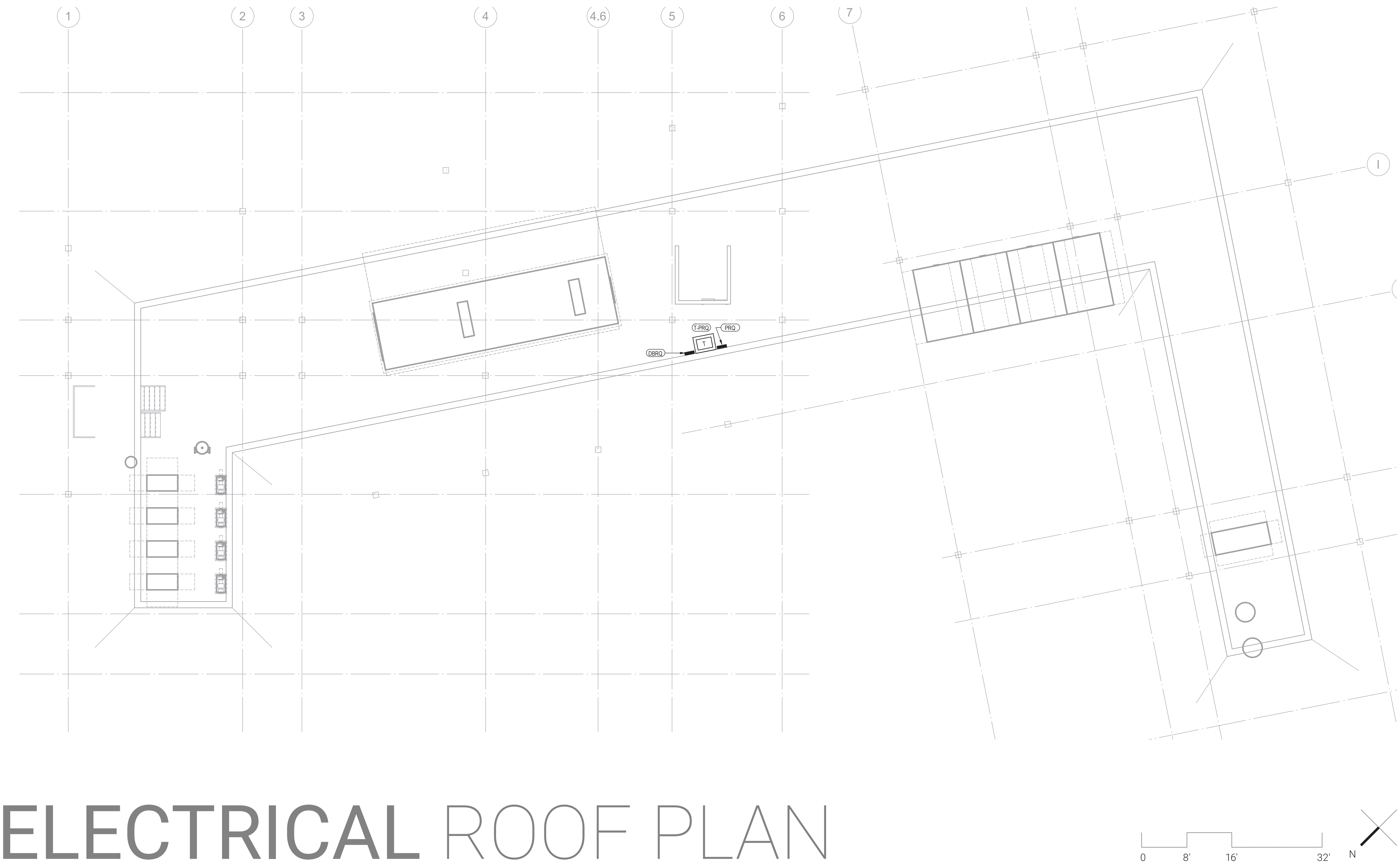



# LEVEL FOUR **ELECTRICAL**

SCIENCE BUILDING | GLENDALE COMMUNITY COLLEGE

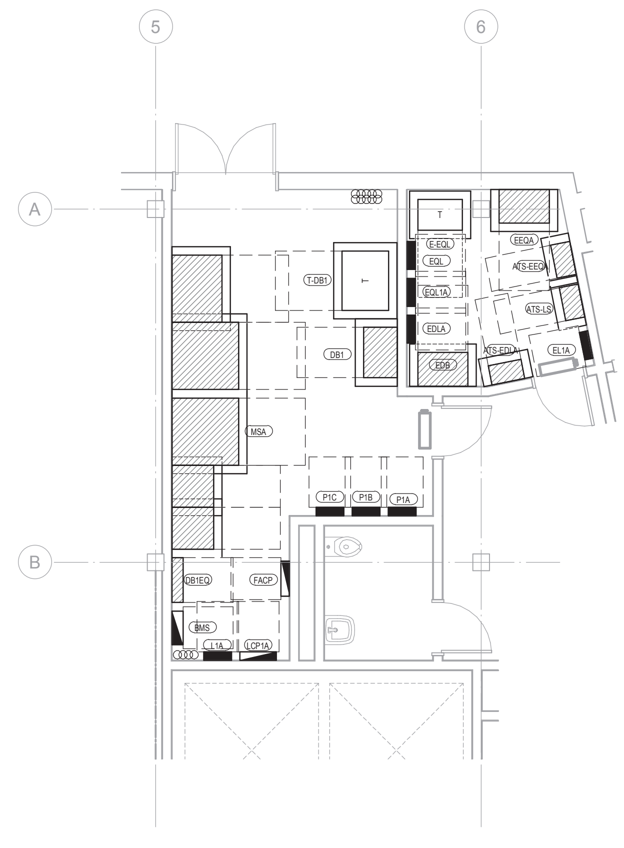


# LEVEL FIVE **ELECTRICAL**

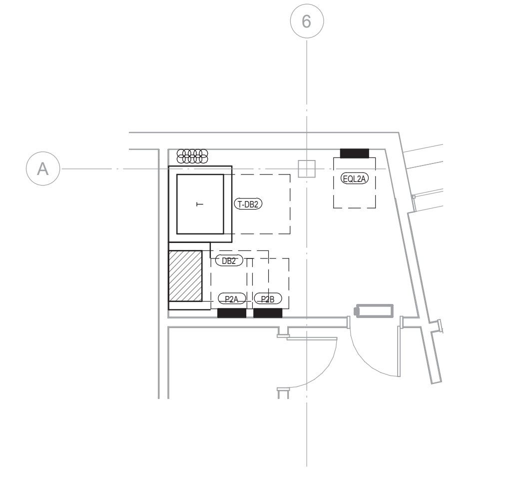



# ELECTRICAL ROOF PLAN

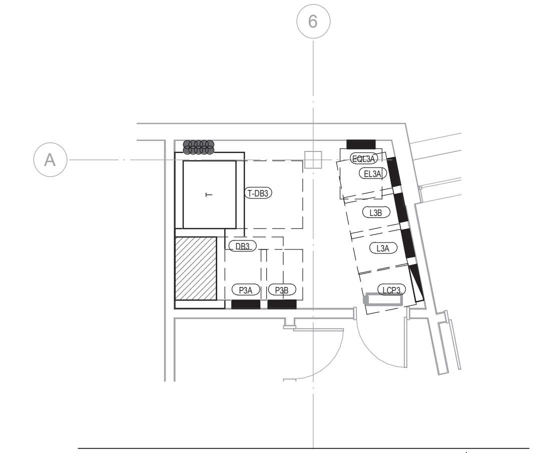
SCIENCE BUILDING | GLENDALE COMMUNITY COLLEGE



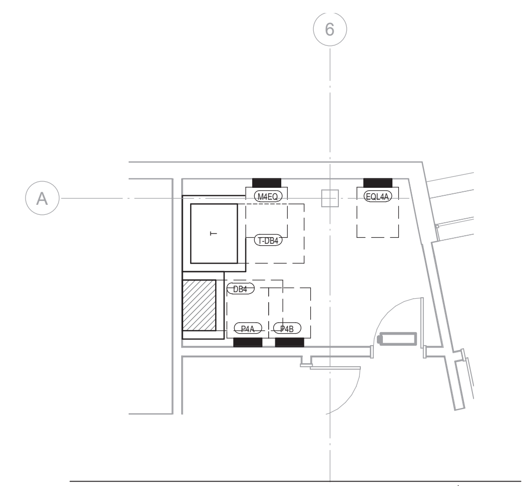
E04 - MAIN ELEC RM 1
1/4" = 1'-0"



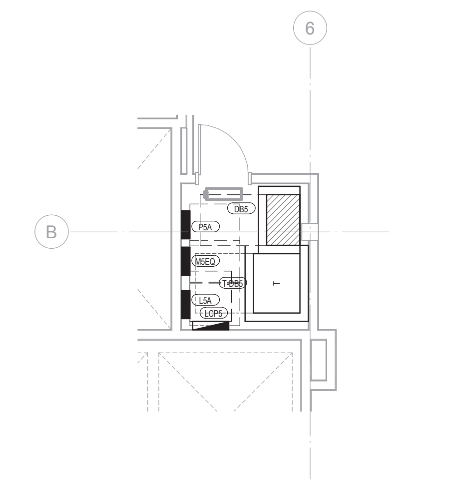
E04-2ND FLOOR ELEC RM 2
1/4" = 1'-0"



E04-3RD FLOOR ELEC RM 3
1/4" = 1'-0"



E04-4TH FLOOR ELEC RM 4
1/4" = 1'-0"



E04-5TH FLOOR ELEC RM 5
1/4" = 1'-0"

# ELECTRICAL ROOMS

**SECTION 6**

**TECHNOLOGY**

**Information Technology Systems (ITS) Goals**

Design infrastructure that can accommodate day one, adds, changes and future technologies. This will be accomplished by designing an infrastructure that is re-enterable with less than 40% fill-ratio, different types of cable such as copper (data, voice, security and controls), coaxial (community antenna television) and fiber (higher bandwidth systems requirements). Collectively these cables can support wide variety of technologies within the building.

**Design Criteria**

The major elements of an Information Technology Systems distribution design are spaces and pathways. Each of these elements will be reflected in the specifications and drawing package and consists of multiple elements as defined below. Collectively they provide an overview of the Information Technology Systems Basis of Design.

- Main Distribution Frame (MDF) & Minimum Point of Entry (MPOE) – Conduits, utility vaults that provide voice, data and video cable access onto the property and into the building from the street (beyond property lines).

- Telecommunications Room (also referred as IDF) – The Intermediate Distribution Frame (IDF) room on each floor will be utilized for:
    - Routing and terminating Building Backbone (riser) system
    - Terminating horizontal cables for station cables
    - Housing IT/telecommunications systems that will service the building (e.g., voice switching node(s), backbone network equipment, video transmission equipment, etc.).

- Building Backbone (Riser) Pathways –In general, "riser pathways" are used for placement of IT/telecom media between the MPOE/MDF room to IDF rooms. These pathways typically must support copper, optical fiber, and coaxial cables serving equipment and cross- connection/termination hardware associated with end-users located on each floor of a building. Conduit fill shall not exceed 40%.

- Horizontal Pathways – The conduit, sleeves, cable tray and other non-continuous cable support devices that transport IT/telecommunications media (twisted copper cable, optical fiber, and coaxial cable) from IDF rooms to the station (user) locations on a given floor. Cable runs shall not exceed 295' from the serving IDF room. Initial conduit fill should not exceed 40%. Cable tray shall provide a minimum capacity of twice the amount of cable as is required in the initial installation.

- Over the life of the facility, the horizontal pathways between the IDF rooms and the station outlet locations will be the component of the IT/telecom infrastructure that is most often re- entered and modified. As such, it will also be the infrastructure component that receives the most criticism if not properly planned and implemented. To mitigate future problems as much as possible, the design will identify specific methods of placing and supporting initial cables with an eye toward optimizing the flexibility to cost effectively meet future changes in user needs and technology.

- Information Outlets – The final termination point of a voice, data and/or video cable. The information outlet will ultimately be configured to serve a variety of needs. Information outlets shall be standardized as much as possible to provide the flexibility to utilize each outlet for various applications that may change over time and do so with minimal cost or lost time caused by the need for physical cable reconfigurations or additions.

The overall low-voltage infrastructure building design shall address each of these areas as both a standalone service and a component of an entire system. There must be pathway interconnection between these components, such as feeder conduits and non-continuous cable support hardware, fire and sound wall considerations, and ceiling and floor penetration sleeves.

Building designs that require the cable installer to drill holes in walls and place sleeves through fire partitions after construction should be avoided. While technology will change between the time of the initial architectural planning and building occupancy, the infrastructure (pathways and spaces) will be in place for the life of the building and must be capable of supporting multiple changes in technology.

**Codes and Standards**

Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean the latest edition of such publications adopted and published prior to submittal of the bid unless otherwise specifically stated.

**Codes**

Perform work and furnish materials and equipment in accordance with applicable requirements of the latest edition of governing codes, rules and regulations including but not limited to the following minimum standards, whether statutory or not:

- 2019 California Building Code (CBC)
- 2019 California Electrical Code (CEC)
- 2019 California Mechanical Code (CMC)
- 2019 California Plumbing Code (CPC)
- 2019 California Energy Code

- 2019 California Green Code (CGC)
- 2019 California Referenced Standards Code
- 2016 National Fire Protection Agency (NFPA)
    - NFPA 70, "National Electrical Code" (NEC)
    - NFPA 72, "National Fire Alarm and Signaling Code"
    - NFPA 75, "Protection of Information Technology Equipment"
    - NFPA 262, "Standard Method of Testing Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces", 2007
- ADA Standards for Accessible Design- Code of Regulations

**Standards**

Perform Work and furnish materials and equipment in accordance with the latest editions of the following standards as applicable:
Underwriters Laboratories (UL): Applicable listings and ratings, including but not limited to the following standards:

- UL 444, "Communications Cables"
- UL 497, "Protectors for Paired-Conductor Communication Circuits"
- UL 497A, "Secondary Protectors for Communications Circuits"
- UL 497B, "Protectors for Data Communications and Fire-Alarm Circuits"
- UL 497C, "Protectors for Coaxial Communications Circuits"
- UL 1651, "Optical Fiber Cable"
- UL1655, "Community-Antenna Television Cables"
- UL 1666, "Test for Flame Propagation Height of Electrical and Optical-Fiber Cable installed Vertically in Shafts"
- UL 1690, "Data-Processing Cable "
- UL 1963, "Communications-Circuit Accessories"
- Telecommunications Industry Association (TIA) 568 Series:
- ANSI/TIA-568-C.0, "Generic Telecommunications Cabling for Customer Premises"
- ANSI/TIA-568-C.1, "Commercial Building Telecommunications Cabling
- Standards - Part 1 General Requirements"
- ANSI/TIA-568-C.2, "Balanced Twisted Pair Telecommunications Cabling and Components"
- ANSI/TIA-568-C.3, "Optical Fiber Cabling Components"
- ANSI/TIA-569-B, "Commercial Building Standard for Telecommunications Pathways and Spaces"
- ANSI/TIA/EIA-598-B, "Optical Fiber Cable Color Coding"
- ANSI/TIA-606-B, "Administration Standard for Telecommunications Infrastructure"

- ANSI/TIA-758-A, "Customer-Owned Outside Plant Telecommunications Infrastructure Standard", including the following addenda"
- ANSI/TIA-1005, "Telecommunications Infrastructure Standard for Industrial Premises"
- EIA testing standards Insulated Cable Engineers Association (ICEA):
- ANSI/ICEA S-83-596-1994, "Fiber Optic Premises Distribution Cable"

# IT CODES AND STANDARDS

- ANSI/ICEA S-87-640-1999, "Fiber Optic Outside Plant Communications Cable"
- ANSI/ICEA S-90-661-2002, "Category 6 Individually Unshielded Twisted Pair Indoor Cable for Use In General Purpose and LAN Communication Wiring Systems"
- ICEA S-102-700-2004, "ICEA Standard For Category 6 Individually Unshielded Twisted Pair Indoor Cables (With Or Without An Overall Shield) For Use In Communications Wiring Systems Technical Requirements"
- Building Industry Consulting Services International (BICSI):
- Telecommunications Distribution Methods Manual (TDMM)
- Customer-Owned Outside Plant Design Manual Wireless Design Reference Manual (WDRM)
- Network Design Reference Manual (NDRM)

**Telecommunication Rooms MDF (room SC-103)**

- Refer to MDF's location shown on architectural plans.
- Provide Security card access HID card reader with electrified mortise lockset, keyed off master
- Telecom room shall not be exposed to any EMI from sources within the building, direct sunlight, excess humidity or other hazardous materials, equipment or conditions.
- MDF should be reserved for the sole use of IT, telecommunications (and potentially security) related materials and equipment and no other trades should be permitted to use the room for placement of equipment or materials.
- No hard cap or drop ceiling shall be installed. Rooms shall be open from floor to roof and shall have a minimum height of 9' above finished floor (AFF) to roof above.
- MDF room shall be equipped with a 36" wide x minimum 84" tall door with access control. Door should swing outward. Doorway shall contain no door sill.
- All walls within all IDF rooms shall be covered with ¾", A/C Grade fire treated plywood back boards (with "A" side out), shall be installed with no gaps and shall be painted with at least two coats of fire retardant paint in a color to match Architectural design. Plywood shall be 8' high with bottom mounted 24" AFF.
- Walls within all MDF rooms should run from finished floor to roof or floor above and sealed (no gaps).
- MDF room, provide Telecommunication Ground Bus (TGB) bar with #6 copper ground wire back to building's main ground source.
- Entire floor of each IDF shall be sealed concrete or covered in static dissipative VCT flooring with copper ground connection back to MTGB.
- Floor rating shall be 100 lbf/ft under a distributed loading and 2000lbf/ft for a concentrated loading.
- Provide MDF with dedicated, 24 hours per day, 365 days per year cooling system capable of maintaining the room between 64°-75°F.
- Lighting in each IDF shall be at a minimum of 50-foot candles measured at 3" above finished floor (AFF). Light fixtures shall be no lower than 8'6" AFF and should have emergency ballasts as needed.
- Each wall of each MDF will be equipped with at least one 120V – 20 AMP (5-20R) quad electrical outlets at 18" AFF. In addition, electrical outlets will need to be provided for any specialty application (such as security.) requirements.
- One 120V, 20 AMP dedicated outlet (5-20R), one dedicated 208V, 30 AMP twist lock outlet (L6- 30R). Minor modifications may need to be made to these requirements upon receipt of the detailed equipment from Glendale Community College ITS. Minor modifications may need to be made to these requirements upon receipt of the detailed equipment from Glendale College IT .
- Provide a minimum of four (4) 4" horizontal conduit sleeves from each telecom room to the cable conveyance system in the ceiling space of the facility.
- If sprinkler heads are required by code, high temperature sprinkler heads shall be placed in wire cages not directly above equipment racks.
- Minimum 18" wide universal cable runway (ladder rack) shall be mounted around the perimeter of each IDF on all four walls as well as across the top of all equipment racks and/or cabinets at 7'-6" AFF. Vertical sections shall also be provided as needed to transition cabling coming up through the floor up to the horizontal ladder rack. Ground all sections of cable runway back to the TGB.
- Provide for a minimum of two (2) 19"x 7' two-post equipment racks with 8" dual sided vertical cable managers at the front of each side of each rack and (1) 4-post 7' equipment rack. Racks should be "ganged" together and seismic braced to the floor at each corner of the rack with a minimum of 5/8" drop-in anchors, as well as to the cable runway with a 6" stand-off. Provide a dedicated ground connection from each rack and vertical cable manager back to the TGB.
- All horizontal cables shall be terminated in rack mount 48-port angled patch panel at nearest telecom room serving that floor.
- Provide at minimum two 2RU horizontal cable manager per equipment rack.
- Provide at minimum one horizontal PDU per 2-post equipment rack and one vertical PDU per 4-post equipment rack.
- Provide at minimum one fix double sided shelf per telecom room, for miscellaneous equipment.
- Provide one 5KVA rack mount UPS per equipment rack including 2-post UPS mounting brackets. Total wattage and UPS size shall be validated during design development. Current call out to capture scope and design intent.

**IDFs (rooms SC-204,SC-304,SC-404 and SC-506)**

- Refer to IDF's location shown on architectural plans.
- Telecom room shall not be exposed to any EMI from sources within the building, direct sunlight, excess humidity or other hazardous materials, equipment or conditions.
- IDF should be reserved for the sole use of IT, telecommunications (and potentially security) related materials and equipment and no other trades should be permitted to use the room for placement of equipment or materials.
- No hard cap or drop ceiling shall be installed. Rooms shall be open from floor to roof and shall have a minimum height of 9' above finished floor (AFF) to roof above.
- IDF room shall be equipped with a 36" wide x minimum 84" tall door with access control. Door should swing outward. Doorway shall contain no door sill.
- All walls within all IDF rooms shall be covered with ¾", A/C Grade fire treated plywood back boards (with "A" side out), shall be installed with no gaps and shall be painted with at least two coats of fire retardant paint in a color to match Architectural design. Plywood shall be 8' high with bottom mounted 24" AFF.
- Walls within all IDF rooms should run from finished floor to roof or floor above and sealed (no gaps).
- IDF room, provide Telecommunication Ground Bus (TGB) bar with #6 copper ground wire back to building's main ground source.
- Entire floor of each IDF shall be sealed concrete or covered in static dissipative VCT flooring with copper ground connection back to TGB. Floor rating shall be 100 lbf/ft under a distributed loading and 1500lbf/ft for a concentrated loading.
- Provide each IDF with dedicated, 24 hours per day, 365 days per year cooling system capable of maintaining the room between 64°-75°F.
- Lighting in each IDF shall be at a minimum of 50-foot candles measured at 3" above finished floor (AFF). Light fixtures shall be no lower than 8'6" AFF and should have emergency ballasts as needed.
- Each wall of each IDF will be equipped with at least one 120V – 20 AMP (5-20R) quad electrical outlets at 18" AFF. In addition, electrical outlets will need to be provided for any specialty application (such as security) requirements.
- One 120V, 20 AMP dedicated outlet (5-20R), one dedicated 208V, 30 AMP twist lock outlet (L6- 30R) . Minor modifications may need to be made to these requirements upon receipt of the detailed equipment from Glendale Community College IT .
- Provide a minimum of four (4) 4" horizontal conduit sleeves from each IDF to the cable conveyance system in the ceiling space of the facility.
- If sprinkler heads are required by code, high temperature sprinkler heads shall be placed in wire cages not directly above equipment racks.
- Minimum 18" wide universal cable runway (ladder rack) shall be mounted around the perimeter of each IDF on all four walls as well as across the top of all equipment racks and/or cabinets at 7'-6" AFF. Vertical sections shall also be provided as needed to transition cabling coming up through the floor up to the horizontal ladder rack. Ground all sections of cable runway back to
- Provide for a minimum of two (2) 19"x 7' two-post equipment racks with 8" dual sided vertical cable managers at the front of each side of each rack. Racks should be "ganged" together and seismic braced to the floor at each corner of the rack with a minimum of 5/8" drop-in anchors, as well as to the cable runway with a 6" stand-off. Provide a dedicated ground connection from each rack and vertical cable manager back to the TGB.
- All horizontal cables shall be terminated in rack mount 48-port angled patch panel at nearest telecom room serving that floor.

- Provide at minimum two 2RU horizontal cable manager per equipment rack.
- Provide at minimum one horizontal PDU per 2-post equipment rack.
- Provide at minimum one fix double sided shelf per telecom room, for miscellaneous equipment.
- Provide one 5KVA rack mount UPS per equipment rack including 2-post UPS mounting brackets. Total wattage and UPS size shall be validated during design development. Current call out to capture scope and design intent.

**Building Backbone (Riser) Pathways**

- All backbone conduits and sleeves shall be minimum 4" in diameter (with exception of those routing from to the rooftop).
- Pathways shall be designed with no more than two (2) 90º bends with a maximum distance between pull boxes of 100 feet.
- Conduit fill shall not exceed 40%.
- Provide (4)4" conduit sleeves (riser pathway) between MDF room IDF rooms.
- Provide (2)2" conduit with weather cap to rooftop.

**Backbone Cables**

- Provide 24-strand multimode, OM4 fiber optic backbone cable from MDF to each IDF .
- Provide 24-strand singlemode, OS2 fiber optic backbone cable from MDF to each IDF.
- All fiber backbone cabling shall home run from each MDF to IDF and terminate in rack-mount patch panels at both ends.
- All fiber pathways shall consist of innerduct and conduit.
- Innerduct ran inside through plenum airways shall be plenum rated. In addition, the fiber cable shall be Plenum rated.
- Provide 25- multipair copper cable from MDF to each IDF in the building terminate on 24-port patch panel.
- Provide 200-pairs of copper from Campus Main MPOE to MDF , terminate both ends on in 110-style rack- mounted .
- Provide 48 strands of OSP Singlemode (OS2) and 48 strands of OSP multimode (OM4) to campus data center. Backbone fiber shall terminate on fiber patch panel at both ends. Coordinate termination on data center with Glendale it prior to installation.

**Horizontal Pathways**

- Where hard-cap (i.e., inaccessible) ceilings are utilized in areas where cables need to be run case basis depending on cable quantities involved, distances, number of directional changes required, and any other construction complexities in the affected cable run).
- Cable tray shall provide a minimum capacity of twice the amount of cable as is required in the initial installation. Assume 18" x 4" wire basket cable tray, size and route to be validated during design development drawings.
- Cable tray shall be the wire basket type manufactured of ASTM A510 high strength steel wires or equal, and comply with NEMA VE1 or the proposed IEC 61537 standards.
- The cable tray shall be UL (Underwriters Laboratory) listed.
- Any outlet separated from the main horizontal support system (such as a cable tray) by a fire or smoke partition must have a rated pathway such as a conduit or sleeve that can be fire-stopped after cable is installed.
- Every room must be provided a specific pathway from a false ceiling area (used to access information outlet locations) to the main horizontal distribution pathway (such as the cable tray).
- Metal conduits must be provided above hard-cap and/or inaccessible ceiling areas, between floors, and through fire and sound walls, and inside walls.
- Where free-standing modular furniture configurations are utilized, floor-boxes must be provided with either:
- In-slab or under-slab conduits from the floor-boxes to the wall nearest the serving IDF, then stubbed up in such wall to 6" above accessible ceiling (preferred Best-Practices method); or
- Access to the ceiling area of the floor below for use of cable tray conveyance on such floor to nearest IDF room.

**Information Outlets**

All communications station cable shall terminate on RJ45 connectors at the faceplate and RJ45 patch panels in the nearest telecom room. The voice riser cable shall extend from 110 blocks in the MDF to each IDF with one pair terminated on each port of a voice riser patch panel.

**Communication Outlet Configurations:**

- All communications outlets shall support a combination of voice, data and media applications.
- The jack position A (top right) on standard outlets will be utilized primarily for voice applications, therefore provide a grey insert at this position to designate voice, all others will be blue.
- For applications where there is no anticipated voice, provide all blue inserts.
- Provide Cat 6 cable drops for all projectors and monitors with homeruns to the IDF telecom rooms passing through the instructor's desk or local A/V equipment cabinets.
- Each work area outlet shall have the conduit connected to double-gang, deep device boxes (2- 1/2 in. deep), equipped with a single-gang mud ring at the outlet location.
- Standard Wall Mounted Outlet: Shall consist of three (2) Category 6 unshielded twisted pair plenum communications cables terminated on RJ45 connectors on faceplate.
- Wall-Mounted Phone Outlet : Shall consist of two (2) Category 6 unshielded twisted pair plenum communications cables terminated on RJ45 connectors on faceplate at 42" above finished floor, unless otherwise noted by Architect.
- Floorbox/Poke-Through: Shall consist of four(4) Category 6 unshielded twisted pair plenum communications cables terminated on RJ45 connectors in the floor devices.
- Audiovisual Communications Outlet: At the instructor location an outlet consisting of six (6) category 6 unshielded twisted pair plenum communications cables terminated on RJ45 connectors on faceplate.
- Projector outlet: At ceiling projector location provide an outlet with two (2) category 6 unshielded twisted pair plenum communications cables terminated on RJ45 connectors on faceplate.

**Conduits and Backboxes:**

- Individual work area outlets shall be a minimum of 1 in. Individual work area outlet conduits are to be dedicated to only one outlet box each and shall not be "daisy-chained" together.

**Audio Visual Systems (AV) Offices**

Each office space shall contain up to two standard wall mounted outlets, at opposite wall. Location to be determined during design development.

**Labs**

Each Lab space will be designed with:

- Ceiling-mounted projector and motorized projection screen for the display of computer/video images.
- Loudspeakers (Program and Vocal Reinforcement): Ceiling-mounted loudspeakers in the center of each lab (SPKR).
- Microphone for the instructor.
- AV equipment shall be stored locally at the Instructor Desk
- Provide Blu-ray DVD player (BLURAY) mounted in the equipment cabinet.
- Auxiliary audio input cables shall be provided at the teacher desk for connection of laptop computers, portable document cameras or other audio and video devices. Audio only devices:
  - (2) VGA connections with stereo audio. VGA connection shall be by standard 15pin D connector. Audio connection shall be via 3.5mm connector
  - Composite Video with stereo audio connection. All connections shall be via RCA connectors
  - HDMI Connection. Connection shall be via female HDMI connection.
- Assistive Listening System (ALS)
  - A wireless transmission system will be provided to all typical classrooms with permanent seating above 50 seats. This transmission system shall be Infrared (IR). The Americans with Disabilities Act (ADA) specifies providing 4 percent of the number of seats with receivers. The ALS shall be a multiple-channel system.
  - All rooms with less than 50 seats shall provide a stereo "Audio Output" for connection of a portable Assistive Listening System at the teacher station interface panel. This will enable hearing-impaired students to request a portable system that can be used in any classroom upon request.
- Each Classroom will be provided with power, data and phone per Campus standards.

# IT CODES AND STANDARDS

**Conference Room**

- Space configured to support audio and video conference.
- Display screen
- Audio reinforcement distributed overhead via ceiling-mounted speakers
- All AV equipment stored locally in credenza.
- Space shall be provided with power, data and phone per Campus standards.

**Security Systems**

**Video Surveillance Systems (VSS)**

The video surveillance system shall be the latest generation of IP camera technology and shall seamlessly integrate with the existing Campus access control system to capture alarm events generated by the access control system and provide an electronic record of security events and/or unlawful behavior. The video surveillance system shall provide video in real time and provide situational assessment/playback/export tools and provide archiving of all video captured. These assets will provide Glendale Community College with video information to assist in the detection, prevention and prosecution of crime.

**Proposed vendors are:**

- Axis Communications for security cameras
- Milestone Systems Xprotect for video management system

All cameras licenses shall be furnished by the contractor.

**Digital Video Recording**

Cameras images will be recorded by the Video Management System (VMS) that send camera images directly to computer hard drives for digital recording. The recording server will be located in the MDF room.
The cameras VMS storage calculation will be based on 30 days retention, H.264 compression, fixed or variable Bit Rate, 12-15 Images per Second, and 24-hour recording. The VMS will interface with the access control system for camera call up and bookmarking when an alarm event is generated. Room for 20% expansion of cameras recording hard disk space shall be integrated into the design.

**Camera Types and Applications**

| Application | Manufacturer | Camera Type | Resolution |
|---|---|---|---|
| **General Surveillance** – Crowd monitoring, intrusion detection, general traffic flow. | Axis Communication | Mini-Dome, Fixed | 1920 x 1080(HD) |
| ****High Detail** – See faces clearly, and clearly see other objects or items | Axis Communication | Mini-Dome, Fixed | 2592 x 1944 (5MP) |

**This scenario may require more storage space because of higher resolution and file size.

All cameras shall be fixed, network based (IP), HD (1080P) resolution cameras that shall utilize Category-6 type UTP cable and Power over Ethernet (POE) for camera power. Fixed, Mini Dome cameras shall be 803.2af compliant.

**Access Control Systems (ACS)**

The new access control system shall be Lenel OnGuard (Mercury board option), integrate with the Campus existing access control system and be monitored from centralized location to be determined , Campus security shall confirm monitor location prior to design development (i.e electrical shop and at Campus Police).

In general, card readers will be placed at designated locations by the Campus Security at minimum at:

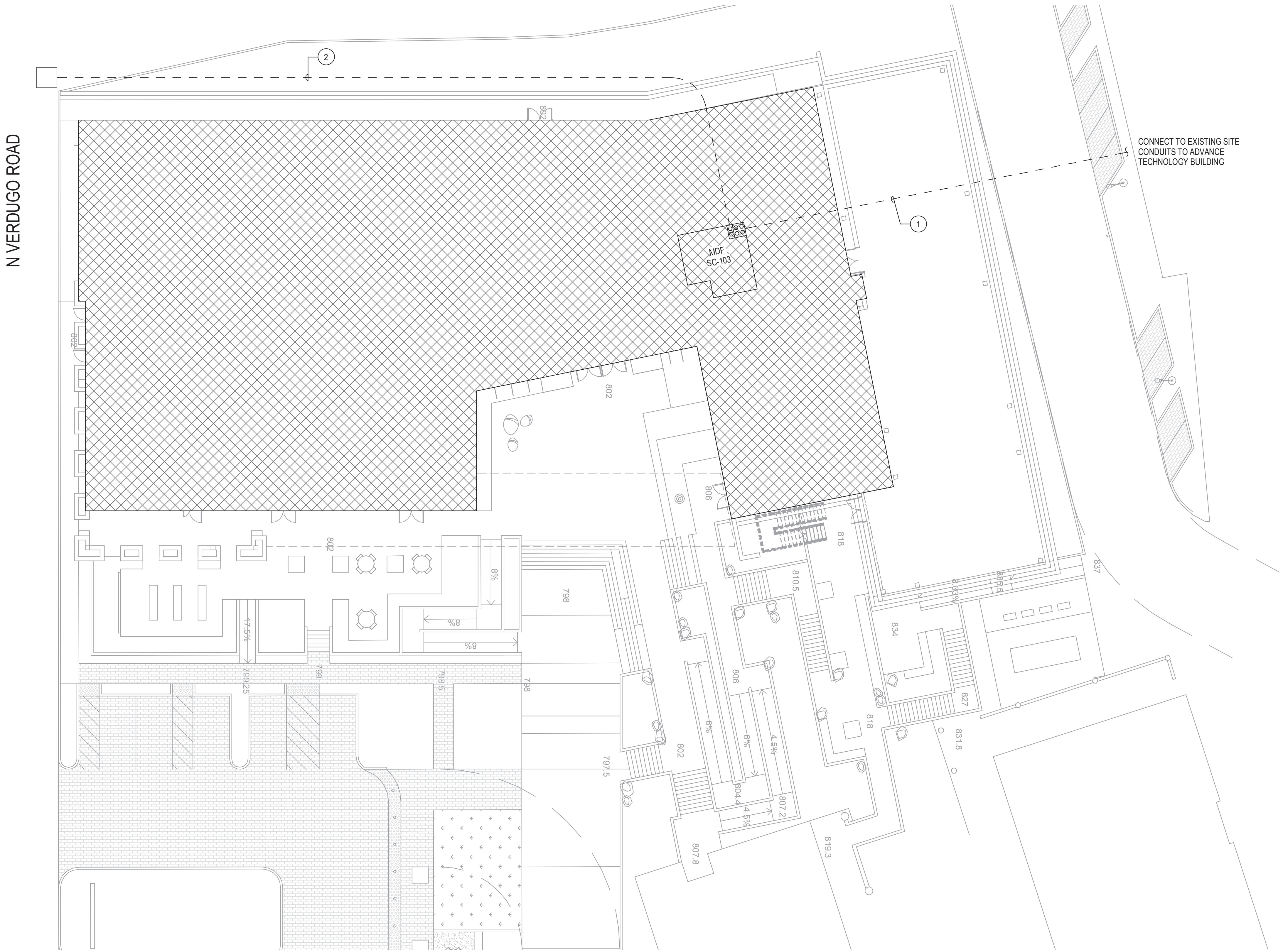
- Entrances and exterior doors
- Telecom rooms

Card readers & card keys/key fobs will be provided to allow access to the building, quantities and type to be determined during design development.

The ACS shall include the ability to monitor door activity by rules and schedules. The ACS will notify certain personnel or record event information when a "breach" has occurred according to the parameters set up in the system. The ACS will also record activity and store this in a database for future use and analysis. The ACS will provide the ability to monitor controlled areas "real time" if necessary, allowing an operator to respond to a "real time" situation.

**Intrusion Detection System (IDS)**

- Intrusion Detection System shall support wired, wireless, and/or combination of wired and wireless sensors.
- Alarm Panel-Includes multi-alarm points for all devices
- Motion detectors
- Glass break detectors




# TECHNOLOGY SITE PLAN

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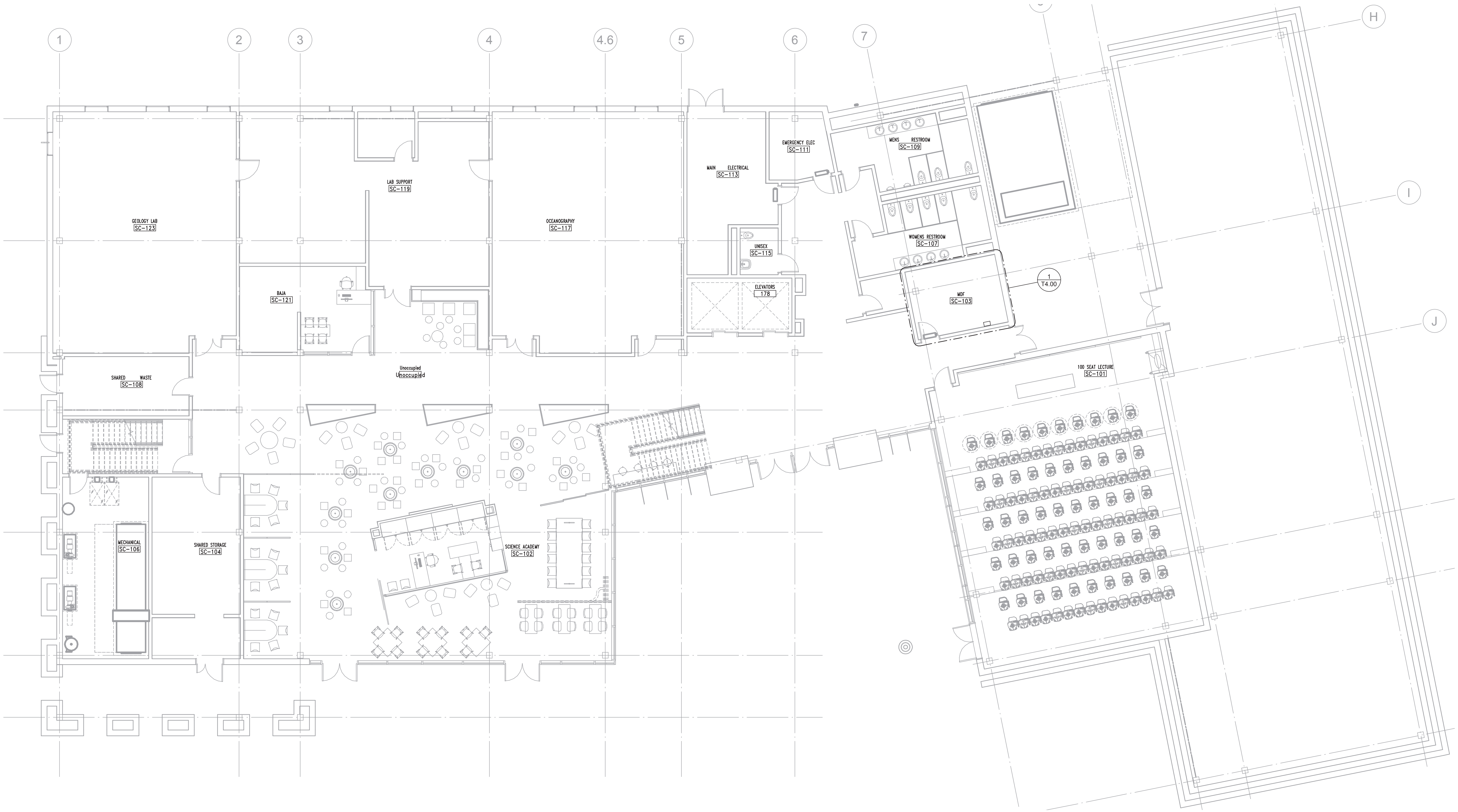


# LEVEL ONE **TECHNOLOGY**


# LEVEL TWO **TECHNOLOGY**

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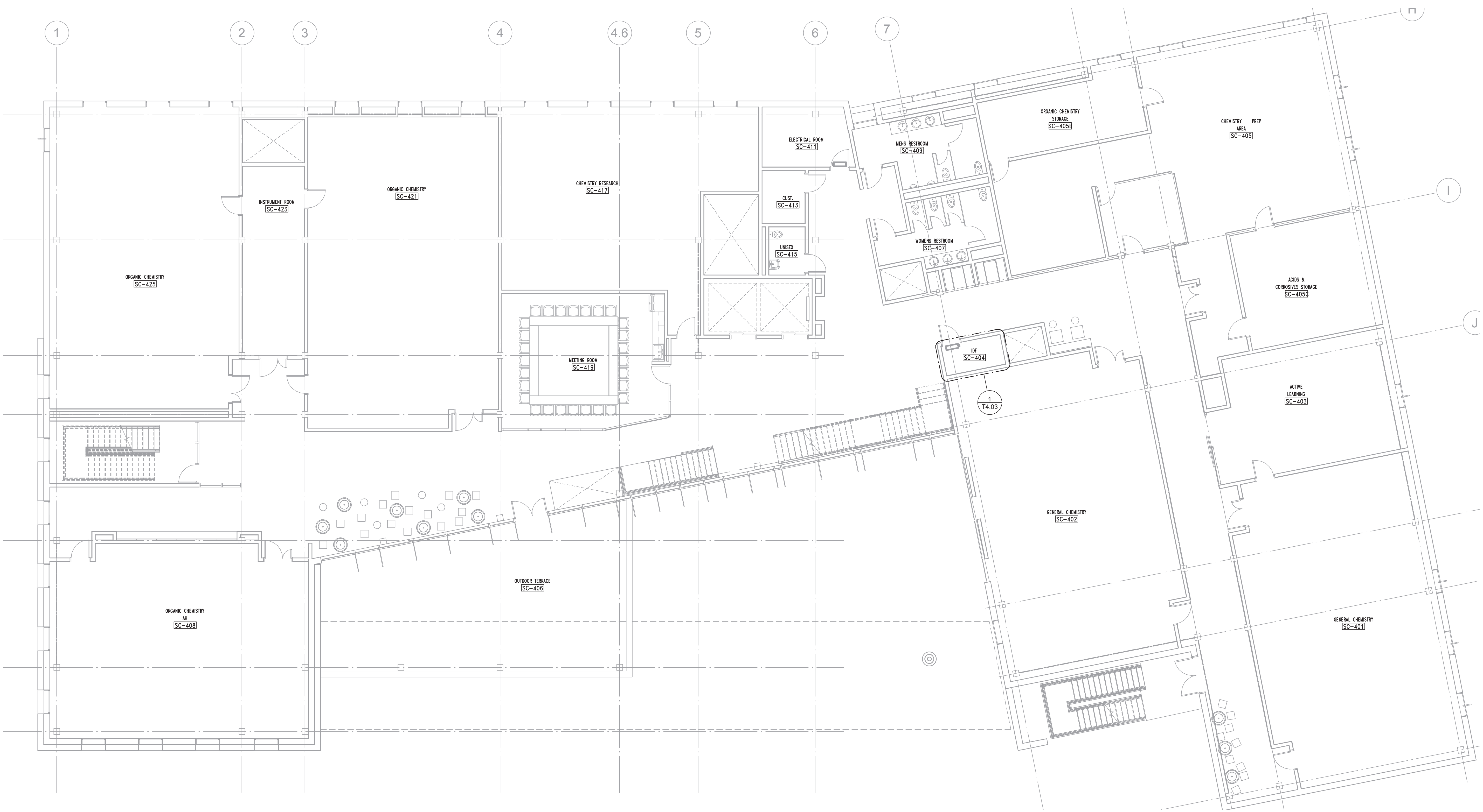
# LEVEL THREE **TECHNOLOGY**




# LEVEL FOUR **TECHNOLOGY**

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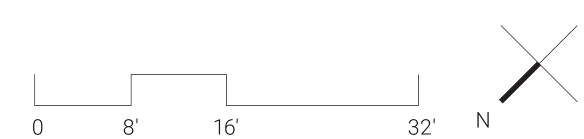
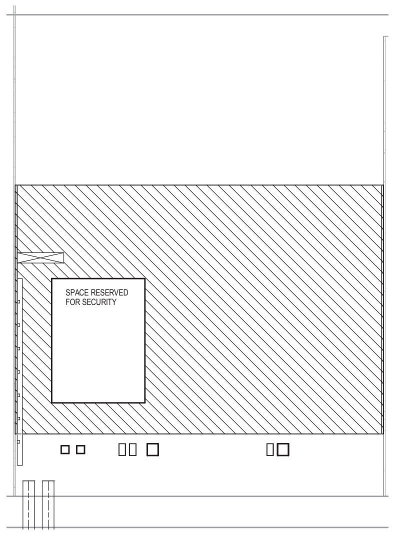
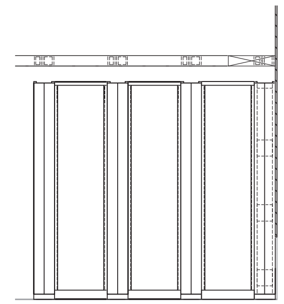
# LEVEL FIVE **TECHNOLOGY**

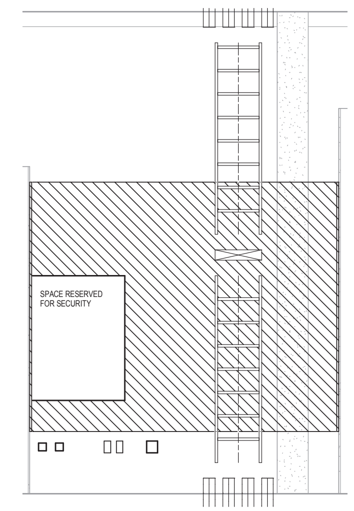




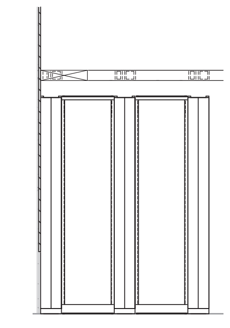

WALL ELEVATION **4** 1/2" = 1'-0"



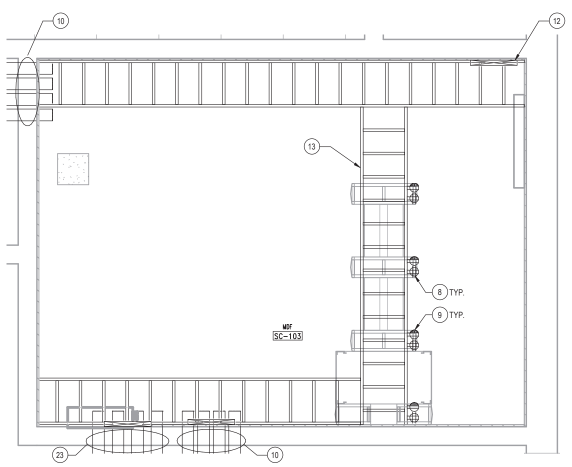
RACK ELEVATION **3** 1/2" = 1'-0"



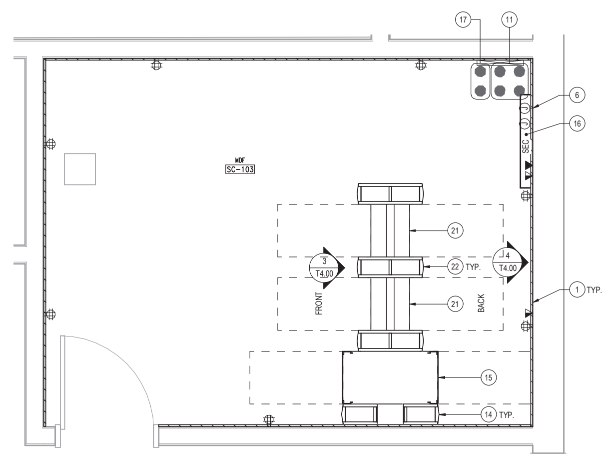

WALL ELEVATION **4** 1/2" = 1'-0"



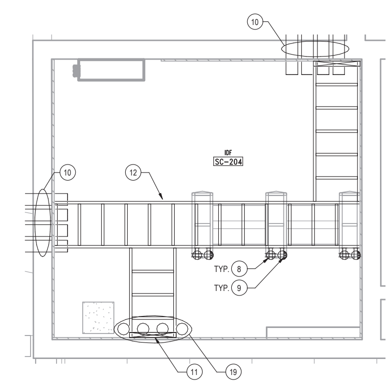
RACK ELEVATION **3** 1/2" = 1'-0"



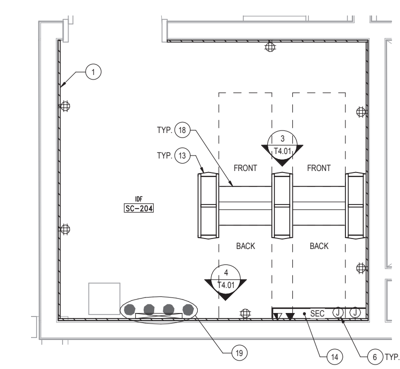
ENLARGED MDF ROOM - SC-103 - RCP **2** 1/2" = 1'-0"




ENLARGED MDF ROOM - SC-103 - FLOOR PLAN **1** 1/2" = 1'-0"



ENLARGED IDF ROOM - SC-204 - RCP **2** 1/2" = 1'-0"




ENLARGED IDF ROOM - SC-204 - FLOOR PLAN **1** 1/2" = 1'-0"

# TECHNOLOGY ROOMS

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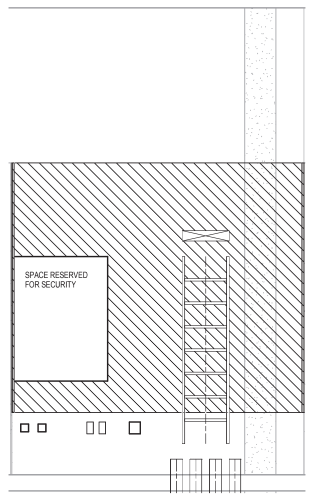
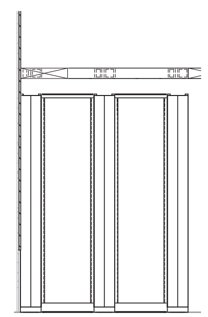
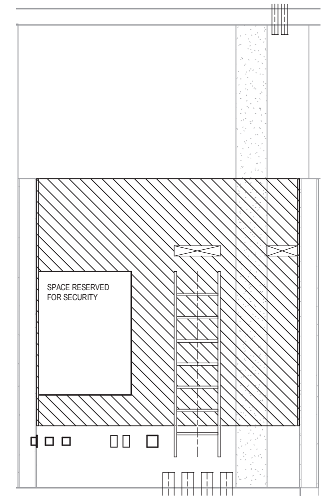


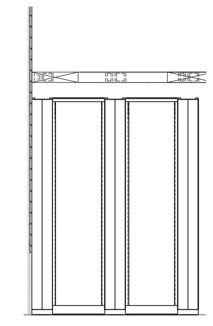
WALL ELEVATION **4**
1/2" = 1'-0"



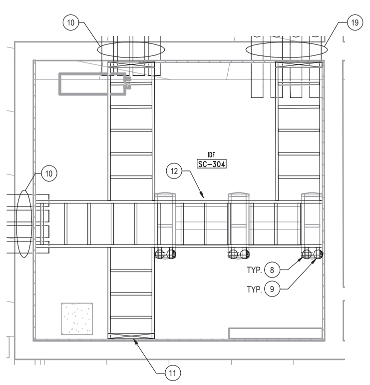
RACK ELEVATION **3**
1/2" = 1'-0"



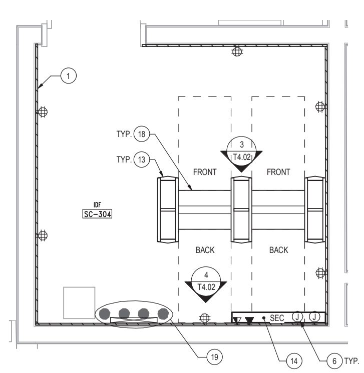
WALL ELEVATION **4**
1/2" = 1'-0"



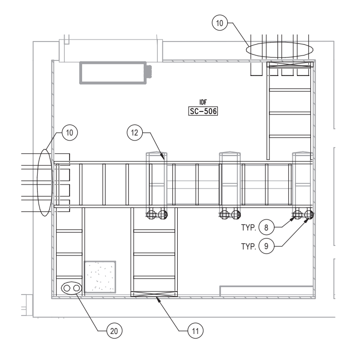
RACK ELEVATION **3**
1/2" = 1'-0"



ENLARGED IDF ROOM - SC-304 - RCP **2**
1/2" = 1'-0"



ENLARGED IDF ROOM - SC-304 - FLOOR PLAN **1**
1/2" = 1'-0"



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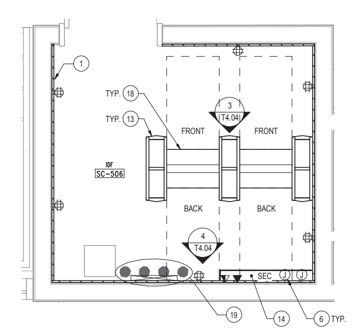
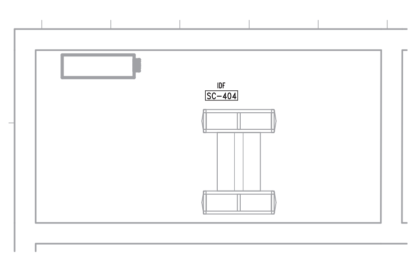
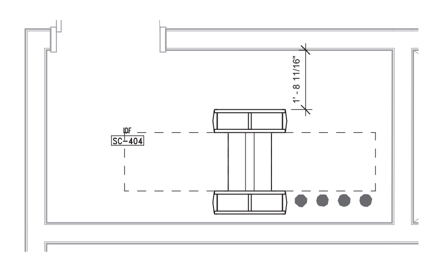


ENLARGED IDF ROOM - SC-506 - FLOOR PLAN **1**
1/2" = 1'-0"



ENLARGED IDF ROOM - SC-404 - RCP **2**
1/2" = 1'-0"



ENLARGED IDF ROOM - SC-404 - FLOOR PLAN **1**
1/2" = 1'-0"

## GENERAL NOTES

A. ELECTRICAL CONTRACTOR SHALL PROVIDE AND INSTALL A MINIMUM OF 50 FOOT CABLES MEASURED 3' ABOVE THE FINISHED FLOOR IN THE MIDDLE OF AISLES BETWEEN RACKS. LIGHT SHALL BE CONTROLLED BY ONE SWITCH LOCATED NEAR THE ENTRANCE DOOR. CONTRACTOR SHALL COORDINATE LIGHT INSTALLATION WITH ECC ITS.

B. THE TEMPERATURE WITHIN THE TELECOM ROOM SHALL RANGE BETWEEN 68°F TO 74°F. GENERAL CONTRACTOR SHALL PROVIDE AND INSTALL ENVIRONMENT SENSOR TO MONITOR THE TEMPERATURE IN ALL TELECOM ROOMS.

C. ALL TELECOM ROOM SPACES SHALL BE PROVIDED WITH HVAC 24 HOURS PER DAY AND 365 DAYS PER YEAR TO SUPPORT EQUIPMENT LOAD PROVIDED.

D. ALL WALL OUTLETS WITHIN THE TELECOM ROOM SHALL BE FLUSH MOUNT, NOT SURFACE MOUNT.

E. SECURITY CONTRACTOR SHALL BE RESPONSIBLE TO VERIFY AND COORDINATE WITH DIVISION 8 DOOR HARDWARE SCHEDULE FOR A COMPLETELY FUNCTIONAL ACCESS CONTROL SYSTEM. COORDINATE LOCATION OF DOOR LOCK POWER SUPPLIES WITH HARDWARE REQUIREMENTS.

F. COMMUNICATION CONTRACTOR SHALL PROVIDE WORKSTATION AND TELECOM ROOM PATCH CORDS. INSTALL PATCH CORDS UP TO SWITCH PORTS.

G. COMMUNICATION CONTRACTOR SHALL CLUSTER TOGETHER ALL SECURITY CAMERAS AND WIRELESS ACCESS POINTS TERMINATION IN A SINGLE PATCH PANEL .

H. IT IS THE CABLING CONTRACTOR'S RESPONSIBILITY TO VERIFY AND CONFIRM REQUIRED QUANTITIES AND COMPLIANCE WITH MAXIMUM ALLOWABLE RUN LENGTH INCLUDING VERTICAL AND SERVICE LOOPS FOR A COMPLETE SCOPE WORK TO MEET DESIGN INTENT.

I. COMMUNICATION CONTRACTOR SHALL CONFIRM RACK AND STACK WITH OWNER PRIOR TO INSTALLATION, CABLING STACK SHOWN TO CAPTURE INTENT, AND SHALL BE APPROVED BY OWNER PRIOR TO INSTALLATION .

## SHEET NOTES

1. GENERAL CONTRACTOR SHALL PROVIDE AND INSTALL ¾" A/C GRADE FIRE RATED PLYWOOD, LEAVE THE FIRE STAMP EXPOSED AND PAINT THE REST OF PLYWOOD TO MATCH. PLYWOOD SHALL BE 8' LONG WITH BOTTOM MOUNTED AT 24" ABOVE FINISHED FLOOR.
2. COMMUNICATION CONTRACTOR SHALL PROVIDE AND INSTALL 2RU FIBER PATCH PANEL.
3. COMMUNICATION CONTRACTOR SHALL PROVIDE AND INSTALL 2RU HORIZONTAL CABLE MANAGEMENT.
4. COMMUNICATION CONTRACTOR SHALL PROVIDE AND INSTALL 24-PORT FLAT PATCH PANEL FOR THE TERMINATION OF 25 – COPPER PAIRS. TERMINATE 1 (ONE) PAIR PER PORT FOR PORTS 1-23 AND 2 PAIRS FOR PORT 24.
5. COMMUNICATION CONTRACTOR SHALL PROVIDE AND INSTALL 2RU 48-PORTS COPPER PATCH PANEL TO SUPPORT HORIZONTAL CABLES.
6. ELECTRICAL CONTRACTOR SHALL PROVIDE DEDICATED 120V - 20A ON JUNCTION BOX FOR SECURITY PANEL.
7. SPACE ALLOCATED FOR SWITCH PROVIDED AND INSTALLED BY OWNER.
8. ELECTRICAL CONTRACTOR SHALL PROVIDE AND INSTALL (1) QUAD NEMA 5-20R MOUNTED ONTO THE SIDE OF CABLE RUNAWAY. CONTRACTOR SHALL OBTAIN APPROVAL FROM ECC ITS PRIOR TO MOUNTING POWER OUTLET ON SIDE OF LADDER RACK.
9. ELECTRICAL CONTRACTOR SHALL PROVIDE AND INSTALL (1) L6-30R MOUNTED ONTO THE SIDE OF CABLE RUNAWAY.
10. ELECTRICAL CONTRACTOR SHALL PROVIDE AND INSTALL (4) 4" CONDUIT SLEEVES TO SUPPORT HORIZONTAL CABLES.
11. COMMUNICATION CONTRACTOR SHALL PROVIDE AND INSTALL 18" VERTICAL LADDER RACK.
12. COMMUNICATION CONTRACTOR SHALL PROVIDE AND INSTALL 18" LADDER RACK 6" ABOVE EQUIPMENT RACK .
13. COMMUNICATION CONTRACTOR SHALL PROVIDE AND INSTALL 8" DOUBLE SIDED VERTICAL CABLE MANAGEMENT.
14. SPACE RESERVED FOR SECURITY EQUIPMENT. COORDINATE DIRECTLY WITH SECURITY CONTRACTOR.
15. COMMUNICATION CONTRACTOR SHALL PROVIDE AND INSTALL OWNER FURNISHED PDU.
16. COMMUNICATION CONTRACTOR SHALL PROVIDE AND INSTALL FURNISHED UPS.
17. ELECTRICAL CONTRACTOR SHALL PROVIDE AND INSTALL TELECOMMUNICATION GROUND BUS BAR 6" ABOVE LADDER RACK.
18. COMMUNICATION CONTRACTOR SHALL PROVIDE AND INSTALL 2-POST 19"X7' EQUIPMENT RACK.
19. ELECTRICAL CONTRACTOR SHALL PROVIDE AND INSTALL (4)4" CONDUIT SLEEVES FLOOR ABOVE AND BELOW.

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# PLUMBING

**SECTION 4**
**Plumbing Engineering (Plumbing, Fire Protection)**

**DESIGN CRITERIA**

**CODE STANDARDS AND REFERENCE**

- 2019 California Building Code (CBC)
- 2019 California Electrical Code (CEC)
- 2019 California Mechanical Code (CMC)
- 2019 California Plumbing Code (CPC)
- 2019 California Energy Code
- 2019 California Fire Code (CFC)
- 2019 California Green Code (CGC)
- 2019 California Referenced Standards Code
- 2019 NFPA 13 Standards for Fire Sprinkler Systems
- ADA Standards for Accessible Design- Code of Regulations (Including Amendments)
- State of California Title 24 Energy Code Title 24

- American National Standards Institute ANSI
- ADA Americans with Disabilities Act Accessibility Guidelines
- ASHRAE Guidelines 0, 1, and 202
- CHPS 2014
- IES DG-29-11
- National Fire Protection Association NFPA
- Underwriters' Laboratories UL

**Location**

- Glendale, CA

**Design Criteria**

- Reduce domestic water consumption and the resulting wastewater production.
- Reduce energy consumption associated with heating and transporting hot water.
- Plumbing fixtures, equipment, pipes, and fittings shall be selected as to be consistent with CCD.

**Water Conservation all buildings**

Low-flow fixtures will be used in all of the domestic water spaces and will reduce the domestic water demand by as much as 35% exclusive of landscape irrigation.

**Fixture flowrates:**

| | |
|---|---|
| Water Closets: | 1.28 gpf |
| Urinals: | 0.125 gpf |
| Lavatories: | 0.35 gpm |
| Showers: | 1.5 gpm |

**WATER SYSTEMS**

**Domestic Cold Water (DCW) and Industrial Cold Water (ICW)**

Main supply pressure using worst case scenario is low, less than 50 PSI. A new 3" Domestic cold water service routed into the building and then piped to all plumbing fixtures providing a minimum of 35 psi at the most remote outlet inside the building in an organized and efficient manner. Domestic cold water will also feed the domestic hot water system as well as wall hydrants on outside wall where required. An expansion tank shall be provided to serve the domestic cold water supply to all storage type water heaters. ICW shall connect to the domestic water system through an approved reduced pressure principle type backflow preventer (RPPBFP).

Domestic cold water piping will be sized in accordance with Appendix A of CPC, based on the following criteria:

Friction drop per 100 feet of pipe shall not exceed 3 psi. Pipe velocity shall not exceed 6 feet per second. Shut-off valves will be provided to isolate the following:

- Each vertical riser.
- Shut-off valves shall be provided for each riser, group of fixtures, in each restroom and branch mains.
- All plumbing equipment.
    - o Emergency fixtures isolation valves shall have locking device at open position.
- At the entering point of building with yard box.

**Purified Water (PW)**

A central purified water system should be designed to satisfy the laboratory requirements. The water system will include pre-treatment softener and carbon filtration, the level of purification will be designed to satisfy ASTM type III specification. Each floor will be provided with a piping distribution independent of other floors. The distribution should be a continuous loop of undiminished pipe size routed on each service location. The branch connection to the service fixture will have a local isolation valve located to minimize dead-legs.

**Domestic Hot Water (DHW) and Industrial Hot Water (IHW)**

Domestic Hot water system shall be produced via high recovery natural gas-fired, storage type domestic water heater, one (1) 100-gallon max to avoid the use of separate storage tank, output temperature of 130 degrees F.
Alternatively, water to water heat pump type, instantaneous water heaters may be provided to reduce energy usage by utilizing boiler hot water. Each instantaneous water heater will produce approximately 300 Gallons of hot water per hour, each instantaneous water heater will be complemented with a 100 gal. buffer tank.
A thermostatic master mixing valve will limit the hot water delivery temperature to 120 degrees F to janitor closets. Tempered water for Lavatories with sensor will be 105 degrees F. Valves will be located in custodian rooms or similar rooms, not readily exposed in restrooms or shower rooms. A recirculating pump will be provided to circulate domestic hot water supply and allow quick delivery of hot water to plumbing fixtures requiring hot water connection.

Design of the domestic hot water system based on the following criteria:

- Hot water will be recirculated using a circulating pump with aquastat and timer.
- Friction drop per 100 feet of pipe shall not exceed 3 psi.
- Hot water pipe velocity shall not exceed 5 feet per second.
- Hot water return velocity shall not exceed 4 feet per second.
- The hot water piping will be insulated in accordance with Title 24 energy requirements. It should be noted that any coper piping connections to steel components of the system such as pumps shall use dielectric pipe fittings.

**OTHER SYSTEMS**

**Sanitary Waste and Vent System (SAN AND V)**

A sanitary vent system shall be connected to the waste system per code and for efficient function. Vent pipes shall terminate above roof at appropriate and coordinated locations. Floor drains will be provided in all public toilet rooms having two or more plumbing fixtures. Mechanical equipment rooms will be provided with floor sinks with minimum 4-inch trap.

**Acid Waste and Acid Waste Vent System (AW AND AV)**

A dedicated acid resistant drainage waste system will be provided to collect and treat the drainage from all sinks located in the science classrooms where acid wastes may be harmful to the domestic drainage system; the dedicated drainage system will be treated through a neutralizing tank; all associated vents from each sink will convey to a dedicated acid vent pipe through the roof.

**Storm Drainage System (SD)**

Roof drainage will be accomplished by internal storm drain leaders as well as traditional (12) 4" roof and overflow drain systems. Overflow roof drains (OD) shall be routed down through the building. The overflow drains shall then be piped to the building exterior wall where they shall discharge at 6" above grade onto a splash block. The overflow discharge locations shall not affect any staff or student walkways. Building roof drain and piping system is to be designed based on a rainfall intensity of 2-inches per hour.

**Condensate (CD)**

Condensate waste (CD) from cooling coils and other mechanical equipment shall be discharged as an indirect waste to a location acceptable to the Authority Having Jurisdiction and connected to sanitary sewer system.

# WATER SYSTEMS

**Natural Gas**

A new medium pressure line (5 psi at the meter and 1 psi maximum drop to most remote outlet) will be brought to the building from the gas meter, a gas regulator with overpressure device (OPD) will be provided and routed to serve building demands. The new gas service penetrating into the building will be above grade. New gas pipe in building or above ground at least six inches will be steel.

**Laboratory Vacuum (LV)**

Laboratories should be provided with a centralized vacuum system. The system should be designed to provide 19 to 23 inch Hg negative pressure at the most remote location of vacuum service.

**FIXTURES**

**Restroom Fixtures**

American Standard Wall Mounted Flush Valve Toilet
- 1.28 gpf hard-wired, automatic sensor-operated
- Maximum Performance MaP Test score of 1000.

American Standard Wall Mounted Flush Valve Urinal
- 0.125 gpf hard-wired, automatic sensor-operated

American Standard - Hardwired Sensor-Operated Faucet
- 0.35 gpm aerator

**Other Fixtures**

- Mop Sink floor mount, corner type, 2.2 gpm wall mounted faucet.
- Water Fountains- (2) High-Low Combined Units with bottle fill stations;

**Domestic-cold water & Industrial cold-water equipment**

- Reduced pressure principle backflow preventers (industrial cold water)
  Purified water systems:
- One (1) 50 GPM Water Softener
- One (1) 50 GPM skid mounted RO-DI water treatment system with filtering system

**Domestic-Hot Water & Industrial-Hot Water Equipment**

- Four (2) 100-gallon gas fired water heaters (two for domestic hot water, two for industrial hot water)
- Hot Water Recirculating Pumps (one for domestic hot water, one for industrial hot water)
- Reduced pressure principle backflow preventer (industrial hot water)
- Expansion tank for each heater
- Thermostatic mixing valve for each heater

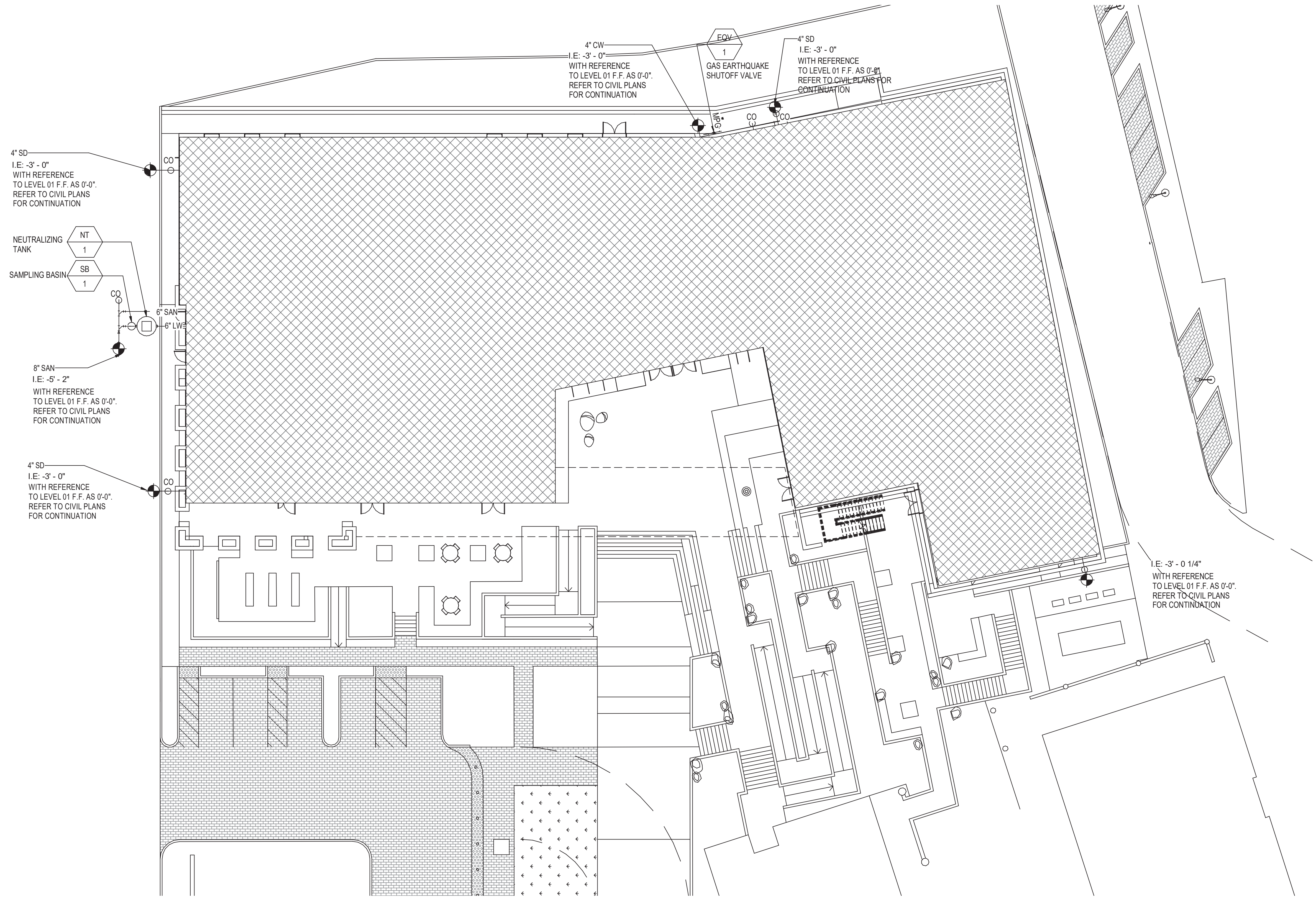
**General Materials**

**Materials**

- Piping Materials Storm and Overflow Drainage: Hubless cast iron ASTM 888 or CISPI 301, heavyweight couplings.
- Sanitary Waste and Vent: Hubless cast iron ASTM 888 or CISPI 301, heavyweight couplings.
- Acid waste and Vent: Hubless ductile iron ASTM A746
- Potable water (above ground): Copper Type L Distribution Piping
- Potable (below ground): Copper Type K Distribution Piping
- Purified water: Polypropylene Pipe & Fittings
- Laboratory Air: Copper Type L Distribution Piping.
- Laboratory Vacuum: Copper Type L Distribution Piping
- Condensate drain pipe: Copper Type M Drainage Piping
- Fire Protection: Black Steel
- Insulation: Fiberglass for indoor installation and Fiberglass w/ PVC jacket for outdoor installation
- Natural Gas: Threaded Schedule 40 Black Steel for low pressure piping and Plain ends-Welded fittings Schedule 40 Black Steel for medium pressure piping.

**Accessories for all buildings**

- Water Hammer Arrestors
- Trap Primers
- Balancing and Shut-off Valves
- Check Valves
- Floor Cleanouts
- Wall Cleanouts
- Overflow Drain terminations with splash blocks




# PLUMBING SITE PLAN

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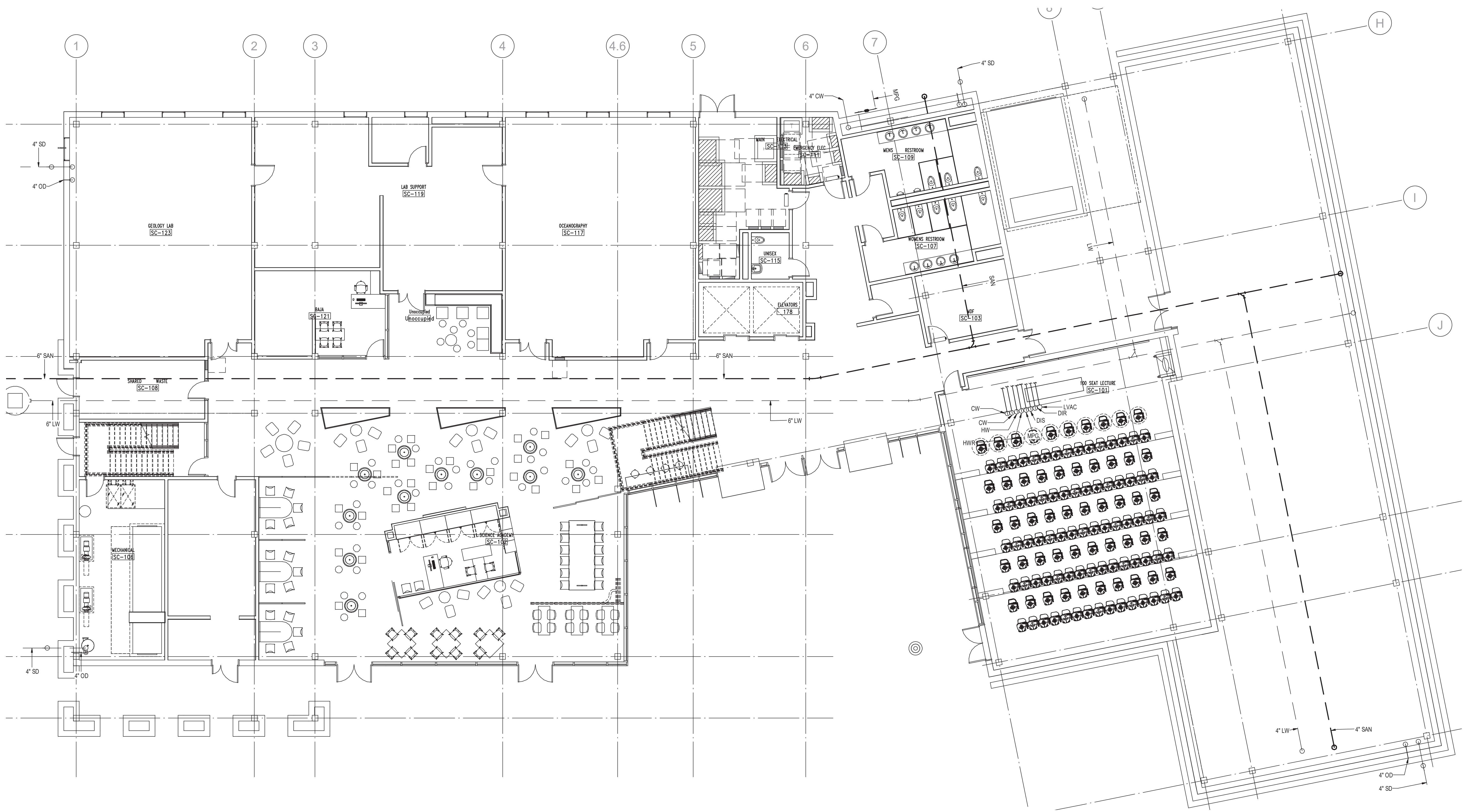
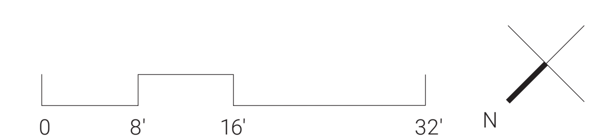
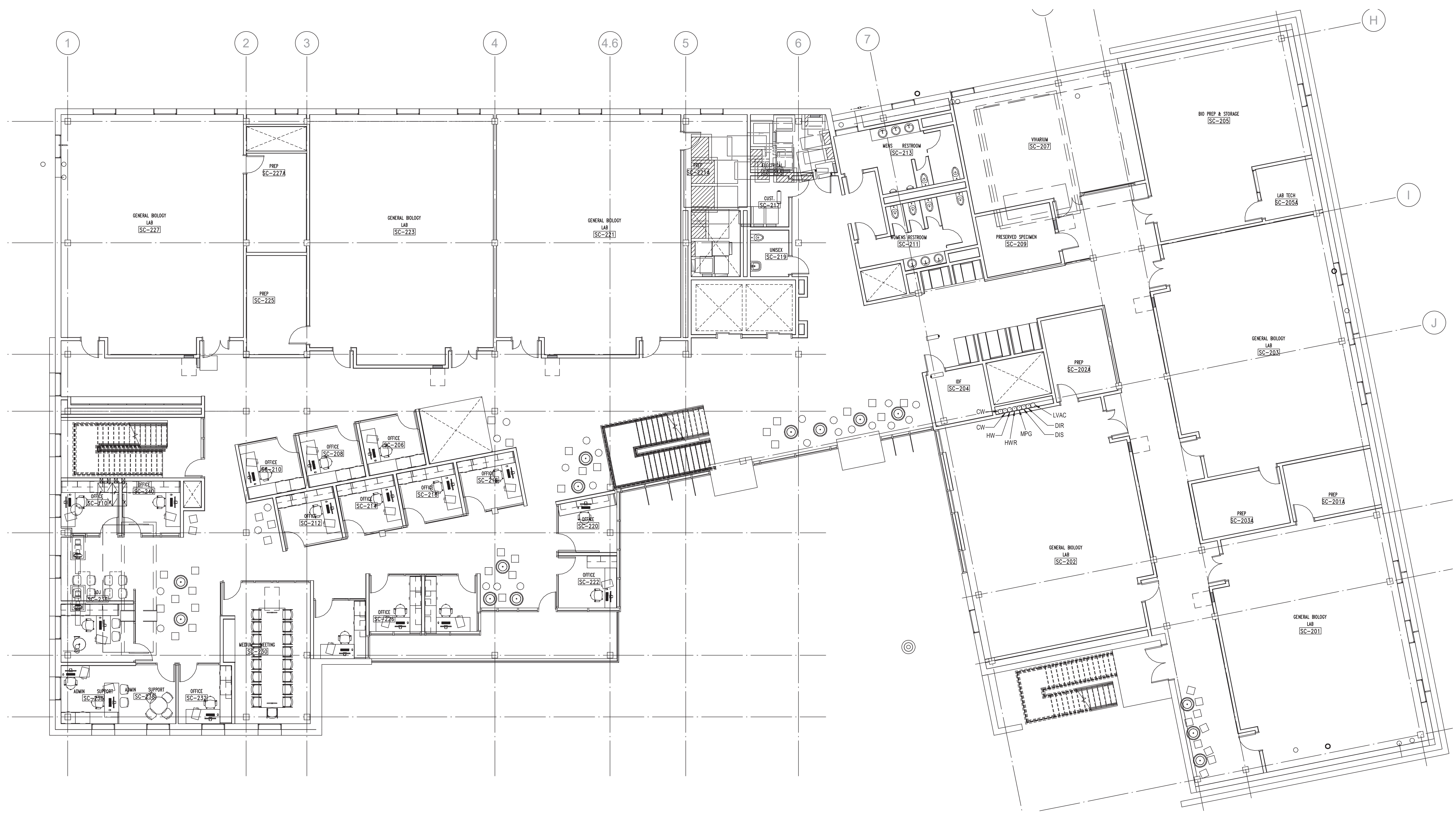



# LEVEL ONE **PLUMBING**






# LEVEL TWO **PLUMBING**

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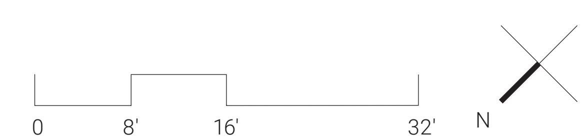
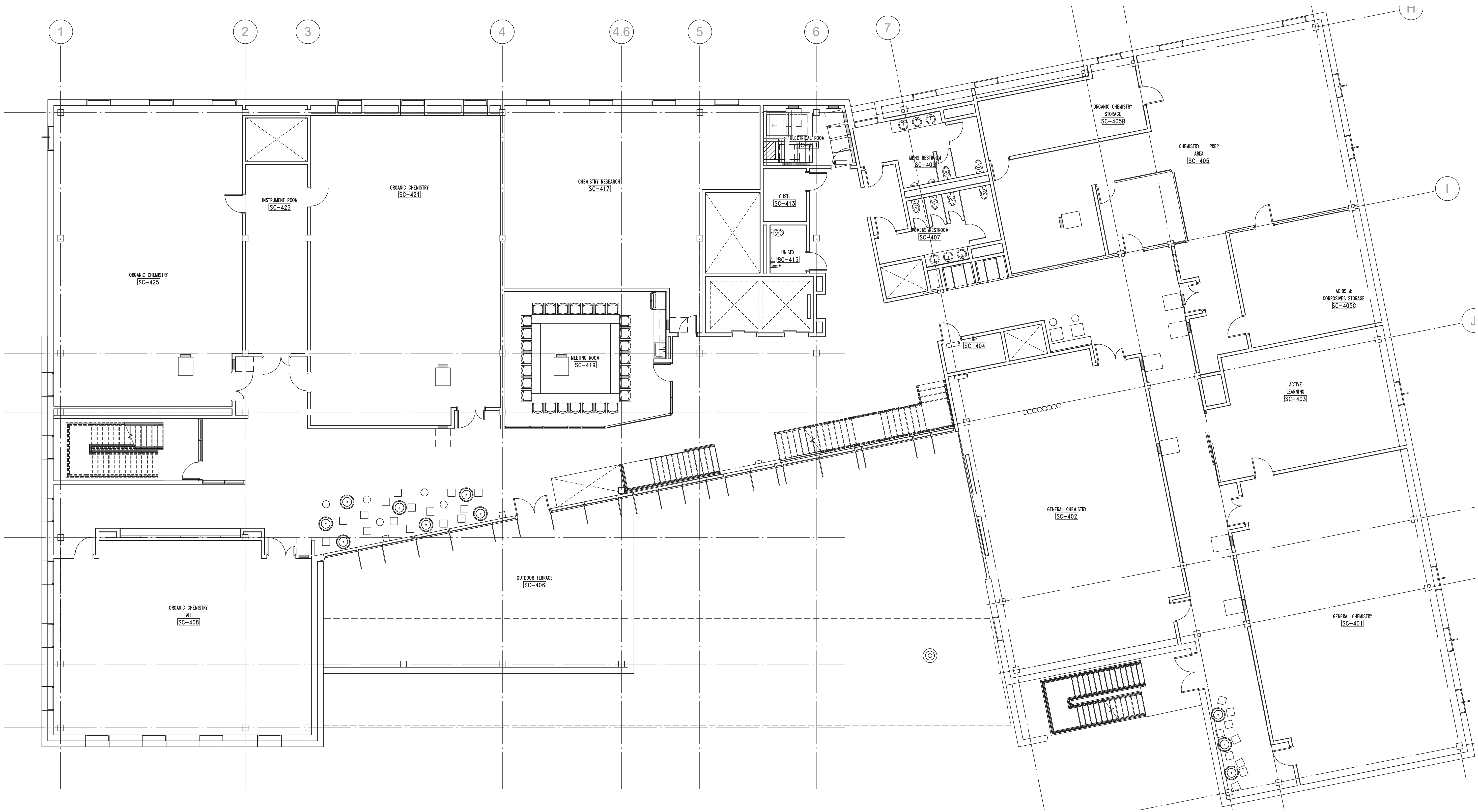
# LEVEL THREE **PLUMBING**






# LEVEL FOUR **PLUMBING**

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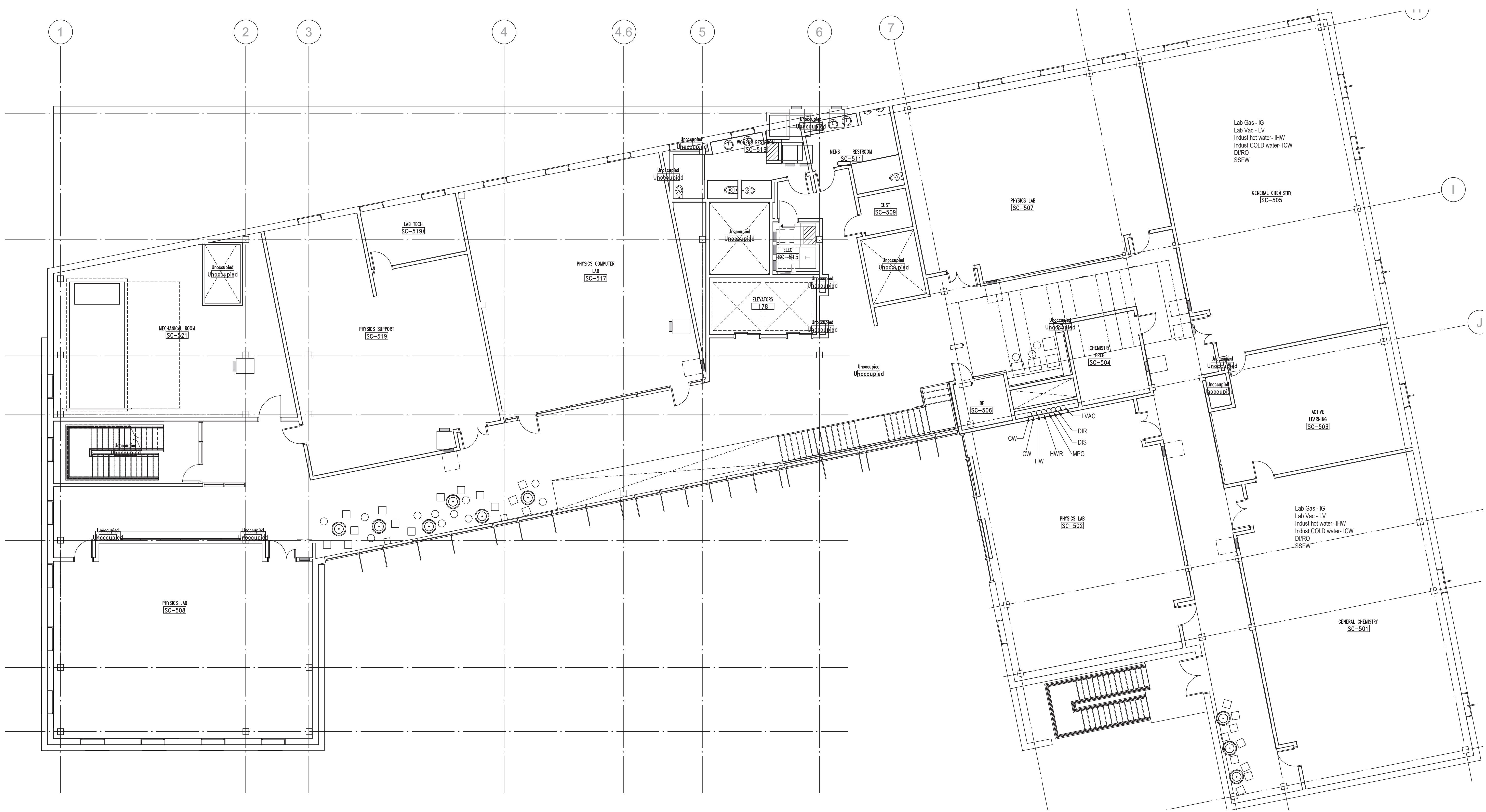


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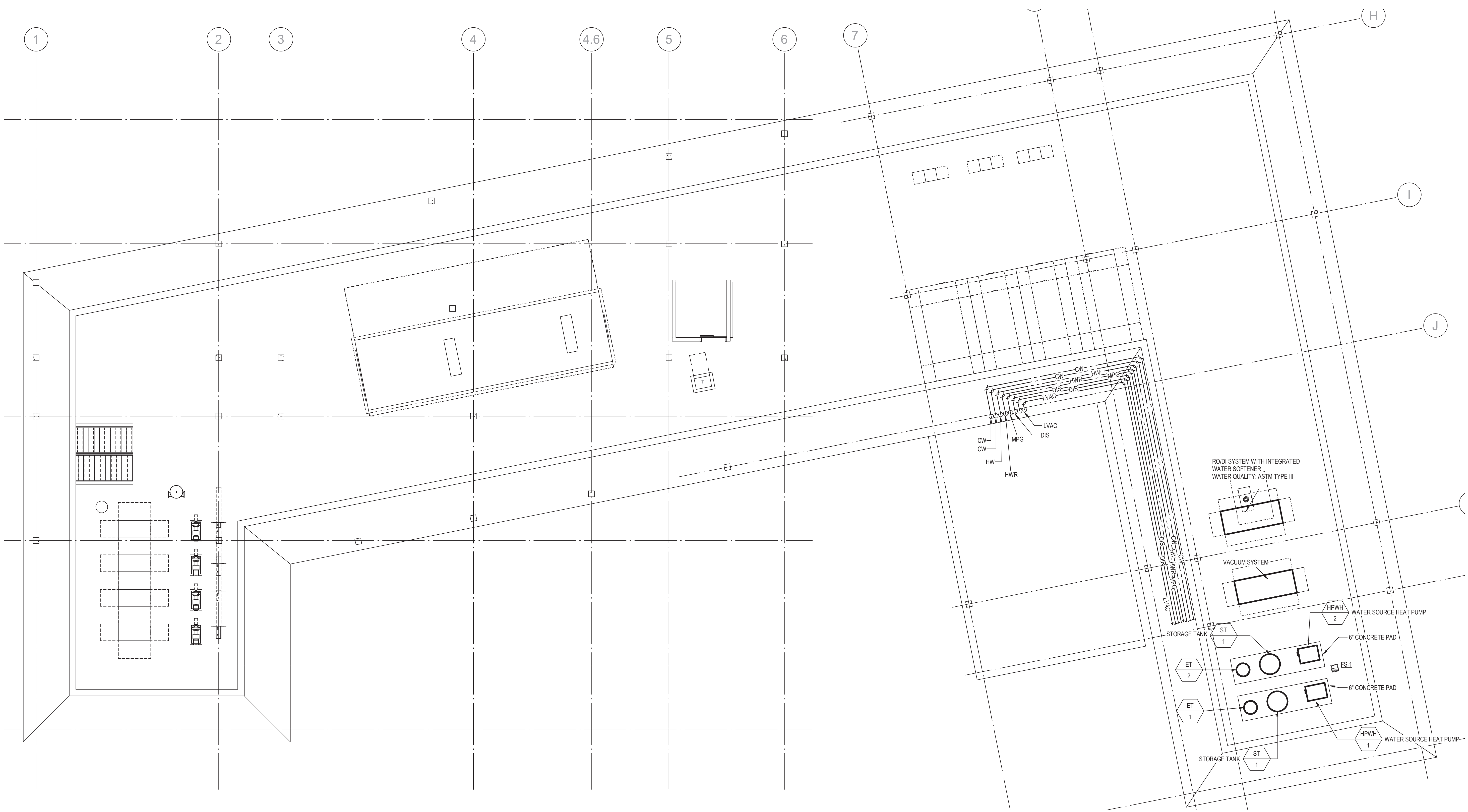
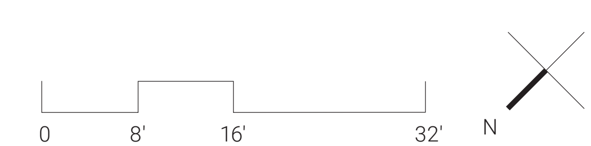



# ATTIC **PLUMBING**

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# FIRE PROTECTION

**Fire Protection System Design Overview**

A new city connection to the existing city public water main will be provided to service the proposed wet fire protection systems. A monitored double detector check valve assembly will be installed outside the building to protect the city water main. Downstream of the building double detector check valve assembly, a 4-way fire department connection will be provided to allow the fire department to pressurize the automatic fire sprinklers as well as the Class I standpipe system.

**Governing Codes**

- California Building Standards Administrative Code (Title 24, Part 1), 2019
- California Building Code (Title 24, Part 2), 2019
- California Plumbing Code (Title 24, Part 5), 2019
- California Fire Code (Title 24, Part 9), 2019
- California Referenced Standards Code (Title 24, Part 12), 2019

**Reference Standards and Guidelines**

| | |
|---|---|
| • UL | Underwriters Laboratories |
| • NFPA | National Fire Protection Association |
| • NFPA 13 | Standard for the Installation of Sprinkler Systems, 2016 Edition |
| • NFPA 24 | Standard for the Installation of Private Fire Service Mains and Their Appurtenances, 2016 Edition |
| • NFPA 25 | Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems (with California Amendments) |
| • NFPA 72 | National Fire Alarm and Signaling Code |
| • DSA GL-1 | Project Submittal Guideline for Automatic Fire Sprinkler Systems |

**Design Criteria**

The hydraulically designed automatic fire sprinkler systems shall be provided with a minimum 10 percent safety margin from the available fire flow to the project site. The hydraulic calculations shall be based on water flow information provided from the water purveyor current within 6 months of the project submittal to the governing agencies. Due to the excess pressure to the site, a pressure reducing valve shall be provided inside the building so the system components are not subject to pressures exceeding their product listings.

**Automatic Fire Sprinkler Occupancy Hazard Design Requirements**

- Light Hazard - 0.10 GPM per ft2 over the most remote 1,500 ft2
- Ordinary Hazard II – 0.20 GPM per ft2 over the remote 1,500 ft2

**Automatic Fire Sprinkler Information & Design Layout**

Intermediate temperature quick-response fire sprinklers shall be installed throughout in accordance with the installation requirements of NFPA-13 as adopted by the 2019 California Fire Code.

Schedule 40 piping shall be concealed above ceilings and within walls except for non-public equipment rooms without ceilings. Sprinkler heads shall be spaced for symmetry with ceiling features. This shall require additional heads that shall be provided in base bid.

Basis of fire sprinkler head locations shall be:

- Equal distance between lights.
- Equal distance between lights and wall.
- Equal distance between lights and air inlets and outlets.
- Equal distance between wall, lights, and air inlets and outlets.
- Locate in center of ceiling tiles.
- Provide coverage for rooms, void spaces, overhangs and other areas as required by applicable codes and standards.

Maximum Automatic Fire sprinkler spacing shall be as follows or limited by hydraulic calculations, whichever is less:

| | |
|---|---|
| • Light Hazard for Noncombustible Construction | |
| Smooth Ceiling Areas | 225 ft2 |
| Obstructed Construction Ceiling Areas | 225 ft2 |
| • Ordinary Hazard Group 2 | 130 ft2 |

**Materials**

Sprinkler heads in ceilings shall be of the recessed pendent type with white or chrome finish cover plates flush with ceilings. Automatic sprinkler heads will generally be concealed, but exposed in non-finished spaces such as mechanical rooms.

**Application**

- Light Hazard -Public Access Areas, General Classrooms, Restrooms, Offices, Meeting Rooms, Hallways, Stairwells
- Ordinary Hazard 2 - Mechanical Rooms, Electrical Rooms, Storage Rooms, Labs, Chemistry Preparation Areas, Custodian Rooms, Lab Tech Rooms, Instrument Rooms, Chemical Storage Rooms

**System Components**

- Automatic fire sprinkler piping, sprinklers, hangers, and seismic bracing.
- Valve and water-flow switch monitoring.
- Audible sprinkler flow alarms on the exterior and interior of the building.

# FIRE-HAZARD REQUIREMENTS

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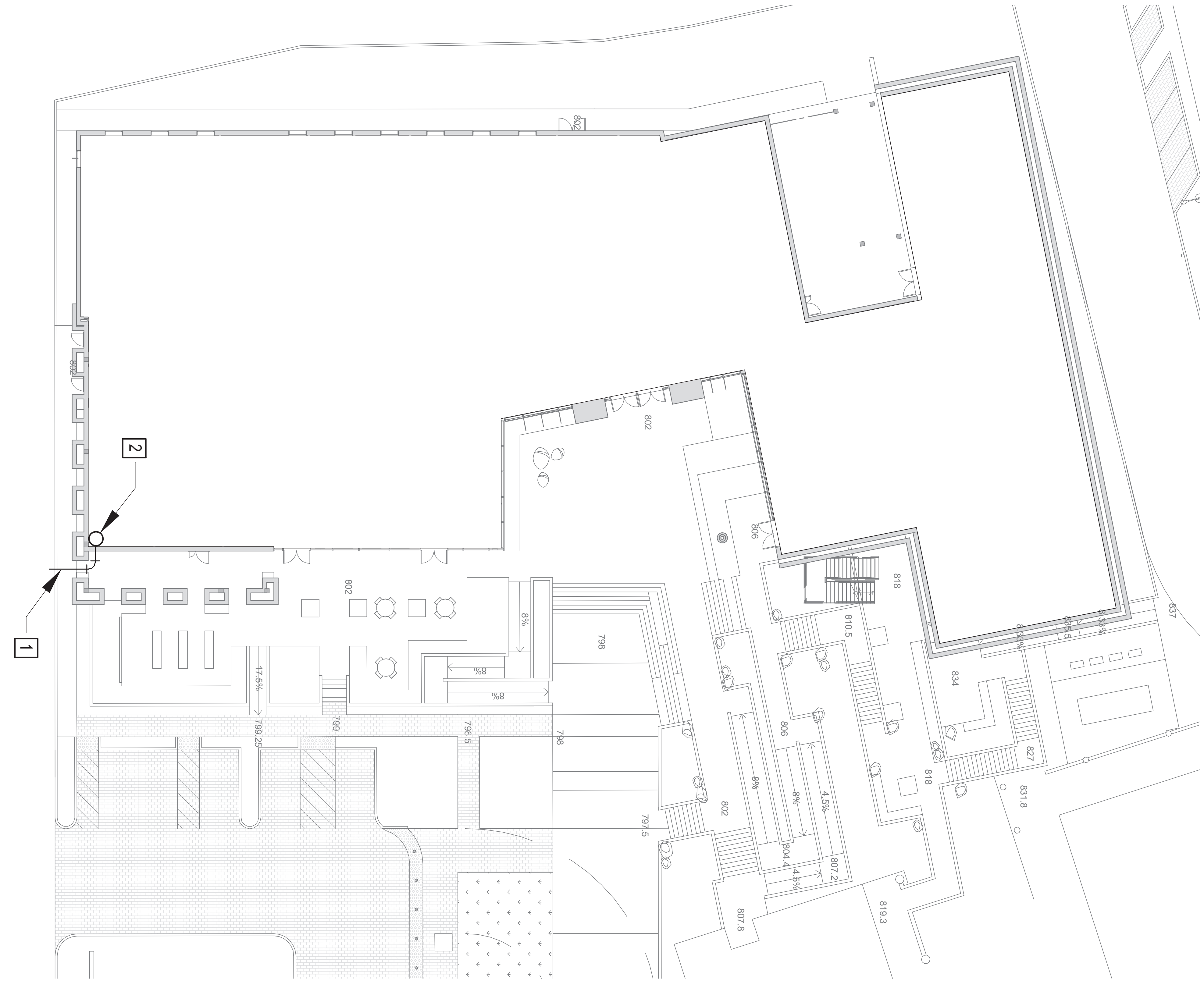


## GENERAL NOTES

THE AUTOMATIC FIRE SPRINKLER SYSTEM WILL BE MONITORED AND SUPERVISED BY A CENTRAL STATION SERVICE. ALL SYSTEM CONTROL VALVES, SECTIONAL VALVES AND FLOW SWITCHES TO BE MONITORED.

SCIENCE BUILDING UNDERGROUND FIRE WATER MAIN IS TO PROTECTED BY A U.L. LISTED BACKFLOW PREVENTER WITH TAMPER SWITCHES MONITORED IN THE OPEN POSITION.

## NOTES

1. FIRE WATER POINT OF CONNECTION 5'-0" FROM FACE OF BUILDING
2. 6" FIRE SPRINKLER RISER ASSEMBLY

# FIRE-PROTECTION SITE PLAN

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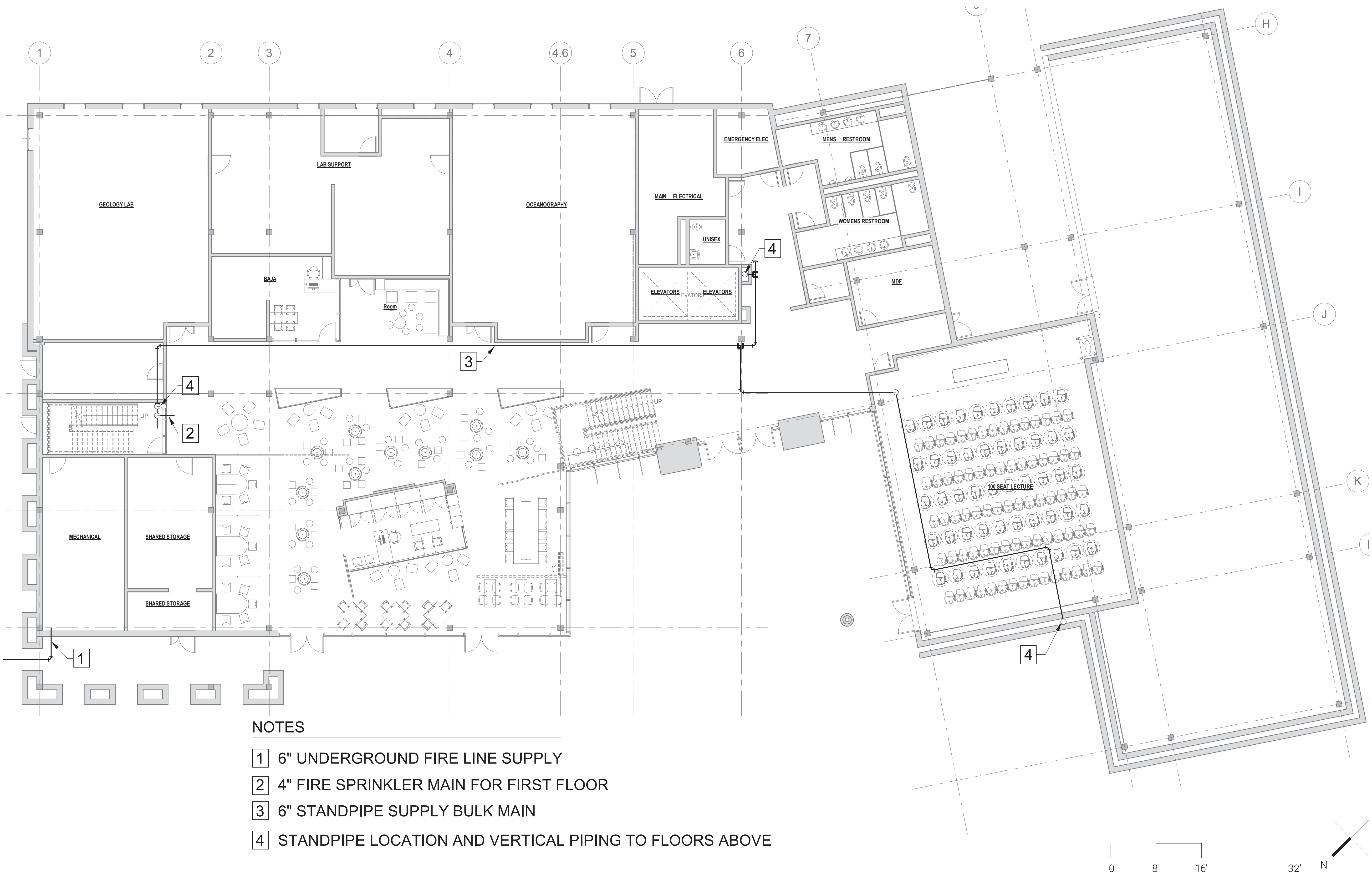


NOTES

1 6" UNDERGROUND FIRE LINE SUPPLY

2 4" FIRE SPRINKLER MAIN FOR FIRST FLOOR

3 6" STANDPIPE SUPPLY BULK MAIN

4 STANDPIPE LOCATION AND VERTICAL PIPING TO FLOORS ABOVE


NOTES

4 STANDPIPE LOCATION

# LEVEL TWO **FIRE PROTECTION**

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NOTES

4 STANDPIPE LOCATION

# LEVEL THREE **FIRE PROTECTION**


NOTES

4 STANDPIPE LOCATION

# LEVEL FOUR **FIRE PROTECTION**

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NOTES

4 STANDPIPE LOCATION

# LEVEL FIVE **FIRE PROTECTION**

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# SECTION FOUR

## APPENDIX

/ CODE ANALYSIS

/ PROJECT SCHEDULE

/ COST ESTIMATE

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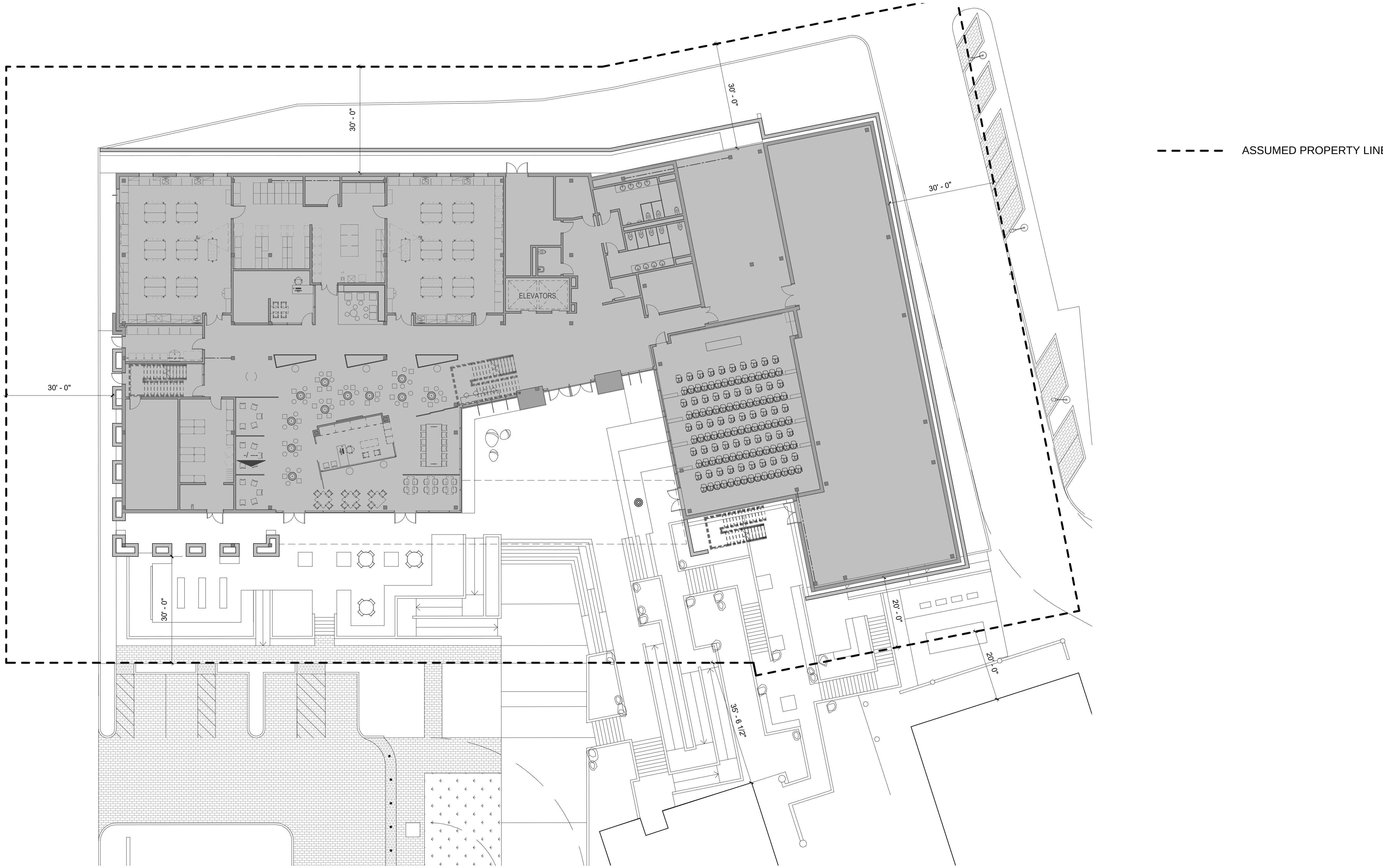


# CODE ANALYSIS SITE PLAN

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# CODE ANALYSIS

| BUILDING NAME | OCCUPANCY CLASSIFICATION PER CBC CHAPTER 3 & IR A-26.cc | CONSTRUCTION TYPE PER CBC TABLE 601 | ALLOWABLE # OF STORIES PER CBC TABLE 504.4 | ACTUAL NUMBER OF STORIES | ALLOWABLE BUILDING HT. IN FT. PER CBC TABLE 504.3 |
|---|---|---|---|---|---|
| SCIENCE BUILDING | A-3 - LECTURE, SCIENCE ACADEMY<br>B - LABS, OFFICES<br>S-2 - GENERAL STORAGE | I-B | 12 STORIES | 5 STORIES + ATTIC | 180' - 0" |

| ACTUAL BUILDING HEIGHT IN FEET | ALLOWABLE AREA FACTOR IN SQ. FT. PER CBC 506.2 | ACTUAL BUILDING AREA IN SQ. FT. (INCLUDES HORIZONTAL PROTECTION + ATTIC) | REQUIRED SEPARATION OF OCCUPANCIES PER CBC TABLE 508.4 | FIRE RESISTIVE RATING REQUIREMENTS PER TABLE 601 | ALLOWABLE OPENINGS PER TABLE 705.8 (OPENINGS ARE UP,S UNLESS NOTED OTHERWISE) | AUTOMATIC FIRE SPRINKLER SYSTEM PER CBC CHAPTER 9 |
|---|---|---|---|---|---|---|
| 93'-3" | A-3: UNLIMITED<br>B: UNLIMITED<br>S-2: UNLIMITED | 119,000 SF | A-3 / B: 1-HR SEPARATION<br>S-2 / B: 1-HR SEPARATION | 2-HR: PRIMARY STRUCTURAL FRAME<br>2-HR: BEARING WALLS<br>2-HR: FLOOR CONSTRUCTION<br>1-HR: ROOF CONSTRUCTION | 15 < X < 20 75%<br>20< X < 25 NO LIMIT<br>WHERE X IS FIRE SEP. DISTANCE IN FEET | SPRINKLERED |

# PLUMBING FIXTURE CALCS

| OCCUPANT LOAD AND AREA DETERMINATION PER 2016 CPC | | | | | | |
|---|---|---|---|---|---|---|
| | AREA | | TOTAL OCCUPANT LOADING PER 2016 CPC TABLE A | | | |
| FLOOR LEVEL | GROUP B | GROUP A-3 | GROUP B | | GROUP A-3 | |
| 1 | 4,175 SF | 4,960 SF | 84 | 1062 | 269 | 374 |
| 2 | 12,668 SF | 298 SF | 254 | | 20 | |
| 3 | 12,579 SF | | 252 | | 0 | |
| 4 | 13,000 SF | 1,272 SF | 260 | | 85 | |
| 5 | 10,562 SF | | 212 | | 0 | |

| | | | REQUIRED |
|---|---|---|---|
| GROUP A-3 | MEN | URINAL | 2 |
| | | WC | 2 |
| | | LAV | 1 |
| | WOMEN | WC | 4 |
| | | LAV | 2 |
| | | DF | 2 |
| GROUP B | MEN | URINAL | 4 |
| | | WC | 5 |
| | | LAV | 6 |
| | WOMEN | WC | 12 |
| | | LAV | 7 |
| | | DF | 8 |

| | | | REQUIRED | PROVIDED |
|---|---|---|---|---|
| TOTAL FIXTURES | MEN | URINAL | 6 | 10 |
| | | WC | 7 | 10 |
| | | LAV | 7 | 15 |
| | WOMEN | WC | 16 | 24 |
| | | LAV | 9 | 19 |
| | | DF | 10 | 10 |

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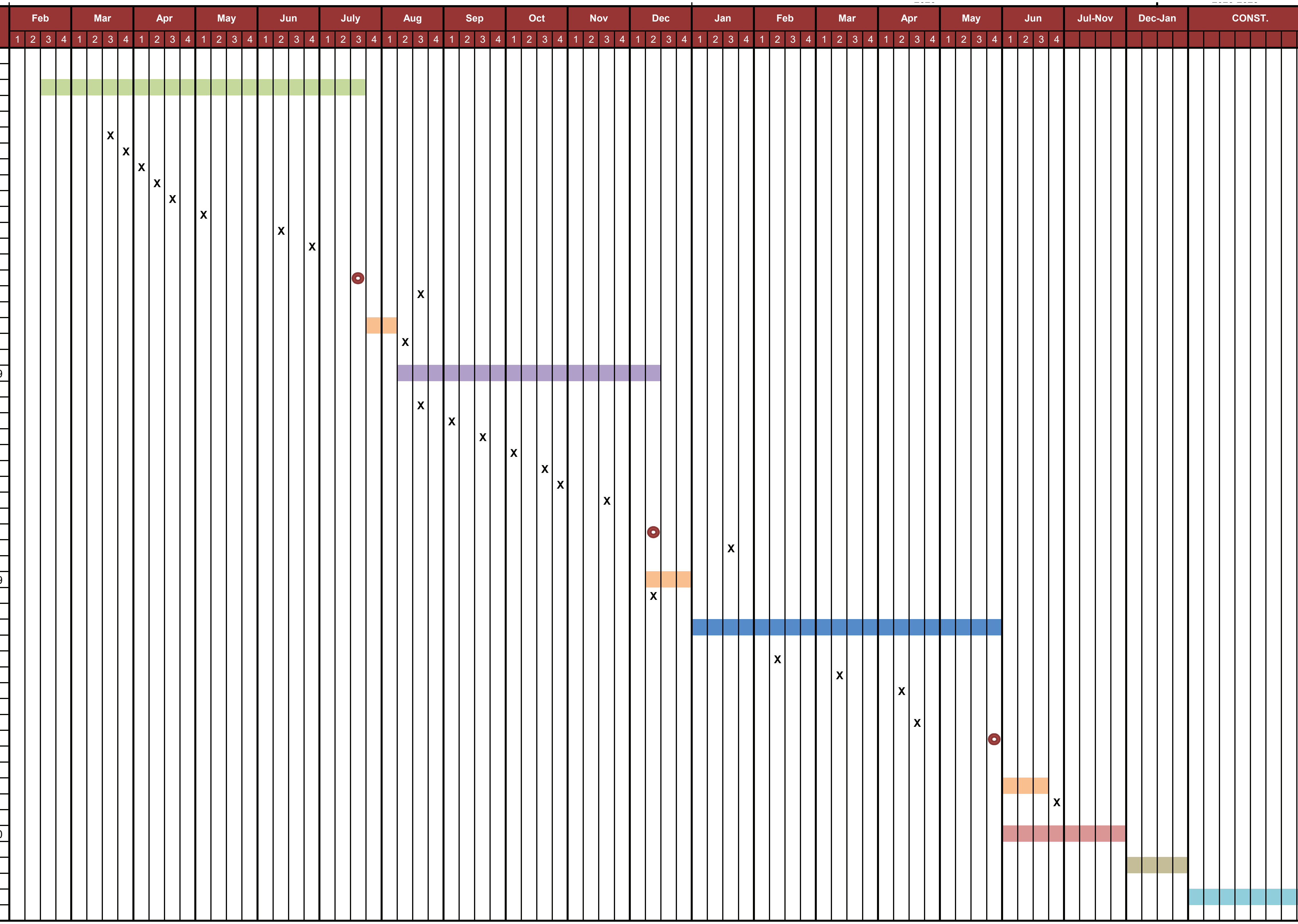
| MILESTONES / ACTIVITIES | START DATE | FINISH DATE |
|---|---|---|
| | | |
| | | |
| **SCHEMATIC DESIGN (4 MOS)** | 1/28/2019 | 7/23/2019 |
| Schematic Design activities | | |
| SD Mtg 01 | 12/13/2018 | |
| SD Mtg 02 | 3/18/2019 | |
| SD Mtg 02a | 3/28/2019 | |
| SD Mtg 03 | 4/11/2019 | |
| Eco-Charrette (If needed) | 4/18/2019 | |
| SD Mtg 04 | 4/25/2019 | |
| SD Mtg 05 | 5/9/2019 | |
| SD Mtg 06 | 6/14/2019 | |
| SD Mtg 07 | 6/28/2019 | |
| GCCD SD Review | | |
| Final Schematic Design due to GCCD | 7/23/2019 | |
| GCCD Board Presentation | 8/20/2019 | |
| Cost Estimate Activities | | |
| Cost Estimate Generation | 7/24/2019 | 8/7/2019 |
| Cost Estimate due to GCCD | 8/12/2019 | |
| | | |
| **DESIGN DEVELOPMENT (4 MOS)** | 8/12/2019 | 12/12/2019 |
| Design Development activities | | |
| DD Mtg 01 - User Group 01 | 8/22/2019 | |
| DD Mtg 02 - IT/AV | 9/5/2019 | |
| DD Mtg 03 - User Group 02 | 9/19/2019 | |
| DD Mtg 04 - Finishes/Equipment | 10/3/2019 | |
| DD Mtg 05 - Security | 10/17/2019 | |
| DD Mtg 06 - M&O | 10/31/2019 | |
| DD Mtg 07 - Finishes 02 | 11/21/2019 | |
| GCCD DD Review | | |
| Final Design Development due to GCCD | 12/12/2019 | |
| GCCD Board Presentation | 1/21/2020 | |
| Cost Estimate Activities | | |
| Cost Estimate Update | 12/13/2019 | 12/30/2019 |
| Cost Estimate due to GCCD | 1/6/2020 | |
| | | |
| **CONSTRUCTION DOCUMENTS (5 MOS)** | 1/6/2020 | 5/29/2020 |
| Construction Documents activities | | |
| CD Mtg 01 | 2/10/2020 | |
| CD Mtg 02 | 3/9/2020 | |
| CD Mtg 03 | 4/13/2020 | |
| | | |
| Set DSA appointment | 4/17/2020 | |
| DSA Submittal | 5/29/2020 | |
| | | |
| Cost Estimate Activities | | |
| Cost Estimate update | 5/30/2020 | 6/20/2020 |
| Cost Estimate due to GCCD | 6/27/2020 | |
| | | |
| **DSA REVIEW / APPROVAL (6 MOS)** | 5/29/2020 | 11/27/2020 |
| | | |
| **BID / AWARD (2 MOS)** | 11/30/2020 | 1/27/2021 |
| | | |
| **CONSTRUCTION (24 MOS)** | 1/28/2021 | 1/27/2023 |
| | | |




Client submittal
X Client meeting or milestone