Wilson Architects

FLORIDA STATE UNIVERSITY

Interdisciplinary Research & Commercialization Building

CONCEPTUAL SCHEMATICS

4 June 2015

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Acoustic/Vibration:	Acentech Inc. 33 Moulton Street Cambridge, MA 02138 tel. 617.499.8000
EMI:	Vitatech Electromagnetics, LLC 115 Juliad Court, Suite 105 Fredericksburg, VA 22406 tel. 540.286.1984

INTERDISCIPLINARY RESEARCH & COMMERCIALIZATION BUILDING

CONCEPTUAL SCHEMATICS

4 June 2015

A draft Program Verification Report for the IRCB project was issued on 16 May 2015 and reviewed at Workshop 3 on 21 May 2015. The revised final Program Verification Report was issued on 27 May 2015.

This Conceptual Schematics package is based on the verified program, however the actual program area on the drawings will vary slightly due to normal development of the floor plans as part of the design process.

1. DRAWINGS

The Conceptual Schematics phase drawings included on the following pages in 11x17 format are also being issued as half-size sheets in a separately bound drawing package.

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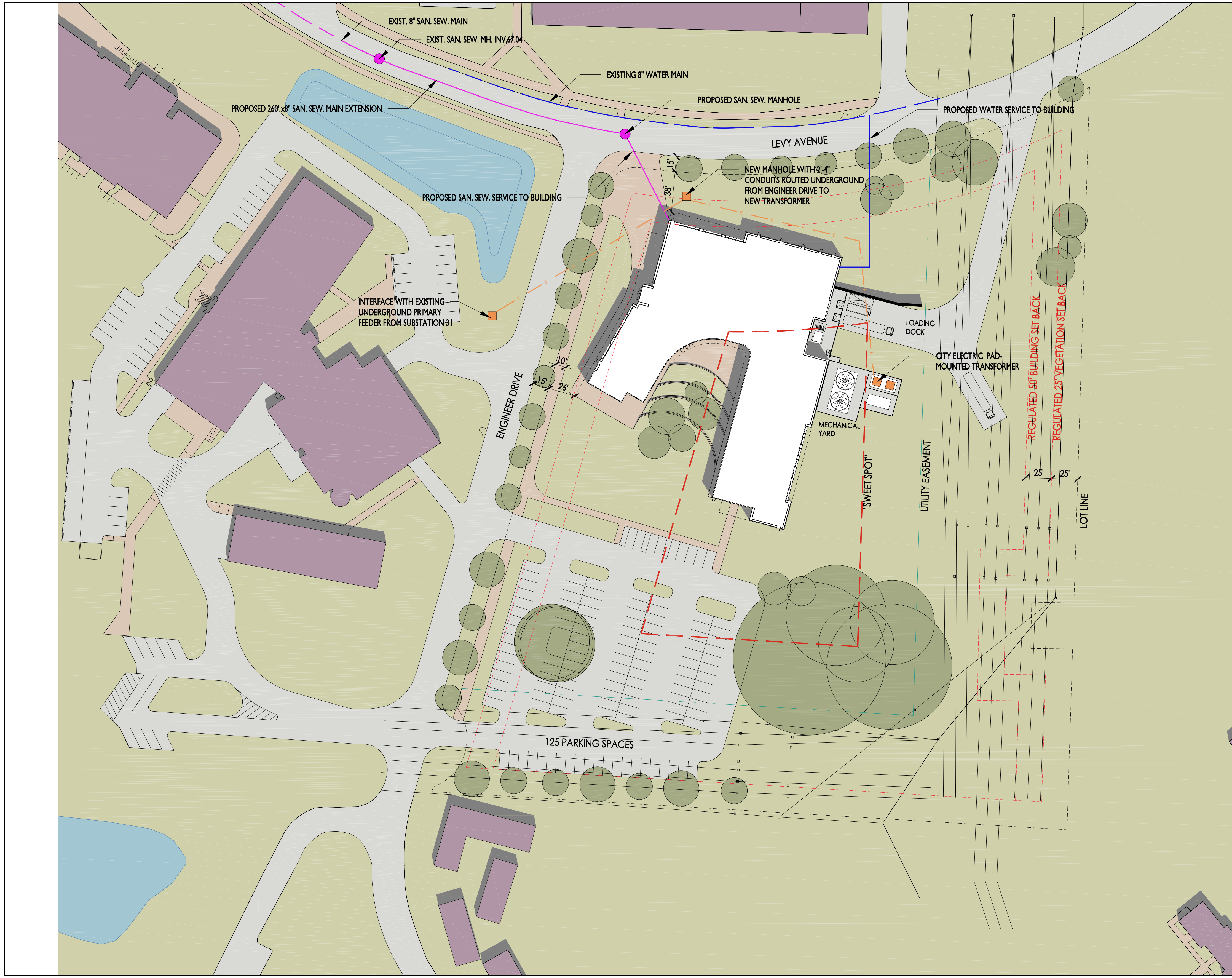
Florida State University - IRCB
Conceptual Schematics Package

Issued 4 June 2015

NO.	DRAWING TITLE	SCALE
	ARCHITECTURL DRAWING SHEET LIST	
COVER	COVER / DRAWING LIST	N / A
A1.10	SITE PLAN	1/32" = 1'-0"
A2.10	LEVEL ONE PLAN	3/32" = 1'-0"
A2.20	LEVEL TWO PLAN	3/32" = 1'-0"
A2.30	LEVEL THREE PLAN	3/32" = 1'-0"
A2.40	PENTHOUSE PLAN	3/32" = 1'-0"
A3.00	BUILDING RENDERINGS	NTS
A3.01	BUILDING RENDERINGS	NTS
A3.20	BUILDING SECTIONS P	3/32" = 1'-0"
A3.21	BUILDING SECTIONS P	3/32" = 1'-0"



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Drawing Scale	1/32" = 1'-0"

SITE PLAN

A1.10

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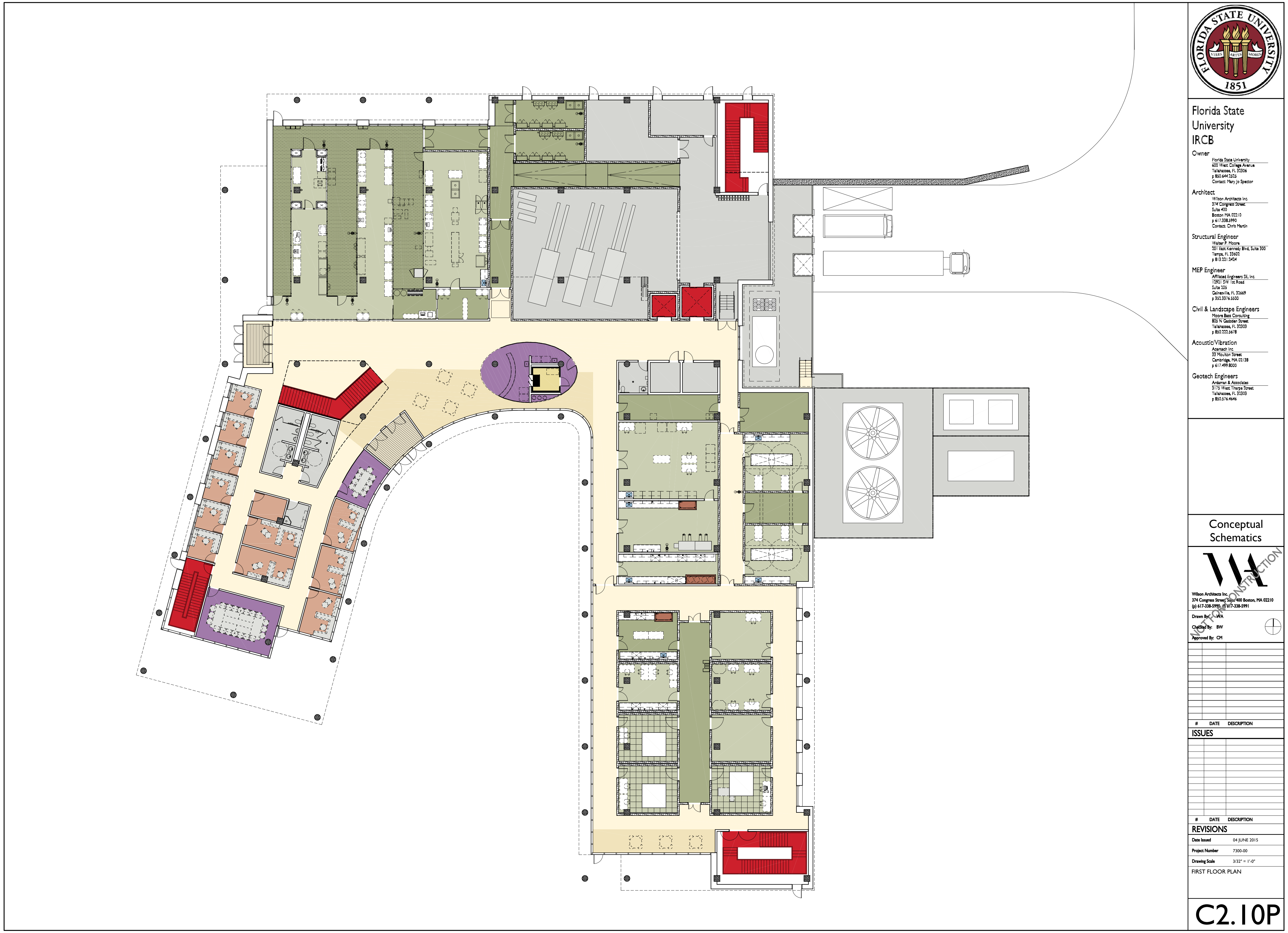
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Project Number 7300-00
Drawing Scale 3/32" = 1'-0"
FIRST FLOOR PLAN
C2.10P
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SECOND FLOOR PLAN

C2.20P

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THIRD FLOOR PLAN

C2.30P

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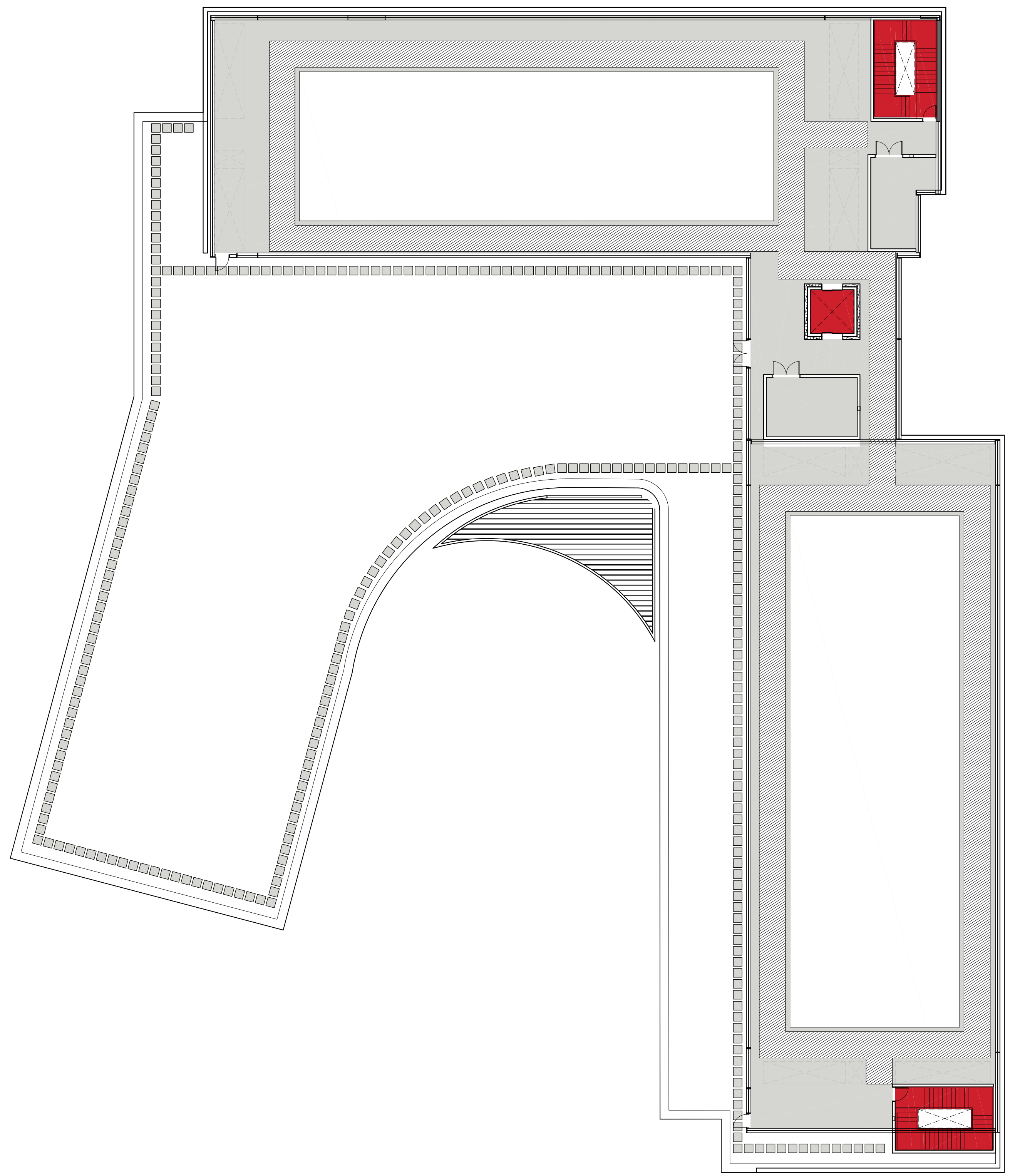

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PENTHOUSE PLAN

C2.40P

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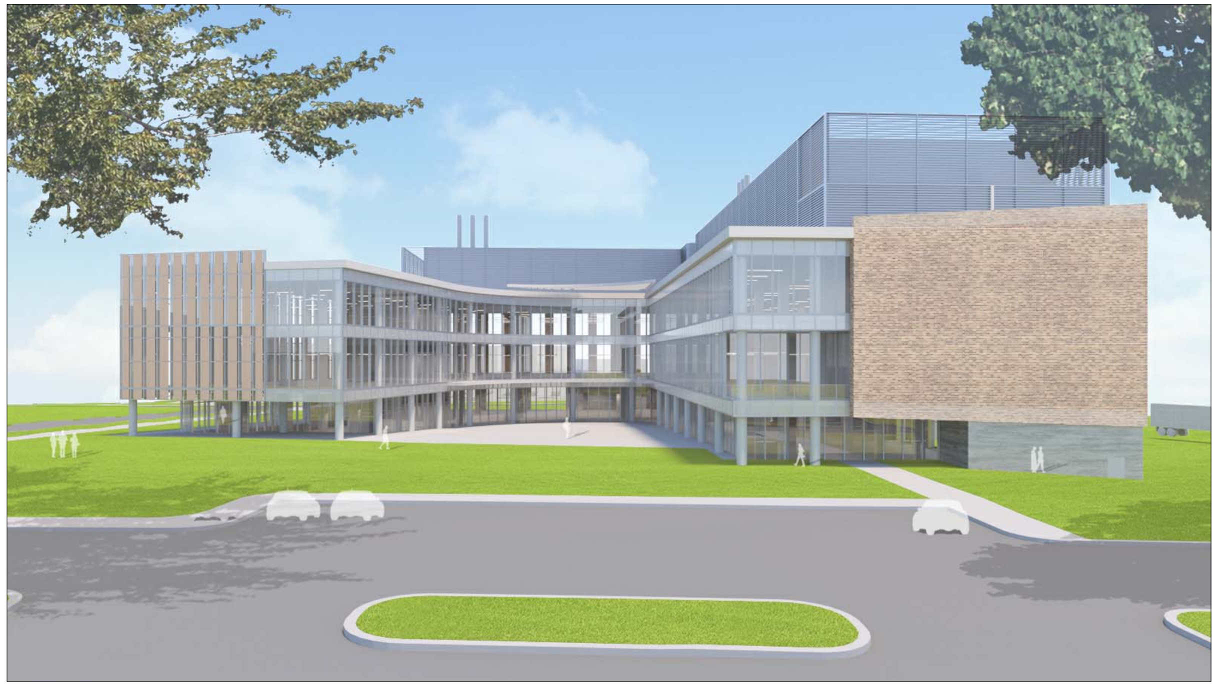

4 VIEW FROM PARKING LOT

2 COURTYARD VIEW

3 VIEW FROM LEVY

1 GATEWAY VIEW

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BUILDING RENDERINGS

A3.00

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4 WEST ELEVATION

2 EAST ELEVATION

3 SOUTH ELEVATION

1 NORTH ELEVATION

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BUILDING RENDERINGS

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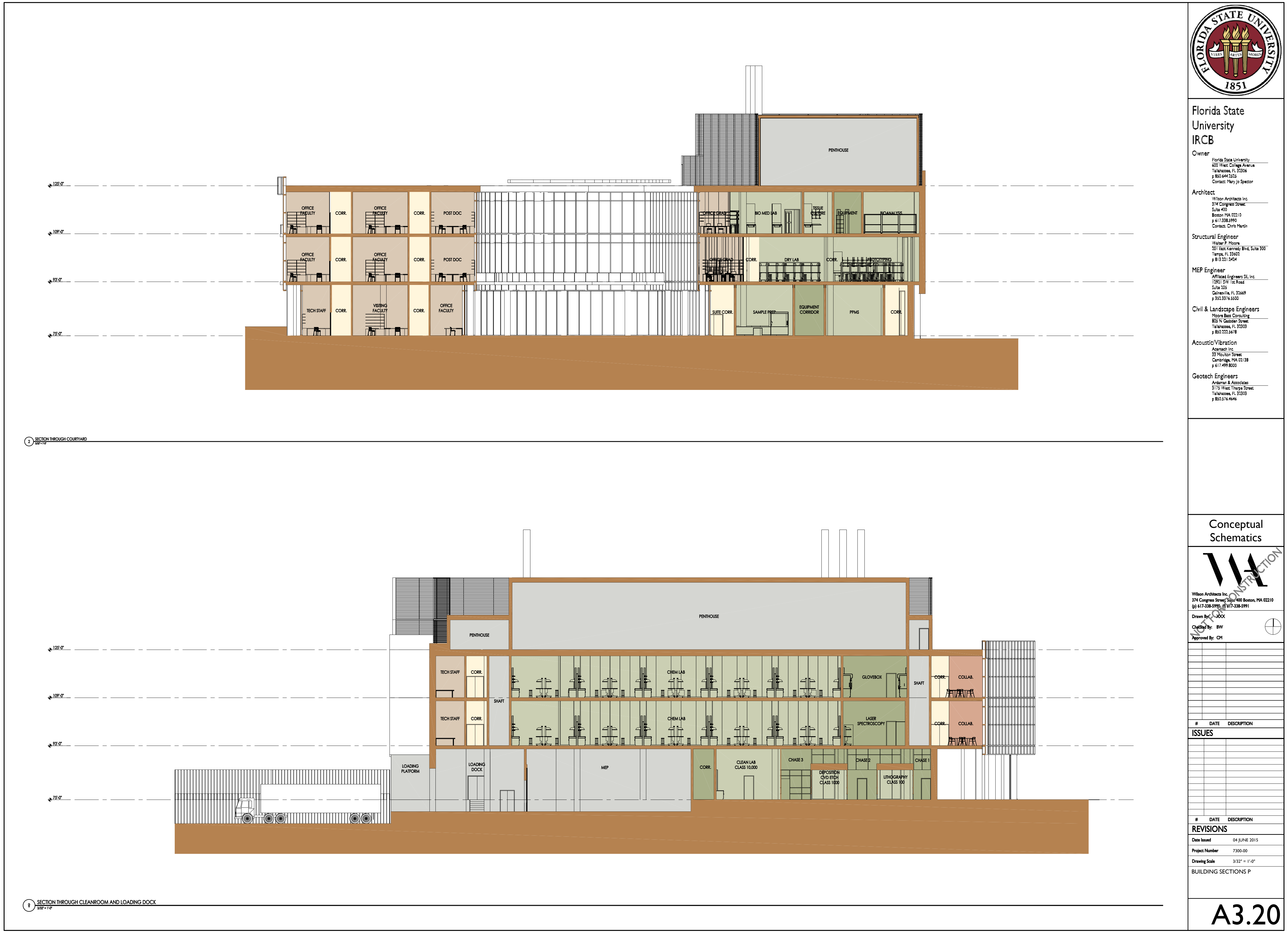
PENTHOUSE
OFFICE FACULTY
CORR.
POST DOC
TECH STAFF
VISITING FACULTY
BIO MED LAB
DRY LAB
SUITE CORR.
SAMPLE PREP
EQUIPMENT CORRIDOR
PPMS
SECTION THROUGH COURTYARD
PENTHOUSE
TECH STAFF
SHAFT
CHEM LAB
GLOVEBOX
LASER SPECTROSCOPY
COLLAB.
LOADING PLATFORM
LOADING DOCK
MEP
CLEAN LAB CLASS 10,000
CHASE 3
CHASE 2
CHASE 1
DEPOSITION CVD ETCH CLASS 1000
LITHOGRAPHY CLASS 100
SECTION THROUGH CLEANROOM AND LOADING DOCK
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BUILDING SECTIONS P
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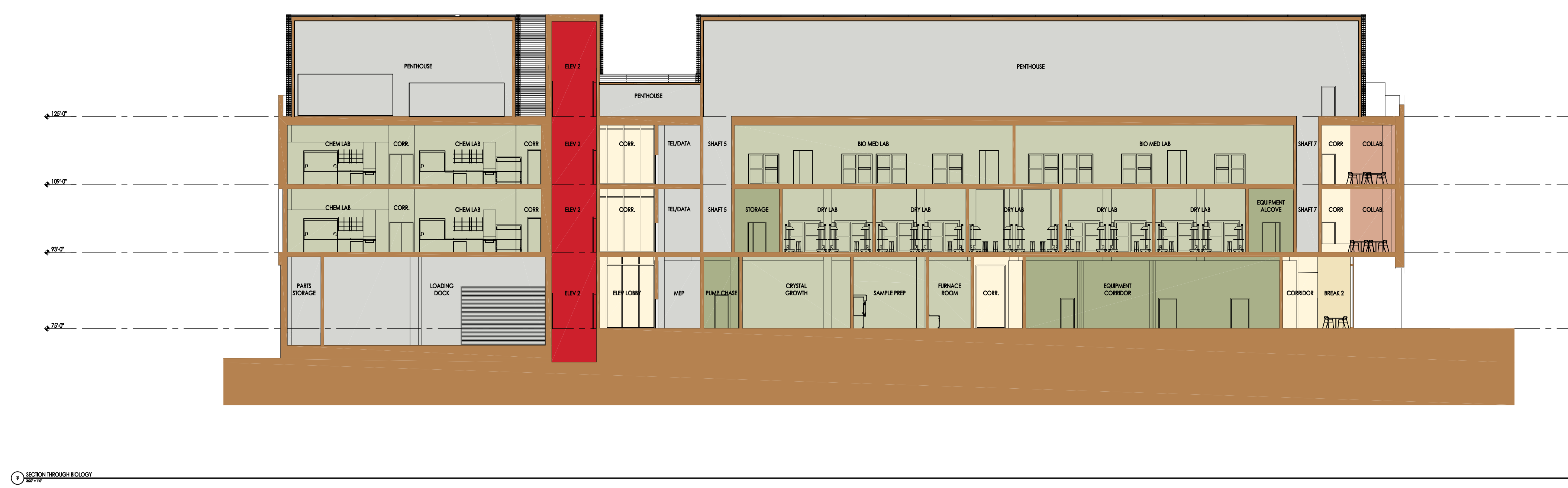

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BUILDING SECTIONS P

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2

2. SITE NARRATIVE

- Coordination with Innovation Park Master Plan
- Accessibility
- Soil/Groundwater Conditions
- Zoning
- Utility Services
- Governing Codes
- Permits

COORDINATION WITH INNOVATION PARK MASTER PLAN - UTILITY SERVICES

Coordination with Innovation Park Master Plan

The project meets the general requirements of the Innovation Park Master Plan / PUD with regard to building use, size and height. Two areas of deviation from the PUD are building setback and required parking. Both issues have been discussed with the Executive Director of Innovation Park (IP). The site plan will be submitted to the IP Board for approval and consideration of a deviation to the building setback as well as the parking provided on-site.

There are two areas of trees on the site which have been the focus of an Arborists report. A small grouping at a central point within the site and a larger grouping to the southeast. The arborist report makes recommendations for retention and preservation of most of the trees in the southeast. The proposed site plan follows this recommendation.

Accessibility

In a larger context of how the proposed building fits into the IP Campus, the Site Plan recommends a broad sidewalk with street trees along Levy Street that will serve as the extension of the existing pedestrian way, provide a suggestion of how other buildings along this spine could enhance the pedestrian experience and also as a link to future development on the former Alumni Village property. A secondary (and smaller) sidewalk system with street trees will also be provided along Engineering Way and both edge sidewalks will integrate into the proposed building and central courtyard / parking field.

Soil / Groundwater Conditions

Preliminary soil testing was performed by Ardaman & Associates in August, 2014.. The findings of the study based on six deep test borings found clayey sands and elastic silts. Groundwater was identified at between 25-35 feet below the surface. The report noted that the high risk for sinkhole development (a known issue around Innovation Park) was possible, but no specific karst feature was located. Also, the opportunity for “pipe clay” is common in the area and may require enhanced foundation requirements. No problem soils were identified within the top 25-30 feet of the borings, however, additional testing is recommended once the building footprint has been set.

Zoning

The site is within the Innovation Park Planned Unit Development (PUD) which serves as the official zoning designation of the property. Portions of Innovation Park – and this site, specifically are also within the Florida State University Master Plan. This Master Plan acts as the Local Government Comprehensive Plan and has been approved by the City of Tallahassee. No further zoning consideration is necessary beyond approval by the IP Board of Directors.

Utility Services

a. Steam – NA

b. Potable Water - Provided by City of Tallahassee, Existing 8" PVC water main located within Levy Avenue to the north of this site. Line will be extended and a service connected at the northeast corner of the proposed building so that backflow preventers and other above ground metering are not in conflict with the entrance to the building.

c. Chilled Water – NA

d. Sanitary Sewer - Provided by City of Tallahassee, Existing 8" PVC sanitary sewer main located within Levy Avenue just west of the Levy Avenue and Engineering Drive intersection, approximately 265' from the northwest corner of this site. Building elevation of 72 will be a critical design element in order to maintain a gravity outfall to the existing forcemain (see utility connection notes on plan).

e. Storm - Stormwater is provided via capacity within the Innovation Park Stormwater Management Facility and will drain to the northeast corner of the site. That facility will be impacted and reconfigured with maximized volume provided on site and the remaining volume provided east of the City’s overhead electric lines. Treatment and rate control will need to be provided for any improvements to the site as well as any disturbance of the existing stormwater system already in place.

   The PUD limits the impervious coverage for this site to 50% of the site area (3.7 acres) based on the existing capacity of the pond located at the northeast corner of the property. The proposed site improvements are roughly calculated at 120,000 sf or 2.75 acres of impervious area – within the design volume of the existing pond. A new pond configuration that is approved by City of Tallahassee Electric Department will confirm the available volume provided on-site and the remaining pond design off-site.

f. Natural Gas - Provided by City of Tallahassee, Exiting gas service is provided via gas main located within the Levy Avenue right-of-way to the north of this site.

g. Power - Provided by City of Tallahassee, Electric power is provided to this site via multiple locations. Initial conversations with the City of Tallahassee Electric Department identify the opportunity for underground feed to the building from the existing lines. The City will work with the design team to determine the best connection point from Substation 31.

h. Telecommunications - An existing fiber optic box and telecom box are located at the northwest corner of this site.

i. Electrical Easement - The site contains two (2) City of Tallahassee Powerline Easements, one 100' easement along the southern boundary of the site (O.R. Book 430, Page 262) and one 150' easement along the

GOVERNING CODES - PERMITS

eastern boundary of the site, (O.R. Book 430, Page 262). These easements contain a series of large transmission lines which cannot be impacted or relocated. Parking is allowed within these easements but is severely restricted by the transmission line poles and guy wires.

Governing Codes

a. Florida Unified Building Code (2010 Edition)
b. Innovation Park Planned Unit Development
c. City of Tallahassee Environmental Management Ordinance (by reference)
d. City of Tallahassee Technical Specifications for Water and Sewer Construction (Levy Street ROW)
e. Florida Department of Transportation (FDOT) MUTCD
f. FDOT Design Standards 2015
g. FDOT Specifications for Road and Bridge Construction

Permits

a. Innovation Park Site Plan approval
b. City of Tallahassee Driveway Connection Permit (Levy Street driveway)
c. City of Tallahassee Utility Placement Permit (Utility extensions)
d. City of Tallahassee Growth Management Notification (Storm Pond)

3

3. SYSTEMS NARRATIVE

3.1 STRUCTURAL SYSTEMS

A. SUBSTRUCTURE

The new Interdisciplinary Research & Commercialization Building (IRCB) is to be located at the corner of Levy Avenue and Engineer Drive on the southwest campus of Florida State University in Tallahassee, Florida. The current building program is for a 125-130,000 gross square foot building, with 3 stories above grade, plus a mechanical penthouse and a partial level 4 feet lower than the first floor level, required for mechanical equipment.

A preliminary geotechnical investigation was completed by Ardaman & Associates with analysis and recommendations submitted 13 August 2014. The following foundation systems were recommended in the geotechnical engineering report.

Materials

Reinforcement

1. Reinforcing Bars: ASTM A615 Typical
2. Welded Wire Fabric (WWF): ASTM A185
3. Glass Fiber Reinforced Polymer Rebar: at Condensed Matter Physics Dilution Refrigerator Labs including pit structures.

Cast-in-Place Concrete (Normal Weight)

1. Slabs-on-Grade 4,000 psi
2. Spread Footings 3,000 psi
3. Basement Walls 4,000 psi
4. Concrete Columns 5,000 to 7,000 psi
5. Elevated Concrete Slabs 5,000 psi

Structural Steel

1. W-Shapes: ASTM A992 Grade 502.
2. Angles, Channels: ASTM A36
3. Square/ Rectangular Hollow Structural Sections (HSS): ASTM A500 .
4. Structural Steel Exposed to Weather shall be Galvanized.

A10. Foundation

Basement Excavation

1. The Levy site consists of 55 to 65 feet of silty, clayey fine sands, sandy clays, and elastic silts to fat clays. Calcareous clay and limestone was generally encountered below 55 feet. Therefore normal excavation techniques are anticipated.
2. Groundwater was generally encountered 25 to 33 feet below grade.
3. Compacted structural fill may be required depending on final placement of building footprint (see geotechnical report).

Foundation System

The project geotechnical engineer conducted a preliminary investigation of the soils on this site to assess sinkhole potential and the presence of highly plastic "fatty" clays. Based on their preliminary recommendations and further discussions with them, the most suitable foundation options for this site appear to be:

a. A shallow single mat foundation which would support all building columns and walls.

b. Shallow isolated column and wall spread footings on soils improved with rammed aggregate piers. Soil remediation would also be required under the slab-on-grade.

c. Concrete auger cast piles or driven steel h-pile deep foundations. Should this option be selected, the slab-on-grade would be approximately 12" thick and would be designed to span between column pile caps. In this scenario, the slab on grade would be subjected to vibration from walking activity and a vibration analysis would need to be performed.

The geotechnical engineer will further assess these options, provide more detailed recommendations, and confirm whether further subsurface remediation will be required after the final geotechnical investigations are conducted.

A20. Basement Construction

Not Anticipated.

B. SHELL

The new Interdisciplinary Research and Commercialization Building (IRCB) is to be located at the corner of Levy Avenue and Engineer Drive on the southwest campus of Florida State University in Tallahassee, Florida. The building program is for a 125-130,000 gross square foot building, and includes a mix of wet and dry labs on the upper floors, with specialized core facilities including a cleanroom and imaging suite on the ground floor. Due to nature of the laboratory spaces on the first floor level, and the extensive mechanical systems anticipated, 18'-0" floor to floor height is recommended. 16'-0 floor to floor height is recommended on levels 2 and 3. A tall penthouse (~20'-0" clear height) will also be required above each of the 2 lab wings. The 3rd wing of the U-shaped building is dedicated to offices & meeting spaces. This narrative describes the structural design criteria and appropriate structural system for the new facility.

<u>DESIGN CRITERIA</u>

1. APPLICABLE CODES AND DOCUMENTS

a. Florida Building Code, 5th Edition (2014)

b. ASCE 7-10

c. ACI 318-11

e. AISC: Manual of Steel Construction - Load and Resistance Factor Design

2. FLOOR & ROOF LOADS

a. Live Loads

Live Loads	psf
Offices & Corridors above First Floor	80
Typical Laboratory Spaces	100
Stairs and Exit Ways	100
First floor corridors	100
Typical Roof	20

Live loads will not be reduced for floor framing members. Live loads on columns will be reduced in accordance with the Florida Building Code.

b. Superimposed Dead Loads

Superimposed Dead Loads	psf
Allowance for Flooring / Partitions	10
Allowance for Ceiling/Mechanical	20

3. WIND LOADS – per ASCE 7-10

Building Risk Category	III
Basic Wind Speed	125 mph
Exposure Category	B
Wind Drift Limit	h/400

4. SEISMIC LOADS

Seismic loads will not control the design of this building.

5. FLOOR VIBRATION CRITERIA

Floor vibration will be accessed in accordance with "Building Floor Vibrations" by Thomas Murray, AISC Journal, 3rd Quarter 1991. The elevated floor structures will be designed to the following vibration criteria:

a.

Location	Vibration Threshold
First floor slab-on-grade (where necessary)	VC-E+ (125 in/sec)
Laboratory spaces (upper floors)	VC-B (1,000 in/sec)
Office spaces	Office (16,000 in/sec)

STRUCTURAL/FRAMING SYSTEMS

1. DESIGN PARAMETERS

The selection of the most appropriate structural system was based upon the following criteria:

a. Economical structural system.

b. Number of floors, typical column spacing

c. Limitations on floor deflections and vibrations

d. Availability of local labor and materials.

e. Depth of structural system, floor-to-floor heights

2. FLOOR & ROOF FRAMING SYSTEMS

We understand that the lab module for this building will allow for a typical column spacing of approximately 22 feet x 30 feet, with areas that exceed this column spacing. Based on this spacing and the other design parameters outlined above, the most appropriate floor system for this building is a cast-in-place concrete pan-formed beam floor system. The typical member sizes are listed below and in the structural sketch sheets that accompany this narrative.

Floor slab: 5" thick

Joists (pan-formed beams): 6" wide, 5"+16" (21" total) deep

Typical Floor Beams:	36" wide x 21" deep
Shearwalls:	12" thick all around elevators and stairs.
Columns:	24" x 24", 5,000 psi cast-in-place concrete

It may be beneficial for the project schedule to construct the roof of the mechanical penthouse out of structural steel in lieu of the cast-in-place concrete system used for the lower floors. The cost and construction schedule impacts of both options will be discussed with the construction manager as the project moves into the Design Development phase. Should the penthouse roof be constructed out of structural steel, the most appropriate framing sizes would be 1 ½" steel roof deck on 12" to 24" deep steel beams at 5'-6" maximum spacing. The steel columns would be 14"x14" wide-flange shapes.

3. LATERAL STABILITY

The primary lateral stability system for the new structure will consist of load-bearing CIP concrete shearwalls at the stair and elevator shafts. The quantity, size, and locations of the shearwalls will be worked out to fit within the architecture as we move into Design Development.

Should the mechanical penthouse roof be constructed with structural steel, steel braced frames will be needed to laterally stabilize the penthouse.

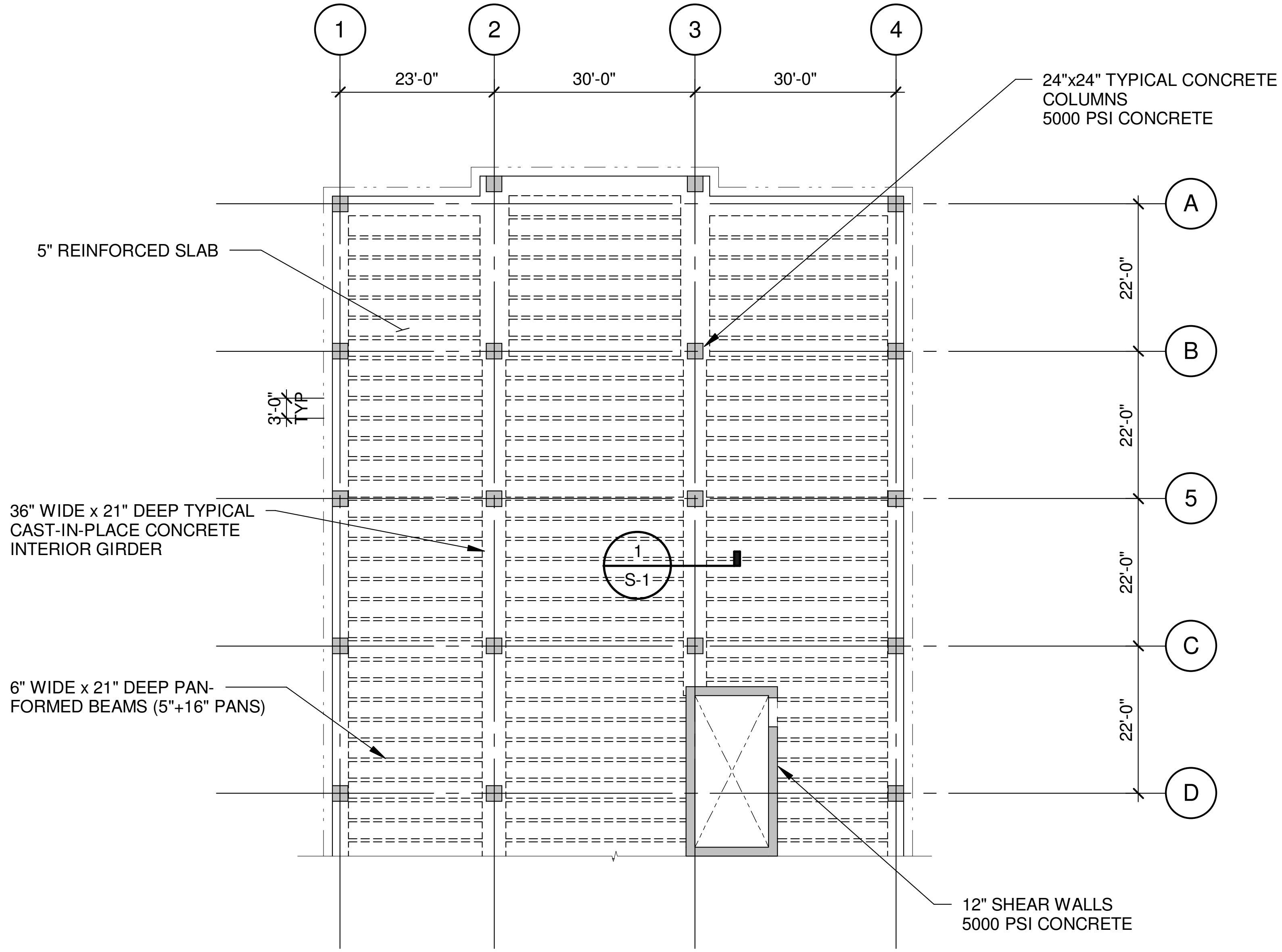
FIREPROOFING OF THE STRUCTURE

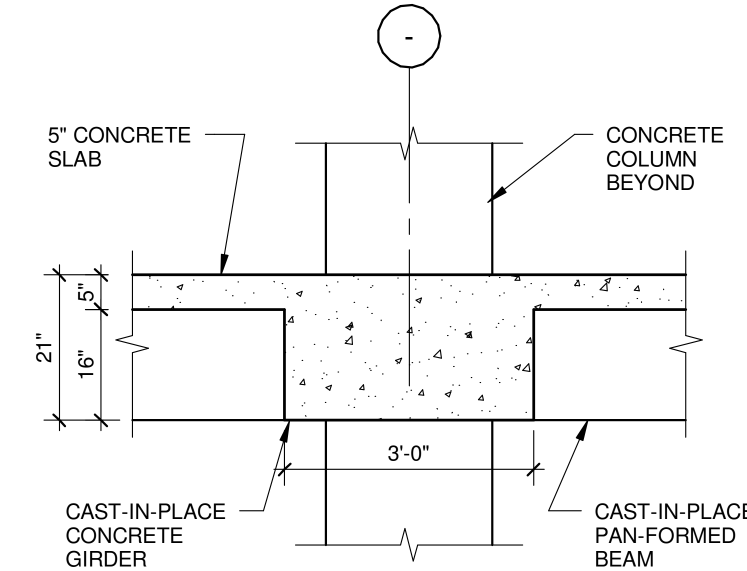
1. The building is classified as Type I and will be fully sprinkled.
2. The primary girders and columns will require a 3-hour rating.
3. The floor system will require a 2-hour rating.
4. Since this will be a cast-in-place concrete structure, no additional fireproofing materials will be needed. Adequate concrete cover to reinforcing steel and slab thickness will be provided to achieve the required fire-rating.
5. Should the mechanical penthouse roof be constructed with structural steel, the roof deck and beams would need to receive spray-on cementitious fireproofing to attain a 1-hour fire-rating.

ENVIRONMENTAL OBJECTIVES

Sustainable design of the structure focuses on the common goal of designing a high performance building that use our resources more responsibly and is environmentally friendly. High performance requires low energy consumption, long term durability, low maintenance and the use of recycled materials.

The selection of the structural system will consider the environmental impact and energy efficiency of selected materials. Initial cost will be important but will be considered with other aspects of materials such as the recycled content, renewable qualities, VOC (volatile organic compounds) content, material sources, and reusability.





NOTE: STEEL REINFORCEMENT NOT SHOWN.

1 TYPICAL SECTION

1/2" = 1'-0"

NOTES:

1. TYPICAL CONCRETE REINFORCEMENT = 8 TO 10 PSF ON ELEVATED FLOORS & ROOF.
2. BASED ON PRELIMINARY ANALYSIS WITH GENERAL ASSUMPTIONS, THE FLOOR SHOWN MEETS "VC-B" VIBRATION CRITERIA WITH MODERATE WALKING EXCITATION (75 STEPS / MINUTE). A MORE DETAILED ANALYSIS WILL BE PERFORMED ONCE EXACT COLUMN LOCATION AND ROOM LAYOUTS ARE KNOWN.

TYPICAL CONCRETE PAN-FORMED BEAM AND SLAB FRAMING LAYOUT

1" = 20'-0"

THESE DRAWINGS ARE FOR COST COMPARISON PURPOSES OF SCHEMES AND ARE NOT INTENDED TO ESTABLISH A CONSTRUCTION BUDGET.

WALTER P MOORE

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TAMPA, FLORIDA 33602.5181
PHONE: 813.221.2424 FAX: 813.221.2289
CERTIFICATE OF AUTHORIZATION NO. 3818

Project Name:
INTERDISCIPLINARY RESEARCH BUILDING
FLORIDA STATE UNIVERSITY
TALLAHASSEE, FLORIDA

Client:
WILSON ARCHITECTS, INC.

Date:	06/04/2015
Project Number:	S05-14050-00
Engineer:	SDM
Drafter:	SDM
Client No.:	-
Sheet:	S-1

3.2 SHELL

B. SHELL

(continued)

Loading Dock

1. The loading dock structure will be isolated from the remainder of the first floor slab system to prevent the transmission of vibrations from delivery trucks to the surrounding first floor areas.

Penthouse Floor Structure

1. Mechanical units are to be mounted on a floating concrete slab to minimize vibrations to the spaces located beneath the air-handling equipment. The floating slab will be a 4-inch concrete slab reinforced with #4's at 12-inch centers and supported on an isolation system manufactured by Mason or Kinetics.

Cooling Tower Grillage and Screenwalls

1. Cooling towers, electrical switch gear, emergency generators, and a Liquid Cryogen storage tank will be located at grade on a structural concrete slab.
2. The screenwall around the cooling towers will be approximately 24 feet tall.
3. The screenwall structure will consist of vertical steel trusses at approximately 22 feet on-center. The vertical truss will be constructed of wide flange and hollow tube sections.
4. Horizontal girts consisting of hollow steel tubes will span between the vertical trusses to support the architectural louver/perforated metal panels concealing the cooling towers.

Stairs and Elevators

1. The stairs will be steel metal pan construction.
2. Back-up steel tubes should be anticipated at the elevator guide rails due to the floor-floor-heights.

B20. Exterior Enclosure

1. Exterior Walls shall be a combination of unitized system of curtainwall, terra-cotta panels, and metal panels in an open/dry joint rainscreen assembly and traditional brick veneer cavity construction with metal stud framing back-up wall
   a. Provide light color "sand stone or buff" panels and brick.
   b. Provide stainless steel or sheet copper flashing where required. Provide end dams at window openings. All joints shall have either mitered joints or be properly lapped and sealed or soldered at inside and outside corners.
2. Exterior Windows/curtainwall assemblies shall be custom assemblies integrated into the rainscreen system or brick veneer assembly. Basis of Design Curtainwall systems shall be:
   a. 6 ¼" Unitized System: Wausau 6250i Series
   b. 7 ¼" Unitized or Stick System: Wausau 7250i Series
3. Provide 1" double glazed IGU, Guardian Sunguard, SNX 51/23 with Low-E coating and Argon and the following characteristics:
   a. Light to Solar Gain: 2.18
   b. Solar Heat Gain Coefficient: 0.23
   c. Shading Coefficient: 0.27
4. Exterior Entry Doors shall be framed stainless steel hinged doors with full light insulating glass lite.
   a. Exterior utility doors shall be insulated metal doors and grouted metal frames, painted.
   b. Loading Dock Door shall be overhead coiling type, 18'-0" wide x 14'-0" high clear.
5. Wall Insulation shall be 3" Rock Wool Insulation:
   a. CavityRock© DD non-combustible, lightweight and water repellent, semi-rigid insulation board, for use in cavity wall applications as manufactured by Roxul, Inc.
6. Louvers shall be extruded aluminum, storm proof and include bird screens.
   a. Louvers shall meet hurricane requirements for Tallahassee, Florida.

B30. Roofing

1. Roof Coverings shall be a built up roof membrane or modified bitumen over protection board, with minimum pitch of ¼ inch per horizontal foot.
   a. Provide roof membrane with solar reflectance index (SRI) that is USGBC LEED Compliant.
2. Provide roof walk pads on flat roofs extending from point of roof access to and around any and all mechanical equipment that will need to be serviced.
3. Provide Poly-isocyanurate insulation with staggered joints and minimum thickness of 6" at the roof drains and a minimum R value of R-30.
4. Roof Openings
   a. Provide roof hatches/vents in penthouse roof, assume 2.
   c. Roof Garden System by AMERGREEN

3.3 INTERIORS

d. Provide planted tray system over roofing membrane where indicated on the drawings. Trays to have drainage core reservoir protected by a root barrier fabric internal to pan.

e. Provide protective membrane under trays.

C. INTERIORS

Basis of design materials shall be as outlined below and as indicated on the finish schedule.

C10. Interior Construction

1. Partitions shall be provided as scheduled;
   a. Provide GWB partitions unless noted otherwise. Typical GWB partition shall be 1 layer 5/8" GWB on each side of 6" 18 ga. Metal studs at 16" o.c.
      - Provide level 5 finish in all public spaces.
   b. Provide 8" CMU at Level 1 Imaging, Condensed Matter Physics and Materials Synthesis areas.
   c. Provide 8" concrete caps at (4) Imaging rooms below Level 1 structural slab.
   d. Shaft walls - Provide 2-hour rated shaft wall partitions with 1" shaft liner, fire batt insulation, and 2 layers 5/8" GWB on exterior side of shaft.
   e. Restrooms - Provide 1 layer 5/8" MR. GWB on interior and 1 layer 5/8" GWB exterior to restrooms. Provide tile backer board where ceramic tile is indicated.
   f. Provide ceramic tile on all wet walls in restrooms and kitchenetts.
   g. Atrium - Provide glass wall occupancy smoke separation barrier at the ground floor atrium.
   h. Offices - Provide modular panel wall system with integral door and frame assembly. Provide 50% glazed panels on corridor partition and 100% opaque panels between offices.
   i. Laboratories – ½" thick tempered glass wall assembly with aluminum head, jamb, and sill frame assembly. Intermediate vertical joints between glass panels to be frameless and joined with preformed transparent plastic muntin strip.
   j. Mechanical/Electrical Spaces - Provide 8" CMU with sand filled cores and grouted cores where reinforcing is required.
   k. Elevator Shafts - Provide cast-in-place concrete at all elevator shafts
2. Interior office, conference, egress, and support room Doors shall be solid core wood faced with hard wood veneer.
   a. Provide 1,296 square inch glass lites in doors with 1 hour ratings.
   b. Provide 100 square inch glass lites in doors with 1 1/2 hour ratings.
   c. Provide ½" thick full glass panel sliding and pivot hinge doors where indicated on drawings for lab and graduate student office areas.
3. Provide Mortise and Cylinder locksets by Best, or equal by Corbin/Russwin or Sargent.
   a. Mortise Locksets shall be:
      - Best 35H7J at laboratories
      - Best 35H7E at offices
      - Best 34H7R at Restrooms
      - Best 34H7EW at custodial closets
   b. Cylinder Locksets shall be Best with removable cores.
4. Door Closers
   a. Exterior - Surface mounted Corbin/Russwin 2800 series, Sargent 1230 series or LCN equivalent with adjustable opening force of 8-15 lbs.
   b. Interior - Surface mounted Corbin/Russwin 2820 series, LCN 4040 series where adjustable opening force may be set to less than 5 lbs.
5. Panic Hardware shall be Von Duprin #99 series.
6. Hinges - shall be 5 knuckle stainless steel, ball bearing hinges with non removable pins by McKinney, Stanley.
   a. Provide extra heavy adjustable pivots at exterior doors that have a high frequency of use.
7. Door Operators shall be cCure Card Access. Where automatic door operators are used install a door stop.
8. Fittings/Specialties
   a. Provide visual display surface including marker boards by Ghent or Claridge in conference rooms, classrooms, and the Innovation Center.
   b. Provide fiberglass matt white projection screens in conference rooms, classrooms, and the Innovation Center.
   c. Provide stainless steel, ceiling mounted, toilet compartment partitions. Provide coat hooks on each door.
   d. Provide stainless steel restroom accessories by Bobrick including mirror, electric hand dryer, grab bars, , sanitary napkin receptacles, , and semi-recessed stainless steel waste receptacles. Integral paper towel dispensers are NOT acceptable.
      - Refer to FSU standards for specification sizes.
   e. Provide Jumbo bath tissue dispenser by Georgia Pacific for (2) 9" jumbo rolls.
      - Plastic – Translucent smoke
      - Tissue - 1PHJ2
   f. Provide Gogo dispenser fmx 1250 ml hand soap dispenser.
   g. Entrance floor mats shall be recessed flush with finished floor and be provided inside and outside of all building entrances. Where possible, recessed and

replaceable walk off mats shall have a 12-foot run length inside of all entrance doors.

- Exterior mats shall be a minimum of 4x6 for a single door, and 6x8 for a double door.
- Exterior mats shall be of the type to scrape and remove heavy dirt and soil.
- Interior mats shall be absorbent and be constructed so as to trap sand and finer particles.

9. Signage

a. Room Naming and Numbering – All room numbers will be assigned by the FSU Office of Space Utilization and Analysis. Contact: Lori Pinkerton (850) 644-9660.

b. Provide marking, signage and other identification for all mechanical equipment and piping.

c. Provide clear marking in accordance with code for all fire rated wall assemblies.

d. Provide a sign at each floor level landing in accordance with NFPA 101 (Life Safety Code), Chapter 5. The sign shall indicate the floor level, the terminus of the top and bottom of the stair enclosure, and the identification of the stair. The sign shall also state the floor level of the direction to exit discharge. The sign shall be located approximately 5 ft. (152 cm) above the floor landing in a position that is readily visible when the door is in the open or closed position.

e. The Architect/Engineer shall include directional signs for direction of the public through corridors to destination together with identification of specific functions of rooms such as, MEN, WOMEN, CUSTODIAL CLOSET, MECHANICAL ROOM, DEPARTMENTAL NAMES, HIGH VOLTAGE, etc.

- Observe requirements of the Handicapped Codes and ADA. Particular attention should be given to placement of exit signs to ensure compliance with applicable codes and occupancy limit at designation on signs at specific areas. Design, placement, and other details will be in accordance with the Fire Marshal's requirements.

10. Building Plaque

a. The construction contract shall contain an adequate allowance for the installation by the contractor of a cast metal building plaque.

b. Location of the plaque in the building shall be as determined by the Project Manager, FSU Facilities Planning and Construction Department.

c. It shall be the responsibility of the contractor to verify all the information on the Building Plaque, including spelling, project name & number, University officials, etc.

11. Fire Protection Specialties

a. Unless otherwise required by Code, all fire extinguishers shall be maximum 5 lb. units, with a 3A40BC rating. 10 lb. units may be used in workshops, parking garages, large mechanical rooms, elevator equipment rooms and labs containing large quantities of flammable liquids. Rooms housing only HVAC systems, small electrical rooms, janitor's closets do not require fire extinguishers unless otherwise determined.

b. CO2 extinguishers – Do not use except with prior approval of the Environmental Health & Safety department.

c. Fire extinguisher cabinets – Use only UL approved pull open, non-locking keyless cabinets, with a flat, shelf bottom without interior hanger and sized for a minimum 10 lb ABC extinguisher. All cabinets shall be fully or partially recessed and shall not extend greater than 4 inches from finish wall surface. Do not use break glass or plastic bubble front units. Extinguisher cabinets shall be installed to maintain the integrity and fire rating of the partition system it is installed in. The words "FIRE EXTINQUISHER" shall be clearly visible on the exterior face of the cabinet. Additional signage will be provided to guide occupants to a fire extinguishers location if hidden by columns or other building components.

d. Use Halatron or FE2000 fire extinguishing agents in computer rooms and laboratories where sensitive equipment exists. 2AC rated water mist extinguishing systems may be used in computer server rooms or laboratories with department approval.

e. Use K – Type extinguishers in commercial kitchens.

C20. Stairs

1. Egress stair construction shall be fabricated steel pan stairs with concrete infill treads. Provide stainless steel mesh guard/handrail design.
2. Open Communicating Stair construction shall be custom steel tube shapes with stone treads and risers on steel plate substrate. Provide cantilevered glass guard rail and stainless steel handrail.
3. Egress stair finishes shall be rubber treads and risers by Roppe or Armstrong.

C30. Interior Finishes (See Room Finish Schedule)

1. Wall Finishes shall be low VOC latex paints in public areas, offices, and generic lab spaces.

   a. Provide epoxy paints in all Tissue Culture labs, Autoclave rooms, Glass wash rooms, and bio hazard rooms.

   b. Provide epoxy paints and masonry block filler at all CMU partitions.

2. Floor Finishes shall be as specified in the finish schedule and as follows:

   a. Office Carpet/Carpet Tile

3.4 SERVICES

b. Corridors Polished Concrete (Stained).

c. Dry Lab Electrostatic Dissipative Flooring (ESD) by Ameriworx

d. Wet Lab Rubber Sheet by Nora. .

3. Ceiling Finishes

a. Provide acoustic panel ceiling systems with the following characteristics:

- Noise Reduction Coefficient (NRC): Not less than 0.90 (labs), 0.80 (offices)
- Ceiling Attenuation Class (CAC): Not less than 35 (labs and offices)
- Light Reflectance: 0.90 (labs and offices)

b. Provide specialty ceiling systems where indicated. Assume 33% GWB, 33% Wood, 33% Specialty Acoustic systems in the Atrium, Innovation Center, Lecture Hall, and Classroom.

D. SERVICES

The IRCB will be designed to accommodate interdisciplinary research for engineering and physical sciences faculty. Research platforms may be included in the building and the building will be designed to accommodate an imaging center, cleanroom, and other high performing laboratory functions. Material and equipment movement though out the IRCB will be served by a dedicated service elevator separate from passenger elevators. Vertical circulation systems shall include passenger elevators, a service elevator, and scissor lifts at the loading dock. Crane rails will be provided at the loading dock and the mechanical penthouse to facilitate changing out of heavy motors or adding equipment should a cold shell approach be necessary in order to protect the budget. Additional hoist beam and hook may be included in high bay/high performance laboratory space.

D10. Conveying

1. Provide 1 passenger elevator and one service elevator from ThyssenKrupp, Schindler, or Otis as follows:

a. Passenger Elevator: Machine roomless, electric traction elevators

- Stops: 3 each (single sided) (45'-0" travel)
- Capacity: 3,000 lbs
- Speed: 500 fpm
- Size: 6'-0"x7'-0" (nominal)
- Door: Center opening, 4'-0" w x 8'-0" tall

b. Service Elevator: Geared Traction Electric Elevator

- Stops: 4 (single sided) (60'-0" travel)
- Capacity: 10,000 lbs
- Speed: 200 fpm
- Size: 10'-0"x12'-0"

c. Other Conveying Systems

- Provide (2) Scissor Lift dock leveler at loading dock by Aaron Bradley Loading Dock Equipment or equal.
- Scissor Lift: LDS Series w/ 42" high removable handrails.
  - Rise: Grade to 48"
  - Capacity: 10,000 lbs
  - Platform size: 6'-0"x8'-0"

d. Provide overhead crane monorail in loading dock and penthouse by American Crane & Hoist, Royce Crane Co., or Spanco, Inc.

D20-D50 Plumbing, HVAC, Fire Protection, and Electrical Systems

Refer to the Mechanical Narrative

D60 LEED CERTIFICATION

1. The building will be designed to achieve LEED Certification (minimum of Silver Level).
2. Refer to separate section of report for LEED / Sustainability goals for the project.

3.5 UTILITY LOADS

The major mechanical, electrical, and plumbing (MEP) system loads for the Interdisciplinary Research and Commercialization Building are summarized below. Refer to the respective MEP design narratives additional detail. The major MEP system loads are:

- Mechanical:
  - Three chillers, each sized for 450 tons
  - Three cooling towers, each sized for 450 tons
  - Six boilers, each sized for 2,900 MBH output
  - Office air handling unit, sized for 15,000 cfm
  - Conference room air handling unit, sized for 9,000 cfm
  - Two laboratory air handling units, each sized for 45,000 cfm
  - Cleanroom makeup air unit, sized for 42,000 cfm
  - Two laboratory fume exhaust systems, each provided with for four 12,000 cfm fans
  - Two laboratory general exhaust systems, each sized for 35,000 cfm
  - Cleanroom exhaust system, provided with three 5,000 cfm fans

- Fire Protection:
  - 6" diameter service

- Plumbing:
  - Storm: Two 10" diameter building drains
  - Sanitary: 6" diameter building drain
  - Corrosion Resistant (Laboratory) Waste: 4" building drain
  - Domestic Water: 4" water service
  - Domestic Water Heaters: Four at 200,000 btuh each
  - NCCLS/CAP II Reagent Grade Water: 3000 gallons per day
  - Semi-Conductor Grade E1 Water: 6000 gallons per day
  - Laboratory Air Compressor: 80 scfm
  - Bulk Liquid Nitrogen storage: 3,000 liters capacity
  - Natural Gas: 21,000,000 btuh

- Electrical systems
  - Utility Load Estimate = 2000 kVA, with 2500kVA transformer
  - Initial Main Switchboard size estimate = 4000A (480Y/277V)
  - The initial Standby System capacity is estimated at 12 W/GSF with a single generator unit rated 1500KW/1875 KVA, operating at 480Y/277V.
  - The fuel supply will be sized for 36 hours of run time at full load.

3.6 PIPING SYSTEMS

III. PIPING SYSTEMS

A. Base Design Criteria:

1. Applicable Codes – Refer to Section 7.1 Preliminary Code Report.

B. System Descriptions:

1. Storm:

a. System Description:

1) Provide a conventional gravity storm drainage system.
2) Connect roof drains, area drains and gutters to the storm drainage system.
3) Route the storm drainage piping to the site storm sewer system.
4) Provide secondary (emergency) roof drainage by spilling over roof edge parapet scuppers dedicated pipe overflow drainage system.
5) Where scuppers are not feasible, provide a dedicated piped overflow drainage system.
6) Route overflow drainage piping to exterior building wall and discharge onto grade.

b. Design Criteria:

1) Piping:
a) Minimum Slope: 1/8" per foot
b) Minimum Design Velocity: 2 fps
c) Provide cleanouts at 100' intervals. Provide additional cleanouts at changes of direction; at the base of stacks; and where the building drain exits the building.
d) Insulate above ground piping to prevent water damage due to condensation. Provide vinyl jacket on insulated piping that is exposed in finished spaces.
e) Pressure Testing: Hydrostatic, 10' head for 30 minutes, inspect every joint, no leakage
2) Sump Pumps: Not anticipated
3) Special Acoustic Provisions: Not anticipated

c. Equipment and Material:

1) Roof Drains: Cast iron body, metallic dome
2) Overflow Roof Drains: Cast iron body, metallic dome, 2" water dam
3) Sump Pumps: (Not anticipated)

d. Distribution:

1) Interior Underground Piping:
a) Hub and Spigot Cast Iron:
Pipe: Cast iron, hub and spigot
Fittings: Cast iron, drainage pattern, hub and spigot
Joints: Neoprene push-on compression gaskets
2) Interior Above Ground Piping:
a) Hubless Cast Iron:
Pipe: Cast iron, hubless
Fittings: Cast iron, drainage pattern, hubless
Joints: Stainless steel couplings, neoprene gasket, heavy duty
Joints: Stainless steel couplings, neoprene gasket, standard weight
3) Cleanouts: Cast iron with bronze plug
a) Floor Cleanouts: Cleanout, nickel bronze access cover
b) Floor Cleanouts, Carpet: Cleanout, nickel bronze access cover, carpet marker
c) Floor Cleanouts, Tile: Cleanout, nickel bronze access cover, square tile top
d) Floor Cleanouts, Bare Concrete: Cleanout, cast iron tractor cover
e) Wall Cleanouts: Cleanout, stainless steel access cover
4) Insulation:
a) Rigid fiberglass pipe insulation, all-service jacket
b) Closed cell elastomeric pipe insulation
c) Vinyl Jacket: 20 mil PVC

2. Storm Water Reuse: (Not Anticipated)

3. Clearwater Waste and Vent:

a. System Description:

1) Modify the existing clearwater waste and vent system.
2) Provide a dedicated gravity clearwater waste and vent system.
3) Connect air handling units, coolers, and other equipment that discharge clear water.
4) Discharge clearwater drainage into the cooling tower sumps.

b. Design Criteria:

1) Piping:
a) Minimum Slope (2" and Smaller): 1/8" per foot
b) Minimum Slope (2-1/2" and Larger): 1/4" per foot
c) Minimum Design Velocity: 2 fps
d) Provide cleanouts at 100' intervals. Provide additional cleanouts at changes of direction; at the base of stacks; and where the building drain exits the building.
e) Insulate above ground piping to prevent water damage due to condensation. Provide vinyl jacket on insulated piping that is exposed in finished spaces.
f) Pressure Testing: Hydrostatic, 10' head for 30 minutes, inspect every joint, no leakage
2) Extend stacks up through the roof to vent terminals.

c. Distribution:

1) Interior Underground Piping:
a) Hub and Spigot Cast Iron:
Pipe: Cast iron, service weight, hub and spigot
Fittings: Cast iron, drainage pattern, hub and spigot
Joints: Neoprene push-on compression gaskets
2) Interior Above Ground Piping:
a) Hubless Cast Iron:
Pipe: Cast iron, hubless
Fittings: Cast iron, drainage pattern, hubless
Joints: Stainless steel couplings, neoprene gasket, heavy duty
Joints: Stainless steel couplings, neoprene gasket, standard weight
3) Cleanouts: Cast iron with bronze plug
a) Floor Cleanouts: Cleanout, nickel bronze access cover

b) Floor Cleanouts, Carpet: Cleanout, nickel bronze access cover, carpet maker
c) Floor Cleanouts, Tile: Cleanout, nickel bronze access cover, square tile top
d) Floor Cleanouts, Bare Concrete: Cleanout, cast iron tractor cover
e) Floor Cleanouts, Heavy Traffic: Cleanout, heavy duty ductile iron cover
f) Wall Cleanouts: Cleanout, stainless steel access cover

4) Insulation:
a) Rigid fiberglass pipe insulation, all-service jacket
b) Vinyl Jacket: 20 mil PVC

4. Sub-soil Drainage: (Not Anticipated)

5. Sanitary Waste and Vent:

a. System Description:
1) Provide a conventional gravity sanitary waste and vent system.
2) Connect to plumbing fixtures and other devices that produce sanitary waste to the sanitary waste and vent system.
3) Route the sanitary drainage piping to the site sanitary sewer system.
4) Basis of Design:
a) Building Drains: One at 8” diameter

b. Design Criteria:
1) Provide traps at each fixture.
2) Drainage Piping:
a) Minimum Slope (2” and Smaller): 1/4” per foot
b) Minimum Slope (2-1/2” thru 6”): 1/8” per foot
c) Minimum Slope (8” and Larger): 1/16” per foot
d) Minimum Design Velocity: 2 fps
e) Maximum Design Depth: Half full
f) Use pipe rated for 200°F effluent for piping connected to equipment capable of high-temperature discharges (autoclaves, glasswashers, etc.). Extend high-temperature piping from the point of discharge downstream until wastes are sufficiently blended with low temperature wastes to minimize the hazard.
g) Provide cleanouts at 100’ intervals. Provide additional cleanouts at changes of direction; at the base of stacks; and where the building drain exits the building.
3) Grease Waste Piping: (Not Anticipated)
4) Animal Waste Piping: (Not Anticipated)
5) Hazardous Waste and Vent: (Not Anticipated)
6) Vent Piping:
a) Provide vent piping to prevent excessive pressures within drainage piping.
b) Extend vent piping up through the roof to vent terminals. Locate vent terminals away from air intakes, exhausts, doors, openable windows and parapet walls as required by Code.
c) Maximum Differential Pressure: 1” water column
7) Pressure Testing: Hydrostatic, 10’ head for 30 minutes, inspect every joint, no leakage
8) Trap Primers: Provide floor drains, floor sinks and indirect waste receptors with automatic trap primers when subject to loss of their trap seals due to evaporation.
9) Sewage Ejectors: (Not Anticipated)
10) Elevator Sump Pumps:
a) Provide sump sumps in elevator pits.
b) Hydraulic Elevators: Provide hydrocarbon sensors that shutoff the pump upon detection of hydraulic oil in the waste stream.
11) Special Acoustic Provisions: (Not Anticipated)
12) Provide standby power:
a) Elevator sump pumps
13) Interface with Building Automation System (BAS):
a) Elevator sump pumps Alarm status

c. Equipment and Material:
1) Floor Drains:
a) Finished Floors: Cast iron body, adjustable nickel bronze top, trap primer
b) Rough Floors: Cast iron body, cast top, trap primer
c) Equipment: Cast iron body, less top, secondary strainer, acid-resisting enamel interior
2) Sewage Ejectors: (Not Anticipated)
3) Elevator Sump Pumps:
a) **Pump: Submersible, simplex, level control, oil sensor shutdown, oil sensor alarm**

d. Distribution:
1) Interior Underground Piping:
a) Hub and Spigot Cast Iron:
Pipe: Cast iron, service weight, hub and spigot
Fittings: Cast iron, drainage pattern, hub and spigot
Joints: Neoprene push-on compression gaskets
2) Interior Above Ground Piping:
a) Hubless Cast Iron:
Pipe: Cast iron, hubless
Fittings: Cast iron, drainage pattern, hubless
Joints: Stainless steel couplings, neoprene gasket, heavy duty
Joints: Stainless steel couplings, neoprene gasket, standard weight
b) Polyvinyl Chloride (PVC): Provide at waterless urinals.
Pipe: PVC, Schedule 40
Fittings: PVC, drainage pattern, socket ends
Joints: Solvent cement
3) Shutoff Valves:
a) Ball Pattern, Bronze (3”” and Smaller): Two piece, full port, stainless steel trim
b) Ball Pattern, PVC: True union, socket ends
c) Butterfly Pattern (3” thru 6”): Ductile iron, lug type, EDPM liner, aluminum-bronze disc, lever handle
4) Check Valves:
a) Swing Check (Horizontal Installation): Cast iron, bronze fitted

5) Cleanouts: Cast iron with bronze plug
   a) Floor Cleanouts: Cleanout, nickel bronze access cover
   b) Floor Cleanouts, Carpet: Cleanout, nickel bronze access cover, carpet maker
   c) Floor Cleanouts, Tile: Cleanout, nickel bronze access cover, square tile top
   d) Floor Cleanouts, Bare Concrete: Cleanout, cast iron tractor cover
   e) Wall Cleanouts: Cleanout, stainless steel access cover

6. Corrosion Resistant (Laboratory) Waste and Vent
   a. FSU policy prohibits the dumping of chemicals into building drainage system.
      1) The nano-cleanroom areas produce wastes that cannot be readily collected for disposal. Waste from these areas will be treated prior to discharge into the sanitary drainage system.
      2) Lab wastes from other areas will be discharged into the sanitary sewer without treatment.
   b. System Description:
      1) Provide a conventional gravity corrosion resistant waste and vent system.
      2) Connect fixtures and other devices that produce waste, which are located in laboratories and laboratory support spaces to the corrosion resistant waste and vent system.
      3) Treat waste for the nano-cleanroom areas prior to discharge into the sanitary sewer.
      4) Route the corrosion resistant waste drainage piping outside the building to and discharge into the sanitary building sewer. Provide a sampling cleanout at the building exit.
   c. Design Criteria:
      1) Provide traps at each fixture.
      2) Drainage Piping:
         a) Minimum Slope (2" and Smaller): 1/4" per foot
         b) Minimum Slope (2-1/2" thru 6"): 1/8" per foot
         c) Minimum Design Velocity: 2 fps
         d) Maximum Design Depth: Half full
         e) Use pipe rated for 210°F effluent for piping connected to equipment capable of high-temperature discharges (autoclaves, glasswashers, etc.). Extend high-temperature piping from the point of discharge downstream until wastes are sufficiently blended with low temperature wastes to minimize the hazard.
         f) Provide cleanouts at 100' intervals. Provide additional cleanouts at changes of direction; at the base of stacks; and where the building drain exits the building.
      3) Vent Piping:
         a) Provide vent piping to prevent excessive pressures within drainage piping.
         b) Extend vent piping up through the roof to vent terminals. Locate vent terminals away from air intakes, exhausts, doors, openable windows and parapet walls as required by Code.
         c) Maximum Differential Pressure: 1" water column
      4) Pressure Testing: Hydrostatic, 10' head for 30 minutes, inspect every joint, no leakage
      5) Trap Primers: Provide floor drains, floor sinks and indirect waste receptors with automatic trap primers when subject to loss of their trap seals due to evaporation.
      6) Waste Treatment (Nano-Cleanroom):
         a) Provide a Neutralization basin to treat acid waste prior to discharging into the sanitary waste and vent system.
         b) Provide acid and caustic chemical injection system to adjust effluent pH.
         c) Acid Monitor: Continuously monitor the pH of the neutralization basin discharge.
      7) Temperature Treatment: (Not Anticipated)
      8) Provide standby power:
         a) Acid Neutralization System
      9) Interface with Building Automation System (BAS):
         a) Acid Neutralization System
   d. Equipment and Material:
      1) Floor Drains:
         a) Finished Floors: Cast iron body, adjustable nickel bronze top, trap primer
         b) Finished Floors: Stainless steel, trap primer
         c) Equipment: Cast iron body, less top, secondary strainer, acid-resisting enamel interior
         d) Equipment: Stainless steel, less top, secondary strainer
      2) **Acid Neutralization System: Packaged, skid mounted, continuous pH adjustment, metered acid and caustic addition, pH monitor/alarm**
   e. Distribution:
      1) Interior Underground Piping:
         a) Polypropylene - Socket Fusion Joint:
            Pipe: Polypropylene, schedule 80
            Fittings: Polypropylene, drainage pattern, fusion socket ends
            Joints: Socket fusion
      2) Interior Above Ground Piping:
         a) Polypropylene - Socket Fusion Joint:
            Pipe: Polypropylene, schedule 80, fire retardant
            Fittings: Polypropylene, fire retardant, drainage pattern, fusion socket ends
            Joints: Socket fusion
         b) Polypropylene - Mechanical Joint:
            Optional: Exposed piping, piping inside casework
            Pipe: Polypropylene, schedule 80, fire retardant
            Fittings: Polypropylene, fire retardant, drainage pattern
            Joints: Mechanical
      3) Cleanouts: Same material as pipe
         a) Floor Cleanouts: Cast iron access box, nickel bronze top and cover
         b) Wall Cleanouts: Stainless steel access cover

7. Domestic Water:
   a. System Description:
      1) Provide a domestic water supply system, including cold water, hot water and hot water return.
      2) Connect to the site potable water main.

3) Route domestic water piping to fixtures and other devices that require potable water, including toilet room fixtures, electric water coolers/drinking fountains, sinks, janitor sinks, showers and hose bibbs.
4) Supply only cold water to toilet lavatories and break room sinks.
5) Produce domestic hot water utilizing natural gas as the energy source.
6) Provide domestic cold water to emergency safety fixtures (showers and eyewashes).

b. Design Criteria:
1) Piping:
a) Minimum Residual Pressure: 40 psig
b) Maximum Static Pressure: 80 psig
c) Maximum Velocity (Cold Water): 8 fps
d) Maximum Velocity (Hot Water): 4 fps
e) Provide shutoff valves at the base of risers, the supply mains for each floor, all branches, and all equipment. Provide stops at each fixture supply.
f) Provide water hammer arrestors at solenoid valves and other potential water hammer sources. Size as recommended by the manufacturer.
g) Insulate aboveground cold water piping that is exposed in unconditioned spaces to prevent water damage due to condensation.
h) Insulate aboveground hot water piping in accordance with ASHRAE energy conservation standards.
i) Provide vinyl jacket on insulated piping that is exposed in finished spaces.
j) Pressure Testing: Hydrostatic, 160 psig for two hours, inspect every joint, no pressure loss.
k) Disinfection: 50 ppm chlorine solution for a 24 hour period. Thoroughly flush. Test water samples. Maximum HPC test 500 organisms/ml.

2) Backflow Preventers:
a) Provide backflow preventers to protect the potable water supply from potential sources of contamination.
b) Provide a duplex reduced pressure zone backflow preventer on building water service. Locate inside the building. Size each backflow preventer at 50% of the calculated load.
c) Provide a reduced pressure zone backflow preventer at the potable water connection to:

HVAC makeup water

High purity water system

d) Provide air gaps at the potable water supply to each fixture or piece of equipment. Where air gaps are not feasible, provide vacuum breakers, pressure vacuum breakers, double check backflow preventers or reduced pressure zone backflow preventers as appropriate.

3) Pressure Reducing Valves: Provide a pressure reducing valve at the water service entrance where supply pressure exceeds 80 psig.
4) Booster Pumps: (Not Required)
5) Water Heaters:
a) Provide a central hot water generation and distribution system.
b) Provide separate central hot water generation and distribution system for Nano-Cleanroom
c) Provide small local water heaters located close to hot water loads.
d) Cold Water Supply: 60°F
e) Hot Water Storage: 120°F
f) Hot Water Distribution: 120°F
g) Energy Source: Natural gas, 7” wc, 96% combustion efficiency
h) Provide duplex heaters. Size each heater at 100% of the calculated load.
i) Provide point-of-use water heaters where remote fixtures are isolated from the central hot water distribution system.

6) Thermal Solar: (Not Required)
7) Temperature Maintenance - Hot Water Recirculation:
a) Provide a pumped closed-loop circulation system to maintain water temperatures throughout the hot water distribution system.
b) Temperature Drop from Heater to Remote Outlet: 5°F
c) Minimum Flow at Balancing Valve: 0.5 gpm

8) Water Softeners: (Not Required)
9) Meters: Provide water meters at:
a) Nano-Cleanroom
b) Cooling tower makeup
c) High purity water supply

10) Standby Power: (Not Required)
11) Building Automation System (BAS) Requirements:
a) Circulating Pumps: motor current sensors
b) Water Meters (Nano-Cleanroom): Pulse signal
c) Hot Water Supply: Temperature, high alarm, low alarm

c. Equipment and Material:
1) Booster Pump: Not anticipated
2) Water Heaters:
a) **Storage type, gas fired, sealed combustion, condensing flue, 94% combustion efficiency**
b) **Basis of Design: A.O. Smith BTH Series, 200,000 btuh**
c) Accessories: Temperature gauges, temperature and pressure relief valve, vacuum breaker, dielectric unions, bladder-type expansion tank

3) **Point-of-Use Water Heaters; Electric, instantaneous type, integral flow controls**
4) **Circulating Pumps: In-line centrifugal, all-bronze construction**
5) Water Meters:
a) Nano-Cleanroom: Nutating disc, bronze housing, totalizing register, pulse output signal to Building Automation System
b) High Purity Water System: Nutating disc, bronze housing, totalizing register

6) Trap Primers: Electronic manifold, time clock, solenoid valve

d. Distribution
1) Below Ground Piping:
a) Copper (2-1/2” Diameter and Smaller):

Pipe: Copper tube, type K, soft temper

Fittings: Wrought copper, socket ends

Joints: Soldered, lead free

b) Ductile Iron (4" Diameter and Larger):

Pipe: Ductile iron, class 52, cement lined

Fittings: Ductile iron, cement lined

Joints: Mechanical

Encasement: Polyethylene

2) Above Ground Piping:

a) Copper (2-1/2" Diameter and Smaller) (Soldered):

Pipe: Copper tube, type L, hard temper

Fittings: Cast copper, socket ends

Fittings: Wrought copper, socket ends

Joints: Soldered, lead free

b) Copper (3" to 4" Diameter) (Brazed):

Pipe: Copper tube, type L, hard temper

Fittings: Wrought copper, socket ends

Joints: Brazed

c) Mechanically Formed Copper Tees and Couplings: (Optional)

d) Nipples: Red brass pipe, threaded

3) Water Heater Intake and Exhaust Piping:

a) Polyvinyl Chloride (CPVC):

Pipe: CPVC, Schedule 40

Fittings: CPVC, socket ends

Joints: Solvent cement

4) Shutoff Valves:

a) Ball Pattern, Bronze (2-1/2" and Smaller): Two piece, full port, stainless steel trim

b) Butterfly Pattern (3" thru 6"): Ductile iron, lug type, EDPM liner, aluminum-bronze disc, lever handle

c) Provide stem extensions on insulated piping.

5) Check Valves:

a) Swing Check (3" and Smaller): Bronze, horizontal swing check, socket ends

b) Swing Check (3" and Larger): Cast iron, horizontal swing check, flanged ends

6) Balancing Valves: Bronze, circuit setter type, pressure ports, memory stop

7) Backflow Preventers: Reduced Pressure Zone (1-1/2" and Larger): Cast iron, flanged ends, strainer, air gap drain, ASSE 1013.

8) Insulation:

a) Rigid fiberglass pipe insulation, all-service jacket

b) Closed cell elastomeric pipe insulation

c) Exposed in Spaces with Finished Ceilings: 20 mil PVC jacket

9) Water Hammer Arrestors: Piston type

8. Plumbing Fixtures:

a. System Description:

1) Provide new, commercial grade products.

2) Provide fixtures designated as barrier-free accordance with local, state and federal accessibility requirements.

b. Equipment and Material:

1) Provide fixtures complying with Florida Americans with Disabilities Accessibility Implementation Act where barrier-free access is required.

2) Water Closets:

a) Bowl: Vitreous china, floor mounted, elongated, 1.28 gpf

Note: Waiver of FSU Standards required floor-mounted fixture.

b) Flush valve: Large diaphragm, battery sensor operated

c) Seat: Plastic, heavy duty, open front, less cover

3) Urinals:

a) Bowl: Vitreous china, wall hung, waterless

Note: Waiver of FSU Standards required for waterless urinal.

4) Lavatories:

a) Bowl: Integral with counter

b) Bowl: Vitreous china wall hung

c) Bowl: Vitreous china, Vitreous china counter mounted, self-rimming

d) Faucet: Single temperature, battery, sensor operated, 0.5 gpm

e) Drain: fixed grate

5) Sinks (Break Rooms):

a) Basin: Stainless steel, counter mounted, self-rimming, single compartment

b) Faucet: Single temperature, gooseneck spout, wrist blades, 1.0 gpm

c) Drain: Stainless steel basket strainer

6) Showers:

a) Stall: Built up ceramic tile

b) Shower Valve (Barrier-Free): Hand Spray, armored hose, vacuum breaker, wall bar, 1.5 gpm

7) Electric Water Coolers:

a) Wall hung, dual level, stainless steel cabinet, sensor operated, bottle filler

8) Janitor Sinks:

a) Basin: Floor mounted, precast terrazzo, drop front, stainless steel splash panels

b) Faucet: Hot/cold mixing, wall mounted, vacuum breaker, hose threads, wall brace

c) Accessories: Hose and hose bracket

9) Hose Bibbs:

a) Exterior: Flush mounted, freeze resistant, vacuum breaker, loose key operator

b) Mechanical Rooms: Wall mounted, vacuum breaker

c) Toilets: Recessed wall box, stainless steel, hinged door, cylinder lock, vacuum breaker

10) Emergency Safety Fixtures:

a) Unfinished Spaces: Combination shower and eyewash, floor flange, galvanized finish, plastic bowl and head

b) Finished Spaces: Combination shower and eyewash, stainless steel, recessed wall box, pull-down eyewash with drain, pull-down shower valve, stainless steel shower and shower arm
c) Alarm: Local alarm, horn, light, dry alarm contacts
d) Do not provide a floor drain under emergency showers.

11) Laboratory Sinks:
a) Basin: Integral with counter
b) Faucet: Hot/cold mixing, gooseneck, serrated tip, vacuum breaker, 2.2 gpm
c) RO Water Faucet (Where Indicated): Polypropylene-lined brass, gooseneck spout
d) Eyewash (Where Indicated): Swivel type, 3.0 gpm flow control
e) Drain: Epoxy resin, removable stopper

12) Laboratory Service Fittings:
a) Natural Gas Outlet: Ball pattern, wall mounted, check valve, serrated tip, single or double outlet
b) Lab Vacuum Outlet: Ball pattern, wall mounted, serrated tip, single or double outlet
c) Compressed Air Outlet: Ball pattern, wall mounted, serrated tip, single or double outlet
d) Cylinder Gas Outlet: (Oxygen, Nitrogen) Ball pattern, wall mounted, serrated tip, single or double outlet

9. Laboratory Water System: (Not Anticipated)
a. Laboratory fixtures and equipment will be connected to the domestic water system.

10. Animal Watering (Not Anticipated)

11. High Purity Water:
a. System Description:
1) General Building: NCCLS/CAP II Reagent Grade Water Specification:
a) **Basis of Design: 3000 gallons per day**
b) Resistivity ≥ 1.0 megohm-cm at 25°C
c) Silicates ≤ 0.1 mg/l SiO_2
d) Microbial ≤ 1000 CFU/ml

2) Nano-Cleanroom: Semi-Conductor Grade E1 Water Specification:
a) **Basis of Design: 6000 gallons per day**
b) Resistivity ≥ 18.2 megohm-cm at 25°C
c) Endotoxin ≤ 0.03 IU/ml
d) TOC ≤ 5 ug/L
e) Dissolved Oxygen ≤ 1 ug/L
f) Residue ≤ 1
g) SEM Particles (0.1 - 0.2 micron) ≤ 1000
h) SEM Particles (0.2 – 0.5 micron) ≤ 500
i) SEM Particles (0.5 – 1.0 micron) ≤ 50
j) SEM Particles (10 micron) ≤ 0
k) Online Particles (0.05 - 0.1 micron) ≤ 500
l) Online Particles (0.1 - 0.2 micron) ≤ 300
m) Online Particles (0.2 – 0.3 micron)≤ 50
n) Online Particles (0.3 - 0.5 micron) ≤ 20
o) Online Particles (>0.5 micron) ≤ 4
p) Bacteria (100 mL sample) ≤ 1 per 100 mL
q) Bacteria (1 L sample) ≤ 1 per 100 mL
r) Total Silica ≤ 3 ug/L
s) Dissolved Silica ≤ 1 ug/L
t) Ammonium, Bromide, Chloride, Fluoride, Nitrate ≤ 0.1 ug/L
u) Nitrate, Phosphate, Sulfate ≤ 0.1 ug/L
v) Aluminum, Barium, Boron, Calcium, Chromium ≤ 0.05 ug/L
w) Copper, Iron, Lead, Lithium, Magnesium ≤ 0.05 ug/L
x) Manganese, Nickel, Potassium, Sodium, Strontium, Zinc ≤ 0.05 ug/L

3) This system will not be validated.
4) Water of this quality will be produced from the potable water system.
5) Pure water will be continuously circulated in closed loops to users throughout the building.
6) Route high purity water piping to fixtures and other devices that require high purity water, including point-of-use polishers and glasswashers.

b. Design Criteria:
1) The system design will be based on performing sanitation using peracetic acid solution.
2) Production and Storage Capacity:
a) Sinks: 15 gallons per day each
b) Glass Washers: 25 gallons per wash cycle
8 wash cycles per day per washer
200 gallons per day each
c) Polishers: 5 gallons per day each
d) Nano-Cleanrooms: To be determined

3) Peak Flow Rates:
a) Sinks: 1.0 gpm per outlet
b) Polishers: 0.25 gpm each
c) Glass washers: XXX gpm each
d) Diversity Factor: 10%
e) Nano-Cleanrooms: To be determined

4) Distribution Piping:
a) Circulation: Continuous
b) Install to be free draining.
c) Uncirculated Dead-Leg (General Building): 2 feet maximum
d) Uncirculated Dead-Leg (Nano-Cleanroom): Zero static
e) Install piping so that it is completely free draining. Provide a minimum slope of 1/8 inch per foot.
f) Velocity: 3.0 feet per second minimum corresponding to a Reynolds number of 20,000
g) Pressure: 15 psig minimum, 80 psig maximum

h) Pressure Testing: Hydrostatic, 160 psig for two hours, inspect every joint, no pressure loss

5) Reverse Osmosis Unit: Size to produce total daily production in 8 hours maximum.

6) Storage Tanks: Size to store 24 hours of estimated usage.

7) Polishers: For use points that require a higher level of quality water, provide point of use polishing units.

8) Controls: The system will be automatically monitored and controlled by a dedicated PLC based control system.

9) Reserve Capacity and Redundancy:
   a) Water Softener: Alternating duplex
   b) Storage Tank: 24 hours
   c) Distribution Pumps: Two at 100% each

10) Sanitization
   a) Thoroughly flushed piping to remove debris.
   b) Sanitize the system with one percent hydrogen peroxide solution for a 24 hour period.
   c) Flush with product water for a 12 hour period.
   d) Draw water samples from two remote outlets for each of the distribution loop.
   e) Test samples to verify compliance with the water quality specification.

11) Standby Power Requirements:
   a) Entire system

12) Building Automation System (BAS) Requirements:
   a) Control Panel: Alarm status
   b) Distribution Pumps: motor current sensors

c. Equipment and Material:

1) **Pre-Treatment Equipment:**
   a) Water Meter:
   b) Pre-Filter
   c) Multimedia Filter:
   d) Water Softener:
   e) Carbon Filter

2) **Production Equipment:**
   a) Reverse Osmosis (RO) Unit: single
   b) Deionization Cylinders: Service exchange, mixed-bed
   c) Post Filter: 1.0 micron
   d) Ultraviolet Light (UV): Stainless steel, 185 nm
   e) Final Filter: 0.2 micron

3) **Storage Tanks:**
   a) linear polyethylene vinyl ester steam-cured fiberglass

4) **Distribution Equipment:**
   a) Pumps: Centrifugal, multi-stage, type 316 stainless steel
   b) Ultraviolet Light (UV): Stainless steel, 254 nm
   c) Final Filter: 0.2 micron

5) Materials in contact with pure water will be:
   a) Equipment: 316L stainless steel polished to 25 Ra
   b) Piping (General Building): Polypropylene (PP)
   c) Piping (Nano-Cleanroom): Polypropylene polyvinylidene fluoride (PVDF)
   d) Elastomers (General Building): EPDM
   e) Elastomers (Nano-Cleanroom): Viton

6) Point-of-Use Polishers: Owner furnished and installed

d. Distribution:

1) General Building:
   a) Polypropylene piping will be used for the distribution system. Joints will be made by socket heat fusion. Tri-clamps or sanitary unions will be used where breakable connections are required.
   b) Valves: Polypropylene, ball pattern, true union

2) Nano-Cleanrooms:
   a) PVDF piping will be used for the distribution system. Joints will be made by bead and crevice free butt fusion. Tri-clamps or sanitary unions will be used where breakable connections are required. Piping will be continuously supported.
   b) Valves: PVDF, diaphragm
   c) Valves - Branch: PVDF, diaphragm, zero static

12. Laboratory Compressed Air:

a. System Description:

1) Compressed Air Source: Campus plant compressed air system

2) Compressed Air Production Equipment: Compressors, aftercoolers, receivers, dryers, filters, pressure regulators

3) Route compressed piping to laboratory fixtures and other devices including benchtop outlets, fume hoods, glasswashers, autoclaves, etc.

b. Design Criteria:

1) General Building:
   a) Laboratory grade
   b) Nominal System Pressure: 50 psig
   c) Pressure Dew Point: 40°F

2) Nano-Cleanrooms:
   a) ISO 8573.1 Class 1
   b) Nominal System Pressure: 120 psig
   c) Pressure Dew Point: -94°F

3) Piping:
   a) Maximum System Pressure Loss: 10% of nominal system pressure
   b) Flowrate (Laboratory Outlets): 1 scfm each
   c) Diversity Factors (Laboratory Outlets):

Table 2
Compressed Air System Diversity Factors

Number of Outlets	Diversity Factor	Minimum Flow (scfm)	Empirical Formula for Flowrate (scfm)

Table 2
Compressed Air System Diversity Factors

Number of Outlets	Diversity Factor	Minimum Flow (scfm)	Empirical Formula for Flowrate (scfm)
1-5	1.00	0	No. of Outlets*1
6-12	0.80	5	5+(No. of Outlets-5)*5/7
13-33	0.60	10	10+(No. of Outlets-12)*10/21
34-80	0.50	20	20+(No. of Outlets-33)*20/47
81-150	0.40	40	40+(No. of Outlets-80)*20/70
151-315	0.35	60	60+(No. of Outlets-150)*50/165
316-565	0.30	110	110+(No. of Outlets-315)*60/250
566 and up	0.25	170	170+(No. of Outlets-565)*80/435

d) Braze pipe joints while continuously purging pipe interior with clean nitrogen.

e) Pressure Testing: Hydrostatic, 160 psig for two hours, inspect every joint, no pressure loss

4) Compressors:

a) Multiplex

b) Sizing: 100% of design load with one compressor out of service

c) Control: On/off/lead/lag/alternate

d) Intake Air Source: Room air

5) Dryers:

a) Duplex

b) Sizing (Percent of Design Load) (Each): 100%

6) Filters:

a) Dryer Intake: Simplex, coalescing, 3.0 micron

b) Final Filters:

Duplex

Particle: 1.0 micron

Activated Carbon: 0.01 micron, 0.003 ppm oil vapor

7) Building Automation System (BAS) Requirements:

a) Compressors: Alarm status, motor current sensors

b) Dryers: Alarm status, motor current sensors

c) System Pressure: High alarm, low alarm

c. Equipment and Material:

1) **Compressors: Scroll, oil-less, single stage, aftercooler, base mounted, basis-of-design Powerex LSE Series, 80 scfm**

2) **Dryers: Refrigerated, duplex, non-cycling**

3) **Receivers: Vertical, epoxy lined, ASME**

4) **Filters:**

a) Housings: Aluminum

b) Filter Elements: Replaceable, stainless steel trim

5) Auto Drains: Zero-loss type

d. Distribution:

1) Provide pipe and fittings will be prepared, packaged and labeled as oxygen clean.

2) General Building:

a) Copper (Brazed):

Pipe: Copper tube, type L, hard temper

Fittings: Wrought copper, socket ends

Joints: Brazed with nitrogen purge

b) Shutoff Valves: Ball pattern, bronze, three piece, stainless steel trim, extended ends

3) Nano-Cleanrooms:

a) Stainless Steel (Welded):

Pipe: Stainless steel tube, type 316L, 0.065” wall

Fittings: Stainless steel tube, type 316L, 0.065” wall, machine weld ends

Joints: Orbital machine welded with argon purge

Interior Finish: 25 Ra

Exterior Finish: Mill

Passivated

b) Shutoff Valves: Ball pattern, stainless steel, three piece, machine weld ends

4) Laboratory Outlets: Quarter-turn

13. Laboratory Vacuum:

a. System Description: Laboratory vacuum will be provided by point-of-use vacuum pumps located inside vacuum cabinets. Pumps and piping will be user furnished and installed.

14. Nitrogen Laboratory System:

a. System Description:

1) Provide a gaseous nitrogen storage and distribution system.

2) Provide a bulk liquid nitrogen storage system.

3) Route nitrogen piping to:

a) Laboratory nitrogen outlets

4) **Basis-of-Design: Bulk liquid nitrogen storage, 3,000 liters capacity**

b. Design Criteria:

1) Piping:

a) Nominal Pressure: 100 psig

b) System Pressure Loss: 10% of nominal system pressure

c) Maximum Velocity: 4000 fpm

d) Provide shutoff valves at the base of risers, the supply mains for each floor, all branches, and all equipment.

e) Pressure Testing: Hydrostatic, 150 psig for 2 hours, inspect every joint, no pressure loss

2) Laboratories Outlets:

a) Nominal Flow: 1 scfm each

b) Diversity Schedule:

5 outlets 100% diversity factor

12 outlets 80% diversity factor

33 outlets 60% diversity factor

80 outlets 50% diversity factor
150 outlets 40% diversity factor
315 outlets 35% diversity factor
566 outlets 25% diversity factor

3) Interface with Building Automation System (BAS):
   a) Nitrogen Supply: Pressure, high alarm, low alarm

c. Equipment and Material:
   1) Bulk Storage Tank and Vaporizer: Provided by the Owner

d. Distribution:
   1) Provide pipe and fittings will be prepared, packaged and labeled as oxygen clean.
   2) General Building:
      a) Copper (Brazed):
         Pipe: Copper tube, type L, hard temper, oxygen clean
         Fittings: Wrought copper, socket ends, oxygen clean
         Joints: Brazed
         Nitrogen purge during brazing
      b) Shutoff Valves: Ball pattern, bronze, three piece, stainless steel trim, extended ends
   3) Nano-Cleanrooms:
      a) Stainless Steel (Welded):
         Pipe: Stainless steel tube, type 316L, 0.065" wall
         Fittings: Stainless steel tube, type 316L, 0.065" wall, machine weld ends
         Joints: Orbital machine welded with argon purge
         Interior Finish: 25 Ra
         Exterior Finish: Mill
         Passivated
      b) Shutoff Valves: Ball pattern, stainless steel, three piece, machine weld ends
   4) Laboratory Outlets: Quarter-turn

15. Cylinder Gases:

a. Description:
   1) Cylinder Gas Types: argon, carbon dioxide, helium, other (to be determined)
   2) Cylinder Gas Types (Nano-Cleanroom): To be determined
   3) Local cylinder gas systems will be provided for laboratory areas requiring gases.
   4) Route piping to laboratory outlets or equipment connections as required.

b. Design Criteria:
   1) Nominal System Pressure: 50 psig
   2) Piping:
      a) Maximum System Pressure Loss: 10% of nominal system pressure
      b) Maximum System Pressure Loss: 10% of nominal system pressure
      c) Diversity Factors:

Table 2
Diversity Factors

Number of Outlets	Diversity Factor	Minimum Flow (scfm)	Empirical Formula for Flowrate (scfm)
1-5	1.00	0	No. of Outlets*1
6-12	0.80	5	5+(No. of Outlets-5)*5/7
13-33	0.60	10	10+(No. of Outlets-12)*10/21
34-80	0.50	20	20+(No. of Outlets-33)*20/47
81-150	0.40	40	40+(No. of Outlets-80)*20/70
151-315	0.35	60	60+(No. of Outlets-150)*50/165
316-565	0.30	110	110+(No. of Outlets-315)*60/250
566 and up	0.25	170	170+(No. of Outlets-565)*80/435

      d) Braze pipe joints while continuously purging pipe interior with clean nitrogen.
      e) Pressure Testing: Hydrostatic, 160 psig for two hours, inspect every joint, no pressure loss

c. Equipment and Material;
   1) **Cylinder Manifolds: High-purity brass construction, single stage, non-changeover, pressure regulator, relief valve, pressure gauges, flexible cylinder connectors**
   2) **Carbon Dioxide Manifolds: Liquid cylinders, brass, single stage, manual semi-automatic changeover, heater**
   3) **Helium Manifolds: High-pressure gas cylinders, brass, single stage, semi-automatic changeover, helium leak certification**
   4) **Oxygen Depletion Monitor: Oxygen concentration sensor, local alarm, remote alarm to Building Automation System (BAS), emergency gas shutdown**
   5) **Cylinder Cabinets (Nano-Cleanrooms): Painted steel cabinet, fire-rated window, exhaust duct, corrosion-resistant sprinkler, cylinder restraints, type 316 stainless steel manifold and regulator, purge protocol, switchover protocol, alarm protocol, emergency gas shutdown**

d. Distribution;
   1) Provide pipe and fittings will be prepared, packaged and labeled as oxygen clean.
   2) Piping - General Building:
      a) Copper (Brazed):
         Pipe: Copper tube, type L, hard temper, oxygen clean
         Fittings: Wrought copper, socket ends, oxygen clean
         Joints: Brazed
         Nitrogen purge during brazing
      b) Shutoff Valves: Ball pattern, bronze, three piece, stainless steel trim, extended ends
   3) Piping - Nano-Cleanrooms:
      a) Stainless Steel (Welded):
         Pipe: Stainless steel tube, double wall, type 316L, 0.065" wall
         Fittings: Stainless steel tube, double wall, type 316L, 0.065" wall, machine weld ends
         Joints: Orbital machine welded with argon purge

Interior Finish: 25 Ra
Exterior Finish: Mill
Passivated

b) Shutoff Valves: Ball pattern, stainless steel, three piece, machine weld ends

4) Laboratory Outlets: Quarter-turn

16. Natural Gas:
    a. Description:
        1) Supply natural gas to the following.
            a) Water heaters
            b) Laboratory natural gas outlets
            c) Nano-cleanroom burn-box scrubber
        2) **Basis-of-Design: 21,000,000 btuh**
        3) Connect to natural gas service and meter provided by the local gas utility.
    b. Design Criteria
        1) Natural gas will be supplied at a pressure of 11" water column. The piping will be sized to limit the pressure drop across the system to 0.5" water column.
        2) A natural gas shutoff valve will be located in a recessed wall valve box at 4'-6" above finished floor at the entrance to each laboratory space.
        3) Natural gas piping system will be sized based on 5 cfh per outlet plus any flow required for individual pieces of equipment. Diversity factors will be applied to laboratory outlets as indicated below:

Table 2
Natural Gas System Diversity Factors

Number of Inlets	Diversity Factor	Minimum Flow (cfh)	Empirical Formula for Flowrate (cfh)
1-5	1.00	0	No. of Inlets*5
6-12	0.80	5	(5+(No. of Inlets-5)*5/7)*5
13-33	0.60	50	(10+(No. of Inlets-12)*10/21)*5
34-80	0.50	100	(20+(No. of Inlets-33)*20/47)*5
81-150	0.40	200	(40+(No. of Inlets-80)*20/70)*5
151-315	0.35	300	(60+(No. of Inlets-150)*50/165)*5

    c. Equipment and Material
        1) Natural gas meter and building pressure regulating valves will be provided by and in accordance with gas utility company requirements.
        2) Where shutoff valves are installed in valve boxes, the valve boxes will be steel frames with stainless steel doors, piano hinges and level latches. All pipe penetrations through the box walls will be sealed.
    d. Distribution
        1) Natural gas piping 2-1/2" and smaller will be Schedule 40 black steel pipe with malleable iron threaded fittings. Natural gas piping 3" and larger will be Schedule 40 black steel pipe with welded fittings.
        2) Natural gas valves 2-1/2" and smaller will be two-piece ball valves with bronze bodies and stainless steel balls. Valves 3" and larger will be plug valves with cast iron bodies.

17. Waterproofing Floor Penetrations: Piping penetrations through elevated floors will be waterproofed utilizing one of the following methods.
    a. Raised concrete curb at penetration with UL "W" rating
    b. Manufactured pipe penetration assemblies with

END OF BOD

3.7 FIRE PROTECTION SYSTEMS

IV. FIRE PROTECTION SYSTEMS

A. Base Design Criteria

1. Applicable Codes – Refer to Section 7.1 Preliminary Code Report.

B. System Descriptions

1. Fire Service: Refer to Civil Basis of Design

a. Hydrant Flow Test:

1) A fire hydrant flow test has not yet obtained. The water supply is presumed adequate for the building's fire demand.

2) Obtain a current fire hydrant flow test conducted per NFPA guidelines. Conduct the test utilizing two hydrants, one for flow and the other for gauge.

2. Fire Pump: (Not Anticipated)

a. The water supply is presumed to have a residual pressure in excess of 75 psig.

3. Standpipe System:

a. System Description:

1) The Contract Documents will indicate a performance specification. The Contractor will be responsible for system layout, design and hydraulic calculations.

2) Connect to the fire pump.

3) Route piping to standpipes and combination standpipes.

4) Basis of Design:

a) Estimated Peak Water Demand: 750 gallons per minute

b) Fire Service: One at 6" diameter

b. Design Criteria:

1) Back Preventer: Provide on fire service. Locate inside building.

2) Post Indicator Valve (PIV): Provide on fire service. Locate at least 40' from building.

3) Fire Department Hose Valves: Location:

a) At intermediate landings of required exit stairs

b) At highest landing where stair extends to roof

c) At roof where stair does not extend to roof

d) At each side of horizontal exits

e) In exit passageway at building entrance

f) Between standpipes to limit travel distance to 200 feet

g) Mounting: Exposed

4) Standpipes:

a) Classification: Class I, manual wet

Building is presumed to not be a high rise.

b) Minimum Residual Pressure: N/A

c) Maximum Static Pressure: 175 psig

d) Design Flow: 250 gpm at remote hose valve; 500 gpm at remote standpipe; 250 gpm for each additional standpipe; 1,000 gpm maximum

e) Protection: Enclosed exit stairways or equivalent fire resistant construction

f) Accessories: Standpipe isolation valve, pressure gauge at top of standpipe

g) Interconnect standpipes into a single piping system for the building

5) Fire Department Connection: Locate on exterior building wall, within 100' of a fire hydrant.

6) Tamper Switches: Provide at each shutoff valve.

7) Roof Manifolds: Protect from freezing with post type control valve and automatic drain.

8) Pressure Testing: Hydrostatic, 50 psi above static (200 psig minimum) for two hours, inspect every joint, no pressure loss

9) Interface with Fire Alarm Control Panel (FACP):

10) Tamper switch supervisory signals will be forward to the building fire alarm system.

11) The fire service entrance will have a double check backflow preventer, located outside the building.

c. Equipment and Material:

1) Backflow preventers will be UL/FM double check assemblies.

2) Fire departments valves will be 2-1/2" hose valves with caps, chains and rough bronze finish.

d. Distribution:

1) Below Ground Piping:

a) Ductile iron:

Pipe: Class 52, cement lining

Fittings: Ductile iron, cement lining

Joints: Mechanical

Encasement: Polyethylene

2) Above Ground Piping:

a) Carbon Steel (2" Diameter and Smaller):

Pipe: Schedule 40, black

Fittings: Cast iron, black

Joints: Threaded

b) Carbon Steel (2-1/2" Diameter and Larger) (Grooved):

Pipe: Carbon steel, Schedule 10, black

Fittings: Ductile or malleable iron, black

Joints: Roll grooved

c) Carbon Steel (2-1/2" Diameter and Larger) (Flanged) (Optional):

Pipe: Carbon steel, Schedule 10, black

Fittings: Cast iron, black, flanged ends

Joints: Cast iron flanges with neoprene gaskets

d) Carbon Steel (2-1/2" Diameter and Larger) (Shop Welded) (Optional):

Pipe: Carbon steel, Schedule 10, black

Fittings: Carbon steel, butt weld ends

Joints: Welded

3) Valves:

a) Gate: Cast iron, outside screw and yoke, flanged ends

b) Check: Cast iron, swing check, flanged ends

c) Butterfly: Lug pattern, gear operator to detect flow within the system, and a combination inspectors test and drain valve. Flow switch alarm signals will be forwarded to the building fire alarm system.

8) Every shutoff valve will be provided with a tamper switch to detect unauthorized use. Tamper switch supervisory signals will be forward to the building fire alarm system.
9) Drains from inspectors test valves and main drain valves will be routed to discharge into the building storm drainage system.

c. Equipment and Material:
1) Tamper Switches: UL/FM, quarter-turn actuation
2) Flow Switches: UL/FM, 10 gpm activation
3) Sprinkler Zone Control Assemblies: Shutoff valve, flow switch inspectors test valve, system drain valve

d. Distribution
1) Below Ground Piping:
a) Ductile iron:
Pipe: Class 52, cement lining
Fittings: Ductile iron, cement lining
Joints: Mechanical
Encasement: Polyethylene
2) Above Ground Piping:
a) Carbon Steel (2” Diameter and Smaller):
Pipe: Schedule 40, black
Fittings: Cast iron, black
Joints: Threaded
b) Carbon Steel (2-1/2” Diameter and Larger) (Grooved):
Pipe: Carbon steel, Schedule 10, black
Fittings: Ductile or malleable iron, painted
Joints: Roll grooved
c) Carbon Steel (2-1/2” Diameter and Larger) (Flanged) (Optional):
Pipe: Carbon steel, Schedule 10, black
Fittings: Cast iron, black, flanged ends
Joints: Cast iron flanges with neoprene gaskets
d) Carbon Steel (2-1/2” Diameter and Larger) (Shop Welded) (Optional):
Pipe: Carbon steel, Schedule 10, black
Fittings: Carbon steel, butt weld ends
Joints: Welded
e) Flexible Sprinkler Hose Assemblies: Braided type 304 stainless steel hose, type 304 stainless ends, ceiling mounting brackets
3) Valves:
a) Gate: Cast iron, outside screw and yoke, flanged ends
b) Check: Cast iron, swing check, flanged ends
c) Butterfly: Lug pattern, gear operator
d) Test and Drain: Combination valve
e) Drain: Bronze, globe pattern, threaded ends

to detect flow within the system, and a combination inspectors test and drain valve. Flow switch alarm signals will be forwarded to the building fire alarm system.

8) Every shutoff valve will be provided with a tamper switch to detect unauthorized use. Tamper switch supervisory signals will be forward to the building fire alarm system.
9) Drains from inspectors test valves and main drain valves will be routed to discharge into the building storm drainage system.

c. Equipment and Material:
1) Tamper Switches: UL/FM, quarter-turn actuation
2) Flow Switches: UL/FM, 10 gpm activation
3) Sprinkler Zone Control Assemblies: Shutoff valve, flow switch inspectors test valve, system drain valve

d. Distribution
1) Below Ground Piping:
a) Ductile iron:
Pipe: Class 52, cement lining
Fittings: Ductile iron, cement lining
Joints: Mechanical
Encasement: Polyethylene
2) Above Ground Piping:
a) Carbon Steel (2” Diameter and Smaller):
Pipe: Schedule 40, black
Fittings: Cast iron, black
Joints: Threaded
b) Carbon Steel (2-1/2” Diameter and Larger) (Grooved):
Pipe: Carbon steel, Schedule 10, black
Fittings: Ductile or malleable iron, painted
Joints: Roll grooved
c) Carbon Steel (2-1/2” Diameter and Larger) (Flanged) (Optional):
Pipe: Carbon steel, Schedule 10, black
Fittings: Cast iron, black, flanged ends
Joints: Cast iron flanges with neoprene gaskets
d) Carbon Steel (2-1/2” Diameter and Larger) (Shop Welded) (Optional):
Pipe: Carbon steel, Schedule 10, black
Fittings: Carbon steel, butt weld ends
Joints: Welded
e) Flexible Sprinkler Hose Assemblies: Braided type 304 stainless steel hose, type 304 stainless ends, ceiling mounting brackets
3) Valves:
a) Gate: Cast iron, outside screw and yoke, flanged ends
b) Check: Cast iron, swing check, flanged ends
c) Butterfly: Lug pattern, gear operator
d) Test and Drain: Combination valve
e) Drain: Bronze, globe pattern, threaded ends

5. Dry Pipe Sprinkler System: (Not Anticipated)
6. Preaction Sprinkler System:
    a. System Description:
        1) The Contract Documents will indicate a performance specification. The Contractor will be responsible for system layout, design and hydraulic calculations.
        2) Protect the following areas with an automatic preaction sprinkler system.
            a) IDF rooms
            b) MDF rooms
            c) Nano cleanrooms
        3) Connect to the wet sprinkler system.
    b. Design Criteria:
        1) All protected areas will be protected per NFPA 13.
        2) All preaction systems will be hydraulically calculated with a computer calculation program using the Hazen-Williams method. Hazard designations shall be as follows:

a)	MDF and IDF rooms	Ordinary Group 1
b)	Hazardous Occupancy H-2	Ordinary Group 1
c)	Hazardous Occupancy H-5	Ordinary Group 2
d)	Hazardous Occupancy H-5 Dispensing	Extra Group 2

        3) Hydraulic design areas shall be as follows:

a)	Ordinary Hazard, Group 1	0.15 gpm/sf	1950 sf
b)	Ordinary Hazard, Group 2	0.20 gpm/sf	1950 sf
c)	Extra Hazard, Group 2	0.40 gpm/sf	3250 sf

            d) Where quick response sprinklers are installed throughout, the size of the hydraulic design area may be reduced as allowed by NFPA 13.
        4) The pipe sizing for the systems will be as required to satisfy the hydraulic demand.
        5) Slope all preaction piping. Provide drains a low points.
        6) Sprinklers: Quick response as follows:
            a) Finished Ceilings: Recessed pendent, polished chrome
            b) Without Ceilings: Upright or pendent, rough brass
            c) The above sprinkler types may be substituted with sidewall sprinklers of similar style and finish.
        7) Each preaction sprinkler zone will be double interlock type to minimize the probability of accidental discharge. Piping will be normally filled with compressed air. The preaction release panel will not trip the deluge valve and fill the system with water until both of the following occur.
            a) Signal from a smoke detector or heat detector indicating a fire.
            b) Signal from pressure switch indicating loss of system air pressure (sprinkler activation).
        8) Heat detector, smoke detector and compressed air pressure signals will be sent to the preaction release panel. Alarm and supervisory signals will be forwarded to the building fire alarm system.
        9) Every shutoff valve will be provided with a tamper switch to detect unauthorized use. Tamper switch supervisory signals will be forward to the building fire alarm system.
        10) Drains from main drain valves will be routed to discharge into the building storm drainage system.
    c. Equipment and Material:
        1) Tamper Switches: UL/FM, quarter-turn actuation
        2) Heat Detectors (IDF and MDF Rooms): UL/FM, fixed temperature type
        3) Smoke Detectors (Nano Cleanrooms): UL/FM, photoelectric type
        4) Preaction Valve Assemblies: UL/FM, deluge valve, double interlock trim, shutoff valve, system drain valve, air compressor, release panel, cabinet enclosure
    d. Distribution
        1) Above Ground Piping:
            a) Carbon Steel (2” Diameter and Smaller):
                Pipe: Schedule 40, galvanized
                Fittings: Cast iron, galvanized
                Joints: Threaded
            b) Carbon Steel (2-1/2” Diameter and Larger) (Grooved):
                Pipe: Carbon steel, Schedule 40, galvanized
                Fittings: Ductile or malleable iron, painted
                Joints: Cut grooved
            c) Flexible Sprinkler Hose Assemblies: Braided type 304 stainless steel hose, type 304 stainless ends, ceiling mounting brackets
        2) Valves:
            a) Drain: Bronze, globe pattern, threaded ends
7. Foam Extinguishing Systems: (To Be Determined)
    a. If significant quantities of flammable liquids are stored within the facility, a foam-water system might be required.
8. Clean Agent Fire Extinguishing System: (Not Anticipated)
9. Dry Chemical Suppression Systems: (To Be Determined)
    a. If water-reactive chemicals are stored or used within the facility, a dry chemical system might be required.
10. Fire Extinguishers: Refer to Architectural Basis of Design.

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3.8 MECHANICAL SYSTEMS

V. MECHANICAL SYSTEMS

A. Base Design Criteria

1. Applicable Codes – Refer to Section 7.1 Preliminary Code Report.
2. Outdoor Design Conditions
   a. Summer
      1). Dry-Bulb Temperature = 96°F
         a). (Based on 0.4% dry-bulb temperature for Tallahassee as published by ASHRAE Handbook of Fundamentals – 2013)
      2). Wet-Bulb Temperature = 76.5°F
         a). (Based on 0.4% mean coincident wet-bulb temperature for Tallahassee as published by ASHRAE Handbook of Fundamentals - 2013)
   b. Winter
      1). Dry-Bulb Temperature = 25.7°F
         a). (Based on 99.6% dry-bulb conditions for Tallahassee as published by ASHRAE Handbook of Fundamentals - 2013)
3. Indoor Design Conditions
   a. Office, Conference and Administrative Support Areas
      1). Dry-Bulb Temperature
         a). Summer = 75°F ± 3°F
         b). Winter = 72°F ± 3°F
      2). Relative Humidity
         a). Summer = 50% maximum ± 5%
         b). Winter = Mechanical humidification not planned
   b. Laboratory and Laboratory Support
      1). Dry-Bulb Temperature
         a). Summer = 72°F ± 2°F
         b). Winter = 72°F ± 2°F
      2). Relative Humidity
         a). Summer = 50% ± 3%
         b). Winter = Mechanical humidification not planned
   c. Clean Rooms
      1). Dry-Bulb Temperature = 68°F ±1°F (year round)
      2). Relative Humidity = 45% ±4% (year round)
   d. Telecommunication Rooms
      1). Dry-Bulb Temperature = 72°F ± 2°F (year round)
      2). Relative Humidity = Mechanical humidification not planned
   e. Mechanical and Electrical Rooms
      1). Dry-Bulb Temperature
         a). Summer = 85°F ± 3°F
         b). Winter = 65°F ± 3°F
      2). Relative Humidity = Mechanical humidification not planned
   f. Elevator Machine Room
      1). Dry-Bulb Temperature = 75°F (year round)
      2). Relative Humidity = Mechanical humidification not planned
   g. Unoccupied Spaces
      1). Dry-Bulb Temperature = 65 - 85°F
      2). Relative Humidity = Mechanical humidification not planned
4. Ventilation Rates
   a. The minimum ventilation (outdoor air) rates will be as follows (ach=air changes per hour):
      1). Offices, Conference and Administrative Support Area
         a). Based on Table 6-1 of ASHRAE 62.1, 2007 Edition
      2). Laboratories and Laboratory Support Areas
         a). Occupied: 6 ach, minimum
         b). Unoccupied: 4 ach, minimum
5. Fume Hood Exhaust Rate
   a. The exhaust air requirements for fume hoods will be based on maintaining a face velocity of 100 fpm through the open sash with the sash positioned at 18" above bottom of hood.
6. Pressure Relationships
   a. Pressure relationships will be maintained by offsets between supply and exhaust airflow rates. Relative pressures to adjacent spaces will be as follows:

Space Area	Relationship to Adjacent
Breakroom	Negative
Offices	Neutral
Corridor	Positive to Laboratory
Laboratory	Negative
Laboratory Support	Negative
Clean Rooms	Positive

B. Systems Descriptions

1. Chilled Water System
   a. System Description
      1). Chilled water system will serve cooling coils and the process cooling system.
      2). Chilled water system will consist of chillers, variable flow primary pumps, and distribution piping system.
      3). Chilled water will be supplied to the air handling unit cooling coils at approximately 42°F with approximately 18°F temperature drop for 60 °F return water temperature.
      4). Chilled water system will be variable volume system utilizing a modulating 2-way control valve at each cooling coil. Each pump will be provided with variable frequency drive (VFD).
      5). A differential pressure transmitter between the chilled water supply and return mains will be utilized to vary the speed of the pumps, via variable frequency drives, to maintain a constant differential pressure between the piping mains.
      6). Chilled water usage will be metered via automated BTU meter with flow rate, supply temperature and return temperature input. Data will be input to Building Automation System (BAS).
   b. Design Criteria
      1). General
         a). Chilled water piping will be sized as follows:

i. Maximum pressure drop of 4 ft of water/100 ft of piping for piping 6" or smaller.
ii. 10 fps maximum velocity for piping 8" and larger.
iii. Subcircuits will be selected for linear control characteristics of the terminal device and control valve combination.

b). All major control valves will be sized by engineering calculations for linear control.

2). Reserve Capacity and Redundancy

a). Chillers and primary pumps will each be sized to provide 50% of the design chilled water flow rate. When any one chiller or pump fails, the remaining units will maintain 100% of the design flow rate.
b). Piping and connections will be designed to allow for the future addition of a fourth chiller and primary pump.
c). A minimum of one primary pump and one chiller will be on emergency power.

c. Equipment and Material

1). Water chillers will be electric variable speed water-cooled type, with oil-free magnetic bearing type or conventional centrifugal type compressors.
2). Chiller primary pumps will be vertical split-case centrifugal type with variable frequency drives.
3). The chilled water system will also include the following components:

a). Chemical pot feeder
b). Air separator
c). Bladder type expansion tank
d). Make-up water assembly
e). Cooling coils
f). Appropriate valving and piping specialties

4). **Chiller capacity is estimated to be three chillers, each sized for 450 tons.**

d. Distribution

1). Chilled water will be distributed through Type L copper piping with soldered fittings for pipes 2" and smaller and carbon steel piping with welded fittings for pipes 2-1/2" and larger.
2). Chilled water piping will be insulated with foam glass type insulation with appropriate insulation jacket.
3). Basin heaters will be used to prevent the tower basin water from freezing during cold weather.

2. Cooling Tower System

a. System Description

1). Cooling tower system will consist of cooling towers, condenser water pumps, and distribution piping system.
2). The towers will be located on the ground.

b. Design Criteria

1). 79°F WB (for tower selection)
2). Reserve capacity and redundancy

a). One condenser water pump will be provided for each chiller and associated tower. Each pump will be sized for 100% of the design flow rate of the chiller that is served by that pump.
b). Piping and connections will be designed to allow for the future addition of a fourth cooling tower and condenser water pump.
c). A minimum of one tower pump and one of the cooling tower fans will be on emergency power.

c. Equipment and Material

1). Towers will be induced draft cross-flow.
2). Tower pumps will be horizontal split-case centrifugal type.
3). A chemical-free water treatment system will control biological growth, scale, and corrosion.
4). The cooling tower system will also include a make-up water assembly to use AHU cooling coil condensation as the primary source of make-up water, and domestic water for backup.
5). Electrical basin heater and electrical heating cable will be used for freeze protection.
6). **Cooling tower capacity is estimated to be three cooling tower, each sized for 450 tons.**

d. Distribution

1). Condenser water will be distributed through carbon steel piping with welded fittings.
2). Underground condenser water piping will be pre-manufactured piping with factory-installed insulation (standard weight carbon steel carrier pipe, polyurethane foam insulation and HDPE outer jacket).

3. Combined Chilled Beam Water and Process Cooling System

a. System Description

1). Combined system will service chilled beam cooling coils and various process equipment in the laboratories and clean rooms.
2). System will consist of a mixing valve station, a backup chiller, a minimum of two distribution pumps, and distribution piping system.
3). Water will be distributed at a temperature no less than 3-5°F higher than the highest design space dewpoint in any chilled beam zone.
4). System will be variable volume system utilizing a modulating 2-way control valve at each chilled beam device. Distribution pumps will each be provided with VFD.
5). A differential pressure transmitter between the supply and return mains will be utilized to vary the speed of the pumps, via variable frequency drives, to maintain a constant pressure differential between the piping mains.

b. Design Criteria

1). General

a). System piping will be sized as follows:

i. Maximum pressure drop of 4 ft of water/100 ft of piping for piping 6" and smaller.
ii. 10 fps maximum velocity for piping 8" and larger.

b). Chilled beam coils will be sized for the maximum water temperature drop as appropriate for the associated cooling loads, approximately 4-7 degrees.

2). Reserve Capacity and Redundancy

a). Each chilled beam distribution pump will be sized for 100% of the chilled beam design load.
b). The backup chiller will be sized for 100% of the process cooling design load.

c. Equipment and Material

1). Mixing valve station will consist of electronic DDC-based temperature control valve and electronic temperature sensor.

2). Distribution pumps will be base mounted end suction centrifugal type with variable frequency drives.
3). The system will also include the following components:
a). Chemical pot feeder
b). Air separator
c). Bladder type expansion tank
d). Make-up water assembly
e). Cartridge type water filter for 10% side stream filtration
f). Chilled beam cooling coils
g). Appropriate valving and piping specialties
h). Inline booster pumps where required due to pressure loss of process equipment

d. Distribution
1). Process cooling water will be distributed through Type L copper piping with soldered fittings for pipes 2" and smaller and carbon steel with welded fittings for pipes 2-1/2" and larger.
2). Distribution piping will be insulated with closed cell foam insulation.

4. Heating Hot Water System
a. System Description
1). Heating hot water system will serve AHU heating coils and terminal heating devices such as reheat coils, fan coil units, etc.
a). Heating hot water system will consist of hot water boilers with dedicated heating distribution pumps, and distribution piping system.
b). Hot water will be distributed at supply temperature of 120°F (adjustable).
c). Heating hot water system will be variable volume system utilizing a modulating 2-way control valve at each terminal heating device. Distribution pumps will each be provided with VFD.
d). A differential pressure transmitter between the supply and return mains will be utilized to vary the speed of the pumps, via variable frequency drives, to maintain a constant pressure differential between the piping mains.

b. Design Criteria
1). General
a). Heating and reheat water piping will be sized as follows:
i. Maximum pressure drop of 4 ft of water/100 ft of piping for piping 6" and smaller.
ii. 10 fps maximum velocity for piping 8" and larger.
iii. Heating coils will be sized for water temperature drop of approximately 20°F.
2). Reserve Capacity and Redundancy
a). Boilers and hot water distribution pump will each be sized to provide 20% of the design heating hot water flow rate. When any one boiler or pump fails, the remaining units will maintain 100% of the design flow rate.

c. Equipment and Material
1). Hot water boilers will be condensing type with sealed combustion and natural gas burners.
2). Distribution pumps will be base mounted end suction centrifugal type with variable frequency drives.
3). The heating hot water system will also include the following components:
a). Chemical pot feeder
b). Air separator
c). Bladder type expansion tank
d). Make-up water assembly
e). Heating coils
f). Appropriate valving and piping specialties
4). **Boiler capacity is estimated to be six boilers, each sized for 2,900 MBH output.**

d. Distribution
1). Heating hot water will be distributed through Type L copper piping with soldered joints for pipes 2" and smaller, and carbon steel piping with welded joints for pipes 2-1/2" and larger.
2). Unions will not be provided at terminal heating devices in copper piping.
3). Piping will be insulated with rigid glass fiber insulation with appropriate insulation jacket.

5. Office Area Air Handling System
a. System Description
1). One air handling unit will serve the office areas.
2). System will consist of factory fabricated custom air handling unit.
3). System will be a single duct variable air volume reheat system, providing heating and cooling to the spaces. The minimum outside air percentage will be determined in accordance with ASHRAE Standard 62.
4). Air will be supplied to all appropriate spaces and a portion of this air will be returned to the air handling unit. The remaining portion of air not returned to the air handling unit shall be utilized as make-up air for the exhaust systems and building pressurization.
5). Ducted return air system will be used instead of return air ceiling plenum to return air from the spaces back to the AHU.

b. Reserve Capacity and Redundant Systems
1). There will be no redundancy.
2). Air handling system will be sized with 10% reserve capacity.

c. Equipment and Material
1). The air handling units will be of galvanized steel double wall construction. The units will consist of the following components:
a). Outside Air Intake Damper
b). MERV 7 Efficient Prefilters
c). MERV 13 Efficient Final Filters
d). Chilled Water Cooling Coils
e). Supply Fan with VFD; arrays of multiple fans will be considered.
f). Sound Attenuating Device at Unit Discharge and Inlet Ductwork
g). Smoke detector at supply air discharge ductwork
2). **Air handling unit is estimated to be 15,000 cfm at 8 inches WG static pressure.**

d. Distribution
1). High pressure galvanized steel ductwork will distribute supply air from the air handling unit to the supply air terminal devices.
2). Low pressure galvanized steel ductwork will be utilized downstream of supply terminal devices to distribute supply air to the spaces.

3). Individual offices up to two offices having a common exterior exposure or a common interior space, and common occupancy, will be served by one supply air terminal device.
4). One air terminal device will be provided where individual space temperature control is required.
5). Supply air ductwork will be externally insulated with fiberglass insulation.

6. Conference Room Air Handling System
   a. System Description
      1). One air handling unit will serve the conference room spaces.
      2). System will consist of factory fabricated custom air handling unit.
      3). System will be a single duct variable air volume reheat system, providing heating and cooling to the spaces. The minimum outside air percentage will be determined in accordance with ASHRAE Standard 62.
      4). Air will be supplied to all appropriate spaces and a portion of this air will be returned to the air handling unit. The remaining portion of air not returned to the air handling unit shall be utilized as make-up air for the exhaust systems and building pressurization.
      5). Supply ductwork will be routed below the floor and return ductwork will be in the ceiling.
   b. Reserve Capacity and Redundant Systems
      1). There will be no redundancy.
      2). Air handling system will be sized with 10% reserve capacity.
   c. Equipment and Material
      1). The air handling units will be of galvanized steel double wall construction. The units will consist of the following components:
         a). Outside Air Intake Damper
         b). MERV 7 Efficient Prefilters
         c). MERV 13 Efficient Final Filters
         d). Chilled Water Cooling Coils
         e). Supply Fan with VFD; arrays of multiple fans will be considered.
         f). Sound Attenuating Device at Unit Discharge and Inlet Ductwork
         g). Smoke detector at supply air discharge ductwork
      2). **Air handling unit is estimated to be 9,000 cfm at 8 inches WG static pressure.**
   d. Distribution
      1). High pressure galvanized steel ductwork will distribute supply air from the air handling unit to the supply air terminal devices.
      2). Low pressure galvanized steel ductwork will be utilized downstream of supply terminal devices to distribute supply air to the spaces.
      3). One air terminal device will be provided for each space where individual space temperature control is required.
      4). Supply air ductwork will be externally insulated with fiberglass insulation.

7. Research Laboratory Air Handling Systems
   a. System Description
      1). One air handling unit will serve each of two wings of research laboratory spaces. Systems will be 100% outside air, single duct, variable air volume, with terminal reheat, providing heating and cooling to the spaces.
      2). Systems will consist of factory fabricated custom air handling units.
      3). Air supplied to all spaces will be exhausted to outdoors. No air from the laboratory or support spaces will be returned to the air handling unit.
      4). Two-position constant volume air valves will be utilized in general. Variable volume venturi valves will be utilized for spaces with fume hoods.
   b. Reserve Capacity and Redundant Systems
      1). Air handling system will be sized with 10% reserve capacity.
      2). Air handling units will consist of multiple equally sized supply fans. If one of the fans fails, the remaining fans will increase speed to provide the design air flow.
      3). The system and distribution that feeds the chemistry lab wing will be sized to support the future addition of ten 6'0" wide fume hoods. Ductwork will be sized to allow for flexibility in terms of the future fume hood locations; ducts will remain full size within the laboratory area and will be located to allow new duct tie-ins to be added in the future.
      4). Air handling units will continue to operate upon activation of the building fire alarm system. Local duct mounted smoke detectors will activate duct smoke dampers closed. Air handling unit mounted smoke detectors will deactivate their respective air handling unit upon detection of smoke.
   c. Equipment and Material
      1). The air handling units will be of galvanized steel double wall construction. The units will consist of the following components:
         a). Outside Air Intake Dampers
         b). MERV 7 Efficient Prefilters
         c). MERV 13 Efficient Final Filters
         d). Hot Water Preheat Coil
         e). Chilled Water Cooling Coils
         f). Supply Fan Array with VFD
         g). Sound Attenuators at supply air discharge ductwork
         h). Smoke detector at supply air discharge ductwork
      2). **Each air handling unit is estimated to be 45,000 cfm at 10 inches WG static pressure.**
   d. Distribution
      1). High pressure galvanized steel ductwork will distribute supply air from the air handling units to the supply air terminal devices.
      2). Low pressure galvanized steel ductwork will be utilized downstream of air terminal devices to distribute supply air to the spaces.
      3). One air terminal device will be provided where individual space temperature control is required. Individual room control will be utilized in most rooms.
      4). Supply air ductwork will be externally insulated with fiberglass insulation.

8. Cleanroom Makeup Air Handling System
   a. System Description
      1). One air handling unit will provide makeup air for cleanroom spaces. System will be 100% outside air, single duct, variable air volume, with terminal reheat, providing heating and cooling to the spaces.
      2). Systems will consist of factory fabricated custom air handling units.
      3). Air supplied to all spaces will be exhausted to outdoors. No air from the cleanrooms or support spaces will be returned to the air handling unit.
      4). Two-position constant volume air valves will be utilized in general.

5). Sub-metering will be required for all heating and cooling utilities associated with the clean room suite.

b. Reserve Capacity and Redundant Systems

1). Air handling system will be sized with 10% reserve capacity.

2). Air handling units will consist of multiple equally sized supply fans. If one of the fans fails, the remaining fans will increase speed to provide the design air flow.

3). Air handling units will continue to operate upon activation of the building fire alarm system. Local duct mounted smoke detectors will activate duct smoke dampers closed. Air handling unit mounted smoke detectors will deactivate their respective air handling unit upon detection of smoke.

c. Equipment and Material

1). The air handling units will be of galvanized steel double wall construction. The units will consist of the following components:

a). Outside Air Intake Dampers

b). MERV 7 Efficient Prefilters

c). MERV 13 Efficient Final Filters

d). Hot Water Preheat Coil

e). Chilled Water Cooling Coils

f). ‘Wrap-around’ Heat Pipe Coils for preconditioning and reheat

g). Supply Fan Array with VFD

h). Sound attenuation section in the air handling unit

i). Smoke detector at supply air discharge ductwork

2). **The actual size of the air handling unit will be determined based on the makeup air requirements of the cleanroom tools. Air handling unit is estimated to be 42,000 cfm at 10 inches WG static pressure.**

d. Distribution

1). High pressure galvanized steel ductwork will distribute supply air from the air handling units to the supply air terminal devices.

2). Low pressure galvanized steel ductwork will be utilized downstream of air terminal devices to distribute supply air to the spaces.

3). One air terminal device will be provided where individual space temperature control is required. Individual room control will be utilized in most rooms.

4). Supply air ductwork will be externally insulated with fiberglass insulation.

9. Cleanroom Return Air Handling Systems

a. System Description

1). Individual ceiling supply plenums with ceiling-mounted filter modules will provide recirculated air for additional air changes per hour in cleanroom spaces.

2). Systems will consist of fan-powered HEPA filter modules and return air tempering coils.

3). Sub-metering will be required for all heating and cooling utilities associated with the clean room suite.

b. Reserve Capacity and Redundant Systems

1). Fan-powered HEPA filter module arrangements will consist of multiple equally sized fans. If one of the fans fails, the remaining fans will increase speed to provide the design air flow.

2). Systems will continue to operate upon activation of the building fire alarm system. Local duct mounted smoke detectors will activate duct smoke dampers closed.

c. Distribution

1). Low pressure galvanized steel ductwork will be utilized to distribute air to the spaces.

10. Toilet and General Exhaust Systems

a. System Description

1). The system will service toilet rooms, janitor's closets, locker rooms, etc.

2). System will consist of several exhaust fans that will be controlled via occupied/unoccupied control.

3). The exhaust system will be constant volume.

b. Reserve Capacity and Redundant Systems

1). There will be no redundancy.

2). During power outages the toilet exhaust fan will be off.

c. Equipment and Materials

1). The exhaust system will consist of the following components:

a). Roof mounted exhaust fans.

b). Backdraft damper at fan inlet.

c). No sound attenuating devices will be provided.

d. Distribution

1). Ductwork will be galvanized steel.

11. Research Laboratory Fume Exhaust Systems

a. System Description

1). Each wing of research laboratory spaces will be served by centralized fume exhaust air system. The systems will combine laboratory fume hood, biosafety cabinets, snorkel and canopy hood exhaust.

2). System will consist of multiple exhaust fans connected to a common exhaust fan inlet plenum and will be located on the roof. The fans are intended to operate in parallel and will each be sized for an equal portion of the design load. Each system will operate 24 hours per day, 365 days per year.

3). Laboratory exhaust system will be variable volume. The exhaust fans will operate at constant volume to maintain a constant stack discharge velocity. A static pressure sensor in the exhaust fan inlet plenum modulates an outside air bypass damper, introducing the required outside air into the plenum to maintain a constant flow rate through the fans. Fans will have packless type sound attenuating devices on the exhaust main, and on the discharge stacks where required to meet noise criteria. Outside air by-passes will be provided with sound attenuating hoods where required to meet noise criteria.

4). Pressure independent, exhaust air valve devices will be provided for the fume hoods, biosafety cabinets, snorkels, and canopy hoods.

5). High pressure exhaust ductwork will be utilized between the exhaust air valves and the central exhaust plenum. Sound attenuating devices at the air valves will not be provided unless required to meet noise criteria.

b. Design Criteria

1). Reserve Capacity and Redundant Systems

a). Multiple exhaust fans will serve each central exhaust system. If one fan fails, the remaining fans will be able to provide 100% of the system design capacity.

b). One of the fans will be provided with emergency power. Note that fume hood face velocities may drop below 60 fpm when one fan is operating. If hood face velocity drops below 100 fpm, it will be locally alarmed.

c). The system and distribution that feeds the chemistry lab wing will be sized to support the future addition of ten 6'0" wide fume hoods. Ductwork will be sized to allow for flexibility in terms of the future fume hood locations; ducts will remain full size within the laboratory area and will be located to allow new duct tie-ins to be added in the future.

d). System will continue to operate during activation of the building fire alarm system. No smoke dampers are provided for laboratory and fume hood exhaust ductwork. Exhaust ductwork risers from each floor will be extended to the common exhaust plenum in the penthouse to control smoke migration in the exhaust ductwork.

2). **The capacity of the laboratory fume hood exhaust system for the base project is estimated to be two sets of four fans, each fan with a capacity of 12,000 cfm each at 6 inches WG static pressure.**

c. Distribution

1). Exhaust ductwork and plenum will be 304 stainless steel. Air valves will be utilized for fume hoods, biosafety cabinets, snorkels, and canopy exhausts and will be heresite coated aluminum construction.

12. Research Laboratory General Exhaust Systems

a. System Description

1). Each research laboratory air handling system will be served by a dedicated centralized general exhaust air system.

2). The exhaust will be routed to energy recovery devices, which will precondition outside air.

3). Laboratory exhaust systems will be constant volume two position in general.

4). Pressure independent, exhaust air terminal devices will be provided to serve general exhaust grilles in lab and non-lab areas.

5). High pressure exhaust ductwork will be utilized between the exhaust air terminal devices and the central exhaust plenum. Sound attenuating devices at the air terminals will not be provided unless required to meet noise criteria. Six feet of sound attenuating flexible ductwork will be provided at general exhaust grilles.

b. Design Criteria

1). Reserve Capacity and Redundant Systems

a). The energy recovery unit (ERU) will be sized with 10% reserve capacity.

b). The system and distribution that feeds the chemistry lab wing will be sized to support the future addition of ten 6'0" wide fume hoods. Ductwork will be sized to allow for flexibility in terms of the future fume hood locations; ducts will remain full size within the laboratory area and will be located to allow new duct tie-ins to be added in the future.

c). The ERUs will consist of multiple equally sized supply and exhaust fans. If one of the fans fails, the remaining fans will increase speed to provide the design air flow.

2). **The capacity of each laboratory general exhaust system for the base project is estimated to be 35,000 cfm at 8 inches WG static pressure.**

c. Distribution

1). Exhaust ductwork and plenum will be galvanized steel sheet metal. Air terminal devices will be utilized for general exhaust and will be galvanized steel.

13. Cleanroom Exhaust System

a. System Description

1). Cleanroom spaces will be served by centralized fume exhaust air system. The systems will combine laboratory fume hood, cleanroom tools, snorkel and canopy hood exhaust.

2). System will consist of multiple exhaust fans connected to a common exhaust fan inlet plenum and will be located on the roof. The fans are intended to operate in parallel and will each be sized for an equal portion of the design load. Each system will operate 24 hours per day, 365 days per year.

3). Cleanroom exhaust system will be constant volume two-position in general. The exhaust fans will operate at constant volume to maintain a constant stack discharge velocity. A static pressure sensor in the exhaust fan inlet plenum modulates an outside air bypass damper, introducing the required outside air into the plenum to maintain a constant flow rate through the fans. Fans will have packless type sound attenuating devices on the exhaust main, and on the discharge stacks where required to meet noise criteria. Outside air by-passes will be provided with sound attenuating hoods where required to meet noise criteria.

4). Pressure independent, exhaust air valves will be provided for the fume hoods, cleanroom tools, snorkels and canopy hoods.

5). High pressure exhaust ductwork will be utilized between the exhaust air valves and the central exhaust plenum. Sound attenuating devices at the air valves will not be provided unless required to meet noise criteria.

b. Design Criteria

1). Reserve Capacity and Redundant Systems

a). Multiple exhaust fans will serve each central exhaust system. If one fan fails, the remaining fans will be able to provide 100% of the system design capacity.

b). One of the fans will be provided with emergency power. Note that fume hood face velocities may drop below 60 fpm when one fan is operating. If hood face velocity drops below 100 fpm, it will be locally alarmed.

c). System will continue to operate during activation of the building fire alarm system. No smoke dampers are provided for laboratory and fume hood exhaust ductwork. Exhaust ductwork risers from each floor will be extended to the common exhaust plenum in the penthouse to control smoke migration in the exhaust ductwork.

2). **The actual size of the exhaust system will be determined based on the exhaust requirements for the cleanroom tools. The capacity of the cleanroom exhaust system for the base project is estimated to be three fans, each with a capacity of 5,000 cfm each at 8 inches WG static pressure.**

c. Distribution

1). Exhaust ductwork and plenum will be 304 stainless steel. Air valves will be utilized for fume hoods, cleanroom tools, snorkels, and canopy exhausts and will be heresite coated aluminum construction.

14. Laboratory Air Flow Control System

a. System Description

1). Each laboratory, cleanroom, and laboratory/cleanroom support space will have stand alone laboratory controllers which will control the space temperature and pressurization. Each space with a laboratory fume hood or cleanroom tool will have a stand-alone fume hood and/or laboratory controller which will control the space temperature, fume hoods, and pressurization.

2). Pressurization will be controlled by supply air/exhaust air tracking.

3). Each fume hood will have a low flow alarm to indicate if fume hood face velocity falls below a specified level.

b. Design Criteria

1). Fume hood and laboratory air flow control system will be interfaced with Building Automation System (BAS).

c. Equipment and Material

1). Systems will be by Siemens.

15. Building Automation System

a. System Description

1). Mechanical systems will be controlled and monitored through a Siemens Building Automation System (BAS) and will interface with the existing Siemens system on the main campus.

2). Data analytics embedded within the sequences of operation will automatically detect operational and energy anomalies.

3). Automated commissioning logic will be applied to air terminal devices. This logic will allow operators, at any time after the building is occupied, to periodically activate an automatic comparison of the actual system performance to its baseline performance that will be established during building start-up using controlled conditions. Any significant deviations in the actual performance from the established baseline will be automatically reported to the operators.

4). Advanced alarm management strategies will prioritize alarms and suppress cascading alarms to reduce nuisance alarms.

5). Measurement and verification graphics will automatically compare the actual instantaneous building performance to its established baseline performance.

b. Design Criteria

1). Each DDC controller will have a minimum of 10% spare points of each type (DI, DO, AI and AO) at each panel. For universal joints, the spares will be divided evenly between the analog and digital types of points.

2). All control panels and DDC controllers will operate on emergency power and have integral Uninterrupted Power Supply (UPS) backup.

16. Energy Conservation Measures

a. Energy Life Cycle Cost Analysis

1). Energy conservation measures will be evaluated using a life cycle cost analysis based on a whole-building energy simulation tool in accordance with Appendix G of ASHRAE 90.1-2007. The following energy conservation schemes will be included in this analysis:

a). Active chilled beams

b). Heat recovery chiller

c). Oil-free magnetic-bearing chillers

b. Office Area

1). Chilled beams will be utilized in the offices.

2). Variable air volume control will be implemented.

c. Conference Rooms

1). Demand control ventilation and variable air volume control will be implemented.

d. Research and Teaching Laboratories

1). Chilled beams will be provided to handle the sensible loads in the laboratory spaces.

2). Energy recovery units with enthalpy wheels will be provided to precondition outside air with general exhaust air from the labs.

3). Energy recovery heat-pipe coils will be provided to precondition outside air with fume exhaust air from the labs and avoid the risk of cross-contamination.

e. Cleanrooms

1). Wrap-around heat pipes will be used to contribute reheat for the cleanroom makeup air system.

2). Pressurized plenum ceilings will be used to minimize fan energy.

3). Fan-powered HEPA filter modules will use direct current (DC) motors.

f. Chiller Plant

1). Oil-free magnetic-bearing chillers will provide the primary cooling source.

2). Heat recovery chillers will recover heat from the process cooling loop for use in the building heating system.

END OF BOD

3.9 ELECTRICAL SYSTEMS

VI. ELECTRICAL SYSTEMS

A. Base Design Criteria

1. Applicable Codes – Refer to Section 7.1 Preliminary Code Report.
2. Power Distribution Design Criteria

a.

Functional Area	Load Density (VA/sq ft)
1) Office Receptacle	6.0
2) Lighting	1.5
3) Wet Lab Bench Areas	15.0
4) Dry Lab Bench Areas	20.0
5) Lab Support & Equipment Areas	30.0
6) General Receptacle	2.0

3. Equipment Sizing Criteria

a. Secondary Design Voltages

1) Motors larger than 1/2 hp	480Y/277V, 3 phase, 3 wire
2) Motors 1/2 hp, or less	120V, 1 phase, 3 wire
3) General Lighting	277V, 1 phase, 3 wire
4) Specialty Lighting	120V, 1 phase, 3 wire
5) Lab Panelboards	208Y/120V, 3 phase, 4 wire
6) General Receptacles	120V, 1 phase, 3 wire

b. Branch Circuit Load Calculations

a) Lighting	100% of installed VA
b) Receptacles	200 VA per outlet
c) Wet Lab Receptacles	300 VA per outlet
d) Dry Lab Receptacles	400 VA per outlet
e) Special Outlets	Per Equipment List load data
f) Motors	100% of rated load

B. System Descriptions

1. Electric Service

a. System Description

1) Underground primary electric service will be provided by the local municipal utility known as City Electric to a new service transformer located in the service drive area behind the new building.

b. Design Criteria

1) Based upon initial discussions with City Electric, a primary supply feeder from substation #31 (across street on north side of Levy) is the preferred. Available substation feeders and supply options are under review by City Electric and will be confirmed with the power company during the Advanced Schematic Design phase.

2) The current concept is based upon a single power company pad-mounted transformer. An option for redundant transformers and dual utility feeders will be developed by City Electric, along with an impact cost for the extra utility infrastructure.

3) **Utility Load Estimate = 2000 kVA, with 2500kVA transformer.**

a) Peak demand of 16.0 VA/SF across 125,000 SF building size.

b) Utility transformer to be sized by City Electric based upon final building load information provided in the construction document phase.

c. Equipment and Material

1) Pad-Mounted service transformer will be provided by the utility company.

2) Project to provide primary conduits, transformer pad, and metering conduit.

d. Distribution

1) The primary ductbank will be encased in reinforced concrete and consist of (3) 4” PVC conduits; top of ductbank 36” minimum below finished grade.

2) Point of interface to be determined by City Electric. The current design concept is based upon a primary supply from existing utility infrastructure routed along the west side of Engineer drive, with a new road crossing near the intersection with Levy Drive.

2. Normal Power Services and Distribution

a. System Description

1) Main distribution will be at 480Y/277V with step down transformers located on each floor to provide 208Y/120V.

2) Electrical rooms will be provided at each floor, and in each major building wing.

3) Recessed panels will be located in lab corridors, equipment corridors, or in vestibules at the lab entrances.

4) Lab panels will be 208Y/120V.

5) Each floor will have a separate 480V power panel available in the electrical rooms for specific equipment such as autoclaves, or other special tools.

6) Emergency loads will be supplied from the normal system via automatic transfer switches located in a dedicated emergency equipment room.

7) Any equipment requiring uninterruptible power will be required to be furnished with unitary UPS units. A central building UPS is not anticipated.

8) Sub-metering will be required for all electrical power associated with the clean room suite, in addition to general sub-meters for LEED Measurement & Verification by major load category (HVAC, Lighting, Plug Load, etc.).

b. Design Criteria

1) The current design concept is based upon a service switchboard with a single main breaker. Consideration has been given to a Main-Tie-Main dual service configuration, but this approach involves significant added cost and space requirements for larger indoor equipment and for more extensive outdoor equipment by City Electric. Instead, the design will be based upon a single service, with a standby sized to carry all critical building loads.

2) The main switchboard distribution will be organized to provide sub-metering of major load blocks: Lighting, HVAC, plug loads, etc.

3) **Initial Main Switchboard size estimate = 4000A (480Y/277V)**

a) Switchboard will utilize a 100% rated main breaker.

4) Secondary electrical rooms will be stacked, with rooms serving each floor.

5) Electrical room doors will swing out where possible and be 42” wide (min.) to allow for transformer replacement.

6) Main equipment will be sized for 15% spare capacity.

c. Equipment and Material

1) Service Entrance equipment will be switchboard type with fixed circuit breakers. Main breakers will be mounted in separate sections along with metering and surge protection. Feeder breakers will be group mounted in distribution sections. Space will be provided for 25% future circuit breakers.
2) Normal power distribution panels will contain bolt-on feeder circuit breakers. Feeder circuit breaker space will be provided for the addition of 25% future circuit breakers.
3) Branch circuit and lighting panelboards will contain bolt-on branch circuit breakers. The panelboards will be rated at 225 amperes, and the demand load will be limited to provide 25% future capacity. The panelboards will have a minimum of 20% of circuit spaces reserved for future uses.
4) Interior transformers will be dry type with 80 degree C rise; aluminum windings.
5) Point-of-use power connection devices will include specification, grade, receptacles (120V, 20A, single-phase), power receptacles, and surface metallic raceway (SMR). The SMR will be divided into two raceway compartments, one for power and one for telecommunications. The density of receptacles in the SMR will typically be 24" OC.
6) Circuit numbers will be labeled on coverplates of receptacles.

d. Distribution
1) Feeders and circuits will be routed in metallic conduit within the building, except PVC will be used for sections located under the ground floor slab.
2) Conductors will be copper.
3) MC cable will not be used.
4) Shielded wiring methods will be utilized in areas with specific EMI requirements.

3. Emergency/Standby Service and Distribution

a. System Description
1) A packaged outdoor diesel generator will be used to supply standby power to emergency loads and optional standby loads, with separate automatic transfer switches (ATS) for each load type or group.
2) The fuel supply will be sized for **36 hours of run time at full load.**

b. Design Criteria
1) Loads to be served include:
a) Life Safety systems including fire alarm, egress lighting, telecommunications rooms, door access controls, and toxic gas monitoring.
b) Building elevators with group control to limit load to a single elevator per elevator group operating under standby power.
c) Limited Clean Room HVAC, operating at reduced flow.
d) Limited Lab HVAC, operating at reduced flow.
e) Limited primary plant HVAC equipment including partial chiller and boiler capacity and associated pumps.
f) Limited misc. equipment such as sump pumps and condensate return pumps.
g) Building Automation System panels, to reduce re-start time from power outages.
h) Lab refrigeration and freezers, and other lab equipment identified with standby power on the lab equipment list.
i) Limited laboratory benchtop receptacles, approximately one per each 15 LF of bench surface in open labs.

2) The initial Standby System capacity is estimated at 12 W/GSF with a single generator unit rated 1500KW/1875 KVA, operating at 480Y/277V.
3) Consideration will be given during schematic design for use of multiple, paralleled, smaller generators if available within the same cost as the larger single unit.
4) The final capacity of the generator will be selected to serve the facility standby load requirements, with approximately 15% future capacity after demand factors are applied.

c. Equipment and Material
1) Generator will have standard outdoor metal enclosure and have access platforms for maintenance if base tank is greater than 24” high.
2) Generator to have critical grade exhaust silencer.
3) Generator to have load bank connection box permanently installed at unit.
4) A custom “walk-in” style sound attenuated enclosure may be considered as an additive alternate.

d. Distribution
1) Feeders and circuits will be routed in metallic conduit within the building, except PVC will be used for sections located under the ground floor slab.
2) Conductors will be copper.
3) MC cable will not be used.

4. Grounding System

a. System Description
1) A complete low-impedance grounding electrode system will be provided for this facility. The grounding electrode system will include the main water service line, structural steel, and ground ring around the perimeter of the building. The equipment grounding system will extend from the building service entrance equipment to the branch circuit. All grounding system connections will be made using exothermic welds or irreversible compression connections.
2) Bonding jumpers will be provided as required across pipe connections to water meters, dielectric couplings in a metallic cold water system, and across expansion/deflection couplings in conduit and piping systems.
3) All feeders and branch circuits will be provided with an equipment ground conductor.
4) Supplemental ground bars will be provided in specific lab spaces requiring local access to low impedance ground.

b. Design Criteria
1) The grounding electrode system will be designed in accordance with NEC article 250.
2) System resistance to ground will be 10.0 ohms or less.

c. Equipment and Material
1) The reference ground for the equipment grounding system will be established from a structural ground grid as follows:

2) A No. 4/0 AWG bare copper ground wire will be installed at 30" below grade around the entire perimeter of the building. 3/4" x 10' driven copper ground rods will be installed and connected to this ground loop at not-greater-than 200-foot intervals with a No. 4/0 AWG bare copper conductor. Steel columns in exterior walls will also be connected to this ground loop with 4/0 AWG bare copper at intervals not to exceed 60 feet. Interior steel columns will be connected to the exterior ground loop on each side of the building at intervals not to exceed 200 feet with a No. 4/0 AWG bare copper conductor.

3) Wall-mounted copper ground bus will be located in the main electrical room, floor electrical rooms, voice/data rooms, and certain lab spaces. The main electrical room ground bus will be connected to exterior ground loop

d. Distribution

1) A separate, insulated 4/0 AWG ground wire will be provided from the main electrical room ground bus to each floor's electrical room ground buses, underground incoming water service line ahead of meter, and underground gas line at the building entrance.

2) The main service entrance neutral will be bonded to the system ground bar within the switchboard by a removable bus bar link.

3) A No. 4/0 AWG, bare copper, grounding electrode conductor will be extended to all voice/data rooms, so that those systems can be properly bonded.

4) A separate ground wire will be provided for all circuits.

5. Lightning Protection System

a. System Description

1) Protect all structures and associated appurtenances with a system of conductance designed to safely divert the energy of a lightning strike to the earth while minimizing damage to the facility.

b. Design Criteria

1) Comply with NFPA 780 - Standard for the Installation of Lightning Protection Systems. Installing Contractor will provide a UL Master Label for the completed system.

c. Equipment and Material

1) Materials will be rated Class I for structure heights of 75 ft or less. Class II for structure heights above 75 ft.

2) Air terminals will be solid copper with a tapered point, 10" minimum height, and have a mounting base suitable for the location.

3) Conductors will be bare-stranded copper, except aluminum will be used where installation is in contact with aluminum surfaces.

4) Ground rods will be copper-clad steel, 3/4" diameter by 10 ft long.

d. Distribution

1) The system layout and design will encompass all exterior surfaces of the facilities under a complete zone of protection as defined by NFPA 780. Air terminal spacing will not exceed 20 feet, except spacing up to 50 feet is allowed for non-perimeter areas of flat roofs. Locations will comply with NFPA 780 and will generally follow the building roof ridges and/or perimeters.

2) One (1) down conductor will be provided for every 250 linear feet of building perimeter, with a minimum of two (2) conductors. Conductors will be configured to provide a two-way path to earth. Metal bodies will be bonded to the conductor system in accordance with NFPA 780.

3) A ground rod will be connected to each down conductor. The electric power service grounding system will be bonded to the Lightning Protection System.

6. Lighting Systems

a. System Description

1) A complete lighting system for all indoor and outdoor illumination will be provided. The indoor lighting system will consist primarily of energy-efficient fluorescent lighting fixtures, supplemented by LED fixtures in specialized applications.

2) In general, indoor lighting controls will be controlled by a non-centralized low-voltage lighting control system utilizing local room occupancy sensors and digital switches. Outdoor lighting controls will utilize photocells and time switches with manual override switches.

3) Emergency/night lighting will be provided by unswitched branch circuits. These unswitched branch circuits will be fed from an emergency lighting panel.

b. Design Criteria

1) Lighting Design Levels, Average Maintained Footcandles:

a) Lab Bench Area	60 + localized task lighting
b) Lab Support Area	50
c) Computer Labs	40/20 (2-level switching)
d) Office/Admin Areas:	40
e) Corridor & Circulation:	15
f) Toilets:	20
g) Storage:	15
h) Mechanical/Electrical:	30
i) Exterior Lighting:	1-2

c. Equipment and Material

1) Lighting fixtures will be selected to utilize both fluorescent and LED lamp systems. Fixture types will be selected with the architect and owner during the early design phases.

2) Lighting controls will be based upon the Wattstopper DLM digital lighting control system.

a) Office lighting will be controlled by “vacancy” sensors, which shut off lighting automatically but require a manual “on”.

3) Outdoor lighting will be based upon the FSU campus standards, utilizing a modern cut-off style fixture along driveways and parking.

a) Pole heights in parking area will need to be coordinated with City Electric so that they do not interfere with existing overhead power lines along the south area of the site.

4) Emergency Blue Light Stations will be provided in coordination with the Campus Police department. Units will match the campus standard.

d. Distribution:

1) An in-grade Quazite junction box will be provided at the base of each exterior light pole to split circuit runs in to the pole base. Circuits will be routed in 1” minimum size conduit.

2) In general lighting circuits will be 277V. Specialty lighting will be 120V, and lighting control wiring will be low voltage. Separate lighting branch circuit panelboards will be provided on each floor.

3) All lighting circuit wiring will be in conduit and routed concealed within walls, partitions, or ceiling spaces. Surface-mounted conduit will be minimized and used only in non-finished spaces.

4) The ampacity of lighting circuits will be sized for 25% future growth plus 125% continuous loading factor per the National Electric Code.

7. Telecommunications Infrastructure System

a. System Description

1) Telecommunications infrastructure will be provided to facilitate the installation of IT networks and phone system by the FSU ITS Division.

2) The building will be connected to the nearest communications manhole for outside plant cabling by FSU.

b. Design Criteria

1) Owner will provide system cables, termination equipment, and IT outlets.

2) Infrastructure will include blank IT outlets distributed throughout the building and connected back to IT rooms via a conduit and cable tray system.

3) Design will be coordinated with the FSU ITS division and the most current ITS standards.

4) Power to IT room receptacles will be on the both normal and emergency system (50/50 split). FSU considers voice communications over IT networks necessary for life safety.

c. Equipment and Material

1) Service entrance conduits will be four (4) 4” size, routed to the existing communications manhole system, and encased in concrete ductbank with 36” minimum cover.

2) Interior conduit will be 1” size, per each outlet.

3) Cable Trays will be aluminum ladder type, with unistrut type trapeze hangers (no center spine tray allowed).

4) A flush, two-gang box with plaster ring will be provided at each IT outlet location.

5) Terminal Boards will be 3/4" plywood painted black on both sides and all edges. The board will be anchored securely to the wall.

d. Distribution

1) A dedicated IT room will be provided at each floor, centrally located. Two rooms may be required for larger floors or if room is more than 230 feet horizontally from the farthest occupied space (to limit total cable link to under 300 feet, after vertical transitions, slack, and service loops are accounted for).

2) IT rooms will be stacked between floors and have interconnecting 4” sleeves (quantity per FSU standards; approximately 4 to 6 each).

3) Cable trays will be routed above accessible corridor ceilings on each floor and extend the full length of the floor to be in close proximity to each occupied area.

8. Fire Alarm System

a. System Description

1) The fire alarm system will be a stand-alone, fully addressable system. The fire alarm system will be comprised of smoke detectors, heat detectors, duct detectors, manual pull stations, and audio/visual signaling devices.

b. Design Criteria

1) The fire alarm system will comply with requirements of NFPA 72 for a protected premises signaling system except as modified and supplemented by this document.

2) A main fire alarm control panel will be located in the electrical room.

3) A fire alarm annunciator panel will be mounted at the main building entrance.

4) Audio/visual devices will be installed in all areas of the building in accordance with the NFPA and the ADA Guidelines.

5) Smoke and heat detectors shall be installed as required by the National Fire Protection Association, the Florida Building Code. Smoke detectors will be installed in, but not limited to, the following locations: air handling units (duct mounted), elevator lobbies, elevator machine rooms and shafts, and above fire control panels.

6) Manual Pull Stations will be installed adjacent to all exit doors and in each elevator lobby.

7) The fire alarm system will be linked with the campus central system.

c. Equipment and Material

1) The system will utilize individual, addressable photoelectric smoke detectors; heat detectors; addressable manual pull stations; and addressable monitor and control modules. The system will monitor all sprinkler supervisory and water flow switches and will interface with elevators, HVAC smoke control, and smoke fire dampers.

d. Distribution

1) All initiating and signaling devices will operate at 24VDC and will be installed in accordance with manufacturer's specifications.

2) All wiring will be installed in conduit. Minimum conduit size will be 3/4".

9. Access Control/Security Infrastructure

a. System Description

1) A conduit/raceway system will be provided to facilitate system installation by FSU.

2) Generally includes rough in and power for door access control devices and for security monitoring devices (cameras, door contacts).

b. Design Criteria

1) The system layout will be coordinated with FSU CASS division during the early design phases and will generally include access control at all exterior doors.

c. Equipment and Material

1) Empty conduits, junction boxes, backboxes, and blank coverplates.

2) 12” square by 4” deep junction boxes above ceilings at door control areas to consolidate conduit drops to door strikes and card readers.

3) 1” conduits to connect door control points to the IT rooms (via cable tray).

4) Emergency power, 120 volt circuits to door controller locations.

d. Distribution

1) System will utilize the IT rooms for central controllers and network terminations.

END OF BOD

3.10 EQUIPMENT & FURNISHINGS

E. EQUIPMENT & FURNISHINGS

The proposed IRCB will include all fixed equipment typically found in a research laboratory building and moveable laboratory casework within the Construction Cost. Moveable furniture and equipment described below will form the Basis of Design and cost estimate for FF&E carried by the owner in the Project Cost.

Note: moveable laboratory casework may be purchased direct by Owner

E10. Equipment

1. Institutional Equipment
   a. Fume hoods - Provide variable volume fume hoods in 4'-0", 5'-0", & 6'-0" models by Bedco Lab, Kewaunee Scientific, or Mott. Refer to fume hood schedule for details. Fume hoods shall be complete with 1 Acid and 1 Solvent base cabinet unless scheduled otherwise.
      - Provide 1 ¼" dished epoxy work surfaces in all fume hoods to match adjacent laboratory casework.

   b. Wet Process Cleanroom Benches:
      - (1) 6'-0" polypropylene acid bench
      - (1) 6'-0" stainless steel solvent bench in the cleanroom
      - (1) 4'-0" polypropylene HF acid bench
      - Include cupsinks, nitrogen and RODI guns, carboy collection for all drains.

   c. Autoclave/Sterilizers - Provide Medium Steam Autoclaves for decontamination of biological waste and Small Steam Sterilizers for sterilizing research instruments. Provide 1 autoclave and 1 sterilizer per floor. Basis of Design Manufacturer - Steris. Basis of Design Model: Amsco Century Medium Steam Sterilizer 26x26x39

   d. Glassware Washers - Provide large capacity glassware washer/drier. Assume 1 per floor. Basis of Design Manufacturer - Steris; Basis of Design Model: Reliance 500 Series

2. Other Equipment to be determined during the SD phase.

E20. Furnishings

1. Window Treatments - Provide motorized window shades, room darkening shades, and blackout shades by Mecho, Lutron, or Draper where indicated.
2. Fixed Laboratory Casework -
   a. Provide premium grade hardwood veneer casework with epoxy tops where indicated in laboratories.
   b. Provide 1" thick hardwood veneer, 3-tier, shelving units on adjustable standards where indicated in laboratories.
   c. Provide hardwood veneer upper wall cabinets with sliding glass doors where indicated in laboratories.
   d. Epoxy tops shall be 1" thick "Khaki" by Durcon. Provide integral epoxy sinks 18"x24"x12" deep unless otherwise noted.
3. Movable Furnishings (Laboratory)
   a. Provide modular movable laboratory furniture. Basis of design shall be Symphony by Bedco Lab with mobile "add-a-drawer" base cabinets on casters.
   b. Mobile laboratory benches (tables) shall be pre-plumbed for up to 4 laboratory gases (Air, Vacuum, Nitrogen, and Special Gas) and pre-wired for electrical services.
   c. Provide 1" thick epoxy top for all mobile benches Epoxy tops shall be by Durcon to match fixed casework and fume hoods (Khaki).
   d. Provide modular utility panels integrated into the ceiling system for delivery of lab services with quick connect fittings for gasses and twist lock connections for electrical services.
4. Provide all plumbing trim for lab services, indexed for each service. Lab plumbing trim shall be by WaterSaver Faucet Co.

3.11 SPECIAL CONSTRUCTION & DEMOLITION

F. SPECIAL CONSTRUCTION & DEMOLITION

The IRCB will be designed to accommodate up to 3 research platforms, a cleanroom, an imaging facility, and a shared characterization/material synthesis core laboratory.

F10. Special Construction

1. Shielded Rooms for elimination of Radio Frequency (RF) and Electromagnetic Interference (EMI) may be required for imaging labs. Assume 4, 6-sided, shielded rooms required on level 1in the Imaging core facility. Provide complete rooms by IAC.
   a. Isolate all utilities from shielded room.
   b. Mechanical controls to "turn room off" required for each room.
2. Environmental Rooms
   a. Provide cold rooms and warm rooms with nominal dimensions of 10'-0"x12'-0"x10'-0"h fabricated from 4" insulating panels with aluminum skins painted white on each side.
   b. Water cooled condensers required, rack mounted in adjacent closet on each floor.
   c. Evaporator condensate - drain to compressor closet adjacent to warm and cold rooms.
3. Cold Room:
   a. Finished Ceiling Height — 8'-0"
   b. Temperature Range — 2-10 degrees C
   c. Temperature Uniformity — +/- 0.3 degrees C
   d. Temperature Gradient — +/- 1.0 degrees C
   e. Humidity — 50% RH, +/- 5% Annual variation
   f. Ventilation Air — 20 CFM minimum
4. Warm Room
   a. Finished Ceiling Height — 8'-0"
   b. Temperature Range — 25-40 degrees C
   c. Temperature Uniformity — +/- 0.5 degrees C
   d. Temperature Gradient — +/- 1.0 degrees C
   e. Humidity — +/- 1% RH, +/- 3% control
   f. Humidity Range — 50% RH
   g. Ventilation Air — 20 CFM minimum

F15. Cleanroom

1. The clean room will be located at level 1 and includes:
   a. Gowning/Pre-gown
   b. Deposition Bay
   c. Lithography Bay
   d. EBL Bay
   e. Clean Aisle
   f. Chases
   g. Offices & Conference
   h. HPM corridor and storage rooms
   i. Tool Move-in
   j. Emergency Response
2. Cleanroom classification
   a. Bay Under Filter — 1 @ 1,000
   b. Bay Under Filter — 1 @ 100
   c. Bay Under Filter — 1 @ 10,000
   d. Corridor Under Filter — 1,000
   e. Gowning — 1,000
3. Cleanroom Construction
   a. Walls: Provide modular cleanroom, aluminum partition system for 12'-0" wide bays and 10'-0" clear height research bays with 8'-0" wide chases (or as shown on plans). Provide return air openings and vision panels in cleanroom partitions as follows:
      - 0'-0" - 2'-0" — Open
      - 2'-0" - 8'-0" — Glass
      - 8'-0" - 10'-0" — Opaque, white aluminum panels.
   b. Floor: Shall be electrostatic dissipative welded vinyl tile flooring with conductive grounding.
   c. Ceiling: Shall be a 2x4 aluminum cleanroom tee grid assembly with hanger rod suspension.
   d. Fan Filter Units: Shall be variable speed ECM type with room-side filter access.
4. Chase Construction:
   a. Overhead piping service spine includes:
      - Nitrogen
      - Compressed Air
      - Cold Water
      - Building RO to local end polisher
      - Special Gasses (space for up to 6 special gasses)

   b. Lab gases shall be valved and capped serving both sides (bays) @ 8'-0" o.c.
   c. Lab Waste stub-ups @ 12'-0" o.c. horizontally.
   d. Solvent and Acid Vent branches at each chase with tees and dampers @ 12'-0" o.c. horizontally.

5. Supplemental Infrastructure
   a. Toxic Gas monitoring system: 30 detection points
   b. Stainless Steel double wall piping for process gases from HPM storage rooms to chases (gas cabinet installation performed under future tool hookup project)
   c. Valve manifold boxes and abatement systems (if any) to be installed under future tool hookup project.
   d. Liquid N2 Tank
6. Scope not included:
   a. Tool hook-up from piping spine to tools
   b. Gas Cabinets, valve manifold boxes, abatement scrubbers
   c. Local Power Conditioners
   d. Cleanroom UPS.
7. Special Controls & Instrumentation

F18. Clean Build Protocol

This document is designed to supplement and enhance Sections 13 60 13 SPECIAL CLEAN ZONE REQUIREMENTS and 13 60 16 CLEANROOM PROTOCOL. It is not designed to replace those contract documents. It is provided to specifically apply them to the construction of the cleanroom for The Florida State University Interdisciplinary Research & Commercialization Cleanroom Project.

The project Clean Zone Director (as defined by the contract documents) is responsible to supplement this document with a clean protocol move in material flow chart, protocol room designs, material flow diagrams, and product submittals for functional execution of the encompassing specification documents and this supplement. The documents are designed to be complimentary and in areas of conflict the more stringent requirement will apply.

The clean zone construction is divided into 5 stages and the anticipated construction tasks, and the requirements to work within the clean zone are defined within this document. Those stages are:

Stage 1: Building Shell Enclosed

Stage 2: Clean Zone Perimeter Boundaries Enclosed

Stage 3: Cleanroom walls, floors, and ceiling assembly completed.

Stage 4: Cleanroom HEPA filters installed

Stage 5: Certification test completed.

ALL CONTRACTORS THAT ARE REQUIRED TO PERFORM TYRADES WITHIN THE DESIGNATED CLEAN ZONE ARE REQUIRED TO PERFORM THOSE TASKS UNDER THE PARAMETERS OF THE BUILD CLEAN PROTOCOL.

3.12 BUILDING SITEWORK

G. BUILDING SITEWORK

Site work for the proposed IRCB will include the site bound by Levy Ave. to the north and Engineering Drive to the west. Street crossings on Levy Ave to the existing transformer serving the proposed IRCB, and for gas and water services are included in the scope of the work. Street crossing on Levy Ave. for sanitary and storm water sewer connections are included in the scope of the work.

G10. Site Preparation

1. Site Clearing shall include:
   a. Stripping and stockpiling of top soil.
   b. Clearing of existing trees, shrubs, and other plant material.
2. Site Demolition & Relocations shall include:
   a. Remove and discard existing utility connections abandoned, curbs, water spouts, gratings and drains impacted by excavation or the footprint of the proposed building.
   b. Protection of existing trees will be required.
      - Provide 6'-0" high chain link fence per direction of the landscape architect and FSU project manager. Refer to Landscape Site Plan for trees to be protected during construction.
3. Hazardous Waste Remediation shall be completed by the Owner.
4.

G20. Site Improvements

1. Roadways - Patch and repair existing roadways where excavations are required for utility tie-ins. Provide new 'table top' pedestrian cross walk where indicated on Landscape Site Plan.
2. Parking Lots provide 250 parking spaces on site. Parking lot to be paved in accordance with FSU design and construction guidelines.
3. Pedestrian Paving as follows:
   a. 6'-0" pedestrian sidewalks - Sandblast finish, color to match custom University standard containing 70% fly ash.
   b. Entry plaza: Provide stone pavers and sandblast/thermal finish. Allow 600 sf of stone paving at the northwest main entry, and 600 sf at the south entry from parking.
4. Site Development - refer to Landscape Site Plan for areas of development and preservation.
5. Landscaping - refer to Landscape Site Plan for new work. Scope of Landscape Contract to include:
   a. All plantings as scheduled.
   b. Exterior signage, way finding, building signs, traffic signage etc.
   c. Bicycle racks shall be University Standard.
   d. Site Lighting shall match existing Innovation Park Standard.

3.13 ROOM CRITERIA

	Architectural					Plumbing									HVAC								
	Flooring	Base	Walls	Ceiling	Ceiling Hgt	Pure Water	Floor Drain	Waste	Eyewash	Emergency Shower	House Vacuum	Research Vacuum	House Gases	Process Gases	Recirculated	Air Changes	Air Velocity	Pressure	Temperature	Relative Humidity	Exhaust	Filtration	Process Cooling Water
Cleanroom (including Gowning, Tool Wipe-down)	Welded ESD Vinyl Tile	Integral	Aluminum Honeycomb / Epoxy PTB GWB	Aluminum Flush Grid	10'-0"	Grade E1 Electronic	AWN floor sinks	Acid Waste Neutralization	Yes	Yes	26" Hg	By Users	N2, CDA	Hi-purity TBD	Yes	90-275	70 fpm	0.05 wg	68° F ± 2°	44% ± 5%	Solvent & Corrosive systems	HEPA	Yes
Characterization/ Imaging - Electron Microscope Room	ESD on 2x2 access flooring	Vinyl	PTD GWB/Acoust Panel	Alum. Open Cell	13'-0"-16'-0"	No	No	No	No	No	No	By Users	N2, CDA	SF6	Yes	Per code for Fresh Air	15 fpm	NA	70° F ± 2°; 0.1° F/Min	30-60%	SF6	Prefilter	Yes
Characterization/Imaging - AFM, MS/GC, MPMS, PPMS	Welded ESD Vinyl Tile	Integral	PTD GWB/Acoust Panel	Cleanroom ACT	10'-0"	Grade E1 Electronic	No	Lab	Yes	Yes	Yes	By Users	N2, CDA	No	Yes	Per code for Fresh Air	NA	NA	70° F ± 2°	30-60%	No	HEPA	Yes
Characterization/Imaging - STM Room (Dilution Refrigerator)	ESD on 2x2 access flooring	Vinyl	PTD GWB/Sound Room Panels (TBD)	ACT/Sound Room Panels (TBD)	13'-0"-16'-0"	No	No	No	No	No	No	By Users	N2, CDA	No	Yes	Per code for Fresh Air	NA	NA	70° F ± 2°	30-60%	Cryogen quench purge	No	Yes
Materials Synthesis	Welded ESD Vinyl Tile	Integral	Epoxy PTD GWB	Cleanroom ACT	10'-0"	Grade E1 Electronic	No	Acid Waste Neutralization	Yes	Yes	Yes	By Users	N2, CDA	Hi-purity TBD	No	6 Minimum	NA	Negative	70° F ± 2°	30-60%	Solvent & Corrosive systems	HEPA	Yes

	Electrical				Lighting		Special Requirements			
	Power	Emergency Power	UPS	Grounding	Footcandles	Lamp type	Vibration	Acoustics	Shielding (EMI/RFI)	Clean Class
Cleanroom (including Gowning, Tool Wipe-down)	110V, 208V, 480V	Yes for controlled cooldown/ shutdown	By Users	Yes	80-100	LED (white and amber)	VC-D	NC-60	No	100/1000
Characterization/ Imaging - Electron Microscope Room	110V, 208V	No	By Users	Yes	100 Dimmable	LED	>VC-E	NC-25	TBD	No
Characterization/Imaging - AFM, MS/GC, MPMS, PPMS	110V, 208V	No	By Users	Yes	80-100	LED	VC-E	NC-40	No	No
Characterization/Imaging - STM Room (Dilution Refrigerator)	110V, 208V	No	By Users	Yes	80-100	LED	>VC-E	NC-40/NC-25 (with sound room panels)	TBD	No
Materials Synthesis	110V, 208V	Yes for controlled cooldown/ shutdown	By Users	Yes	80-100	LED	VC-C	NC-50	No	No

4

4. FUME HOOD SCHEDULE

FUME HOODS

Fume hoods in the IRCB will likely be mix of 5'-0" , 6'-0" and 8'-0" fume hoods.

The Basis of Design fume hood exhaust load is based on this fume hood schedule, which shows 58 fume hoods on Day 1, and an additional 24 fume hoods in the future, for a Full Build total of 82 fume hoods. At this time, the HVAC exhaust loads are based on the hoods operating at a face velocity of 100 fpm and a sash height of 18 inches.

Please refer to the MEP narrative in Section 3 for details regarding fume hood systems.

Fume Hood No.	Size	Type/ Material	Quantity			Sash Area	Air Volume (CFM) Face Velocity/Hood			Air Volume (CFM) Face Velocity/Hood/Floor		
			Day One	Future Add	IRCB Subtotal	18" Ht	70	80	100	70	80	100
FH-1	5'-0"	Standard Bench	5	0	**5**	6.25	437.54	500.04	625.05	2,188	2,500	3,125
FH-2	6'-0"	Chemistry	7	16	**23**	7.75	542.54	620.04	775.05	12,478	14,261	17,826
FH-3	6'-0"	Synthetic Chem	25	8	**33**	7.75	542.54	620.04	775.05	17,904	20,461	25,577
FH-4	6'-0"	Dispense/Waste	4	0	**4**	7.75	542.54	620.04	775.05	2,170	2,480	3,100
FH-6	8'-0"	Synthetic Chem	17	0	**17**	10.75	752.54	860.04	1,075.05	12,793	14,621	18,276
			58	**24**	**82**					**47,603**	**54,403**	**68,004**

Assumes 5" FH post

Percent Reduction of Air Flow		
70%	80%	100%

Fume Hoods by Level						
Size No.	5'-0"	6'-0" Chem	6'-0"` Synth	8'-0"	Day 1	Day 2
Level 3	4	5	10	8	27	43
Level 2	1	2	15	9	27	35
Level 1	2	2	0	0	4	4
Totals	7	9	25	17	58	**82**

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5. LEED CHECKLIST

LEED Checklist & Sustainability

During the schematic design phase to date, the design team and FSU stakeholders have held three sustainability meetings, including a kick-off session and 2 focused design charrettes, to set sustainability goals for the project. Those goals are described in a separate report dated 29 May 2015. We have not included the entire report here, but we do include the working draft of the project's LEED Checklist.

Related to sustainability and energy conservation, please refer to the MEP systems narrative in Section 3 for our statement of energy conservation measures and life cycle cost analyses proposed for the project.

LEED Checklist Update

LEED 2009 for New Construction and Major Renovations

Project Checklist

Y	?	N			
12	7	7	**Sustainable Sites**	Possible Points:	26
Y			Prereq 1	Construction Activity Pollution Prevention	
	1		Credit 1	Site Selection	1
		5	Credit 2	Development Density and Community Connectivity	5
		1	Credit 3	Brownfield Redevelopment	1
6			Credit 4.1	Alternative Transportation—Public Transportation Access	6
1			Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Roon	1
	3		Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Ve	3
2			Credit 4.4	Alternative Transportation—Parking Capacity	2
	1		Credit 5.1	Site Development—Protect or Restore Habitat	1
	1		Credit 5.2	Site Development—Maximize Open Space	1
1			Credit 6.1	Stormwater Design—Quantity Control	1
1			Credit 6.2	Stormwater Design—Quality Control	1
		1	Credit 7.1	Heat Island Effect—Non-roof	1
1			Credit 7.2	Heat Island Effect—Roof	1
	1		Credit 8	Light Pollution Reduction	1

4	6		**Water Efficiency**	Possible Points:	10
Y			Prereq 1	Water Use Reduction—20% Reduction	
2	2		Credit 1	Water Efficient Landscaping	2 to 4
	2		Credit 2	Innovative Wastewater Technologies	2
2	2		Credit 3	Water Use Reduction	2 to 4

7	12	16	**Energy and Atmosphere**	Possible Points:	35
Y			Prereq 1	Fundamental Commissioning of Building Energy Systems	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	Fundamental Refrigerant Management	
2	10	7	Credit 1	Optimize Energy Performance	1 to 19
		7	Credit 2	On-Site Renewable Energy	1 to 7
2			Credit 3	Enhanced Commissioning	2
2			Credit 4	Enhanced Refrigerant Management	2
1	2		Credit 5	Measurement and Verification	3
		2	Credit 6	Green Power	2

3	5	6	**Materials and Resources**	Possible Points:	14
Y			Prereq 1	Storage and Collection of Recyclables	
		3	Credit 1.1	Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 3
		1	Credit 1.2	Building Reuse—Maintain 50% of Interior Non-Structural Element	1
1	1		Credit 2	Construction Waste Management	1 to 2
		2	Credit 3	Materials Reuse	1 to 2

Y	?	N			
			Materials and Resources, Continued		
1	1		Credit 4	Recycled Content	1 to 2
1	1		Credit 5	Regional Materials	1 to 2
	1		Credit 6	Rapidly Renewable Materials	1
	1		Credit 7	Certified Wood	1

11	4		**Indoor Environmental Quality**		Possible Points:	15
Y			Prereq 1	Minimum Indoor Air Quality Performance		
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control		
1			Credit 1	Outdoor Air Delivery Monitoring		1
	1		Credit 2	Increased Ventilation		1
1			Credit 3.1	Construction IAQ Management Plan—During Construction		1
1			Credit 3.2	Construction IAQ Management Plan—Before Occupancy		1
1			Credit 4.1	Low-Emitting Materials—Adhesives and Sealants		1
1			Credit 4.2	Low-Emitting Materials—Paints and Coatings		1
1			Credit 4.3	Low-Emitting Materials—Flooring Systems		1
1			Credit 4.4	Low-Emitting Materials—Composite Wood and Agrifiber Product		1
1			Credit 5	Indoor Chemical and Pollutant Source Control		1
1			Credit 6.1	Controllability of Systems—Lighting		1
	1		Credit 6.2	Controllability of Systems—Thermal Comfort		1
1			Credit 7.1	Thermal Comfort—Design		1
1			Credit 7.2	Thermal Comfort—Verification		1
	1		Credit 8.1	Daylight and Views—Daylight		1
	1		Credit 8.2	Daylight and Views—Views		1

4	2		**Innovation and Design Process**		Possible Points:	6
	1		Credit 1.1	Innovation in Design: Exemplary Performance		1
1			Credit 1.2	Innovation in Design: Pilot Credit Approach		1
1			Credit 1.3	Innovation in Design: Process Water Use Reduction		1
1			Credit 1.4	Innovation in Design: Campus ID Credits		1
	1		Credit 1.5	Innovation in Design: Integrated Pest Management		1
1			Credit 2	LEED Accredited Professional		1
2	1	1	**Regional Priority Credits**		Possible Points:	4
1			Credit 1.1	Regional Priority: EAc1 (28%)		1
	1		Credit 1.2	Regional Priority: MRc5 (20%)		1
		1	Credit 1.3	Regional Priority: SSc2 Development Density		1
1			Credit 1.4	Regional Priority: SSc4.1 Public Transportation Access		1
43	37	30	**Total**		Possible Points:	110

Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 to 110

Likely	Maybe	Unlikely
43	37	30

Certified: 40-49 points

Silver: 50-59 points

Gold: 60-79 points

Platinum: 80-110 points

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6. CODE SUMMARY & ACCESSIBILITY APPROACH

6.1 CODE SUMMARY

CODE COMPLIANCE – CONCEPT PHASE

Introduction

This report serves as a Concept Phase Preliminary Code Narrative for the proposed Interdisciplinary Research & Commercialization Building (IRCB) at Florida State University. The narrative describes the applicable codes, and at a high level, the code approach for the project.

Project Description

The proposed IRCB is planned to be approximately 120,000 to 130,000 gross square feet with 3 occupied stories plus an unoccupied mechanical penthouse floor. A typical laboratory floor level has an area of approximately 40,000 gsf. The lowest level will be designed as a story above grade on the sloping site. The building will contain laboratories, imaging facilities, cleanroom facilities, and meeting and office spaces.

Use and Occupancy

The building contains the following occupancy classifications and uses (FBC 302.1).

Applicable Codes	Based on this standard:
2014 Florida Building Code, Building (FBC-B)	2012 International Building Code
2014 Florida Building Code, Mechanical (FBC-M)	2012 International Mechanical Code
2014 Florida Building Code, Fuel Gas (FBC-FG)	2012 International Fuel Gas Code
2014 Florida Building Code, Plumbing (FBC-P)	2012 Fuel Gas Code
2014 Florida Building Code, Energy Conservation (FBC-EC)	Replaces FBC-B Chapter 13
2014 Florida Building Code Accessibility (FBC-A)	Replaces FBC-B Chapter 11
2015 Florida Fire Prevention Code (FFPC)	2012 NFPA 1 and NFPA 101
2011 NFPA 70, National Electrical Code	
2010 NFPA 13, Standard for Installation of Sprinkler Systems	
2010 NFPA 72, National Fire Alarm & Signaling Code	
2012 NFPA 30, Flammable Liquids & Combustible Liquids Code	
2012 NFPA 318, Standard for the Protection of Semiconductor Fabrication Facilities	

* Based on the anticipated design and construction schedule for the project, the applicable codes would be:

- 2013 FFPC if adopted as currently scheduled on 31 December 2014
- 5th edition FBC (based on 2012 IBC) if adopted as currently scheduled in April 2015.

Occupancy Classification	Uses
Business (Group B) Occupancy	Offices, Classrooms, or Conference Rooms containing 49 occupants or less, Laboratories
Assembly (Group A-3) Occupancy	Conference and/or Classrooms with more than 50 occupants
High Hazard (Group H-5) Occupancy	Clean Room and support spaces
High Hazard (Group H-2, H-3, H-4) Occupancy	Bulk Chemical Storage
Low Hazard Storage (S-2) Occupancy	Storage Rooms, MEP Rooms

Floor Level	Functions (Use Groups)
L1	Entry/Lobby, Offices, Imaging Labs (B), Cleanroom (H-5), Bulk Chemical Storage (H-2, H-3, H4), MEP Rooms & Storage (S-2)
L2	Research Laboratories & Office/Conference Spaces (B), possible meeting room with >49 persons (A-3)
L3	Research Laboratories & Office/Conference Spaces (B), possible meeting room with >49 persons (A-3)
Penthouse (L4 – unoccupied)	Mechanical (S-2)

Height, Area and Construction Classification

The building will be less than 75 ft in height from the lowest level of fire department vehicle access to the highest occupied floor level, and thus will not be considered a high-rise building (Section 403).

Based on the height of the building, and including allowable height and area increases, the building could potentially be constructed of Type IIA (1 hr) protected non-combustible construction. However, to comply with requirements for 2 hour horizontal separations between FBC control areas, 2 hour floor assemblies and supporting construction, is required. So, if the more restrictive FBC requirement for "control areas" are the basis for the design of the laboratory spaces rather than the less restrictive FFPC's requirement for "laboratory units", then Type IB (2 hr) protected non-combustible construction is recommended.

Because these important details will be determined in the design phase, for the concept phase report we have assumed that the higher construction type (Type IB) will be used. Based on Type IB construction, the height and area limitations of the applicable occupancies in the building will be as follows:

Type IB *(tabular limits, without allowable height & area increases)*		
Occupancy	Height (stories)	Area (square feet)
B	11 stories	Unlimited
A-3	11 stories	Unlimited
S-2	11 stories	79,000
H-2	3 stories	16,500
H-3	6 stories	60,000
H-4	7 stories	Unlimited
H-5	4 stories	Unlimited

- Automatic Suppression system increase: The building will be fully sprinklered but this allowable increase is not needed to comply with height and area limits, and is not included.
- Open perimeter increase: the building will be fully sprinklered and has at least 50% frontage, but this allowable increase is not needed to comply with area limits, and is not included.
- Height and Area Evaluation: The building will comply with the height and area limits allowable by code for the proposed Type IB construction.

Hazardous Materials Considerations

1. The cleanroom will be designed as an H-5 fabrication area following the FBC Quantity Limits for Hazardous Materials in a single fabrication area in Group H-5
   - See Section 7.3 for FBC Table 415.8.2.1.1 showing the quantity limits.

2. All other laboratory spaces will be Group B (with separate H-2/H-3/H-4 chemical storage if needed), and will be designed to comply with one or both of the following code requirements, subject to confirmation from the AHJ.

   a. FBC: Group B Control Areas - FBC Table 307.1 Maximum Allowable Quantities per Control Area of Hazardous Materials, by Floor.
      - See Section 7.2 of this report for quantity limits by floor calculated from FBC Table 307.1

   b. FFPC: NFPA 45-2004 Table 10.1.1 - requirements for Laboratory Units.
      - See Section 7.2 of this report for NFPA 45-2004 Table 10.1.1

   A meeting with the AHJ is needed early in the design phase to confirm the applicable code requirement(s).

6.2 ACCESSIBILITY APPROACH

MEMORANDUM

TO:	IRCB File – **Schematic Design – Accessibility Coordination**
FROM:	Matt Leslie
DATE:	1 June 2015
RE:	FSU IRCB WA Job 7300-00
Copies:	Biff Quarles, Mary Jo Spector, Chris Martin, Jeff Puleo

At Biff's suggestion, I called Amber Wagner, the Assistant Director and ADA Coordinator, Office of Equal Opportunity & Compliance at FSU.

The purpose of the call was to introduce ourselves and briefly review the IRCB project, and to understand any special accessibility concerns or issues early in the design process.

1. We reviewed current sketches of the site plan and floor plans.

   a. The site is at the corner of Levy Ave and Engineer Drive on Southwest Campus, and it slopes from the southwest down to the northeast corner. Despite the slope, the approaches to the building will likely be accessible without the need for ramps.
   b. The building is a 3 story research laboratory, with shared core facilities on ground level and dedicated interdisciplinary research labs on the two upper floors. The shared core facilities will be a draw, and will be used by the building occupants and by other FSU researchers, meaning that the user population will likely vary more than a department based research facility.
   c. The plan is "U" shaped, with 2 lab wings and 1 office wing oriented around an outdoor courtyard.
   d. There are no teaching spaces for undergraduates; the building will be occupied by faculty, post doc, grad students, and staff.
   e. The main building entrances from street corner to the north, and from the parking lot to the south, enter into an open area which links the 2 lab wings and the office wing.
   f. The open area includes conference rooms and collaboration spaces looking out to the courtyard, and an open stair connecting the 3 floors.

2. Discussion:

   a. FSU does not require push button actuated door openers, but she likes to see them on main entrance doors. I told her there would be card access to the building, and that door openers would likely be provided at the two main entrances.
   b. Amber asked about how accessibility to the cleanroom could be accommodated if necessary at any point. Would there be any barriers, and could they easily be removed? I described this as more of an operational issue if/when it became necessary (possible dedicated clean wheelchair in gowning area, etc.).
   c. If there is a green roof/terrace area as shown on the current plans, it must be accessible.
   d. Amber asked that we provide at least one single stall unisex restroom in the building. I told her this was common in our university projects, and good practice.
   e. I confirmed that the required accessible parking spaces would be located closest to the building. Amber mentioned that striping of parking spaces has been problematic at times, in terms of meeting the required number and size of spaces.

3. We agreed to meet when the design is further developed, timing to be determined.

4. Amber noted that FSU uses the 2012 Florida Accessibility Code, which incorporates the 2010 ADA Standards.

End of Memo

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7. SPACE ANALYSIS & PROBABLE COST

7.1 SPACE ANALYSIS

ARCHITECT / ENGINEER ESTIMATE SUMMARY & BUDGET COMPARISON

Project Name: FSU IRBC (Interdisciplinary Research & Commercialization Bldg.) FS-275 Date: 4 June 2015

Estimated Building Construction Cost						Probable Construction Cost by Phase:						
Space Type	NASF	NASF/GSF Factor	(a) GSF	(b) $/GSF	Total Cost (a x b)	Approved Program NASF Jan. 2015	Program Verification NASF 27-May-15	Concept Schematics NASF 4-Jun-15	Advanced Schematics NASF Date:	Design Developmt NASF Date:	50% CDs NASF Date:	100% CDs NASF Date:
Research Lab	33,140	1.89	62,614	$420	$26,297,931	33,165	33,140	33,140				
Cleanroom/ Mat.Synth.	6,578	1.89	12,428	$707	$8,786,848	6,562	6,578	6,578				
Imaging/ Charact.	5,200	1.89	9,825	$472	$4,637,299	5,280	5,200	5,200				
Office/Conf. Room	20,555	1.89	38,836	$308	$11,961,564	21,000	20,555	20,555				
Building Support	3,015	1.89	5,696	$296	$1,686,160	3,015	3,015	3,015				
Totals	68,488	1.89	129,400	$412	$53,369,803	69,022	68,488	68,488				
				Efficiency Factor		1.81	1.83	1.89				
				Total GSF		125,068	125,470	129,400				
				Cost per GSF		$412	$412	$412				
				Bldg. Constr. Cost		$51,495,565	$51,748,919	$53,369,803				

Note: this is ~3.5% higher than the approved program budget simply because the area is 3.5% greater and we have not adjusted the unit costs/GSF. At Advanced Schematics, the CM will provide a detailed cost estimate to verify the budget, however our opinion at this time is that the project can be completed within budget.

Proposed additive alternates (with estim. Cost)

1.
2.
3.
4.
5.

Professional Services Guide Criteria (per subparagraph 3.14.2)

Bldg. GSF (3.14.2.1)

Net Assignable Sq. Ft. (3.14.2.2)

Covered Walkway GSF (3.14.2.3)

7.2 PROBABLE COST

ARCHITECT / ENGINEER ESTIMATE SUMMARY & BUDGET COMPARISON

Project Name: FSU IRBC (Interdisciplinary Research & Commercialization Bldg.) FS-275 Date: 4 June 2015

Construction Components	Probable Construction Cost by Phase:						
	Approved Program Jan. 2015	Program Verification 15-May-15	Concept Schematics Date:	Advanced Schematics Date:	Design Developent Date:	50% CDs Date:	100% CDs Date:
a. Building Construction Cost	$51,495,565	$51,748,919	$53,369,803				
b. Environmental Impacts / Mitigation	$0	NA	$0				
c. Demolition / Site Prep	$100,000	NA	$100,000				
d. Landscape / Irrigation (addt'l to const. contract)	$150,000	NA	$150,000				
e. Plazas/Walks/Bike Paths	$200,000	NA	$200,000				
f. Roadway Improvements	$100,000	NA	$100,000				
g. Parking (230 space originally programmed, 125 spaces now planned))	$300,000	NA	$300,000				
h. Telecommunications -Outside Plant (OSP)	$75,000	NA	$75,000				
i. Site Utilities	$330,000	NA	$330,000				
-- Escalation 6.16%	$3,249,435	NA	$3,249,435				
Total	$56,000,000	--	$57,874,238				

See Note on page 1

Signature

4-Jun-15
Date

WA

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8. PROJECT SCHEDULE

Project Schedule