

## **SCHEMATIC DESIGN BASIS OF DESIGN**

### **WAYNE STATE UNIVERSITY SCOTT HALL VIVARIUM UPDATES**

**PREPARED FOR:  
WAYNE STATE UNIVERISTY  
DETROIT, MI**

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**FTCH PROJECT NO. 190777  
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## LIST OF ABBREVIATIONS/ACRONYMS

BOD	Basis of Design
FTCH	Fishbeck, Thompson, Carr & Huber, Inc.
HVAC	Heating, Ventilating, and Air Conditioning
WSU	Wayne State University
OPR	Owner’s Project Requirements
VAV	Variable Air Volume

## INTRODUCTION

Wayne State University (WSU) is renovating the 10,400 SF Vivarium in the basement of the Gordon H. Scott Hall of Basic Medical Sciences (Scott Hall). Scott Hall is located at 540 East Canfield, Detroit, MI 48201. The project will upgrade the facility to meet current standards, including those for cage washing, ventilated cage racks and dedicated changing stations, controllability of systems, redundancy, and other aspects of daily operations.

Prior to design, WSU commissioned a study of the Vivarium, which resulted in identification of issues and conceptual recommendations for new systems, spaces, and phasing of construction. WSU is opting to pursue a single-phase approach to the renovation. Alterations include major mechanical and control upgrades, new electrical and lighting control systems, and a new space layout to improve flow, operations, and meet current and future user requirements.

The following Basis of Design (BOD) documents the concepts, design assumptions, requirements, decisions, rationale, and guidelines the designer incorporates in order to satisfy the Owner's Project Requirements (OPR). The BOD serves as a tool for communicating the designer's approach to meeting expectations of the facility function as stated by WSU.

## ARCHITECTURAL BASIS OF DESIGN

### REFERENCES

1. AAALAC including:
  - a. Guide for Care and Use of Lab Animals NRC 2011
  - b. European Convention for the Protection of Vertebrate Animals used for Experimental and Other Scientific Purposes, including Appendix A and B
2. WSU Design and Construction Standards, November 2018.
3. WSU Standards for Communications.
4. Scott Hall Vivarium Study prepared by iDesign Solutions.

### EXISTING CONDITIONS

The Scott Hall Vivarium was constructed in two phases, resulting in two different organizational strategies. The original portion, organized linearly along single Corridor 0400, was constructed in 1971 and the cage wash area was renovated with new equipment in 1997. A second animal holding area was constructed in 1985 in the space formerly occupied by non-animal-related research facilities. It is organized around racetrack style Corridor 0200.

### SELECTIVE DEMOLITION

1. In accordance with the scope of the concept plan:
  - a. Remove all equipment in the spaces and cap all utilities back to the closest main, as required.
  - b. Remove all concrete masonry walls, bond beams, and lintels, as required.
  - c. Remove sloped base, as required, for new walls.
  - d. Remove all acoustical ceilings and grid, as required.
  - e. Remove all casework, as required.
  - f. Remove hollow metal doors and frames, as required.
  - g. Remove concrete slab, as required, for new cage wash, autoclave, and drying pits.

### ENVIRONMENTAL REQUIREMENTS

The procedure and holding spaces shall meet the following temperature and humidity requirements. The system shall allow the end user to set the temperatures based on the species utilized in the studies.

1. Animal Holding Rooms and Procedure Rooms:
  - a. Requirements listed below are per the Guide and Care and use of Laboratory Animals by the Institute of Laboratory Resources, Commissioning on Life Sciences, National Research Council.

Species	Dry Bulb Temperature Range deg. C	Dry Bulb Temperature Range deg. F	Humidity Range
Mouse	18-26	64-79	30-70%
Rat	18-26	64-79	30-70%
Rabbit	16-22	61-72	30-70%

## 2. Feed and Bedding Room:

- a. Per the Guide and Care and use of Laboratory Animals by the Institute of Laboratory Resources, Commissioning on Life Sciences, National Research Council, the storage of natural-ingredient diets at less than 21 degree-C and below 50% relative humidity is recommended.

## CONCEPT PLAN ORGANIZATION

### 1. The revised plan can be broken down into four distinct zones:

- a. Entry and Administration area. This area allows for staff to enter a controlled area that has access to a locker room with unisex toilet room and the Administrative Area that can directly observe all those entering the facility.
- b. Standard holding areas with their associated procedure rooms.
- c. Specialty holding and procedure rooms that are isolated from the main corridor by a door. This area provides holding rooms for hazardous and light controlled studies. The Quarantine/flex space is also located in this area so that it can utilize the egress only vestibule, allowing incoming animals to be isolated from the rest of the housed animals in the facility.
- d. The Support area is located between the two holding areas and provides a cage wash facility, feed and bedding, laboratory and storage areas for the general use of all staff, and a clean cage storage area.

## ROOM DATA

### 1. Animal Holding Room – Type 1 Standard

- a. Number of Rooms: Six (6)
- b. Adjacencies: Near or direct connection to the procedure room:
  - 1) Three (3) holding rooms have a direct connection to a procedure room.
  - 2) Three (3) holding rooms are near their procedure rooms.
- c. Species: Mice, Rats.
- d. Bio-Containment Level: BSL2.
- e. Pressure: Negative to corridor.
- f. Cages: Eight (8) ducted ventilated racks of 140 cages, with a direct connection to exhaust.
- g. Equipment:
  - 1) Allentown Phantom: 4'-0" Laminar flow change station
  - 2) 5'-0" Tecniplast Safe seal 2GM 140 Cage rack:
    - a) Tecniplast library type ventilation system
- h. Utilities:
  - 1) Wall hung sink with hot and cold water.
  - 2) Animal watering system using tap water with online rack flushing capabilities.
  - 3) Electrical receptacles on emergency power.
- i. Lighting Controls: Refer to electrical section.
- j. BAS to monitor lighting levels, temperature, relative humidity, and pressure.

- k. Cleaning SOP: Wipe down spaces.
- 2. Animal Holding Room – Type 2 Light Cycle
  - a. Number of Rooms: Three (3)
    - 1) Two (2) animal holding rooms are to be light cycle rooms.
    - 2) One (1) animal holding room is to be 24-hour dark.
  - b. Adjacencies: All three rooms will be off a ante room/corridor.
  - c. Species: Mice, Rats.
  - d. Bio-Containment Level: BSL2.
  - e. Pressure: Negative to the corridor.
  - f. Cages: Eight (8) ducted ventilated racks of 140 cages with a direct connection to exhaust.
  - g. Equipment:
    - 1) Allentown Phantom - 4'-0" Laminar flow change station
    - 2) 5'-0" Tecniplast Safe seal 2GM 140 Cage rack:
      - a) Tecniplast library type ventilation system
  - h. Utilities:
    - 1) Wall hung sink with hot and cold water.
    - 2) Animal watering system using tap water with online rack flushing capabilities.
    - 3) Electrical receptacles on emergency power.
  - i. Lighting Controls: Refer to electrical section.
  - j. BAS to monitor lighting levels, temperature, relative humidity, and pressure.
  - k. Cleaning SOP: Wipe down spaces.
  - l. Special Requirements: Provide light tight seals on doors and internal shades on door lights
- 3. Animal Holding Room – Type 3 Hazard
  - a. Number of Rooms: Two (2)
    - 1) Two (2) animal holding rooms are to be Hazard spaces.
  - b. Adjacencies: Two (2) rooms will be off a ante room.
  - c. Species: Mice, Rats.
  - d. Bio-Containment Level: BSL2.
  - e. Pressure: Negative to the corridor.
  - f. Cages: Eight (8) ducted ventilated racks of 140 cages with a direct connection to exhaust.
  - g. Equipment:
    - 1) Nuair – 4'-0" Class II Type A2 Biological Safety Cabinet. Direct connection type required.
    - 2) 5'-0" Tecniplast Safe Seal 2GM 140 Cage rack:
      - a) Tecniplast library type ventilation system.

- h. Utilities:
    - 1) Wall hung sink with hot and cold water.
    - 2) Animal watering system using tap water with online rack flushing capabilities.
    - 3) Electrical receptacles on emergency power.
  - i. Lighting Controls: Refer to electrical section.
  - j. BAS to monitor lighting levels, temperature, relative humidity, and pressure.
  - k. Cleaning SOP: Wipe down spaces.
4. Animal Holding Room – Type 4 Flex
- a. Number of Rooms: Four (4)
    - 1) These spaces can either be set up as procedure rooms or animal holding spaces.
    - 2) In order to maintain the two to one relationship between holding spaces and procedure rooms, three of these will need to be procedure rooms and one can be either a holding room or quarantine, based on the needs of the facility.
    - 3) One of the four can be utilized as a quarantine space, if required, since it has a direct connection to the egress vestibule. If used as quarantine, the two doors will need to have a locking system allowing for one door to be locked while in use, not allowing access into the space.
  - b. Adjacencies: Varies based on setup.
  - c. Species: Varies.
  - d. Bio-Containment Level: BSL2.
  - e. Pressure: Negative to the corridor.
  - f. Cages: Eight (8) ducted ventilated racks of 140 cages with a direct connection to exhaust.
  - g. Equipment:
    - 1) Holding: Nuair 4'-0" Class II Type A2 Biological Safety Cabinet. Direct connection type required.
    - 2) Holding: 5'-0" Tecniplast Safe Seal 2GM 140 Cage Rack.
    - 3) Holding: Tecniplast library type ventilation system.
    - 4) Procedure: Nuair - 4'-0" Class II Type A2 Biological Safety Cabinet.
    - 5) Procedure: Stainless steel mobile tables with painted metal mobile cabinet below.
  - h. Utilities:
    - 1) Wall hung sink with hot and cold water.
    - 2) Animal watering system using tap water with online rack flushing capabilities.
    - 3) Electrical receptacles on emergency power.
  - i. Lighting Controls: Refer to electrical section.
  - j. BAS to monitor lighting levels, temperature, relative humidity, and pressure.
  - k. Cleaning SOP: Wipe down spaces.

5. Procedure Room:
  - a. Number of Rooms: Two (2)
    - 1) Procedure rooms will need to be designed so that they can house animals.
    - 2) Three of the procedure rooms are part of the flex animal holding rooms.
  - b. Adjacencies: Direct connection or near animal holding rooms.
  - c. Bio-Containment Level: ABSL2.
  - d. Pressure: Negative to corridor.
  - e. Equipment:
    - 1) One (1) Nuair Class II Type A2 BSC's per procedure room. Connection type is to be recirculating or a direct connection. No thimbles to be used.
  - f. Casework:
    - 1) Painted metal base cabinets with epoxy tops. Provide glass fronted wall cabinets above fixed benches.
    - 2) Mobile stainless steel tables with painted metal mobile cabinets below.
  - g. Utilities:
    - 1) Wall hung or bench mounted sink with hot and cold water.
    - 2) Animal watering system using tap water with online rack flushing capabilities.
    - 3) Electrical receptacles on emergency power.
    - 4) Data.
    - 5) CO2 and O2 at two locations.
6. Laboratory:
  - a. Number of Rooms: One (1)
  - b. Adjacencies: Passage.
  - c. Bio-Containment Level: ABSL2.
  - d. Pressure: Negative to corridor.
  - e. Equipment:
    - 1) One (1) four-foot bench top fume hood. No utilities are required in the hood but power.
    - 2) One (1) chest freezer.
  - f. Fixed Casework:
    - 1) Epoxy resin work surface with painted metal cabinets above and below.
  - g. Utilities:
    - 1) Electrical receptacles on emergency power.
    - 2) Data.
    - 3) Under mount epoxy sink with process hot and cold water.



## 7. Clean Cage Wash:

- a. Number of Rooms: One (1)
- b. Adjacencies: Passage and storage room.
- c. Bio-Containment Level: ABSL2.
- d. Pressure: Negative to corridor.
- e. Equipment:
  - 1) Refer to dirty side cage wash for additional equipment.
  - 2) Better Built bottle fill station.
- f. Fixed Casework: None.
- g. Utilities:
  - 1) Electrical receptacles on emergency power.
  - 2) Stainless Scullery Sink with drain boards on each side and process hot and cold water.
  - 3) Compressed air reel.
  - 4) Steam capture hood above autoclave and cage/rack washer.
- h. Special Requirements:
  - 1) Drip pit with protruded fiberglass grating, similar to Strongwell Dura grate.
  - 2) Stainless steel modular equipment enclosure.

## 8. Dirty Cage Wash:

- a. Number of Rooms: One (1)
- b. Adjacencies: Passage and detergent room.
- c. Bio-Containment Level: ABSL2.
- d. Pressure: Negative to corridor.
- e. Equipment:
  - 1) Better Built Cage/Rack Wash Model R630
  - 2) Better Built Bottle Wash Model C520
  - 3) Primus Floor Mounter Autoclave Model PSS11-P-MSDD
  - 4) Nuaire AllerGard ES NU-607 Class I HEPA filtered Animal Bedding Disposal Station
  - 5) Pressure washer and curtain
- f. Fixed Casework: None.
- g. Utilities: (Verify based on selected equipment)
  - 1) Electrical receptacles on emergency power.
  - 2) Stainless Scullery Sink with drain boards on each side and process hot and cold water with prewash fixture.
  - 3) Compressed air.
  - 4) Steam (provide steam generator).
  - 5) Hot and cold water.

- 6) Drain.
  - 7) Vents required for Autoclave and cage/rack washer.
  - h. Special Requirements:
    - 1) Pits for Autoclave, cage/rack washer, and wash down area.
  - i. Stainless steel equipment modular enclosure wall with door into service area.
9. Feed and Bedding:
- a. Number of Rooms: One (1)
  - b. Adjacencies: Passage.
  - c. Bio-Containment Level: ABSL2.
  - d. Pressure: Negative to corridor.
  - e. Equipment:
    - 1) Under counter refrigerator.
  - f. Fixed Casework:
    - 1) Epoxy resin worksurface with painted metal base cabinets below and glass front wall cabinets.
  - g. Utilities: (Verify based on selected equipment)
    - 1) Electrical receptacles on emergency power.
    - 2) Undermount epoxy resin sink with hot and cold water.
10. Laundry:
- a. Number of Rooms: One (1)
  - b. Adjacencies: Administration area.
  - c. Bio-Containment Level: ABSL2.
  - d. Pressure: Not controlled.
  - e. Equipment:
    - 1) Washer and dryer.
  - f. Fixed Casework:
    - 1) Built-in 24" deep solid surface countertop.
  - g. Utilities:
    - 1) Electrical receptacles.
    - 2) Washer dryer hook up with hot and cold water and drain.
    - 3) Lint collection system.
11. Toilet & Locker Room:
- a. Number of Rooms: One (1)
  - b. Adjacencies: Vestibule.
  - c. Bio-Containment Level: ABSL2.
  - d. Pressure: Not controlled.

- e. Equipment:
    - 1) Fourteen (14) 13" wide half high lockers.
    - 2) Coat hooks.
    - 3) Bench with capture shoe rack below.
  - f. Fixed Casework: None.
  - g. Utilities:
    - 1) Electrical receptacles.
    - 2) Hot and cold water.
    - 3) Floor mounted toilet.
    - 4) Wall mounted hand sink.
12. Ante Room:
- a. Number of Rooms: One (1)
  - b. Adjacencies: Holding rooms.
  - c. Bio-Containment Level: ABSL2.
  - d. Pressure: Negative.
  - e. Equipment: None.
  - f. Fixed Casework: None.
  - g. Utilities:
    - 1) Electrical receptacles.
13. Administration Area:
- a. Number of Rooms: Three (3)
    - 1) Includes enclosed vet office.
    - 2) Breakroom.
    - 3) Enclosed agile seating area.
  - b. Adjacencies: Vestibule.
  - c. Bio-Containment Level: None.
  - d. Pressure: Not controlled.
  - e. Equipment:
    - 1) Refrigerator/freezer
  - f. Fixed Casework:
    - 1) Breakroom: Solid surface worksurface with painted metal base and glass front wall cabinets. Provide a stainless-steel drop in sink.
    - 2) Agile Seating Area: Solid surface built in desk with file cabinets below. Provide wall shelving on two walls.

- g. Utilities:
  - 1) Electrical receptacles.
  - 2) Data.
  - 3) Hot and cold water.
- h. Special Requirements: Visibility
  - 1) Breakroom: Provide visual connection between the break area and vestibule.
  - 2) Office Area: Provide visual connection between the office and break room and vestibule.
  - 3) Agile seating area: Provide visual connection between break room and agile seating area.

## INTERIOR FINISHES

1. General: The materials will be durable and low maintenance, utilizing renewable and recycled materials, as appropriate. However, this is not considered to be a LEED project.
2. Flooring:
  - a. Administrative Area: Vinyl composition tile.
  - b. All floors in the vivarium shall install a vapor barrier coating and epoxy flooring with integral cove base.
3. Walls:
  - a. Construction: 8" nominal concrete masonry units.
  - b. Paint all walls with epoxy paint, color to match existing facility.
  - c. All walls to have stainless steel corner guards and wall rails mounted high and low on the wall.
4. Ceiling:
  - a. Holding Rooms:
    - 1) Suspended gypsum wall board ceiling painted with epoxy paint.
  - b. Vestibule, Procedure, Laboratory, Feed and Bedding, Storage, Circulation, Ante Rooms, and Administration Area:
    - 1) Ceiling Tile: 2' x 4' x 1/2" white lay in ceiling tile; similar to Climaplus clean room
    - 2) Ceiling Grid: 1-1/2" exposed tee system with gaskets and hold down clips.
  - c. Cage Wash:
    - 1) Ceiling Tile: 2'-0" x 4'-0" fiberglass composite ceiling panels; similar to Life Science products grid lock system.
    - 2) Ceiling Grid: Fiberglass Suspension System with gaskets and hold down clips. Provide access panels as required.
5. Doors and Interior Windows:
  - a. Doors:
    - 1) Animal Holding and Procedure Rooms: 3'-6" x 7'-0" hollow metal door and frame.
    - 2) Cage Wash: Automatic sliding doors.
    - 3) Other Doors: 3'-0" x 7'-0" hollow metal door and frame.

- b. Glazing:
    - 1) Holding: 2'-0" x 1'-0" laminated glass with red inner layer and internal blinds.
    - 2) Administrative Area: Clear laminated.
  - c. Kickplates: Stainless steel kickplates on each side of the door.
  - d. Hardware:
    - 1) Holding and procedure rooms to have continuous hinges.
    - 2) Door hardware to be selected during design development.
    - 3) Card readers may be located on all animal holding rooms and entry locations.
    - 4) Provide hardware on stairway doors to allow no entry from inside the stairway.
  - e. Windows:
    - 1) Administrative area shall be hollow metal frames and glass; size and location to be determined.
6. Lab Casework:
- a. New Casework: Manufacturer, style, and color to be selected during Design Development phase.
  - b. New casework will be fixed modular 36" high painted steel cabinets with a 1" thick epoxy resin top and mobile tables with 1" thick epoxy top. Provide one mobile base cabinet below each mobile table.
7. Safety Equipment:
- a. Each sink in a procedure room shall have a deck mounted dual purpose eye wash/drench hose.
  - b. Safety stations shall be located in the corridor throughout the facility, as required.
  - c. The Laboratory shall have a recessed barrier-free safety station, which includes an emergency shower and swing down eye/face wash. Thermostatic mixing valves and backflow preventers shall be provided for each emergency shower and eye/face wash.
  - d. Location for personal protection equipment, first aid, and spill kits to be determined.
8. Exhaust System:
- a. Class II Type A2 Biological Safety Cabinets: Two cabinets are to have a direct connection.
  - b. Fume Hood: Direct connect.
  - c. Holding rooms exhaust drops.
  - d. Ventilated Rack Connection: 6" stainless steel duct with slide damper to extend below the ceiling by 6". Users to connect to the drops by flexible hosing as required. Verify size and quantity required based on ventilated rack manufacturer and rack layout for each space.
  - e. Procedure Room Exhaust Drops:
    - 2) Provide one (1) 6" stainless steel duct with slide damper to extend below the ceiling by 6" in each space for future animal rack.
    - 3) Provide an additional 6" stainless steel duct with slide damper to extend below the ceiling by 6" in each space, in two (2) spaces for future local exhaust vents (LEV).

9. Lab Utilities:
- a. General: All utilities shall be distributed from overhead through an umbilical or wall chase.
  - b. House Distributed Gasses:
    - 1) Gasses: CO<sub>2</sub> and O<sub>2</sub> gasses to be distributed from central closet with manifolds and cylinder restraints.
    - 2) Procedure Room Gases: Provide wall mounted service block for CO<sub>2</sub> and O<sub>2</sub>.
    - 3) Compressed Air: Provide a small compressor to supply compressed air to cage wash equipment and cord reel.
  - c. Electrical:
    - 1) Holding Rooms and Cage Wash: Provide recessed electrical outlets with weather tight covers. Spacing to be confirmed during the design development phase.
    - 2) If surface mounted conduits are required, they shall be installed with standoffs and all back boxes shall be caulked.
    - 3) Procedure Rooms and Laboratory: Dual duct surface mounted raceway with power and data.
  - d. Emergency Power: Provide emergency power as required.
  - e. Plumbing:
    - 1) Sinks:
      - a) Basis of Design for all fixtures is Water Saver.
      - b) All sinks to have hot and cold water.
      - c) Animal Holding Rooms: Surface mounted sink.
      - d) Laboratory: Epoxy resin undermount sink.
      - e) Cage Wash: Stainless steel triple tub with drain boards. Provide a prewash fixture on the dirty cage wash side.
      - f) Procedure Rooms: Epoxy resin undermount or wall mounted sink.
      - g) Breakroom: Drop-in stainless-steel sink.
  - f. Phone/Data:
    - 1) Phone Locations: Vet office, Agile seating area, and laboratory. Locations to be verified.
    - 2) Data is required in procedure rooms, administrative area, and cage wash. Locations to be verified.
  - g. Security:
    - 1) Card readers on the perimeter doors into the facility.
    - 2) Animal holding rooms may have card readers. To be verified.

## MECHANICAL BASIS OF DESIGN

### EXISTING CONDITIONS

#### HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

The Vivarium space is currently served by both AC-1 and AC-2. Ductwork extends from AC-1 to terminal units (TU) supplying the zones they serve. Ductwork extends from AC-2 to duct-mounted heating coils to the zones they serve.

1. Fume hood located in Room 0401 is served by EF-29.
2. Fume hood located in Room 0407 is ducted into the general exhaust system served by EF-3.
3. EF-3 also serves general exhaust within Suite 400.
4. The fume hoods located in Room 0401 and 0407 have auxiliary supply air connected into the top of the fume hood.
5. EF-1 serves the cage wash, cage wash support, Room 0406, and Room 0408.
6. Electrical Suite 200 is exhausted into existing incinerator and crematory rooms, served by EF-87.

#### HYDRONIC

1. The chilled water system supplying the Vivarium space is currently tied into the building's chilled water system.
2. The heating hot water system is currently tied into the building's steam-to-hot water heat exchangers.

### DEMOLITION

#### HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

1. AC-2, the associated piping, ductwork, and heating coils will be demolished.
2. AC-1 will be reduced in airflow but will continue to serve areas in the basement that are outside the scope of work. A preliminary TAB report of the existing system will be conducted prior to demolition to determine capacity.
3. EF-29, EF-3, and all associated ductwork will be demolished. The auxiliary supply air will be cut and capped prior to routing through the First Level.
4. Room 0405 exhaust ductwork will be demolished along with associated exhaust fan (EF-89).
5. Exhaust ductwork from cage wash, cage wash support, Storage Room 0406, and Electrical Room 0408 will be demolished back to main. The exhaust ductwork serving Suite 200 will be demolished and capped back to main.

#### HYDRONIC

1. The chilled water system supplying AC-2 cooling coil will be cut and capped back to the main. The chilled water connection to AC-1 will remain.
2. The heating coil piping for AC-2 will be demolished and cut and capped back to the main, while AC-1 will remain.
3. The HHW piping to the heating coils and TU's will be demolished back to their respective mains.

## **FIRE PROTECTION**

1. The existing building, including the project area, is fully sprinklered. A fire pump is in Fire Pump Room G-142 within basement Mechanical Equipment Room G-85. The building is supplied by three risers with isolation located outside the Fire Pump Room labeled as East Riser, West Riser, and Standpipe. The existing fire protection drawings indicate the project area is served by the East Riser.
2. The sprinkler layout within the project area will be revised to maintain compliance with NFPA 13.

## **PLUMBING AND LAB UTILITIES**

1. A complete plumbing system shall be provided in accordance with the 2015 Michigan Plumbing Code and local ordinances. Systems shall include sanitary and acid waste, and domestic hot and cold water with recirculating hot water return.
2. Existing cold water, hot water, and hot water return piping branch lines and mains within the corridor routed from Mechanical Equipment Room G-85 will be replaced. Mixing valves will be provided where required by code for handwashing fixtures. Laboratory sinks will not be provided with mixing valves. RO water will be provided from the building RO system as required.
3. Emergency fixtures will be provided within the spaces, as required, based on hazardous material usage or storage. Mixing valves will be provided as required by code. The combination emergency shower/eyewash units will be recessed wall with a drain outlet to allow for fixture testing. Floor drains will not be provided at the emergency fixtures.
4. New acid waste and sanitary piping will be provided to serve the project area. The new piping will tie into the existing sanitary and acid waste mains. An alternate for consideration in this project, the existing glass acid waste pipe located at the ceiling above the project area serving the First Floor may be replaced.
5. An existing air compressor located within Mechanical Equipment Room G-85 is providing compressed air to the cage washer in DLAR Room 410. The capacity of the existing compressor will be evaluated and will be utilized if it meets new equipment requirements. If the existing compressor does not meet laboratory requirements, a new compressor will be provided.
6. A central closet will contain CO2 and O2 cylinders and gas manifolds. A hard-piped distribution system will provide service to required spaces.

## **PIPING**

1. Sanitary and Vent Systems (above grade): Service weight "no hub" cast iron pipe with drainage pattern cast iron fittings.
2. Acid Waste System: Piping shall be selected to withstand the chemicals expected to be utilized within laboratories.
3. Domestic Hot and Cold Water (above grade): Type L hard drawn copper piping. Hot water will be recirculated system.
4. Compressed air.

## **FIXTURES AND EQUIPMENT**

1. Water Closets: Vitreous china, wall hung, 1.28 gpf high efficiency sensor flush valve.
2. Lavatories: Vitreous china, wall hung, sensor faucet and stainless steel, undermount, sensor faucet.
3. Breakroom Sink: Stainless steel.
4. Laboratory Sinks: Epoxy Resin or stainless steel, as required by laboratory.



5. Emergency Fixtures: Combination Emergency Shower, Eye/Face Wash. Barrier-free, recessed, wall mounted, stainless steel. Water collection drain pain with daylight drain at front of unit for drainage.

## HVAC – AIR SIDE

### HVAC SYSTEM DESIGN CONDITIONS

1. Indoor animal spaces in accordance with AAALAC standards:
  - a. Standard occupied temperature of 68 degrees F DB/50% RH Summer and 72 degrees F DB/30% RH Winter. These setpoints will meet macroenvironment conditions for mice, rats, hamsters, gerbils, guinea pigs, and rabbits. To meet researcher requirements, spaces will be able to be controlled as low as 65 degrees F summer and 78 degrees F winter.
  - b. Unoccupied (no animals or people in space) temperature limits of 80 degrees F Summer and 60 degrees F Winter.
  - c. Unoccupied mode shall be manually set for spaces with animals when rooms are unoccupied.
2. Indoor non-animal spaces in accordance with WSU standards:
  - a. Occupied temperature of 76 degrees F DB/50% RH Summer and 70 degrees F DB/30% RH Winter.
  - b. Unoccupied (no people in space) temperature limits of 80 degrees F Summer and 60 degrees F Winter.
  - c. Spaces for human occupancy only shall have an occupancy sensor integrated with the Building Management System to allow a dead band temperature offset when the building is in the occupied mode, but the space is unoccupied.
3. Sound Levels:
  - a. Laboratories NC- 40
  - b. Offices NC-30
  - c. Common Spaces NC-35
4. Outdoor:
  - a. In accordance with ASHRAE 90.1, CDS Trace 700 weather tape for Detroit with overrides and WSU Standards:
    - 1) Summer: 95 degrees F DB, 75 degrees F WB.
    - 2) Winter: -10 degrees F (reduced temperature due to 100% outdoor air requirement).
    - 3) CO2 level of 400 ppm.
    - 4) Ground reflectance of 0.2.

### AIR DISTRIBUTION AND EXHAUST SYSTEM DUCTWORK

All ductwork associated with the scope of work is required to be replaced in full.

1. Round or flat oval supply ductwork from AHU supply fan to terminal unit shall be sized per static regain. Supply ductwork systems shall be galvanized steel spiral wound, round or flat oval duct.
2. Low pressure/low velocity ductwork shall be galvanized steel spiral round or rectangular and constructed in accordance with SMACNA standards. Ductwork shall be sized based on 0.08 inches of water/100 feet of duct.
3. Terminal units serving offices and corridors will have a heating water coil.

4. Terminal units serving laboratories with fume hoods or exhaust requirements will have air valve supply and lab exhaust air valves for exhaust tracking. The supply air valve will have a heating water coil.
5. If sound attenuation is required, individual silencers will be used and duct liner will be avoided where possible. Duct sound attenuators shall be duct insertion type located as necessary to meet specific space sound level requirements.
6. Exhaust ductwork from laboratories containing fume hoods shall be stainless steel or PVC coated spiral, round, or flat oval.
7. Canopy exhaust in the ceiling will be located on either side of the cage wash. Exhaust ductwork shall be stainless steel construction.
8. Diffusers shall be 2 x 2, louvered face type, lay-in frame, or slot type with the ability to modify between horizontal and vertical throw patterns.
9. For diffusers in the vicinity of biosafety cabinets or fume hoods, laminar flow, lab-grade diffusers will be used to prevent cross-drafts from affecting hood capture.
10. Supply grilles shall be double deflection surface mounted.
11. Return and exhaust grilles shall be 1/2" x 1/2" grid, aluminum lay-in or surface mounted.

## AIR SIDE SYSTEMS

1. The HVAC system will have a new custom air handler provided solely for the Vivarium space. The new air handler will be a 100% outdoor air unit that contains filters, an energy recovery coil, heating coil, humidification manifold, cooling coil, and a supply fan array. The air handler will be sized for approximately 20,000 cfm.
  - a. For energy recovery, FTCH will investigate the option of a run-around loop vs a plate type.
    - 1) The run-around loop consists of a coil in the air handler and a coil in the exhaust air stream. A glycol solution would be pumped between these two coils to transfer energy between the exhaust air and outside air streams to reduce the overall heating and cooling demand.
    - 2) Plate type energy recovery consists of an energy exchanger that utilizes the heat from the exhaust air stream to pre heat the make-up air to reduce the required heat load of the system.
2. It is important that the Vivarium systems remain operational and are not impacted by maintenance activities or equipment failures. A conceptual way to address this need at the air handler level is to provide the new air handling unit with two separate air tunnels. The air handler would be one large unit with an interior wall down the middle that creates two tunnels. Each tunnel would contain the components listed above (fans, coils, filters, etc.), and each tunnel would be capable of being isolated from the system. In normal operation, the air handler would utilize both tunnels where both air tunnels would be seeing 50% of the airflow. The design of the air handler would keep the velocity through the components (coils and filters) around 300 – 350 fpm during normal operation. The air handler would have the ability to go into emergency mode where one of the tunnels is isolated. The active tunnel would be designed to provide 100% of the airflow. The velocity through the components would be higher than normal mode, but the design of the fans would account for this higher velocity. This approach will provide N+1 redundancy for all fans, coils, filters, dampers, and the associated controls.
  - a. Manufacturers: AHUs based on Trane, York, Daikin, and TMI.
3. The AHU will supply approximately 25 to 30 terminal units and lab air valves.
  - a. Office, breakrooms, and general spaces will be supplied by VAV terminal units with a reheat coil.
    - 1) Manufacturers: Supply terminal units based on Titus.

- b. Lab spaces will be supplied by air valves with a reheat coil and exhausted by air valves.
  - 1) Manufacturers: Supply/exhaust air valves based on CRC.

## HVAC – WATER SIDE

### CHILLED WATER

1. Two dedicated air-cooled chillers will be sized for the Vivarium's peak cooling load. Both chillers will be approximately sized for 60 tons. A potential location for the air-cooled chillers is on the Fourth-Floor roof. With the new air-cooled chillers, the Vivarium space would be completely removed from the building's main chilled water plant. Each chiller would be sized for 100% of the load providing N+1 redundancy. Each chiller will be designed to have multiple circuits so losing a compressor does not disable the entire chiller.
2. FTCH will investigate options for using the building chilled water plant for chilled water redundancy. A pre-construction testing of the chilled water system quality will need to occur if this option is used.

### HEATING PLANT

1. The heating system for the vivarium space will come from two steam to hot water heat exchangers. A heating water loop will be utilized to distribute hot water to heating devices throughout the vivarium space (reheat coils and air handling unit coils). To provide a measure of redundancy, parallel exchangers will be each be sized for 100% of the heating load. With the installation of the new heat exchangers, the Vivarium space will be completely removed from the buildings heating hot water system. Heating hot water distribution shall be by two parallel system pumps with variable frequency drives (VFDs) sized for 100% of the load. Heating water supply temperature shall be designed for 180 degrees F. Terminal unit heating coils will have a 20 to 30-degree delta T. AHU heating coils will be sized with a delta T of 40.

### CAGE WASH EQUIPMENT

1. Bottle Washer Connections: Steam, HW, CW, condensate, drain, vent, and air.
2. Cage and Rack Washer Connections: Steam, HW, CW, condensate, drain, vent, and air.
3. Bulk Steam Sterilizer Connections: Steam (50-80 psig), CW, drain, CA.

### EXHAUST FANS

1. General exhaust will be provided for all spaces within the Vivarium and will be connected to new Strobic Tri-Stack exhaust fans. The intent is to locate the Strobic Tri-Stack exhaust fans on the Penthouse roof.
2. Exhaust from laboratories with fume hoods shall go through a high plume induction laboratory exhaust fan based on Strobic Tri-Stack with heat recovery. The fan system shall have a redundant fan (each fan sized for 50% of full exhaust air flow).

### CONTROLS

1. Scott Hall currently has a Honeywell building control system. Basis of design for controls will be based on Honeywell to coincide with existing building controls.
2. Separate lighting and lab control systems will be integrated with the building HVAC BMS.
3. WSU Scott Hall currently utilizes both electronic and pneumatic controls. Small actuators, such as terminal units coil valves, will be electronic. Larger actuators AHU control valves will be pneumatic. Existing air compressor located in the basement will be utilized for new pneumatic systems.

## **FACILITY MONITORING SYSTEM**

1. Facility monitoring system (Aircuity) will be utilized throughout the vivarium space.

## ELECTRICAL BASIS OF DESIGN

### DEMOLITION

1. Remove all panelboards and feeders completely. Maintain overcurrent protection to re-serve new panelboards.
2. Remove all general and emergency lighting, switches, and wiring completely back to the panelboards. Retain existing conduit where practical to re-serve general or emergency lighting.
3. Remove all existing finished surface mounted raceways and conduits back to the panelboards,
4. Remove branch circuit for demolished mechanical equipment AC-2 and Exhaust Fans EF-29, EF-89, EF-1, and EF-3 back to associated motor control center.
5. Remove all branch circuits for lab equipment and operation equipment (hoods, cage wash machines, etc.) back to the panelboards.
6. Remove wiring completely to source.

### LIGHTING

1. Upgrade lighting with new LED luminaires with dimmable drivers for general lighting. Luminaires in the animal holding area will be weatherproof and fully gasketed with switchable red and white LEDs.
2. Upgrade lighting control to comply with latest energy code using vacancy sensors and occupancy sensors with manual override switches.
3. Lighting for staff areas shall utilize 4000 degree K LED's, while lighting for the animal holding areas shall be 5000 degree Kelvin, with a CRI greater than 80.
4. A central monitoring and control station for animal holding areas will be capable of the following:
  - a. Cycle Controls: Individual room light/dark cycle will be controlled via simple user interface to allow programming of diurnal cycles and any override durations.
  - b. Monitoring: A photocell will be located in each individual room to allow monitoring of light levels in the room for reporting and alarm purposes.
  - c. Overrides: A local switch at each individual room will be able to override the lighting in the room. Duration of override is programmable. During low and high light cycles, the switch will turn lighting off. During dark cycles, the override switch will turn the red LEDs on.
  - d. Alarming: When light levels are outside of programmed conditions, an alarm will provide notification at the control station and text alert to public safety.
5. The lighting control system will be Honeywell based or equal.

### ELECTRICAL POWER DISTRIBUTION SERVICE

1. The existing electrical service is comprised of a 13.2 KV lineup with a main-tie-main arrangement, served from two utility feeders. The facility has two (2) 2000 KW, 13.2 KV standby generators that back up the entire facility. No changes for the incoming service or generator systems are recommended.
2. The facility has a central uninterruptable power supply (UPS) system, however, power has not been allocated for the Vivarium. Any critical loads shall be served from localized UPS systems.
3. New 208Y/120V branch panelboards shall be installed to replace demolished panelboards to serve the new loads. The panels shall be served using the existing transformers and associated overcurrent protection. New feeders will be installed between the transformers and new panelboards. Wall repair shall be anticipated to accommodate new branch circuit conduit installation.

4. The overcurrent protective devices used in panelboards shall be thermal magnetic type circuit breakers. The distribution equipment shall be manufactured by Square D, General Electric, or Eaton.
5. Distribution equipment shall utilize copper for busses.

### **MECHANICAL REVISIONS**

1. Provide electrical support for new general and laboratory exhaust fans, air handling systems, and pumps for hot water heater systems. The intent is to reuse the existing motor control center and distribution equipment to serve the loads.
2. Provide electrical support for new water chillers.

### **GROUNDING SYSTEM CONSIDERATIONS**

1. A separate green insulated ground conductor shall be provided for each feeder and branch circuit.
2. All receptacles, switches, light fixtures, cable tray systems, panelboards, and electrical equipment shall be grounded and bonded in accordance with NEC.

### **MISCELLANEOUS ELECTRICAL**

1. In animal holding areas, GFCI receptacles with weatherproof, heavy duty covers will be provided.
2. New specification grade receptacles will be provided in staff areas. GFCI receptacles will be provided within 6'-0" of all sinks.
3. Special connection will be provided for cage wash equipment per manufacturer recommendations.

### **FIRE ALARM SYSTEM**

1. The existing building fire alarm system is a Simplex 4100 system, which shall be modified and expanded as required to accommodate the renovation.
2. The evacuation tone for rodent rooms only shall be produced by a separate audio control module and amplifier that generate a slow whoop or warble sound with a peak frequency below the hearing range of rodents (i.e. 500 Hz).

## BASIS OF DESIGN VERSION HISTORY

The following is a summary of the changes made to the Basis of Design document throughout Pre-Design, Design, Construction, and Occupancy and Operations. This information is critical to understand and document the trade-offs made and the resulting impact on the project.

<b>Rev. No.</b>	<b>Date</b>	<b>Description of Revisions</b>
1	08/23/2019	SD Preliminary Draft
2	08/26/2019	SD Final Draft
3	09/05/2019	SD Final Due