

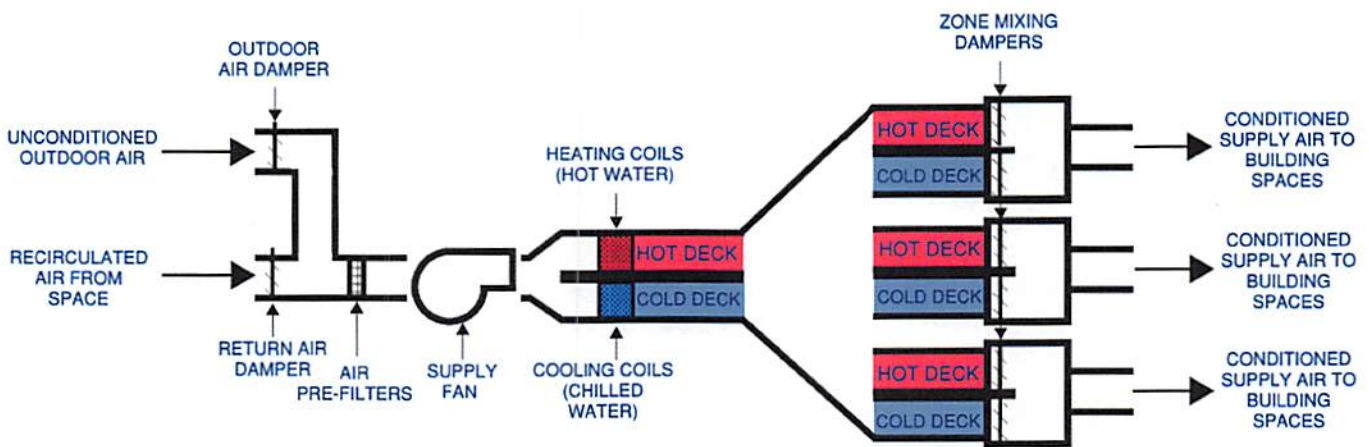
## BOYD GRADUATE STUDIES BUILDING

The Boyd Graduate Studies Building was originally built with multi-zone air handling units, one per floor. Outside air is provided through a chase that runs vertically through the center of the building and opens into each floor's mechanical room, where it mixes with return air from above the ceiling of each floor as the constant-speed fan in the air handling unit draws it through a wall of filters.

The 1<sup>st</sup> (2018), 7<sup>th</sup> (2013), and 8<sup>th</sup> (2009) floors have been renovated in recent years and now have modern variable-volume air handling units with air side economizer functions which increase ventilation when ambient temperature conditions allow it. Lecture room 328 has also been renovated with a demand-controlled ventilation unit and UV filtration.

### MULTI-ZONE AIR HANDLING UNITS (2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> Floors)

Each Multi-zone Air Handling Unit (AHU) provides ventilation, air filtration and movement, and heating and cooling functions to a single floor. Each AHU has a hot water heating coil and chilled water cooling coil that respectively generate parallel warm and cool air streams. The air flow is distributed to a number of ducts that exit the AHU to serve individual zones, which may be single rooms or groups of rooms depending on their size. Each zone's duct has a mixing damper that allows only warm air, only cool air, or a mixture of the two, depending on the signal being sent from the zone thermostat. Ventilation is provided at each AHU by drawing a mixture of fresh air from outdoors and recirculated air from the floor being served by each AHU.



**MULTI-ZONE AIR HANDLING SYSTEM SCHEMATIC**

## VARIABLE VOLUME AIR HANDLING UNITS (1<sup>st</sup>, 7<sup>th</sup> and 8<sup>th</sup> Floors)

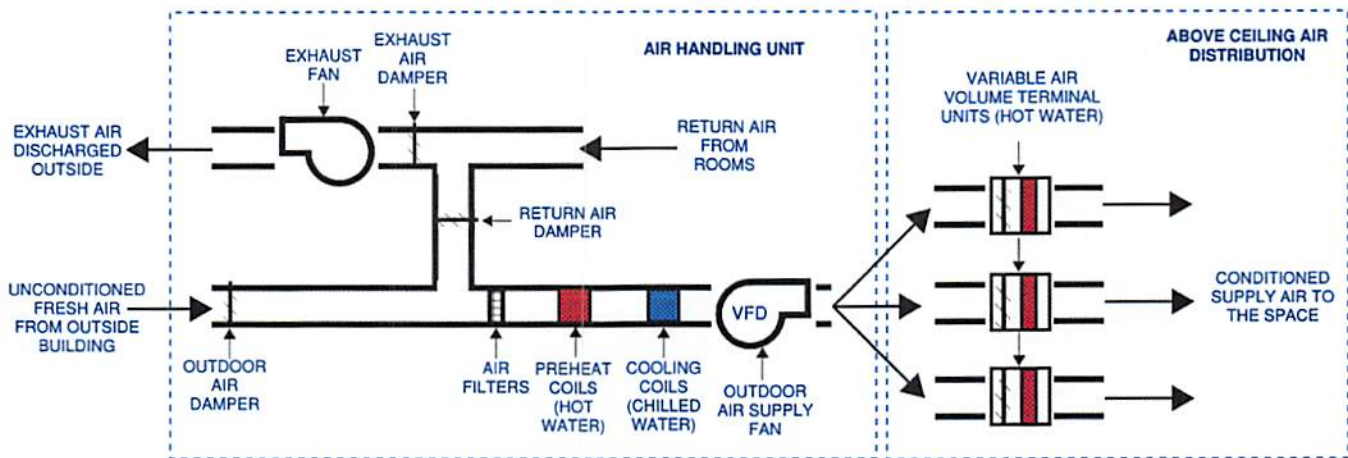
Variable Volume Air Handling Units (AHUs) deliver a variable volume of conditioned air consisting of a mixture of recirculated building air and fresh air from outside of the building. The building return air is mixed with outdoor air, filtered and cooled with chilled water coils in each of the two building air handling units before being supplied to rooms throughout the building via above ceiling ductwork.

Space heating is provided by Variable Air Volume terminal units (VAVs) with hot water reheat coils located in supply ductwork throughout the building. The VAVs are equipped with an air damper to regulate the volume of air delivered from the central AHU to the space based on the current space temperatures and a hot water reheat coil to provide space heating when called for by a space thermostat.

Air is recirculated from the spaces back to the air handling unit through ceiling mounted air return registers located in each space. Return air is pulled from a plenum space above the ceiling, in lieu of ductwork. Exhaust is provided in restrooms on each floor to remove odors and to maintain a slightly positive building pressurization.

Chilled water is supplied throughout the building from a chiller located in the basement mechanical room along with being imported from the North Campus Chilled Water District.

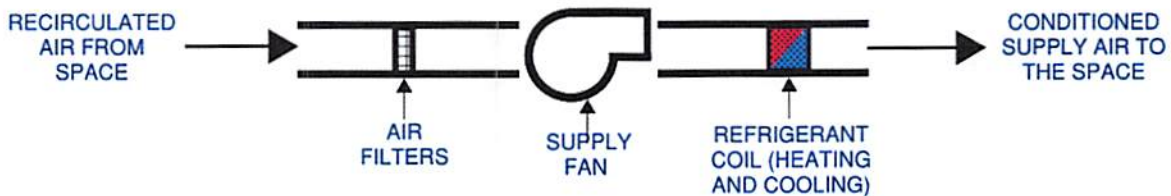
Hot water is provided by a steam to water heat exchanger which uses steam delivered from the Central Campus Steam Plant to heat water used for air heating in the building.



**1ST FLOOR VARIABLE VOLUME AIR HANDLING UNIT - UNIT SCHEMATIC**

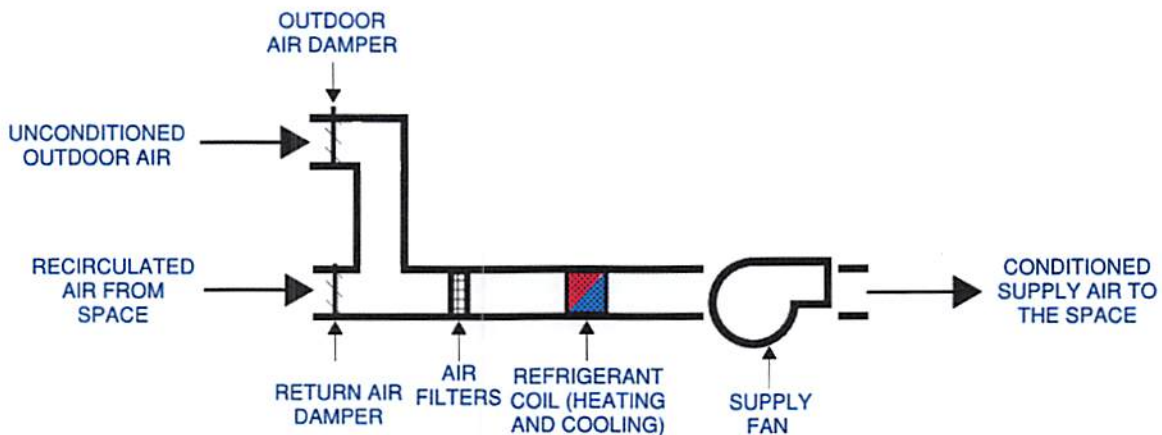
## JOE BROWN HALL

Joe Brown Hall is conditioned primarily with occupant-controlled window air conditioning units that served individual spaces. The window air conditioning units rely on refrigerant cycled between vapor and liquid phases through compression and heat transfer process to absorb heat from the space and reject it outside the building. These units filters and recirculates room air and cool and dehumidify the air whenever the unit is running based on the space temperature and need for cooling.



### WINDOW AC UNIT SCHEMATIC

Classrooms 117 and 213 are each served by split-system heat pump units. These systems resemble larger versions of a residential air conditioning system, with the exception that they both incorporate an outside air intake that mixes fresh air in with recirculated air from the space being served when the system is operating. These heat pump units provide heating and cooling via heat exchange with a refrigerant coil.



### VENTILATED HEAT PUMP UNIT SCHEMATIC

## **CALDWELL HALL**

Caldwell Hall was originally constructed in 1979 and has undergone a number of partial HVAC renovations since this time. The two primary air handling units were replaced in 2001 and the building was progressively converted from constant air volume with separate heating and cooling units and duct systems, to a modern variable air volume system beginning in the late 1990s.

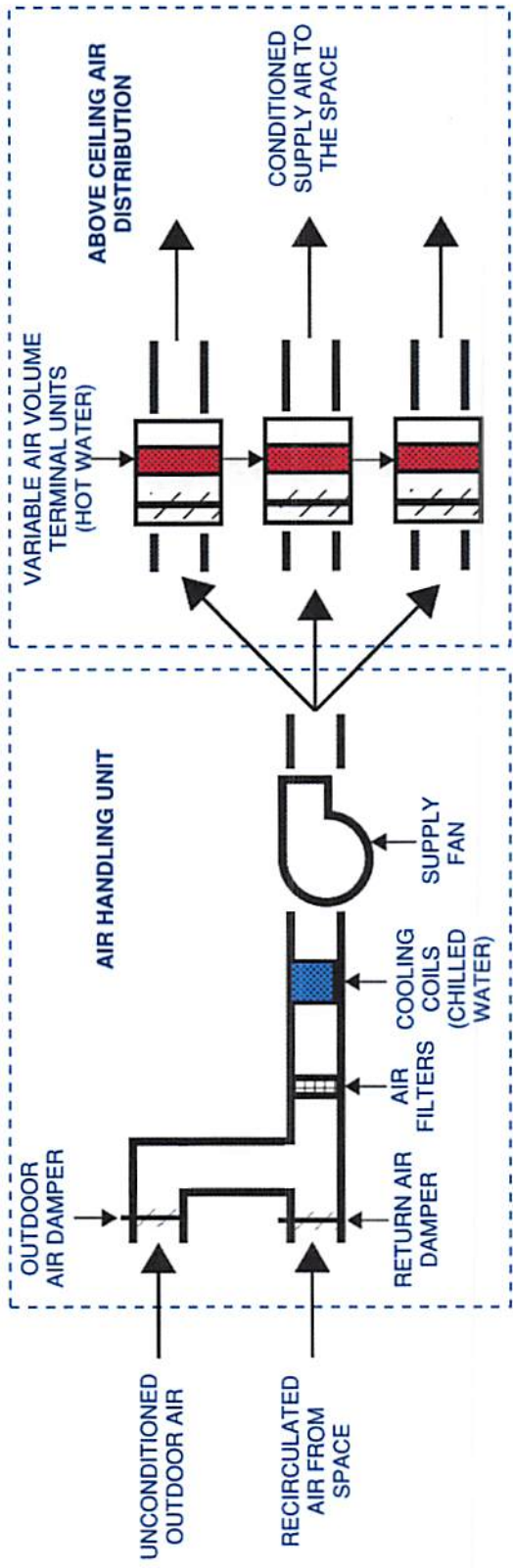
The building primarily consists of two large Air Handling Units (AHUs) located in the ground floor mechanical room. Each AHU provides air movement, cooling, ventilation and dehumidification functions for the building. AHU-1 is dedicated to serving the Ground, 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> floors with AHU-2 dedicated to serving the 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> floors.

The air handling unit delivers a variable volume of conditioned air consisting of a mixture of recirculated building air and fresh air from outside of the building. The building return air is filtered, mixed with outdoor air and cooled with chilled water coils in each of the two building air handling units before being supplied to rooms throughout the building through above ceiling ductwork. Space heating is provided by Variable Air Volume terminal units (VAVs) with hot water reheat coils located in supply ductwork throughout the building. The VAVs are equipped with an air damper to regulate the volume of air delivered from the central AHU to the space based on the current space temperatures and a hot water reheat coil to provide space heating when needed. A portion of the VAVs also include a fan and a filter combination that will mix in air from the above ceiling plenum with the conditioned air from the central AHU when the space requires heating.

Air is recirculated from the spaces back to the air handling unit through ceiling mounted air return registers located in each space. Return air is pulled from a plenum space above the ceiling, in lieu of ductwork. Exhaust is provided in restrooms on each floor to remove odors and to maintain a slightly positive building pressurization.

Chilled water is supplied throughout the building from a chiller located in the basement mechanical room along with being imported from the North Campus Chilled Water District.

Hot water is provided by a steam to water heat exchanger which uses steam delivered from the Central Campus Steam Plant to heat water used for air heating 3968+399 in the building.



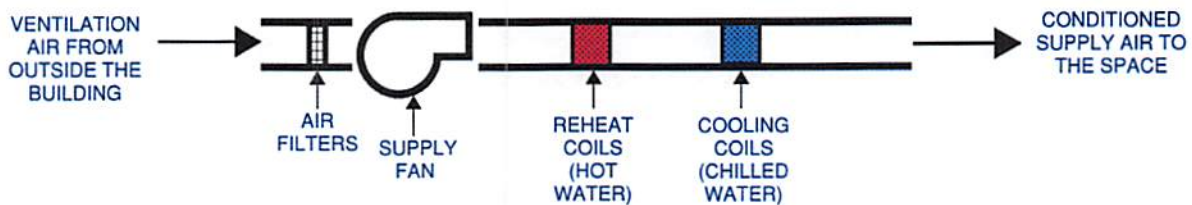
**CALDWELL VARIABLE AIR VOLUME AIR DISTRIBUTION SCHEMATIC**

## **GILBERT HALL – OLD GILBERT (EAST BUILDING)**

The original Gilbert Hall's HVAC systems were renovated in 1974 to include two separate air distribution systems. One system is dedicated to providing ventilation air to each floor and the other system is dedicated to providing space heating and cooling.

### **VENTILATION SYSTEM**

The ventilation system can be thought of as a building fresh air system that brings in outside air, conditions it to a moderate temperature, and distributes it to each floor of the building. This also includes controlled exhaust which provides exhaust at restrooms on each floor to control odors and maintain appropriate building pressurization via roof mounted exhaust fans. The two Dedicated Ventilation Air Units located on the roof include hot water and chilled water coils for heating and cooling and a fan which delivers fresh air from outside of the building through a ductwork riser where it is delivered to each floor in the corridors of the East building.



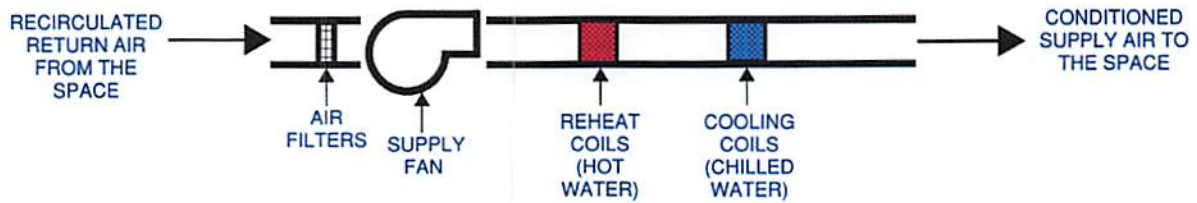
### **DEDICATED VENTILATION UNIT SCHEMATIC**

### **SPACE HEATING AND COOLING SYSTEM**

The space heating and cooling system consists of greater than 40 Fan Coil Units (FCUs) located above the ceilings with supply air ductwork distributing conditioned air from each FCU to ceiling diffusers in each space along with return air ductwork to carry recirculated room air back to the FCUs. Most offices along the East elevation have their own dedicated unit, while some FCUs providing conditioned air to multiple adjacent spaces.

With individual FCUs serving a small number of offices (generally 1, but not more than 2), there should be minimal room air circulated between spaces, except where room air from offices and classrooms is pulled through door undercuts into corridors and eventually exhausted through ceiling exhaust registers located in restrooms. The FCUs pull air from the space(s) they serve, condition as needed, and dump it back into the space. Both the fan in the fresh air system and the fans in the FCUs run all the time.

FAN COIL UNITS- A fan coil unit is fairly simple: it's a fan with a coil or coils (like a car radiator) that can add heating and cooling to the air stream flowing through it. The FCUs in Gilbert Hall have air filters to remove particulate matter from the air, a hot water coil and chilled water coil for heating and cooling the air, and a supply fan for forced air circulation through the unit and into the space. The hot water is produced in the mechanical room by way of a heat exchanger that takes heat from the campus steam system and adds it to Gilbert Hall's hot water loop. The chilled water is provided from a chiller located in Gilbert Hall's basement mechanical room and UGA's North Campus Chilled Water District.



**DEDICATED VENTILATION UNIT SCHEMATIC**

## GILBERT HALL – WEST ADDITION

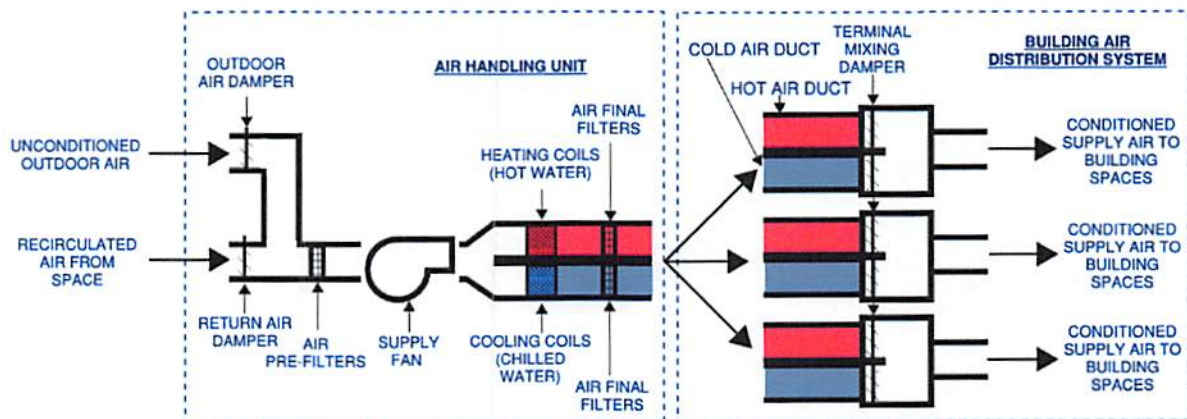
The West addition to Gilbert Hall uses the original Dual Duct Air Handling Unit (AHU) from 1974, located in the penthouse mechanical room which provides ventilation, cooling, heating and air filtration and distribution functions for the building. The air handling unit delivers heated air and cooled air simultaneously through a hot deck and cold deck within the unit which comes from a mixture of recirculated building air and fresh air from outside of the building.

The building return air is filtered, mixed with outdoor air and cooled with chilled water coils in each of the four building air handling units before being supplied to rooms throughout the building through above ceiling ductwork. The mixed airstream goes through two sets of filters within the AHU, a set of pre-filters prior to entering the unit and a set of higher efficiency final filters where it leaves the unit. The original building design called for approximately 23% of the building's air to be composed of fresh air from outside the building.

Space heating and cooling is provided by duct mounted, mixing boxes in supply ductwork throughout the building. The dual duct mixing boxes blend hot and cold air from the hot air duct and cold air duct supplied by the central AHU to provide either heating or cooling to the spaces served by each box based on space temperatures.

Air is recirculated from the spaces back to the air handling unit through ceiling mounted air return registers located in each space. Recirculated air from the spaces is then drawn through ductwork up to the central AHU where it is mixed with outdoor air, filtered and conditioned with hot water and chilled water coils before being supplied back to the building. Exhaust is provided in restrooms on each floor to remove odors and to maintain a slightly positive pressure building.

The heating hot water is produced in the mechanical room by way of a heat exchanger that takes heat from the campus steam system and adds it to Gilbert Hall's hot water loop. The chilled water is provided from a chiller located in Gilbert Hall's basement mechanical room and UGA's North Campus Chilled Water District.



**DUAL DUCT AIR HANDLING SYSTEM SCHEMATIC**

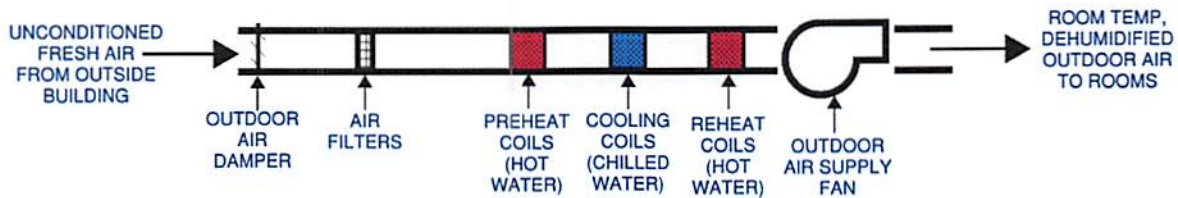


## **LECONTE HALL**

LeConte Hall is served by two separate air distribution systems, one for providing ventilation air to the building and the other for space heating and cooling. LeConte's HVAC systems were renovated in 1995.

### **VENTILATION SYSTEM**

The ventilation system can be thought of as a whole-building fresh air system that brings in outside air, dehumidifies and conditions it to a moderate temperature, and distributes it throughout the building via ductwork to each Fan Coil Unit where it is combined with recirculated room air before being heated or cooled as needed and delivered to each office or classroom. This also includes a controlled exhaust which provides exhaust at restrooms on each floor to control odors and maintain appropriate building pressurization.



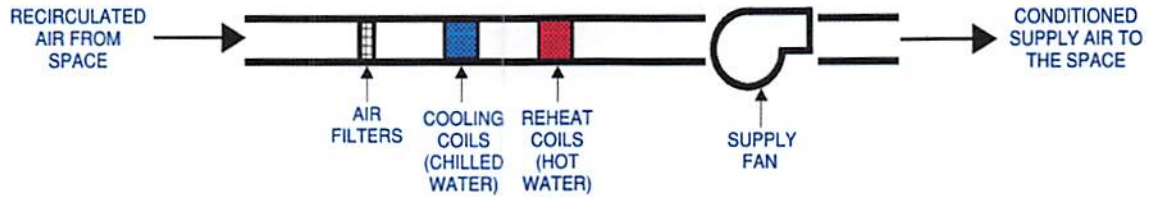
### **DEDICATED VENTILATION AIR UNIT SCHEMATIC**

### **SPACE HEATING AND COOLING SYSTEM**

The space heating and cooling system consists of greater than 50 Fan Coil Units (FCUs) located above the ceilings with supply air ductwork distributing conditioned air from each FCU to ceiling diffusers in each space along with return air ductwork to carry recirculated room air back to the FCU. Some larger rooms have their own unit, while some FCUs providing conditioned air to multiple adjacent space.

With individual FCUs serving a small number of offices (between 2 and 5) and generally one FCU dedicated to each classroom, there should be minimal room air circulated between spaces, except where room air from offices and classrooms is pulled through door undercuts into corridors and eventually exhausted through ceiling exhaust registers located in restrooms. The FCUs pull air from the space(s) they serve, condition as needed, and dump it back into the space. Both the fan in the fresh air system and the fans in the FCUs run all the time.

FAN COIL UNITS- A fan coil unit is fairly simple: it's a fan with a coil or coils (like a car radiator) that can add heating and cooling to the air stream flowing through it. The FCUs in LeConte Hall have air filters to remove particulate matter from the air, a hot water coil and chilled water coil for heating and cooling the air, and a supply fan for forced air circulation through the unit and into the space. The hot water is produced in the mechanical room by way of a heat exchanger that takes heat from the campus steam system and adds it to LeConte Hall's hot water loop. The chilled water is provided from UGA's North Campus Chilled Water District.



**4-PIPE FAN COIL UNIT SCHEMATIC**

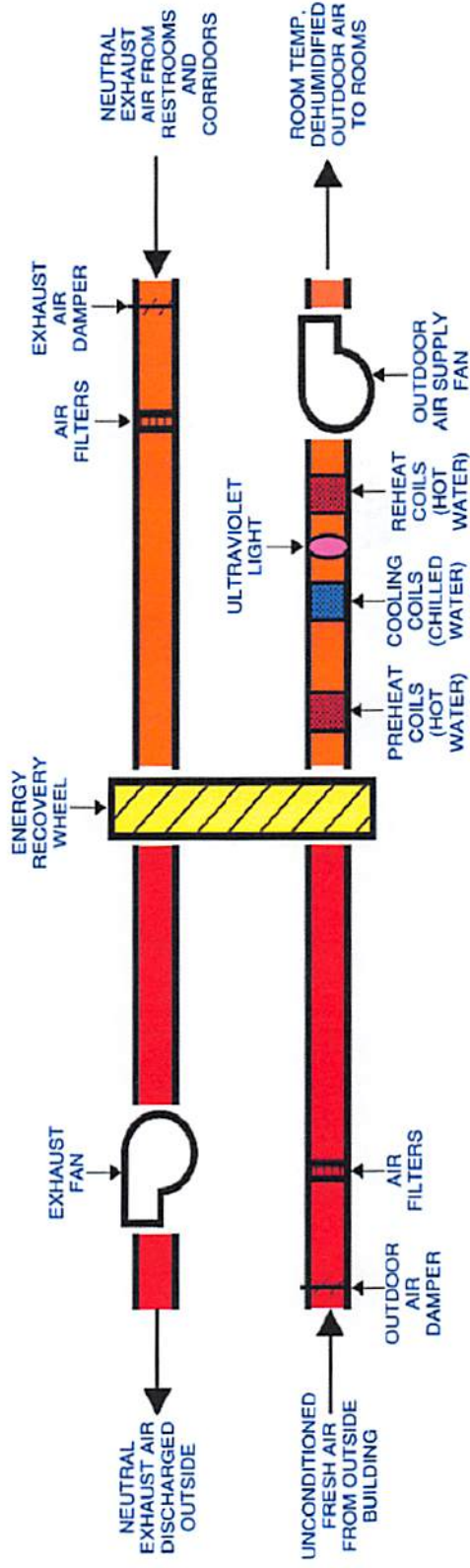
## **PARK HALL – OLD PARK**

Original Park Hall is served by separate air distribution systems, one for ventilation and the other for space heating and cooling. Old Park's HVAC systems were renovated in 2013.

## **VENTILATION SYSTEM**

The ventilation system can be thought of as a whole-building fresh air system that brings in outside air, dehumidifies and conditions it to a moderate temperature, and distributes it directly to each classroom and office. This also includes a controlled exhaust which provides exhaust at restrooms on each floor to control odors and maintain appropriate building pressurization. The two Dedicated Outdoor Air System (DOAS) units include an energy recovery wheel that helps pre-condition the outdoor air coming into the building by recovering some of the energy from the exhaust air. The exhaust and outdoor air streams are kept separate from each other in the process.

The DOAS units are also equipped with UV lights to inhibit biological activity within these units. The two DOAS units serving original Park Hall were designed with ventilation rates that exceed current code required ventilation by more than 50%.



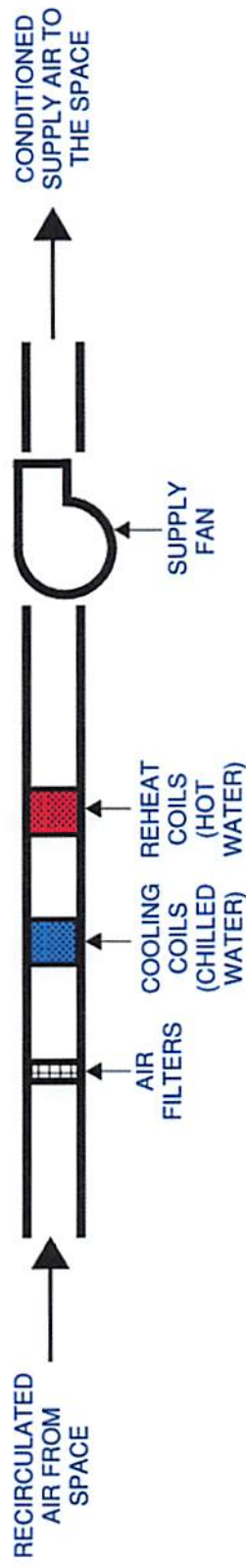
**DEDICATED OUTDOOR AIR SYSTEM - UNIT SCHEMATIC**

### SPACE HEATING AND COOLING SYSTEM

The space heating and cooling system consists of approximately 50 Fan Coil Units (FCUs) that are mostly located along exterior walls below windows. Most individual offices have a single FCU to heat and cool the space, while classrooms typically have two FCUs with a shared thermostat to provide space heating and cooling.

With a dedicated FCU serving each office individually, there should be minimal room air circulated between spaces, except where room air from offices and classrooms is pulled through door undercuts into corridors and eventually exhausted through ceiling exhaust registers located in restrooms. The FCUs pull air from the space(s) they serve, condition as needed, and dump it back into the space. Both the fan in the fresh air system and the fans in the FCUs run all the time.

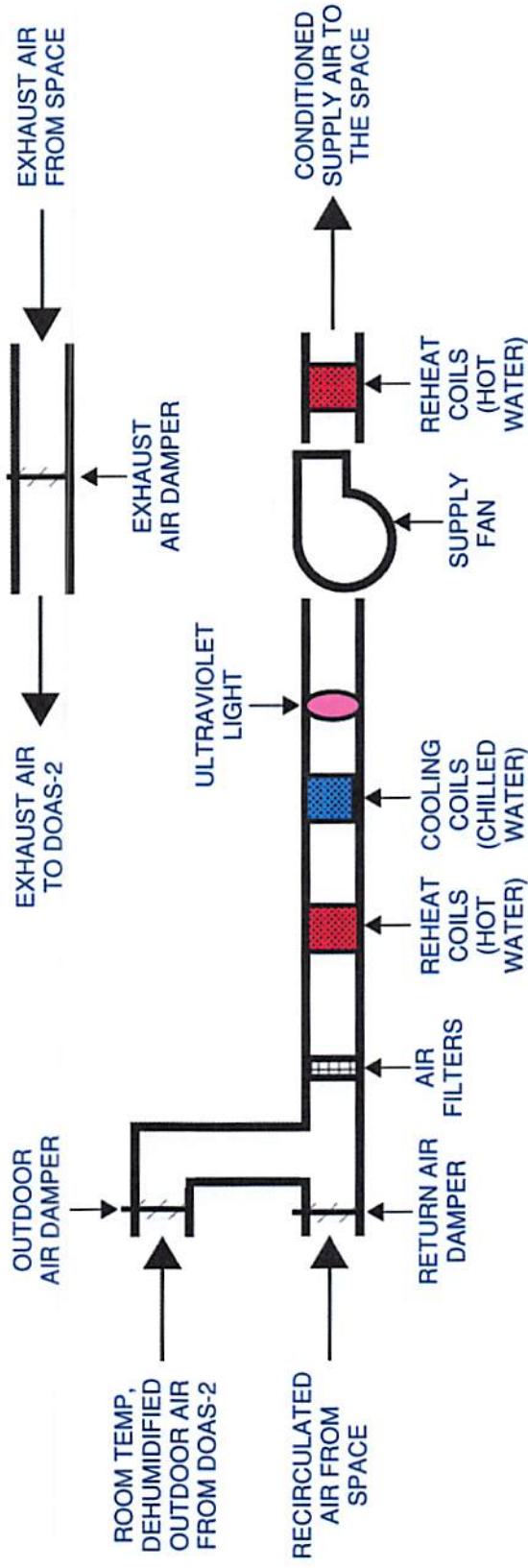
FAN COIL UNITS- A fan coil unit is fairly simple: it's a fan with a coil or coils (like a car radiator) that can add heating and cooling to the air stream flowing through it. The FCUs in old Park Hall have air filters to remove particulate matter from the air, a hot water coil and chilled water coil for heating and cooling the air, and a supply fan for forced air circulation through the unit and into the space. The hot water is produced in the mechanical room by way of a heat exchanger that takes heat from the campus steam system and adds it to Park Hall's hot water loop. The chilled water is provided from UGA's central campus chilled water district and a building chiller located in the basement of Park Hall.



**4-PIPE FAN COIL UNIT SCHEMATIC**

AIR HANDLING UNIT RM 265 - There is a single zone, dedicated Air Handling Unit (AHU) serving large classroom 265. The AHU mixes in fresh air that has been pre-conditioned and dehumidified from DOAS-2 with recirculated air from the classroom. There is also general exhaust provided in room 265 which serves to continuously remove a portion of the air in this room from the building. This is done to avoid over pressurizing the space, but also serves to continuously remove a portion of the room air from the building..

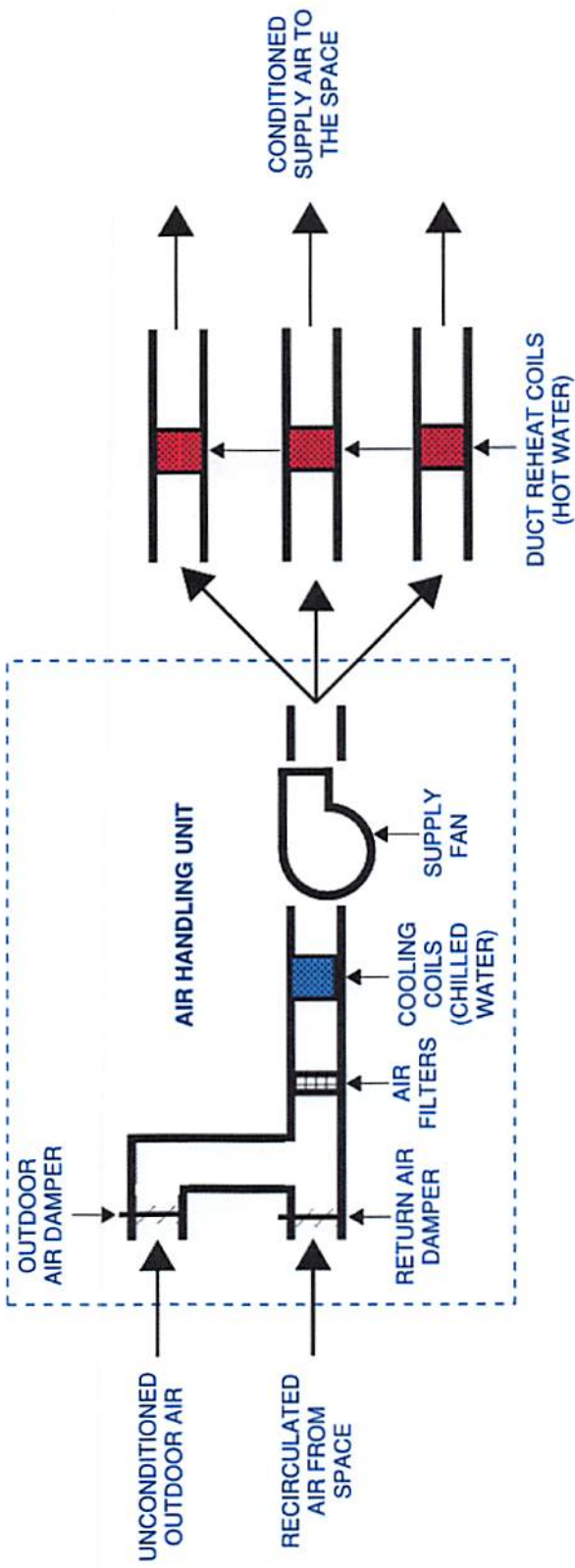
The AHU fans run continuously according to a building schedule (currently 24/7 operation as part of FMD's COVID-19 response program). The AHU is equipped with air filters, along with hot water and chilled water coils to heat, cool and dehumidify the air delivered to the space. This unit is equipped with demand based ventilation controls which reduce ventilation during periods when the classroom is vacant as an energy savings measure. The demand controlled ventilation strategies have been disabled in order to provide continuous ventilation even while the classroom is not in use as a means to increase the air changes in the space as part of FMD's COVID-19 response program.



## ROOM 265 - AIR HANDLING UNIT SCHEMATIC

## PARK HALL – NEW PARK

The West addition to Park Hall uses the original Multizone Air Handling Units from 1968, located on each floor which provide ventilation, cooling and air distribution functions for the building. The air handling unit delivers a constant volume of conditioned air which comes from a mixture of recirculated building air and fresh air from outside of the building. The building return air is filtered, mixed with outdoor air and cooled with chilled water coils in each of the four building air handling units before being supplied to rooms throughout the building through above ceiling ductwork. Space heating is provided by ~40 duct mounted, hot water reheat coils located in supply ductwork throughout the building. Air is recirculated from the spaces back to the air handling unit through ceiling mounted air return registers located in each space. Return air is pulled from a plenum space above the ceiling, in lieu of ductwork. Exhaust is provided in restrooms on each floor to remove odors and to maintain a slightly positive building pressurization.



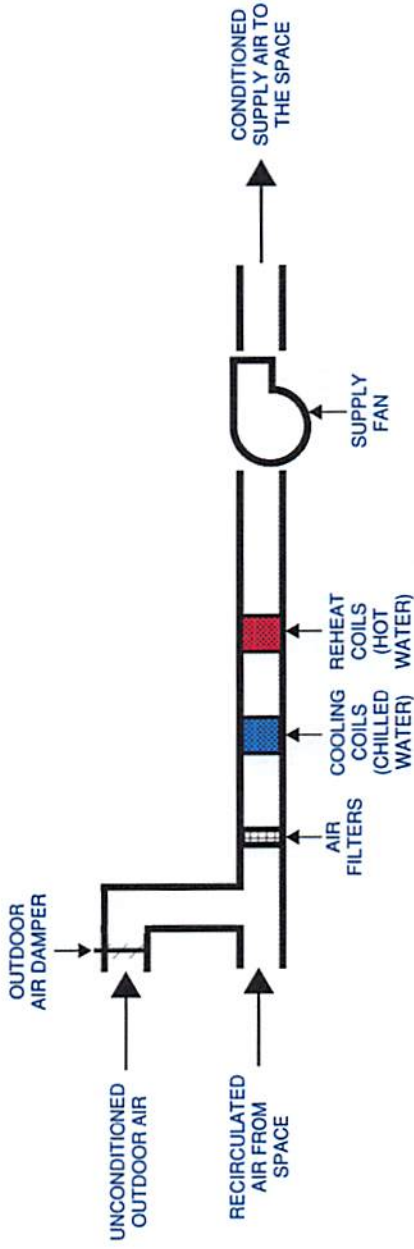
**NEW PARK - AIR HANDLING UNIT SCHEMATIC**

## PEABODY HALL

Peabody Hall is served by a combination of 10 Single Zone, Constant Volume Air Handling Units (4 pipe) and 8 Fan Coil Units spread across three floors of the building. Cooling is provided by chilled water imported from the North Campus Chilled Water District. Heating is provided by hot water generated in the building via a steam to water heat exchanger, using steam from the Campus Central Steam Plant.

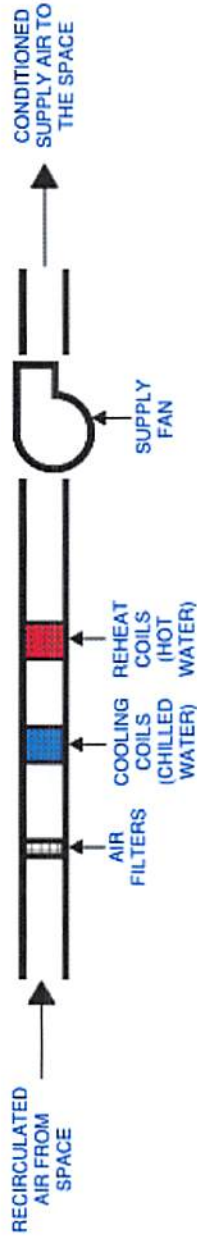
AIR HANDLING UNITS (AHUs)- The single zone, air handling units deliver a constant volume of either heated, or cooled air consisting of a mixture of recirculated building air or fresh air from outside of the building. The building return air is filtered, mixed with outdoor air and cooled or heated with chilled water coils and hot water coils in each of the 10 building air handling units before being supplied to rooms throughout the building through above ceiling ductwork. There are generally between 4 and 10 rooms served by each AHU in Peabody Hall, with the exception of the main auditorium which is served by two AHUs.

Air is recirculated from the spaces back to the air handling units through ceiling mounted air return registers located in each space. Return air is pulled from a plenum space above the ceiling, in lieu of ductwork. Exhaust is provided in restrooms on each floor to remove odors and to maintain a slightly positive building pressurization.



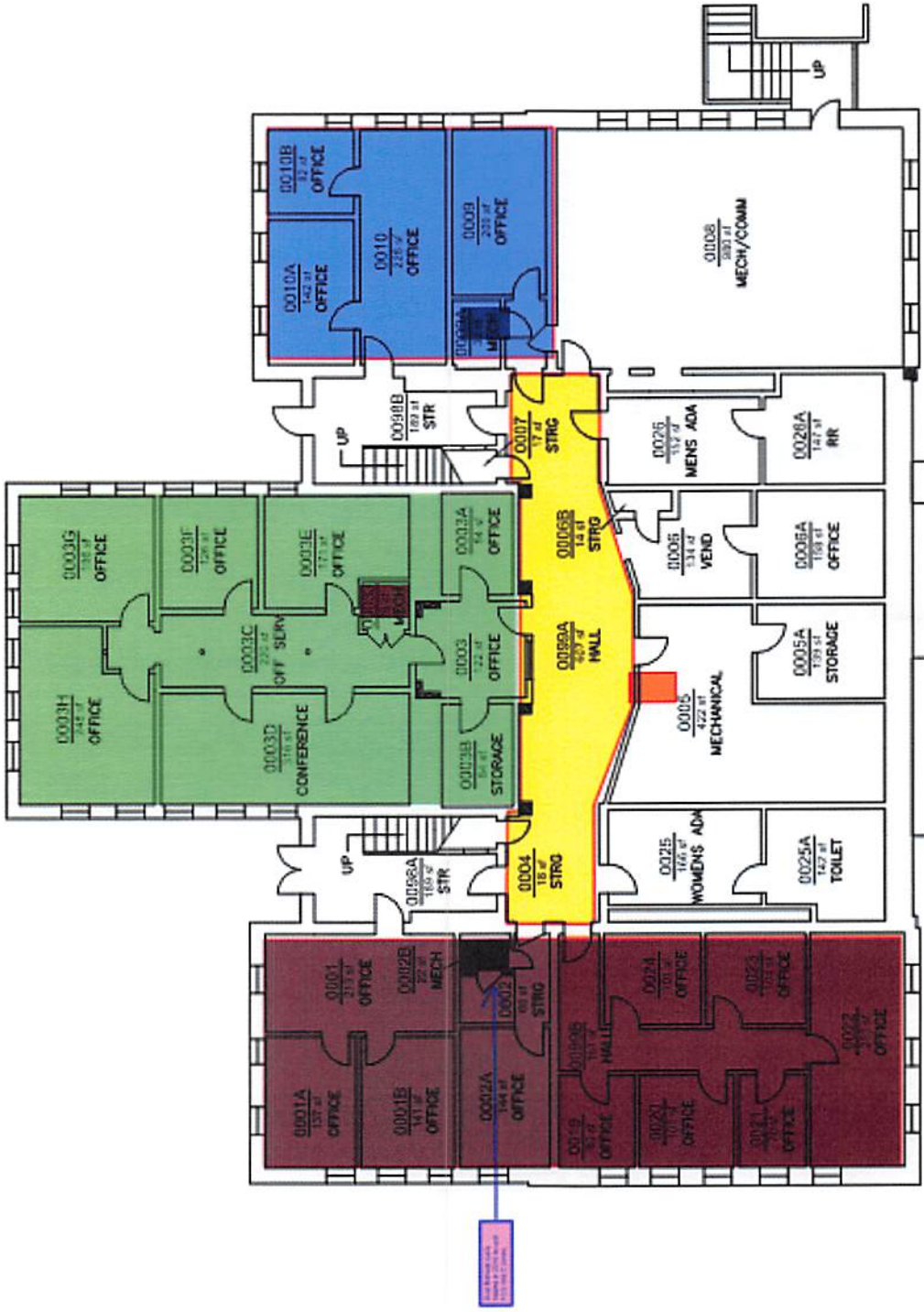
**SINGLE ZONE AIR HANDLING UNIT SCHEMATIC**

**FAN COIL UNITS (FCUs)**- A fan coil unit is fairly simple: it's a fan with a coil or coils (like a car radiator) that can add heating and cooling to the air stream flowing through it. The FCUs in old Peabody Hall have air filters to remove particulate matter from the air, a hot water coil and chilled water coil for heating and cooling the air, and a supply fan for forced air circulation through the unit and into the space. The coils provide heat transfer from building circulated heating hot water and chilled water with in the fan coil unit. Fan Coil Units in Park Hall generally have no ductwork and are visible in the space they serve, located against walls and below windows where possible. Each FCU is dedicated to a single room and recirculates the air within that space.

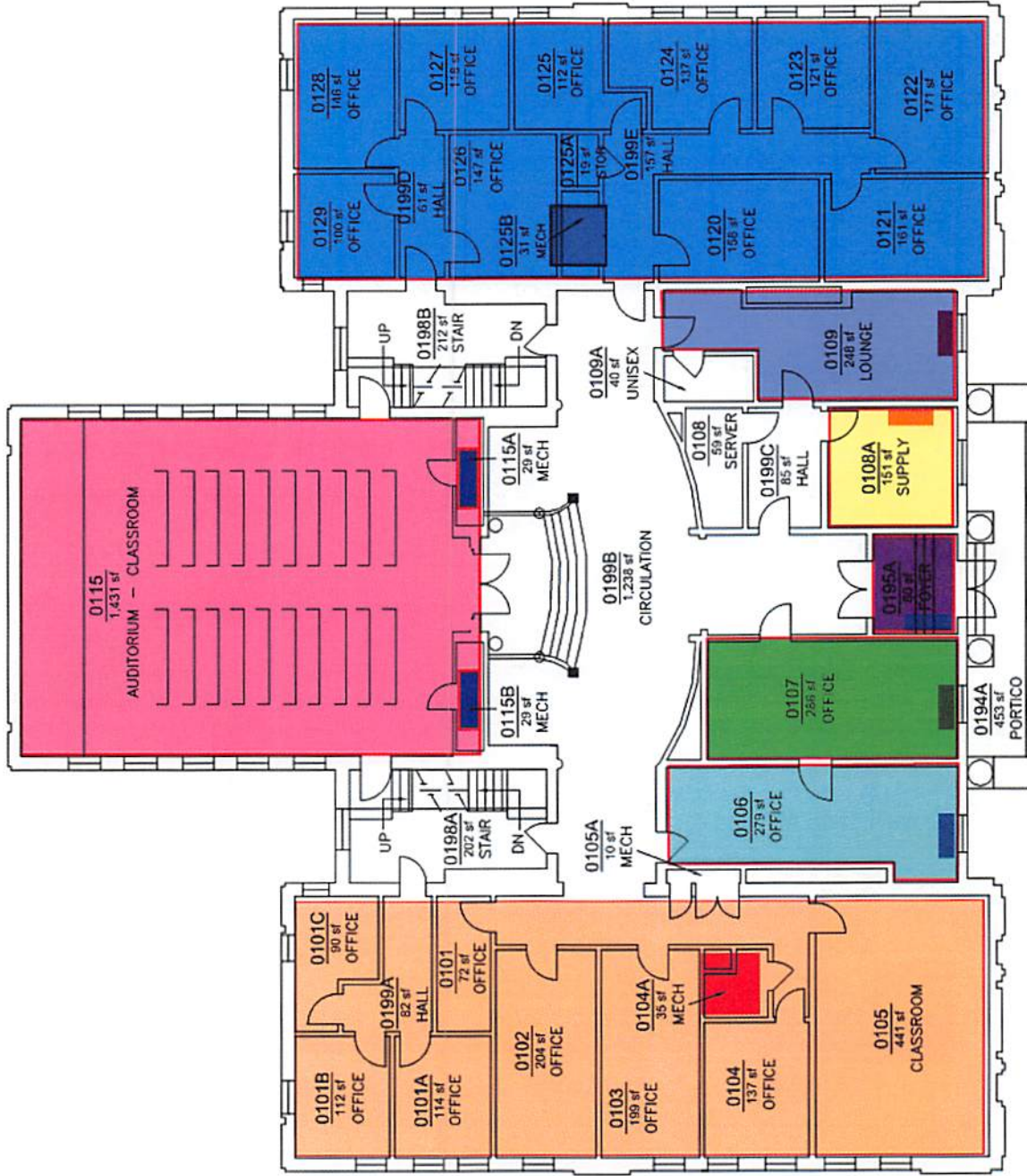


**4-PIPE FAN COIL UNIT SCHEMATIC**

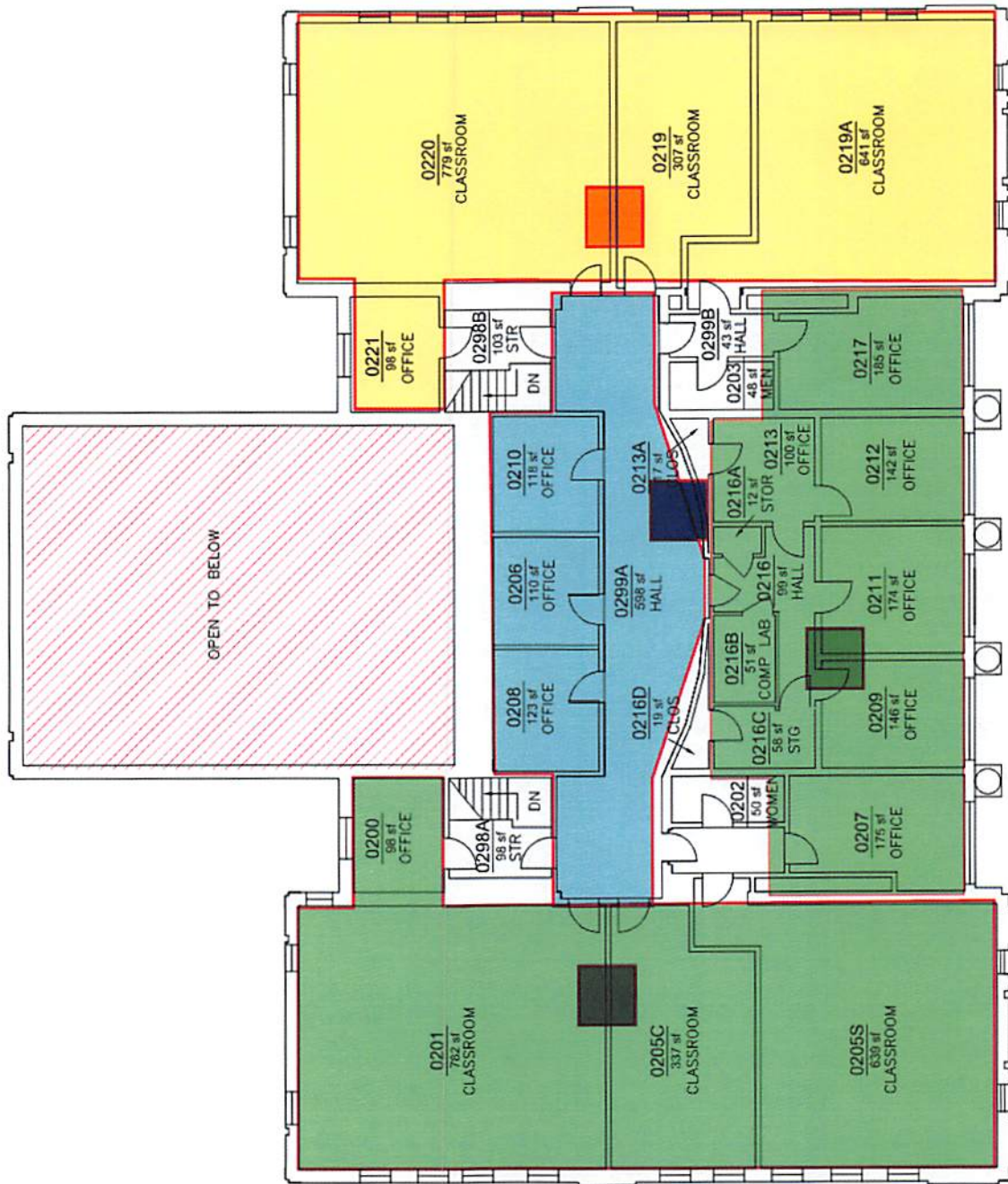




GROUND FLOOR HVAC ZONES



FIRST FLOOR HVAC ZONES



SECOND FLOOR HVAC ZONES

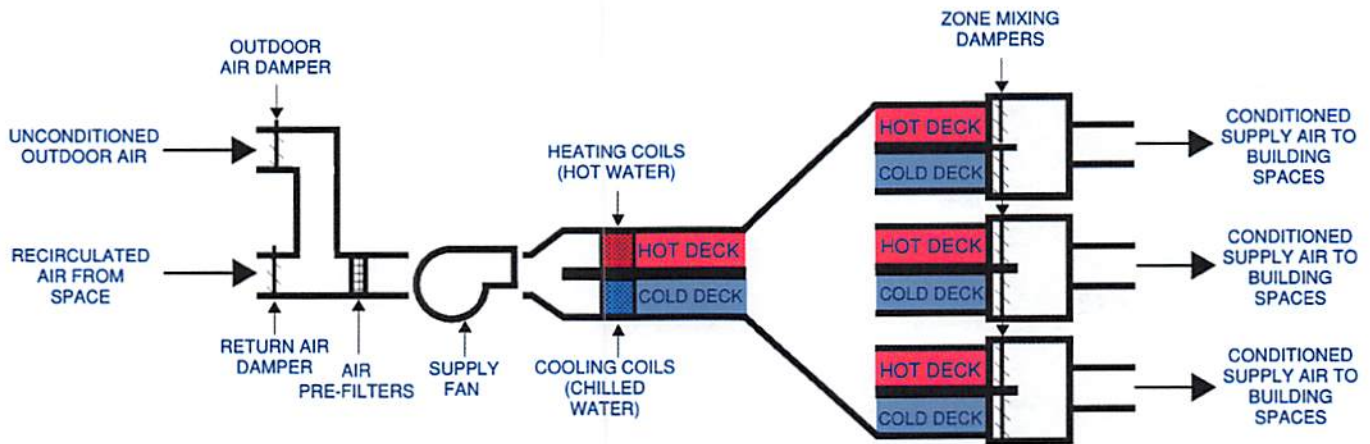
## PHYSICS BUILDING

The Physics Building was originally built with multi-zone air handling units. Outside air is ducted to each Multi-zone unit where it mixes with ducted return air from each floor as the constant-speed fan in the air handling unit draws it through a wall of filters.

The auditorium HVAC was renovated in 2012 with a roof-mounted variable air volume system that includes UV filtration, demand-controlled ventilation, and outside air economizer capability.

### MULTI-ZONE AIR HANDLING UNITS

Each Multi-zone Air Handling Unit (AHU) provides ventilation, air filtration and movement, and heating and cooling functions to a single floor. Each AHU has a hot water heating coil and chilled water cooling coil that respectively generate parallel warm and cool air streams. The air flow is distributed to a number of ducts that exit the AHU to serve individual zones, which may be single rooms or groups of rooms depending on their size. Each zone's duct has a mixing damper that allows only warm air, only cool air, or a mixture of the two, depending on the signal being sent from the zone thermostat. Ventilation is provided at each AHU by drawing a mixture of fresh air from outdoors and recirculated air from the floor being served by each AHU.



**MULTI-ZONE AIR HANDLING SYSTEM SCHEMATIC**

## VARIABLE VOLUME AIR HANDLING UNITS (Physics Auditorium)

Variable Volume Air Handling Units (AHUs) deliver a variable volume of conditioned air consisting of a mixture of recirculated building air and fresh air from outside of the building. The building return air is mixed with outdoor air, filtered and cooled with chilled water coils in each of the two building air handling units before being supplied to rooms throughout the building via above ceiling ductwork.

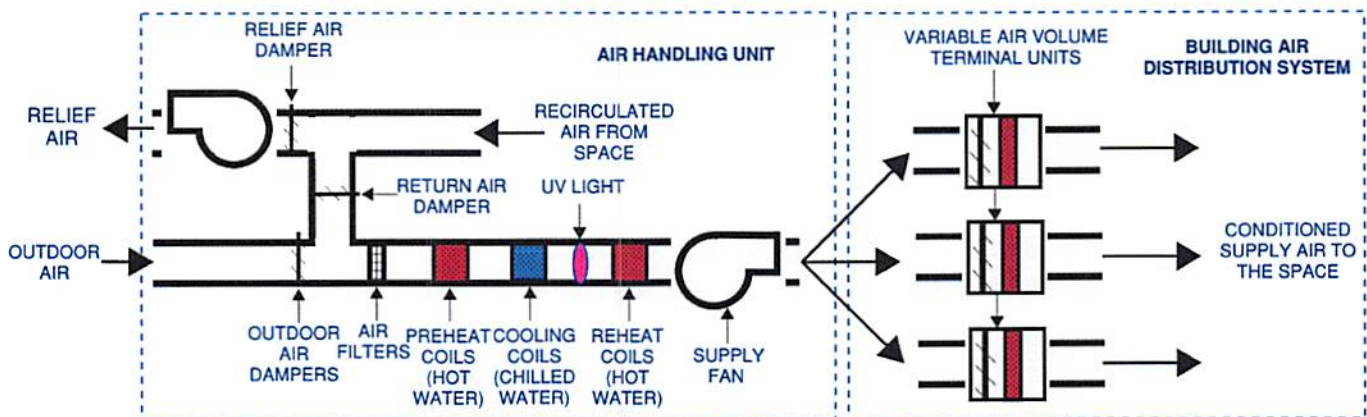
Space heating is provided by Variable Air Volume terminal units (VAVs) with hot water reheat coils located in supply ductwork throughout the building. The VAVs are equipped with an air damper to regulate the volume of air delivered from the central AHU to the space based on the current space temperatures and a hot water reheat coil to provide space heating when called for by a space thermostat.

Air is recirculated from the spaces back to the air handling unit through ceiling mounted air return registers located in each space. Return air is pulled from a plenum space above the ceiling, in lieu of ductwork. Exhaust is provided in restrooms on each floor to remove odors and to maintain a slightly positive building pressurization.

The auditorium AHU is also equipped with demand controlled ventilation strategies which serve reduce ventilation levels when the space is unoccupied; however, this has been disabled as part of FMD's COVID-19 Response Plan. The AHU is also capable of air side economizer operation which serves to increase the ventilation rate when outdoor air conditions are appropriate. The AHU is also equipped with UV lights which serve to inhibit biological activity in the unit.

Chilled water is supplied throughout the building from a chiller located in the basement mechanical room along with being imported from the South/Science Campus Chilled Water District.

Hot water is provided by a steam to water heat exchanger which uses steam delivered from the Central Campus Steam Plant to heat water used for air heating in the building.



**VARIABLE VOLUME AIR HANDLING UNIT SCHEMATIC**