



SUNNYLANDS

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OPTION: MECHANICAL

PENNSTATE



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EXECUTIVE SUMMARY

Technical report 1 is a documentation of the additions to the Sunnylands complex in regards to their compliance with ASHRAE Standards 62.1-2010 Ventilation for Acceptable Indoor Air Quality and ASHRAE 90.1-2010 Energy Standard for Buildings except Low-Rise Residential Buildings. The Sunnylands buildings will function as office spaces, archival storage, and technical support spaces and therefore must comply with the standards put forth by ASHRAE. In total, these spaces will occupy 45,000 square feet on the North side of the Sunnylands campus located in Southern California.

The investigation of these new campus buildings show compliance with ASHRAE 62.1 in both sections 5 and 6. Section 5 of ASHRAE 62.1 discusses systems and equipment servicing the facilities while Section 6 discusses the requirements for the air within the inhabitable spaces. Additionally, the four new buildings on the North campus meet the minimum requirements outlined in ASHRAE 90.1 which outlines the minimum efficiencies and performance design in order to create an energy-effective building.

Not only did the design for the North Campus meet the minimum requirements established by ASHRAE 62.1 and 90.1, it exceeded them in many cases. These results are expected since the client has set goals for the building that are above and beyond the standards in industry. The Annenberg Foundation has set goals of a net zero facility, high utilization of rainwater on site and a LEED Platinum rating.

The following pages document a detailed breakdown of the compliance with ASHRAE standards. Please refer to the table of contents beginning on page 1 to locate appendices that document all visual aids presented in this technical report.

BUILDING OVERVIEW

Sunnylands North Campus is a new complex of administration buildings totaling to approximately 45,500 square feet. The complex is located in Rancho Mirage, California on the North side of an existing campus. The new construction package will include four buildings designed to house administrative services, archives, operations management offices as well as support buildings. Figures 1 and 2 depict the location of the site and the relative location of the buildings respectively.

Set into the beautiful Sunnylands campus, the new buildings are intended to attract the best technical employees to further develop and oversee the nonprofit organization known as the Annenberg Foundation. This is accomplished through high performance, state-of-the-art facilities that can be marketed by the Annenberg Foundation as an innovative and inspirational work environment. Embodying these high performance qualities are two quantifiable goals for this project: LEED Platinum certification and net zero status.

In addition to the technological innovation incorporated throughout the campus, the architectural designs of the buildings are meant to inspire those who work on the campus. Exterior materials include plaster, CMU blocks, and aluminum. The interior spaces are designed to keep employees happy, comfortable and focused.

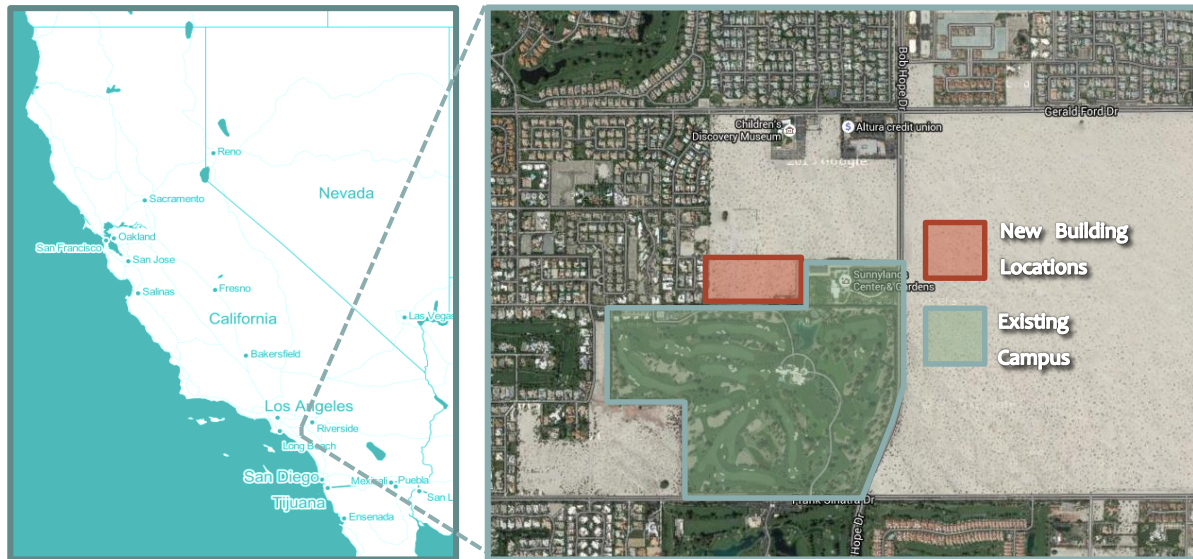


FIGURE 1: SUNNYLANDS LOCATION

MECHANICAL OVERVIEW

The addition to the Sunnylands campus incorporates 4 conditioned buildings. These buildings all utilize Variable Refrigerant Flow (VRFs) and two-part rooftop units in their cooling schemes and a Boiler and Domestic Water Heater for heating purposes. Each facility building has its own boiler and rooftop unit. The two-part rooftop units utilize energy recover wheels at 80% effectiveness in order to conserve energy, dx cooling and electric heating coils. Only two buildings on site are utilizing the two-part

ASHRAE STANDARDS 62.1

SECTION 5 | SYSTEMS AND EQUIPMENT

5.1 Ventilation Air Distribution

As shown in the analysis of Section 6, the Sunnylands complex meets all minimum ventilation rates. The majority of the spaces on the complex follow conventional ventilation air distribution methods and therefore comply with Section 5.1; however, unconventional distribution methods used in the Administrative building required further analysis.

The open office area shown below uses a ductsox product above the ceiling to distribute conditioned air to the ceiling cavity. The ceiling cavity then allows the air to spread and drop down into the space. This is accomplished with a slatted ceiling as shown below in Figure 1.

All other spaces on the Sunnylands campus are more conventional and comply with Section 5.1 through the notation of balancing values on drawings, the implementation of dampers on all runoffs and the ability to adjust airflow to the minimum specified ventilation rates.



FIGURE 2: ADMINISTRATION INTERIOR

5.2 Exhaust Duct Location

In order to assure no contaminated air recirculates into occupied spaces, any and all rooms and ducts that contain contaminated air are kept negatively pressurized relative to all of their surroundings. This is accomplished by exhausting air from rooms without their own supply. This forces air to be pulled in from the surrounding spaces rather than the contaminated air spilling its way into other spaces. There are 8 exhaust fans EF-1 through EF-8 located through the additions to the Sunnylands campus.

5.3 Ventilation System Controls

All terminal units include a control box damper that allows minimum ventilation rates to be met. All requirements are taken from Section 6 of ASHRAE 62.1. In all buildings being added to the campus, the entire building is served with a minimum outdoor airflow that satisfies the zone with the highest requirement.

5.4 Airstream Surfaces

The vast majority of airstream surfaces constructed on Sunnylands' complex are resistant to mold growth and erosion in accordance with the sheet metal surfaces and metal fasteners exception. However, as previously mentioned, there is a unique duct in the open office space in the Administrative building. This space uses a product from ductsox. The ductsox product also complies with Section 5.4 airstream surfaces in relation to mold growth and corrosion. According to the manufacturer, ductsox provide a healthy environment through

“Cleaner distribution systems, launderable, no mold, no condensation, uniform environment”

-from ductsox website

5.5 Outdoor Air Intakes

Outdoor Air Intakes shall be located at the distance required by table 5-1

TABLE 5-1 Air Intake Minimum Separation Distance

Object	Minimum Distance, ft (m)
Class 2 air exhaust/relief outlet (Note 1)	10 (3)
Class 3 air exhaust/relief outlet (Note 1)	15 (5)
Class 4 air exhaust/relief outlet (Note 2)	30 (10)
Plumbing vents terminating less than 3 ft (1 m) above the level of the outdoor air intake	10 (3)
Plumbing vents terminating at least 3 ft (1 m) above the level of the outdoor air intake	3 (1)
Vents, chimneys, and flues from combustion appliances and equipment (Note 3)	15 (5)
Garage entry, automobile loading area, or drive-in queue (Note 4)	15 (5)
Truck loading area or dock, bus parking/idling area (Note 4)	25 (7.5)
Driveway, street, or parking place (Note 4)	5 (1.5)
Thoroughfare with high traffic volume	25 (7.5)
Roof, landscaped grade, or other surface directly below intake (Notes 5 and 6)	1 (0.30)
Garbage storage/pick-up area, dumpsters	15 (5)
Cooling tower intake or basin	15 (5)
Cooling tower exhaust	25 (7.5)

Note 1: This requirements applies to the distance from the outdoor air intakes for one ventilation system to the exhaust/relief outlets for any other ventilation system.

Note 2: Minimum distance listed does not apply to laboratory fume hood exhaust air outlets. Separation criteria for fume hood exhaust shall be in compliance with NFPA 45⁵ and ANSI/AIHA Z9.5.⁶ Information on separation criteria for industrial environments can be found in the *ACGIH Industrial Ventilation Manual*⁷ and in the *ASHRAE Handbook—HVAC Applications*.⁸

Note 3: Shorter separation distances shall be permitted when determined in accordance with (a) ANSI Z223.1/NFPA 54⁹ for fuel gas burning appliances and equipment, (b) NFPA 31¹⁰ for oil burning appliances and equipment, or (c) NFPA 211¹¹ for other combustion appliances and equipment.

Note 4: Distance measured to closest place that vehicle exhaust is likely to be located.

Note 5: Shorter separation distance shall be permitted where outdoor surfaces are sloped more than 45 degrees from horizontal or that are less than 1 in. (3 cm) wide.

Note 6: Where snow accumulation is expected, the surface of the snow at the expected average snow depth constitutes the “other surface directly below intake.”

Building	Minimum Distance (ft.)	Actual Distance (ft.)
Administrative	15	18
Archives	15	16
Operations	30	54
Storage	30	42

Table 1 - Most Severe Minimum Outdoor Airflow Requirements by Building

All outdoor air intakes have been designed to manage rain entrainment in accordance with ASHRAE standards. All new buildings on Sunnylands' campus utilize the intake louvers to manage rainfall. The last time snow fell in Palm Springs, the year was 1979. For this reason, Sunnylands is not designed to manage any water from snow on site. All outdoor air intakes include a screening device which prevents bird nesting within the outdoor air intake. Please see below for Figure 3 which details the louvers used at Sunnylands.

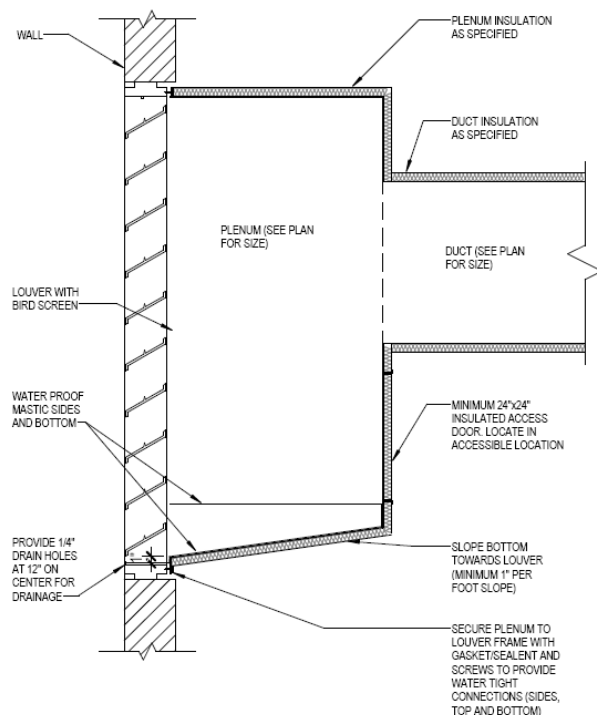


Figure 3 – Louver Section

5.6 Local Capture of Contaminants

Discharge from non-combustion equipment is captured and the contaminants generated by the equipment is ducted directly to the outdoors in compliance with section 5.6.

5.7 Combustion Air

In the Storage Building, there will be space allocated for the storage of site maintenance vehicles. The air within this space is provided with sufficient air for combustion and adequate removal of combustion products. This air is vented directly outdoors. The Operations Building is the only new structure on campus that is applicable to this requirement.

5.8 Particulate Matter Removal

MERV 8 filters are provided upstream of all cooling coils or other devices with wetted surfaces through which air is supplied to an occupiable space, exceeding the ASHRAE standard of MERV 6.

There are no wetted surfaces in the design of Sunnylands as the buildings are designed with variable flow refrigerant, not evaporative cooling.

5.9 Dehumidification Systems

Relative Humidity is limited to a maximum 65% or less (typically 50%). This is accomplished through humidistats located in the ductwork which communicate with the controls system. If the humidity levels approach design conditions, the system responds by cooling the air below the set temperature point and re-heating it to remove excess moisture from the mixed air.

Building	Minimum CFM intake	CFM exhausted	Exfiltration Achieved?
Administrative	2400	1350	Y
Archives	1050	800	Y
Operations	1250	1850	N
Storage	2400	6000	N

Table 2 – Exfiltration Analysis

The Operations Building and Storage Building do not meet the exfiltration requirement because they have a large volume of air that must be exhausted. The spaces being exhausted are not being conditioned, but they need high amounts of air flow to remove potentially harmful pollutants in the air. For example, there will be vehicle exhaust, a grinding area, a paint booth with fume hood and a loading dock that all need fresh air.

According to the exception in Section 5.9.2 where excess exhaust is required by process considerations, the Sunnylands facility is still in compliance with ASHRAE 62.1 standards.

5.10 Drain Pans

Drain pans are specified to have at least 1 percent slope in two planes, extend downstream from leaving surface to comply with ASHRAE 62.1 2004, have a minimum depth of two inches, be constructed of single-wall

stainless-steel, and connect at lowest point of pan. ASHRAE 62.1 of 2004 has the same drain pan requirements as ASHRAE 62.1 2004, therefore, drain pans specified on Sunnylands' campus are compliant with section 5.10.

5.11 Finned-Tube Coils and Heat Exchangers

Drain pans are designed to be provided for all finned-tube coils and heat exchangers per instruction in Section 5.10. Finned-tube are all designed to be installed with 24 inches surrounding space for cleaning.

5.12 Humidifiers and Water-Spray Systems

The only new building on the Sunnylands campus that uses a Humidifier is the Archives building due to special requirements for the items that will be stored there. This is accomplished with an electric humidifier with the design conditions listed below.

Room Served	Dry Bulb	Relative Humidity
Cold Storage	60	35
Archival Storage	65	40
High Security Storage	65	40
Object Storage	68	45

Table 3 – Humidity Analysis

These humidifiers have dampers downstream of humidifiers shall be located at a distance equal to or greater than the 10 ft. absorption distance recommended by Nortec. All humidifiers use potable water and a drain pan is installed below each humidifier.

5.13 Access for Inspection, Cleaning, Maintenance

According to the MEP specifications, there will be access doors provided on both side of duct coils, at outdoor-air intakes and mixed-air plenums, at drain pans and seals, upstream from duct filters, adjacent to fire and smoke dampers, and at control devices.

Ventilation equipment is designed with a 2ft. minimum unobstructed working clearance where any access panels are located. Some equipment may have overlap of clearance space but there is no other equipment occupying the space dedicated for maintenance. In the open office space within the Administrative building, the slatted ceiling can be removed in sections to allow for easy access to all equipment. Furthermore, all rooftop equipment is located adequately far away from any other obstacles as per the recommendations by AAON, the manufacturer.

5.14 Building Envelope and Interior Surfaces

All building envelopes designed for the additions to Sunnylands campus include a vapor barrier. Also in compliance with Section 5.14, there are expansion joints where needed. For example, in figure 4, there is an expansion joint shown at the moment between a light shelf and meeting room.

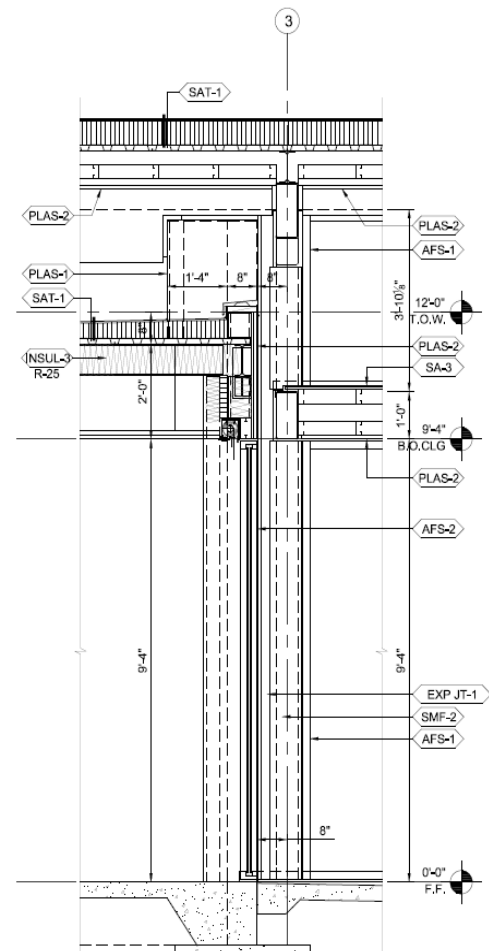


Figure 4 – Wall Section Example

Additionally, specification section 230719 documents what piping systems are required to be insulated in order to prevent condensation.

5.15 Buildings with Attached Parking Garages

One addition to the Sunnylands campus can be considered to have a parking garage. In the storage building, there are two garage spaces for the vehicles used to maintain the grounds. These spaces are heavily exhausted as discussed above in section 5.9 and therefore maintain the garage pressure below the pressure of any adjacent occupiable spaces.

5.16 Air Classification and Recirculation

The majority of spaces on Sunnylands' campus are Class 1 or Class 2 air and are able to recirculated. However, in areas where there are high levels of contaminants, mostly in the Storage and Operations buildings, the air needs to be exhausted rather than returned. This accounts for the high percentages of exhaust air discussed in section 5.5.

5.17 Requirements for Buildings Containing ETS Areas

All of Sunnylands campus is smoke-free and all spaces are classified as ETS-free spaces. Furthermore, all air intake locations are located on the roofs, away from any locations where occupants may be smoking. For these reasons, section 5.17 is not applicable with Sunnylands campus.

SECTION 6 | PROCEDURES

6.1 General

The outdoor air is deemed acceptable for purposes of ventilation in all buildings on the Sunnylands campus. The airflow rates for achieving proper amounts of outdoor air follow the ventilation rate procedure and exhaust rate procedure. Natural ventilation strategies are only used in the administrative building.

6.2 Ventilation Rate Procedure

All airflow other than the garage area are deemed acceptable by section 4.1 ventilation rates. The portion of the building that does not meet the ventilation requirements falls under the exception of enclosed parking garages listed in section 6.2.1 Outdoor Air Treatment.

All breathing zone air flows are calculated using Equation 6-1 provided by ASHRAE 62.1-2010 (shown below).

$$V_{bz} = R_p * P_z + R_a * A_z \quad (6-1)$$

A _z :	Occupiable area of the zone	[ft ²]
P _z :	Population of the zone during typical usage	[People]
R _a :	Outdoor air rate per unit area	[cfm/ft ²]
R _p :	Outdoor air rate per person in the zone	[cfm/person]

The numerical values for R_a and R_p are listed in ASHRAE 62.1-2010 Table 6-1 according to space type; this table is included in figure 1 of Appendix A for reference. Table 6-2 from ASHRAE 62.1-2010 provides E_z values dependent on the air distribution configuration in the space. The Zone Air Distribution Effectiveness (E_z) can then be used to calculate the outdoor air requirement for each zone.

$$V_{oz} = V_{bz} / E_z \quad (6-2)$$

The outdoor airflows are depicted in Table 2 in Appendix A. The table below depicts the classification categories of section 6.2.5.

Building	Space	Classification
Administrative	RTU-1A	1350
Storage	RTU-1D	6000

6.5 Exhaust Ventilation

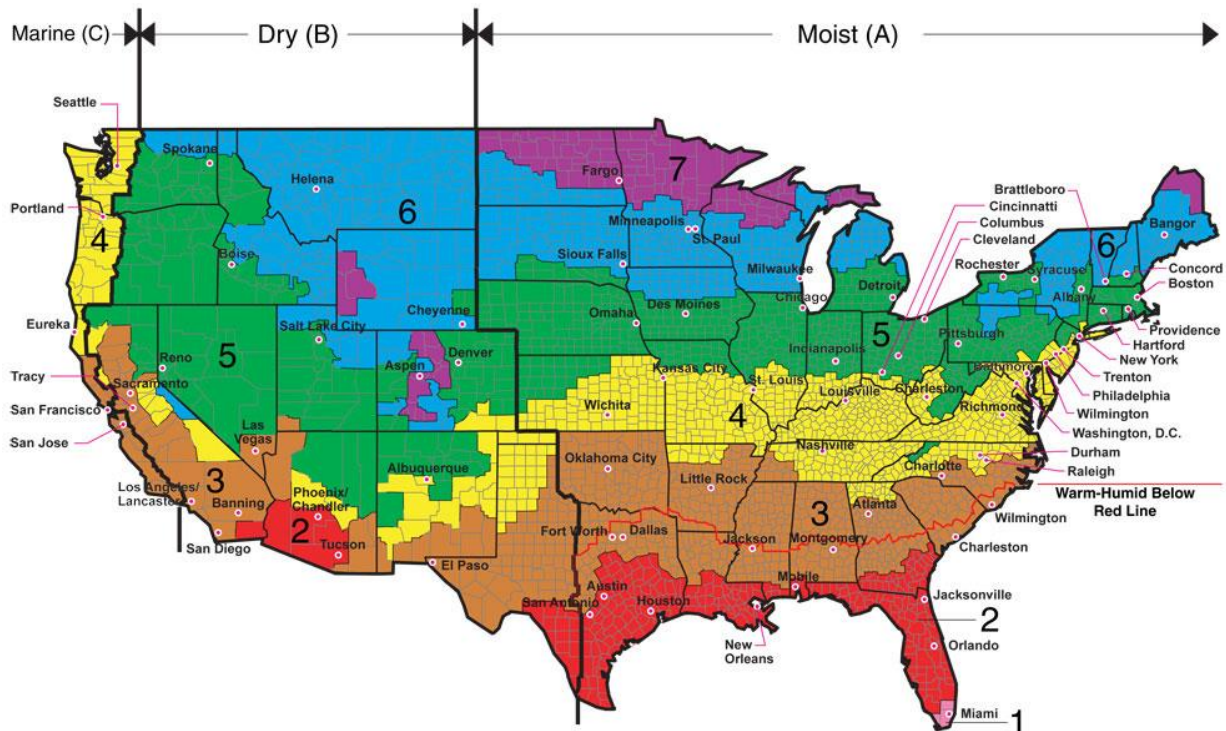
Exhaust airflows are calculated using Table 6-4 which is provided as figure 3 in Appendix A. ASHRAE 170 table 7.1 states whether or not a space must be exhausted. If it has to be exhausted, then the entire supply outside air cfm must be exhausted. All exhaust ventilation calculations are documented in Table 1 of Appendix A.

ASHRAE 90.1 COMPLIANCE

SECTION 5 | BUILDING ENVELOPE

5.1 General

Palm Springs, California falls into category 3B which indicates a dry, warm climate. This region hardly ever sees snowfall, receives rain only an average of 15/365 days a year and has average high temperatures ranging from 68°F in late December to 106°F in mid-September.



All of Alaska in Zone 7 except for the following Boroughs in Zone 8: Bethel, Dellingham, Fairbanks, N. Star, Nome North Slope, Northwest Arctic, Southeast Fairbanks, Wade Hampton, and Yukon-Koyukuk

Zone 1 includes: Hawaii, Guam, Puerto Rico, and the Virgin Islands

5.2 Compliance Paths

Table ## below illustrates the window to wall percentages on Sunnylands. The maximum allowable percentage of glass on wall space is 40%. The maximum allowable glass space on roofs is 5%.

	N	E	S	W	Total walls	Roof
Administrative Building						
Wall Area (sf.)	3820	1141	3820	920	9701	20139
Window Area (sf.)	2393	148	2234	128	4903	228
% Window Area	63%	13%	58%	14%	51%	1%
Archives Building						
Wall Area (sf.)	1738	868	1760	931	5297	7925
Window Area (sf.)	348	0	232	36	616	0
% Window Area	20%	0%	13%	4%	12%	0%
Operations Building						
Wall Area (sf.)	2436	2369	2436	2380	9621	13478
Window Area (sf.)	48	306	295	191	840	0
% Window Area	2%	13%	12%	8%	9%	0%
Storage Building						
Wall Area (sf.)	2056	848	1720	848	5472	7935
Window Area (sf.)	48	0	0	62	110	0
% Window Area	2%	0%	0%	7%	2%	0%

All bold numbers in the table are final percentages. Any of these number highlighted in green meet ASHRAE Standard 5.2. The only structure that does not meet this standard is the administrative building. There is a large amount of glass utilized in the design of this building. In order to mitigate the negative effects of this glass, there are large shading devices over the North and South faces of the building as well as utilization of glass with higher than normal U-Values and ceramic frit.

5.5 Prescriptive Building Envelope Evaluation

Table ## below shows compliance with ASHRAE Standard 90.1-2010 Section 5.5 maximum U-Values. The Actual U-Values listed are for the worst case scenario on any/all buildings being added to the Sunnylands campus. All materials used in the construction of the four new buildings at Sunnylands are compliant with section 5.5.

Category	Description	Actual U-Value	ASHRAE Prescribed U-Value	Compliance
Roof	Concrete Deck	0.030 btu/h·ft²·F	0.048 btu/h·ft²·F	Yes
Above-Grade Wall	Painted Wood Siding	0.053 btu/h·ft²·F	0.104 btu/h·ft²·F	Yes
Below-Grade Wall	Concrete Masonry Unit	0.067 btu/h·ft²·F	0.123 btu/h·ft²·F	Yes
Slab	8" Concrete Slab on Grade	0.690 btu/h·ft²·F	0.730 btu/h·ft²·F	Yes
Window	Non-Fritted Double-Pane	0.320 btu/h·ft²·F	0.650 btu/h·ft²·F	Yes

Table ##

SECTION 6 | HEATING, VENTILATING, AND AIR CONDITIONING

6.4 Mandatory Provisions

All equipment selected for use at Sunnylands meets the minimum efficiency standards outlined by ASHRAE 90.1-2010 Table 6.8.1A through Table 6.8.1H as well as Table 6.8.1K. Load calculations were performed in accordance with ANSI/ASHRAE/ACCA Standard 183 in order to size the systems and equipment.

6.5 Prescriptive Path

All of the air handling equipment at Sunnylands is equipped with economizers, energy wheels, and control systems that are in accordance with ASHRAE 90.1-2010 Section 6.5.1. Under ideal conditions, the buildings can utilize free cooling through the implementation of the air side economizer. None of the High-Limit Shutoff Controls at Sunnylands are Differential dry bulb, in compliance with climate zone 3a in Table 6.5.1.1.3A. The only exceptions experienced on site are due to exception b in section 6.5.2.1: zones where special pressurization relationships, cross-contamination requirements or code-required minimum circulation rates are such that VAV systems are impractical. This takes place in the spaces discussed above in section 5.9 where there are high exhaust rates for work areas.

SECTION 7 | SERVICE WATER HEATING

Sunnylands implements a recirculating piping system for the hot-water on site. This includes the supply and return piping of circulating tank water. All necessary pipes are noted as insulated. Temperature controls allow adjustable water temperatures on water heaters.

SECTION 8 | POWER

The 2013 Edition of the California Electrical Code (CEC) contains electrical design and construction standards that override the ASHRAE 90.1 Standards listed in this section. These requirements include service metering which allow the building owner to get useful information for managing the use of electrical power, disaggregation of electrical circuits, a voltage drop in compliance with Section 8 of 3% branch circuit and 2% feeder, circuit controls for 120-volt receptacles, demand response controls, and energy management control system. All of the aforementioned provisions were met in the design of the new facilities at Sunnylands camps.

SECTION 9 | LIGHTING

The 2013 Edition of the California Nonresidential Indoor Lighting Code supersedes Section 9 of ASHRAE 20.1-2010. In this code, the designs can be approached as complete buildings, area categories, or through a tailored approach all listed under the prescriptive method. Alternatively, the building can be analyzed as a performance approach wherein the designer can use an energy commission-certified compliance software to demonstrate the proposed buildings energy consumption, including lighting power, meets the energy budget. The buildings on Sunnylands are modeled to comply with the performance approach. The calculated actual lighting power is adjusted based on control credits and compared to an allowed lighting power as outlined in the performance method of compliance. All buildings on the Sunnylands campus have an energy consumption that meets the energy budget.

References

- ANSI/ASHRAE. (2010). Standard 62.1-2010, Ventilation for Acceptable Indoor Air Quality. Atlanta, GA: American Society of Heating Refrigeration and Air Conditioning Engineers, Inc.
- ANSI/ASHRAE. (2010). Standard 90.1-2010, Energy Standard for Buildings Except Low Rise Residential Buildings. Atlanta, GA: American Society of Heating Refrigeration and Air Conditioning Engineers, Inc.
- California Energy Commission, 2013 Nonresidential Compliance Manual for the 2013 Building Energy Efficiency Standards Title 24, Part 6, and Associated Administrative Regulations in Part 1

APPENDIX A: Tables and Charts

TABLE 6-1 MINIMUM VENTILATION RATES IN BREATHING ZONE
(This table is not valid in isolation; it must be used in conjunction with the accompanying notes.)

Occupancy Category	People Outdoor Air Rate		Area Outdoor Air Rate		Notes	Default Values			Air Class
	R_p		R_a			Occupant Density (see Note 4)	Combined Outdoor Air Rate (see Note 5)		
	cfm/person	L/s·person	cfm/ft ²	L/s·m ²		#/1000 ft ² or #/100 m ²	cfm/person	L/s·person	
Correctional Facilities									
Cell	5	2.5	0.12	0.6		25	10	4.9	2
Dayroom	5	2.5	0.06	0.3		30	7	3.5	1
Guard stations	5	2.5	0.06	0.3		15	9	4.5	1
Booking/waiting	7.5	3.8	0.06	0.3		50	9	4.4	2
Educational Facilities									
Daycare (through age 4)	10	5	0.18	0.9		25	17	8.6	2
Daycare sickroom	10	5	0.18	0.9		25	17	8.6	3
Classrooms (ages 5–8)	10	5	0.12	0.6		25	15	7.4	1
Classrooms (age 9 plus)	10	5	0.12	0.6		35	13	6.7	1
Lecture classroom	7.5	3.8	0.06	0.3		65	8	4.3	1
Lecture hall (fixed seats)	7.5	3.8	0.06	0.3		150	8	4.0	1
Art classroom	10	5	0.18	0.9		20	19	9.5	2
Science laboratories	10	5	0.18	0.9		25	17	8.6	2
University/college laboratories	10	5	0.18	0.9		25	17	8.6	2
Wood/metal shop	10	5	0.18	0.9		20	19	9.5	2
Computer lab	10	5	0.12	0.6		25	15	7.4	1
Media center	10	5	0.12	0.6	A	25	15	7.4	1
Music/theater/dance	10	5	0.06	0.3		35	12	5.9	1
Multi-use assembly	7.5	3.8	0.06	0.3		100	8	4.1	1
Food and Beverage Service									
Restaurant dining rooms	7.5	3.8	0.18	0.9		70	10	5.1	2
Cafeteria/fast-food dining	7.5	3.8	0.18	0.9		100	9	4.7	2
Bars, cocktail lounges	7.5	3.8	0.18	0.9		100	9	4.7	2
Kitchen (cooking)	7.5	3.8	0.12	0.6		20	14	7.0	2
General									
Break rooms	5	2.5	0.06	0.3		25	10	5.1	1
Coffee stations	5	2.5	0.06	0.3		20	11	5.5	1
Conference/meeting	5	2.5	0.06	0.3		50	6	3.1	1
Corridors	–	–	0.06	0.3		–			1
Occupiable storage rooms for liquids or gels	5	2.5	0.12	0.6	B	2	65	32.5	2
Hotels, Motels, Resorts, Dormitories									
Bedroom/living room	5	2.5	0.06	0.3		10	11	5.5	1
Barracks sleeping areas	5	2.5	0.06	0.3		20	8	4.0	1
Laundry rooms, central	5	2.5	0.12	0.6		10	17	8.5	2
Laundry rooms within dwelling units	5	2.5	0.12	0.6		10	17	8.5	1
Lobbies/prefunction	7.5	3.8	0.06	0.3		30	10	4.8	1
Multipurpose assembly	5	2.5	0.06	0.3		120	6	2.8	1

Occupancy Category	People Outdoor Air Rate R_p		Area Outdoor Air Rate R_a		Notes	Default Values			Air Class
	cfm/person	L/s·person	cfm/ft ²	L/s·m ²		Occupant Density (see Note 4)	Combined Outdoor Air Rate (see Note 5)		
						#/1000 ft ² or #/100 m ²	cfm/person	L/s·person	
Office Buildings									
Breakrooms	5	2.5	0.12	0.6		50	7	3.5	1
Main entry lobbies	5	2.5	0.06	0.3		10	11	5.5	1
Occupiable storage rooms for dry materials	5	2.5	0.06	0.3		2	35	17.5	1
Office space	5	2.5	0.06	0.3		5	17	8.5	1
Reception areas	5	2.5	0.06	0.3		30	7	3.5	1
Telephone/data entry	5	2.5	0.06	0.3		60	6	3.0	1
Miscellaneous Spaces									
Bank vaults/safe deposit	5	2.5	0.06	0.3		5	17	8.5	2
Banks or bank lobbies	7.5	3.8	0.06	0.3		15	12	6.0	1
Computer (not printing)	5	2.5	0.06	0.3		4	20	10.0	1
General manufacturing (excludes heavy industrial and processes using chemicals)	10	5.0	0.18	0.9		7	36	18	3
Pharmacy (prep. area)	5	2.5	0.18	0.9		10	23	11.5	2
Photo studios	5	2.5	0.12	0.6		10	17	8.5	1
Shipping/receiving	10	5	0.12	0.6	B	2	70	35	2
Sorting, packing, light assembly	7.5	3.8	0.12	0.6		7	25	12.5	2
Telephone closets	—	—	0.00	0.0		—			1
Transportation waiting	7.5	3.8	0.06	0.3		100	8	4.1	1
Warehouses	10	5	0.06	0.3	B	—			2
Public Assembly Spaces									
Auditorium seating area	5	2.5	0.06	0.3		150	5	2.7	1
Places of religious worship	5	2.5	0.06	0.3		120	6	2.8	1
Courtrooms	5	2.5	0.06	0.3		70	6	2.9	1
Legislative chambers	5	2.5	0.06	0.3		50	6	3.1	1
Libraries	5	2.5	0.12	0.6		10	17	8.5	1
Lobbies	5	2.5	0.06	0.3		150	5	2.7	1
Museums (children's)	7.5	3.8	0.12	0.6		40	11	5.3	1
Museums/galleries	7.5	3.8	0.06	0.3		40	9	4.6	1
Residential									
Dwelling unit	5	2.5	0.06	0.3	F,G	F			1
Common corridors	—	—	0.06	0.3					1
Retail									
Sales (except as below)	7.5	3.8	0.12	0.6		15	16	7.8	2
Mall common areas	7.5	3.8	0.06	0.3		40	9	4.6	1
Barbershop	7.5	3.8	0.06	0.3		25	10	5.0	2

Occupancy Category	People Outdoor Air Rate R_p		Area Outdoor Air Rate R_a		Notes	Default Values			Air Class
						Occupant Density (see Note 4)	Combined Outdoor Air Rate (see Note 5)		
	cfm/person	L/s·person	cfm/ft ²	L/s·m ²		#/1000 ft ² or #/100 m ²	cfm/person	L/s·person	
Beauty and nail salons	20	10	0.12	0.6		25	25	12.4	2
Pet shops (animal areas)	7.5	3.8	0.18	0.9		10	26	12.8	2
Supermarket	7.5	3.8	0.06	0.3		8	15	7.6	1
Coin-operated laundries	7.5	3.8	0.12	0.6		20	14	7.0	2
Sports and Entertainment									
Sports arena (play area)	—	—	0.30	1.5	E	—			1
Gym, stadium (play area)	—	—	0.30	1.5		30			2
Spectator areas	7.5	3.8	0.06	0.3		150	8	4.0	1
Swimming (pool & deck)	—	—	0.48	2.4	C	—			2
Disco/dance floors	20	10	0.06	0.3		100	21	10.3	2
Health club/aerobics room	20	10	0.06	0.3		40	22	10.8	2
Health club/weight rooms	20	10	0.06	0.3		10	26	13.0	2
Bowling alley (seating)	10	5	0.12	0.6		40	13	6.5	1
Gambling casinos	7.5	3.8	0.18	0.9		120	9	4.6	1
Game arcades	7.5	3.8	0.18	0.9		20	17	8.3	1
Stages, studios	10	5	0.06	0.3	D	70	11	5.4	1

GENERAL NOTES FOR TABLE 6-1

- 1 **Related requirements:** The rates in this table are based on all other applicable requirements of this standard being met.
- 2 **Environmental Tobacco Smoke:** This table applies to ETS-free areas. Refer to Section 5.17 for requirements for buildings containing ETS areas and ETS-free areas.
- 3 **Air density:** Volumetric airflow rates are based on an air density of 0.075 lb_m/ft³ (1.2 kg_m/m³), which corresponds to dry air at a barometric pressure of 1 atm (101.3 kPa) and an air temperature of 70°F (21°C). Rates may be adjusted for actual density but such adjustment is not required for compliance with this standard.
- 4 **Default occupant density:** The default occupant density shall be used when actual occupant density is not known.
- 5 **Default combined outdoor air rate (per person):** This rate is based on the default occupant density.
- 6 **Unlisted occupancies:** If the occupancy category for a proposed space or zone is not listed, the requirements for the listed occupancy category that is most similar in terms of occupant density, activities and building construction shall be used.

ITEM-SPECIFIC NOTES FOR TABLE 6-1

- A For high school and college libraries, use values shown for Public Assembly Spaces—Libraries.
- B Rate may not be sufficient when stored materials include those having potentially harmful emissions.
- C Rate does not allow for humidity control. Additional ventilation or dehumidification may be required to remove moisture. "Deck area" refers to the area surrounding the pool that would be expected to be wetted during normal pool use, i.e., when the pool is occupied. Deck area that is not expected to be wetted shall be designated as a space type (for example, "spectator area").
- D Rate does not include special exhaust for stage effects, e.g., dry ice vapors, smoke.
- E When combustion equipment is intended to be used on the playing surface, additional dilution ventilation and/or source control shall be provided.
- F Default occupancy for dwelling units shall be two persons for studio and one-bedroom units, with one additional person for each additional bedroom.
- G Air from one residential dwelling shall not be recirculated or transferred to any other space outside of that dwelling.

TABLE 6-2 Zone Air Distribution Effectiveness

Air Distribution Configuration	E_z
Ceiling supply of cool air.	1.0
Ceiling supply of warm air and floor return.	1.0
Ceiling supply of warm air 15°F (8°C) or more above space temperature and ceiling return.	0.8
Ceiling supply of warm air less than 15°F (8°C) above space temperature and ceiling return provided that the 150 fpm (0.8 m/s) supply air jet reaches to within 4.5 ft (1.4 m) of floor level. <i>Note:</i> For lower velocity supply air, $E_z = 0.8$.	1.0
Floor supply of cool air and ceiling return provided that the 150 fpm (0.8 m/s) supply jet reaches 4.5 ft (1.4 m) or more above the floor. <i>Note:</i> Most underfloor air distribution systems comply with this proviso.	1.0
Floor supply of cool air and ceiling return, provided low-velocity displacement ventilation achieves unidirectional flow and thermal stratification.	1.2
Floor supply of warm air and floor return.	1.0
Floor supply of warm air and ceiling return.	0.7
Makeup supply drawn in on the opposite side of the room from the exhaust and/or return.	0.8
Makeup supply drawn in near to the exhaust and/or return location.	0.5

1. "Cool air" is air cooler than space temperature.

2. "Warm air" is air warmer than space temperature.

3. "Ceiling" includes any point above the *breathing zone*.

4. "Floor" includes any point below the *breathing zone*.

5. As an alternative to using the above values, E_z may be regarded as equal to air change effectiveness determined in accordance with ANSI/ASHRAE Standard 129¹⁷ for all air distribution configurations except unidirectional flow.

TABLE 6-4 Minimum Exhaust Rates

Occupancy Category	Exhaust Rate, cfm/unit	Exhaust Rate, cfm/ft ²	Notes	Exhaust Rate, L/s-unit	Exhaust Rate, L/s-m ²	Air Class
Arenas	—	0.50	B	—	—	1
Art classrooms	—	0.70		—	3.5	2
Auto repair rooms	—	1.50	A	—	7.5	2
Barber shops	—	0.50		—	2.5	2
Beauty and nail salons	—	0.60		—	3.0	2
Cells with toilet	—	1.00		—	5.0	2
Copy, printing rooms	—	0.50		—	2.5	2
Darkrooms	—	1.00		—	5.0	2
Educational science laboratories	—	1.00		—	5.0	2
Janitor closets, trash rooms, recycling	—	1.00		—	5.0	3
Kitchenettes	—	0.30		—	1.5	2
Kitchens—commercial	—	0.70		—	3.5	2
Locker/dressing rooms	—	0.25		—	1.25	2
Locker rooms	—	0.50		—	2.5	2
Paint spray booths	—	—	F	—	—	4
Parking garages	—	0.75	C	—	3.7	2
Pet shops (animal areas)	—	0.90		—	4.5	2
Refrigerating machinery rooms	—	—	F	—	—	3
Residential kitchens	50/100	—	G	25/50	—	2
Soiled laundry storage rooms	—	1.00	F	—	5.0	3
Storage rooms, chemical	—	1.50	F	—	7.5	4
Toilets—private	25/50	—	E	12.5/25	—	2
Toilets—public	50/70	—	D	25/35	—	2
Woodwork shop/classrooms	—	0.50		—	2.5	2

A Stands where engines are run shall have exhaust systems that directly connect to the engine exhaust and prevent escape of fumes.

B When combustion equipment is intended to be used on the playing surface additional dilution ventilation and/or source control shall be provided.

C Exhaust not required if two or more sides comprise walls that are at least 50% open to the outside.

D Rate is per water closet and/or urinal. Provide the higher rate where periods of heavy use are expected to occur, e.g., toilets in theatres, schools, and sports facilities. The lower rate may be used otherwise.

E Rate is for a toilet room intended to be occupied by one person at a time. For continuous system operation during normal hours of use, the lower rate may be used. Otherwise use the higher rate.

F See other applicable standards for exhaust rate.

G For continuous system operation, the lower rate may be used. Otherwise use the higher rate.

APPENDIX B: Ventilation Calculations and Exhaust Rates

Manual Inputs													Calculations						Engineering Checks			Lookups					
Room Number and Description	ASHRAE 62 Space Type (Pull-down Menu)	Area ft ²	Height ft	People	AC/HR Min	Load Calc Peak cfm	CFM/ft ² Min	People Diversity	ASHRAE 62 Zone Distribution System (Pull-down Menu)	Heating Min cfm	Exhaust cfm		Peak cfm	OA cfm	Z Crit	People #	Heating cfm	Exhaust cfm	Peak AC/HR	Peak CFM/ft ²	OA CFM/ft ²	ASHRAE cfm/person	ASHRAE CFM/ft ²	ASHRAE People Density	Zone Dist. Effectiveness	People OA cfm	Area OA cfm
Administrative Building	System Totals	13,731		156									3,363	275	0.21	31	1,009	0		0.24						152	123
A01 VESTIBULE	Reception areas	241	9.25	7		0	1.00	100%	A-Ceiling supply, cooling	30%	0		241	51	0.21	7	72	0	6.5	1.00	0.21	5	0.06	30	1.0	36	14
A02 LOBBY/RECEPTION AREA	Reception areas	653	12.75	5		870	1.00	100%	A-Ceiling supply, cooling	30%	0		870	64	0.07	5	261	0	6.3	1.33	0.10	5	0.06	30	1.0	25	39
A03 MECHANICAL	*None*	442	12.75	1		135	1.00	100%	A-Ceiling supply, cooling	30%	0		442	0	0.00	1	133	0	4.7	1.00	0.00	0	0	0	1.0	0	0
A04 LARGE MEETING ROOM	Conference / meeting	530	10.5	15		960	1.00	100%	A-Ceiling supply, cooling	30%	0		960	107	0.11	15	288	0	10.4	1.81	0.20	5	0.06	50	1.0	75	32
A05 PRESUDEBT'S ASSISTANT	Office space	340	10.5	2		310	1.00	100%	A-Ceiling supply, cooling	30%	0		340	29	0.09	2	102	0	5.7	1.00	0.09	5	0.06	5	1.0	9	20
A06 PRESIDENT'S OFFICE	Office space	290	10.5	1		510	1.00	100%	A-Ceiling supply, cooling	30%	0		510	25	0.05	1	153	0	10.0	1.76	0.09	5	0.06	5	1.0	7	17
A07 PRESIDENTS MEETING ROOM	Conference / meeting	300	10.5	15		410	1.00	100%	A-Ceiling supply, cooling	30%	0		410	93	0.23	15	123	0	7.8	1.37	0.31	5	0.06	50	1.0	75	18
A08 PANTRY	Storage rooms	110	9.25	0		95	1.00	100%	A-Ceiling supply, cooling	30%	0		110	13	0.12	0	33	0	6.5	1.00	0.12	0	0.12	0	1.0	0	13
A09 HALLWAY	Corridors	408	9.25	0		0	1.00	100%	A-Ceiling supply, cooling	30%	0		408	24	0.06	0	122	0	6.5	1.00	0.06	0	0.06	0	1.0	0	24
A10 HALLWAY	Corridors	110	9.25	0		0	1.00	100%	A-Ceiling supply, cooling	30%	400		110	7	0.06	0	33	400	6.5	1.00	0.06	0	0.06	0	1.0	0	7
A11 WOMEN'S RESTROOM	*None*	185	9.25	0		100	1.00	100%	A-Ceiling supply, cooling	30%	400		185	0	0.00	0	56	400	6.5	1.00	0.00	0	0	0	1.0	0	0
A12 MEN'S RESTROOM	*None*	185	9.25	0		100	1.00	100%	A-Ceiling supply, cooling	30%	0		185	0	0.00	0	56	0	6.5	1.00	0.00	0	0	0	1.0	0	0
A13 DIGITAL EDIT	Computer Lab.	96	9.25	2		85	1.00	100%	A-Ceiling supply, cooling	30%	0		96	36	0.37	2	29	0	6.5	1.00	0.37	10	0.12	25	1.0	24	12
A14 SICK ROOM	Bedroom/Living Room	96	9.25	1		100	1.00	100%	A-Ceiling supply, cooling	30%	0		100	11	0.11	1	30	0	6.8	1.04	0.11	5	0.06	10	1.0	5	6
A15 STAFF LOUNGE	Cafeteria / fast food dining	1,048	11.5	30		1,155	1.00	100%	A-Ceiling supply, cooling	30%	0		1,155	414	0.36	30	347	0	5.8	1.10	0.39	7.5	0.18	100	1.0	225	189
A16 ELECTRICAL	Telephone/data entry	115	10.5	7		320	1.00	100%	A-Ceiling supply, cooling	30%	0		320	41	0.13	7	96	0	15.9	2.78	0.36	5	0.06	60	1.0	35	7
A17 WOMEN'S RESTROOM	*None*	200	9.25	0		175	1.00	100%	A-Ceiling supply, cooling	30%	430		200	0	0.00	0	60	430	6.5	1.00	0.00	0	0	0	1.0	0	0
A18 MENS RESTROOM	*None*	200	9.25	0		175	1.00	100%	A-Ceiling supply, cooling	30%	400		200	0	0.00	0	60	400	6.5	1.00	0.00	0	0	0	1.0	0	0
A19 CO-ED LOCKERS	*None*	110	9.25	0		100	1.00	100%	A-Ceiling supply, cooling	30%	250		110	0	0.00	0	33	250	6.5	1.00	0.00	0	0	0	1.0	0	0
A20 SHOWER	Gym, stadium (play area)	90	9.25	3		0	1.00	100%	A-Ceiling supply, cooling	30%	140		90	27	0.30	3	27	140	6.5	1.00	0.30	0	0.3	30	1.0	0	27
A21 JANITOR CLOSET	*None*	63	9.25	0		125	1.00	100%	A-Ceiling supply, cooling	30%	125		125	0	0.00	0	38	125	12.9	1.98	0.00	0	0	0	1.0	0	0
A22 STORAGE	Storage rooms	230	9.25	0		75	1.00	100%	A-Ceiling supply, cooling	30%	0		230	28	0.12	0	69	0	6.5	1.00	0.12	0	0.12	0	1.0	0	28

A23 HALLWAY	Corridors	134	9.25	0	0	1.00	100%	A-Ceiling supply, cooling	30%	0	134	8	0.06	0	40	0	6.5	1.00	0.06	0	0.06	0	1.0	0	8
A24 IT	Office space	110	9.25	1	320	1.00	100%	A-Ceiling supply, cooling	30%	0	320	9	0.03	1	96	0	18.9	2.91	0.09	5	0.06	5	1.0	3	7
A 25 OPEN OFFICE WORKSPACE	Office space	4,965	14.5	30	3,505	1.00	100%	F-Displacement ventilation, cooling	30%	0	4,965	373	0.08	30	1,490	0	4.1	1.00	0.08	5	0.06	5	1.2	125	248
A26 OFFICE	Office space	250	12.5	1	400	1.00	100%	A-Ceiling supply, cooling	30%	0	400	21	0.05	1	120	0	7.7	1.60	0.09	5	0.06	5	1.0	6	15
A27 OFFICE	Office space	240	12.5	1	400	1.00	100%	A-Ceiling supply, cooling	30%	0	400	20	0.05	1	120	0	8.0	1.67	0.09	5	0.06	5	1.0	6	14
A28 OFFICE	Office space	240	12.5	1	400	1.00	100%	A-Ceiling supply, cooling	30%	0	400	20	0.05	1	120	0	8.0	1.67	0.09	5	0.06	5	1.0	6	14
A29 OFFICE	Office space	240	12.5	1	400	1.00	100%	A-Ceiling supply, cooling	30%	0	400	20	0.05	1	120	0	8.0	1.67	0.09	5	0.06	5	1.0	6	14
A30 OFFICE	Office space	240	12.5	1	400	1.00	100%	A-Ceiling supply, cooling	30%	0	400	20	0.05	1	120	0	8.0	1.67	0.09	5	0.06	5	1.0	6	14
A 31 OFFICE	Office space	250	12.5	1	400	1.00	100%	A-Ceiling supply, cooling	30%	0	400	21	0.05	1	120	0	7.7	1.60	0.09	5	0.06	5	1.0	6	15
A32 HALLWAY	Corridors	140	12.5	0	0	1.00	100%	A-Ceiling supply, cooling	30%	0	140	8	0.06	0	42	0	4.8	1.00	0.06	0	0.06	0	1.0	0	8
A33 WORK ROOM	Office space	345	12.5	2	235	1.00	100%	A-Ceiling supply, cooling	30%	0	345	29	0.09	2	104	0	4.8	1.00	0.09	5	0.06	5	1.0	9	21
A34 MEETING ROOM 2	Conference / meeting	280	12.5	14	685	1.00	100%	A-Ceiling supply, cooling	30%	0	685	87	0.13	14	206	0	11.7	2.45	0.31	5	0.06	50	1.0	70	17
A35 MEETING ROOM 3	Conference / meeting	255	10	13	455	1.00	100%	A-Ceiling supply, cooling	30%	0	455														
Archives	System Totals	6,749		17							2,370	199	0.18	17	711	0		0.35						85	114
B01 ENTRY VESTIBULE	Lobbies	95	9.25	1	0	1.00	100%	A-Ceiling supply, cooling	30%	0	95	11	0.11	1	29	0	6.5	1.00	0.11	5	0.06	150	1.0	5	6
B02 CONFERENCE SPACE	Conference / meeting	385	9.25	10	990	1.00	100%	A-Ceiling supply, cooling	30%	0	990	73	0.07	10	297	0	16.7	2.57	0.19	5	0.06	50	1.0	50	23
B03 ARCHIVE WORKSPACE	Libraries	432	9.25	2	760	1.00	100%	A-Ceiling supply, cooling	30%	0	760	62	0.08	2	228	0	11.4	1.76	0.14	5	0.12	10	1.0	10	52
B04 DIRECTORS OFFICE	Office space	211	9.25	2	350	1.00	100%	A-Ceiling supply, cooling	30%	0	350	23	0.06	2	105	0	10.8	1.66	0.11	5	0.06	5	1.0	10	13
B05 LIBRARIAN	Libraries	175	9.25	2	100	1.00	100%	A-Ceiling supply, cooling	30%	0	175	31	0.18	2	53	0	6.5	1.00	0.18	5	0.12	10	1.0	10	21
B06 HALLWAY	Corridors	309	9.25	0	0	1.00	100%	A-Ceiling supply, cooling	30%	0	309	19	0.06	0	93	0	6.5	1.00	0.06	0	0.06	0	1.0	0	19
B07 UNISEX	*None*	88	9.25	0	0	1.00	100%	A-Ceiling supply, cooling	30%	100	88	0	0.00	0	26	100	6.5	1.00	0.00	0	0	0	1.0	0	0
B08 COPY/COFFEE	Cafeteria / fast food dining	132	9.25	0	180	1.00	100%	A-Ceiling supply, cooling	30%	130	180	123	0.68	13	54	130	8.8	1.36	0.93	7.5	0.18	100	1.0	99	24
B09 PHOTO STUDIO	Photo studios	190	9.25	2	270	1.00	100%	A-Ceiling supply, cooling	30%	0	270	33	0.12	2	81	0	9.2	1.42	0.17	5	0.12	10	1.0	10	23
B10 UTILITY/JANITOR	Storage rooms	50	9.25	0	0	1.00	100%	A-Ceiling supply, cooling	30%	90	50	6	0.12	0	15	90	6.5	1.00	0.12	0	0.12	0	1.0	0	6
B11 OBJECT CONSERVATION	Libraries	346	9.25	2	310	1.00	100%	A-Ceiling supply, cooling	30%	0	346	52	0.15	2	104	0	6.5	1.00	0.15	5	0.12	10	1.0	10	42
B12 CLOSET	Storage rooms	74	9.25	0	0	1.00	100%	A-Ceiling supply, cooling	30%	0	74	9	0.12	0	22	0	6.5	1.00	0.12	0	0.12	0	1.0	0	9
B13 MECHANICAL/ELECTRICAL	*None*	219	9.25	0	500	1.00	100%	A-Ceiling supply, cooling	30%	0	500	0	0.00	0	150	0	14.8	2.28	0.00	0	0	0	1.0	0	0
B14 HALLWAY	Corridors	492	9.25	0	0	1.00	100%	A-Ceiling supply, cooling	30%	0	492	30	0.06	0	148	0	6.5	1.00	0.06	0	0.06	0	1.0	0	30
B15 OBJECT STORAGE	Libraries	1702	9.25	1	1,000	1.00	100%	A-Ceiling supply, cooling	30%	0	1,702	209	0.12	1	511	0	6.5	1.00	0.12	5	0.12	10	1.0	5	204
B 16 COLD STORAGE	Warehouses	263	9.25	0	0	1.00	100%	A-Ceiling supply, cooling	30%	0	263	16	0.06	0	79	0	6.5	1.00	0.06	0	0.06	0	1.0	0	16
B17 ARCHIVAL STORAGE	Libraries	1065	9.25	1	1,400	1.00	100%	A-Ceiling supply, cooling	30%	0	1,400	133	0.09	1	420	0	8.5	1.31	0.12	5	0.12	10	1.0	5	128
B18 HIGH SECURITY STORAGE	Libraries	256	9.25	1	310	1.00	100%	A-Ceiling supply, cooling	30%	0	310	36	0.12	1	93	0	7.9	1.21	0.14	5	0.12	10	1.0	5	31
B19 INTAKE AREA	Shipping/Receiving	162	9.25	0	350	1.00	100%	A-Ceiling supply, cooling	30%	0	350	19	0.06	0	105	0	4.0	2.16	0.12	0	0.12	0	1.0	0	19

B20 LOADING DOCK	Shipping/Receiving	103	9.25	0		0	1.00	100%	A-Ceiling supply, cooling	30%	0	103	12	0.12	0	31	0	6.5	1.00	0.12	0	0.12	0	1.0	0	12
Operations	System Totals	12,354		10								1,046	103	0.14	10	314	0		0.08						50	53
C01 OPS STAFF	Office space	434	9.25	4		500	1.00	100%	A-Ceiling supply, cooling	30%	0	500	46	0.09	4	150	0	7.5	1.15	0.11	5	0.06	5	1.0	20	26
C02 HALLWAY	Corridors	89	9.25	0		0	1.00	100%	A-Ceiling supply, cooling	30%	0	89	5	0.06	0	27	0	6.5	1.00	0.06	0	0.06	0	1.0	0	5
C03 CONFERENCE	Conference / meeting	129	9.25	4		200	1.00	100%	A-Ceiling supply, cooling	30%	0	200	28	0.14	4	60	0	10.1	1.55	0.22	5	0.06	50	1.0	20	8
C04 HALLWAY	Corridors	92	9.25	0		0	1.00	100%	A-Ceiling supply, cooling	30%	0	92	6	0.06	0	28	0	6.5	1.00	0.06	0	0.06	0	1.0	0	6
C05 DREW'S OFFICE	Office space	142	12.75	2		165	1.00	100%	A-Ceiling supply, cooling	30%	0	165	19	0.11	2	50	0	5.5	1.16	0.13	5	0.06	5	1.0	10	9
C06 MAINTENANCE OFFICE	Office space	232	9.25	2		300	1.00	100%	A-Ceiling supply, cooling	30%	0	300	24	0.08	2	90	0	8.4	1.29	0.10	5	0.06	5	1.0	10	14
C07 HALLWAY	Corridors	94	9.25	0		0	1.00	100%	A-Ceiling supply, cooling	30%	0	94	6	0.06	0	28	0	6.5	1.00	0.06	0	0.06	0	1.0	0	6
C08 LAUNDRY	Coin operated laundries	114	9.25	2		125	1.00	100%	A-Ceiling supply, cooling	30%	0	125	22	0.17	2	38	0	7.1	1.10	0.19	7.5	0.06	20	1.0	15	7
C09 LOW VOLTAGE	*None*	39	9.25	0		135	1.00	100%	A-Ceiling supply, cooling	30%	0	135	0	0.00	0	41	0	22.5	3.46	0.00	0	0	0	1.0	0	0
C10 ELECTRIC/IRRIGATION	*None*	114	9.25	0		635	1.00	100%	A-Ceiling supply, cooling	30%	0	635	0	0.00	0	191	0	36.1	5.57	0.00	0	0	0	1.0	0	0
C11 GENERAL STORAGE	Storage rooms	290	12.75	0		200	1.00	100%	A-Ceiling supply, cooling	30%	0	290	35	0.12	0	87	0	4.7	1.00	0.12	0	0.12	0	1.0	0	35
C12 MECH	*None*	56	9.25	0		100	1.00	100%	A-Ceiling supply, cooling	30%	0	100	0	0.00	0	30	0	11.6	1.79	0.00	0	0	0	1.0	0	0
C13 BREAK ROOM	Cafeteria / fast food dining	792	9.25	20		1,400	1.00	100%	A-Ceiling supply, cooling	30%	0	1,400	293	0.21	20	420	0	11.5	1.77	0.37	7.5	0.18	100	1.0	150	143
C14 JANITOR	*None*	27	9.25	0		0	1.00	100%	A-Ceiling supply, cooling	30%	50	27	0	0.00	0	8	50	6.5	1.00	0.00	0	0	0	1.0	0	0
C15 MEN'S RESTROOM	*None*	640	9.25	0		530	1.00	100%	A-Ceiling supply, cooling	30%	960	640	0	0.00	0	192	960	6.5	1.00	0.00	0	0	0	1.0	0	0
C16 WOMEN'S RESTROOM	*None*	260	9.25	0		150	1.00	100%	A-Ceiling supply, cooling	30%	390	260	0	0.00	0	78	390	6.5	1.00	0.00	0	0	0	1.0	0	0
C17 MAINTENANCE	*None*	730	12.75	3		640	1.00	100%	A-Ceiling supply, cooling	30%	0	730	0	0.00	3	219	0	4.7	1.00	0.00	0	0	0	1.0	0	0
C18 EQUIPMENT STORAGE	Storage rooms	5993	12.75	0		0	1.00	100%	A-Ceiling supply, cooling	0%	7,200	5,993	719	0.12	0	0	7,200	4.7	1.00	0.12	0	0.12	0	1.0	0	719
C19 PAINT ROOM	Art classroom	266	12.75	0		0	1.00	100%	A-Ceiling supply, cooling	0%	300	266	101	0.38	5	0	300	4.7	1.00	0.38	10	0.18	20	1.0	53	48
C20 PARTS STORAGE	Storage rooms	444	12.75	2		0	1.00	100%	A-Ceiling supply, cooling	0%	0	444	53	0.12	2	0	0	4.7	1.00	0.12	0	0.12	0	1.0	0	53
C21 WORK AREA	Wood/metal shop	1162	12.75	5		0	1.00	100%	A-Ceiling supply, cooling	0%	900	1,162	259	0.22	5	0	900	4.7	1.00	0.22	10	0.18	20	1.0	50	209
C22 STORAGE	Storage rooms	115	12.75	0		0	1.00	100%	A-Ceiling supply, cooling	0%	0	115	14	0.12	0	0	0	4.7	1.00	0.12	0	0.12	0	1.0	0	14
C23 MECH OFFICE	Office space	100	13	2		0	1.00	100%	A-Ceiling supply, cooling	0%	0	100	16	0.16	2	0	0	4.7	1.00	0.16	5	0.06	5	1.0	10	6
STORAGE	System Totals	1,426		6								1,426	171	0.12	6	0	0		1.00						0	171
STORAGE SPACE 1	Storage rooms	720	14.67	2		19	1.00	100%	A-Ceiling supply, cooling	0%	0	720	86	0.12	2	0	0	4.1	1.00	0.12	0	0.12	0	1.0	0	86
STORAGE SPACE 2	Storage rooms	706	14.67	4		37	1.00	100%	A-Ceiling supply, cooling	0%	0	706	85	0.12	4	0	0	4.1	1.00	0.12	0	0.12	0	1.0	0	85

APPENDIX C: Lighting Power Density

Administrative Building	SQ FT	WATTS	T24 W/SQ FT	
			ACTUAL	ALLOWABLE
A01 VESTIBULE	241	0	0.000	0.6
A02 LOBBY/RECEPTION AREA	653	1,013	1.551	1.1
A03 MECHANICAL	442	315	0.713	0.7
A04 LARGE MEETING ROOM	530	642	1.211	1.4
A05 PRESIDENT'S ASSISTANT	340	386	1.135	1
A06 PRESIDENT'S OFFICE	290	350	1.207	0.75
A07 PRESIDENTS MEETING ROOM	300	616	2.053	1.1
A08 PANTRY	110	148	1.345	1
A09 HALLWAY	408	224	0.549	0.6
A10 HALLWAY	110	224	2.036	0.6
A11 WOMEN'S RESTROOM	185	125	0.676	0.6
A12 MEN'S RESTROOM	185	125	0.676	0.6
A13 DIGITAL EDIT	96	72	0.750	1
A14 SICK ROOM	96	72	0.750	1
A15 STAFF LOUNGE	1,048	731	0.698	1.1
A16 ELECTRICAL	115	70	0.609	0.7
A17 WOMEN'S RESTROOM	200	100	0.500	0.6
A18 MENS RESTROOM	200	100	0.500	0.6
A19 CO-ED LOCKERS	110	70	0.636	0.6
A20 SHOWER	90	50	0.556	0.6
A21 JANITOR CLOSET	63	35	0.556	0.6
A22 STORAGE	230	140	0.609	0.6
A23 HALLWAY	134	224	1.672	0.6
A24 IT	110	90	0.818	0.7
A 25 OPEN OFFICE WORKSPACE	4,965	3,930	0.792	0.75
A26 OFFICE	250	240	0.960	1
A27 OFFICE	240	240	1.000	1
A28 OFFICE	240	240	1.000	1
A29 OFFICE	240	240	1.000	1
A30 OFFICE	240	240	1.000	1
A 31 OFFICE	250	240	0.960	1
A32 HALLWAY	140	108	0.771	0.6
A33 WORK ROOM	345	456	1.322	1
A34 MEETING ROOM 2	280	296	1.057	1.4
A35 MEETING ROOM 3	255	240	0.941	1.4
TOTALS	13,731	12,392	33	30