BUILDING AND PLANT ENERGY ANALYSIS

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NATIONAL AUDIO VISUAL CONSERVATION CENTER

CULPEPER COUNTY, VA

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MECHANICAL OPTION

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1 EXECUTIVE SUMMARY

The National Audio Visual Conservation Center mechanical systems were evaluated with LEED-NC Version 2.2, ASHRAE Standard 90.1 – 2004, and Trane TRACE to verify that the building is environmentally and energy conscious. Because the building serves many different functions including storage spaces for different media types, conservation office and lab space where the media is restored and conserved, and public areas to view and listen to the media, there are many different systems providing each space with different conditions. As a result, a simple analysis of loads and energy consumption may cause inaccuracies. For further analysis it may be beneficial to utilize a more advanced program.

In this report, all three buildings are examined together. As a result many of the calculations became rather lengthy and may be found in the Appendix.

2 ASSUMPTIONS

- Building data measured by hand accurately represents space areas and exterior wall dimensions
- All glazing is clear 1" IGU with ¼" glazing providing an SHGC of 0.55
- R-Value for below grade walls was obtained as a function of R-Value above grade and depth of wall – the calculated R-Value was used to model the wall above grade since below grade walls are not available in TRACE
- All inputs were derived from drawing sets, design narratives, and equipment cutsheets – any information not obtained this way was left as the Trane TRACE default

- Building Systems Summary

2.1 Airside Systems

2.1.1 AHU Zoning

The AHU zoning is broken up based upon the function of each space. Below is a diagrammatical break down of AHU zoning followed by Table 3.1-1 which provides the function of each AHU:

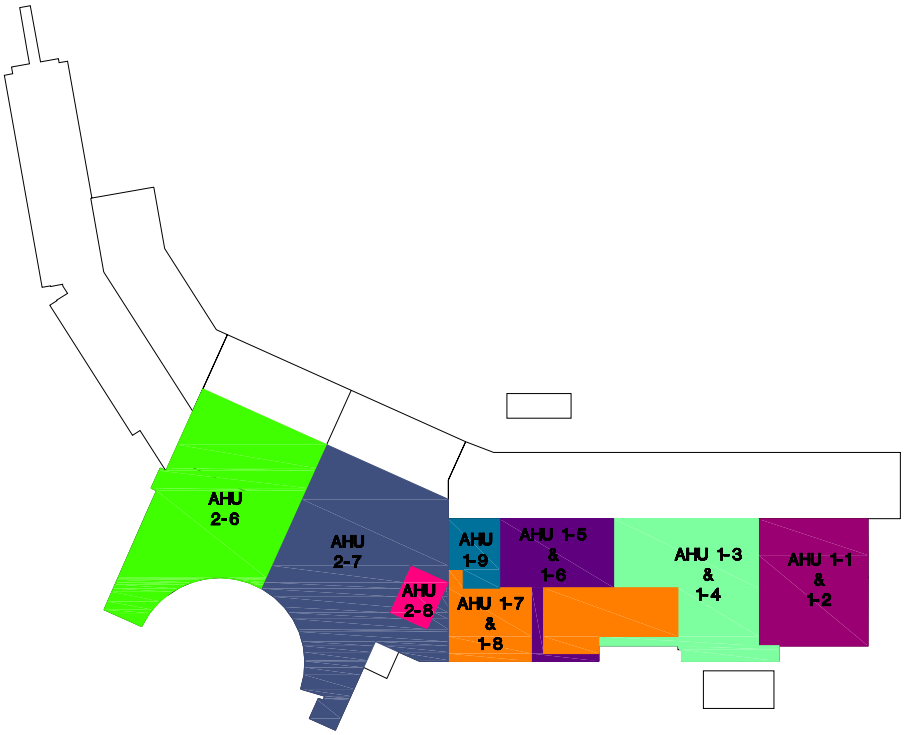

Figure 2.1-1 First Floor AHU Zoning

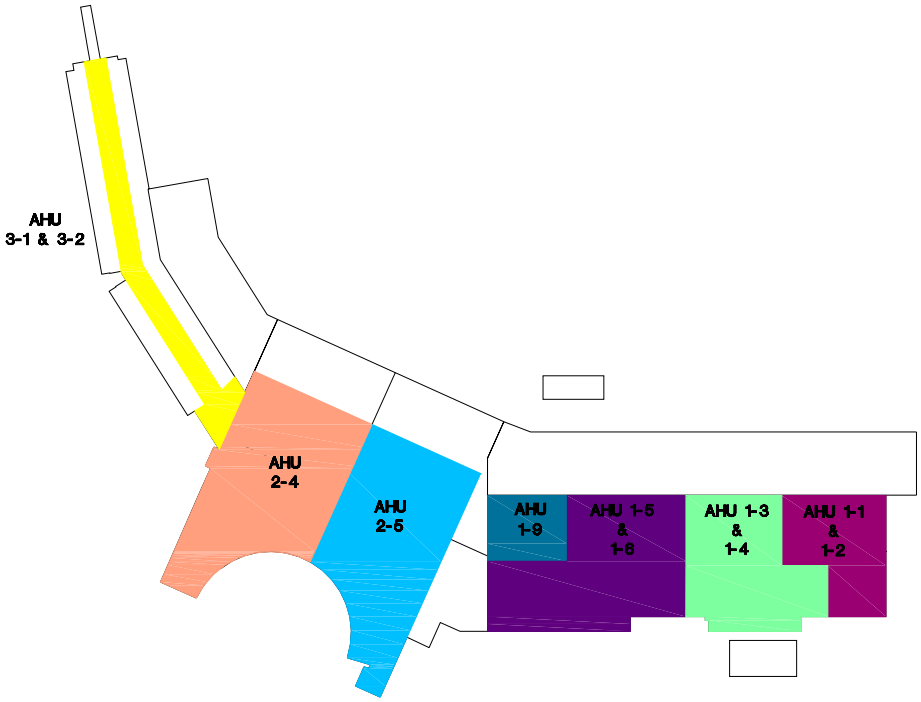

Figure 2.1-2 Second Floor AHU Zoning

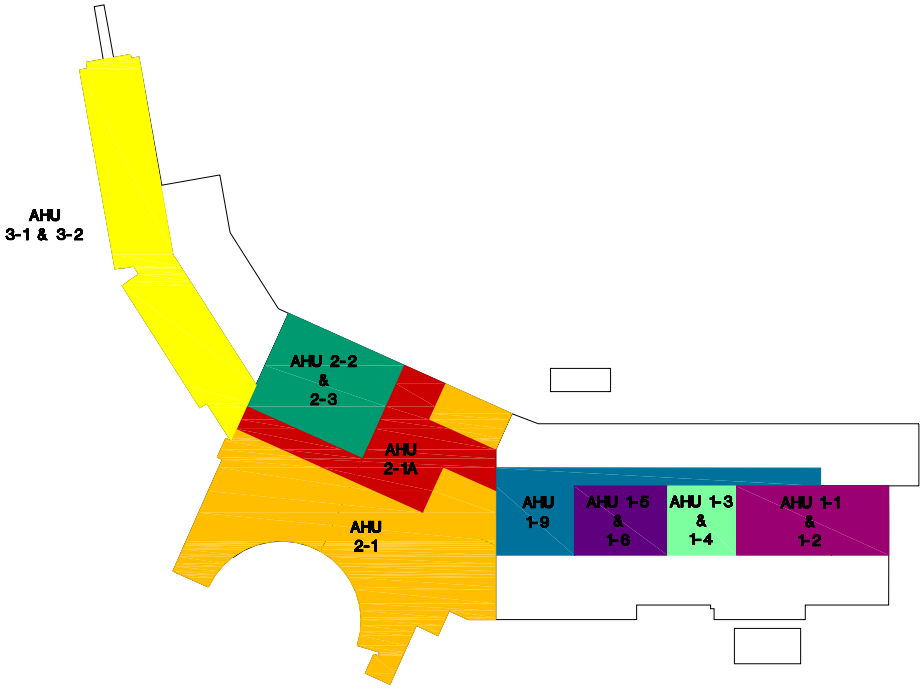

Figure 2.1-3 Third Floor AHU Zoning

AHU Service & Function		
AHU Tag	**Location**	**Service**
AHU 1-1	4th Floor Collections Building	Collections Vaults
AHU 1-2	4th Floor Collections Building	Collections Vaults
AHU 1-3	4th Floor Collections Building	Collections Vaults
AHU 1-4	4th Floor Collections Building	Collections Vaults
AHU 1-5	4th Floor Collections Building	Collections Vaults
AHU 1-6	4th Floor Collections Building	Collections Vaults
AHU 1-7	4th Floor Collections Building	Collections Vaults
AHU 1-8	4th Floor Collections Building	Collections Vaults
AHU 1-9	4th Floor Collections Building	Collections Office
AHU 1-10	4th Floor Collections Building	Main Electrical Room
AHU 2-1	4th Floor Collections Building	Cons 3rd Floor office
AHU 2-1A	4th Floor Collections Building	Cons A/V Lab
AHU 2-2	4th Floor Collections Building	Cons Film Lab
AHU 2-3	4th Floor Collections Building	Cons Film Lab
AHU 2-4	2nd Floor Conservation Bldg	Cons 2nd Floor office
AHU 2-5	2nd Floor Conservation Bldg	Cons 2nd Floor office
AHU 2-6	1st Floor Conservation Bldg	Cons 1st Floor office
AHU 2-7	1st Floor Conservation Bldg	Cons 1st Floor office
AHU 2-8	1st Floor Conservation Bldg	Theater
AHU 2-9	1st Floor Conservation Bldg	Holding Room
AHU 3-1	c	Nitrate Vaults
AHU 3-1	Nitrate Vault Mech Room	Nitrate Vaults

Table 2.1-1 Summary of AHU service

2.1.2 Space Design Criteria

The space design criteria is determined by the function of each space. Since each different types of film have separate requirements for ambient conditions, the space requirements vary throughout the buildings. Table 3.1-2 summarizes space criteria for typical space types.

Space Design Criteria			
Space	**DBT (F) Summer/Winter**	**RH (%) Summer/Win**	**HR (gr/lb) Summer/Win**
Office Area	75/70 ±2	50/40 ±5	65/43
Photographic Lab	75/70 ±2	50/40 ±5	65/43
Collections Holding	68 ±2	50 Max	50 Max
Collections Storage	50 ±5	35 ±5	19
Nitrate Film Storage	39 ±5	30 ±5	10
Motion Picture Storag	25 ±5	30 ±5	6

Table 2.1-2 Summary of space design criteria

2.2 Cooling Systems

Each AHU is served with 42 F air from chillers 1&2 to support the chilled water cooling coils. Chillers 1&2 are each 450 ton three stage centrifugal chillers. The 42 F water is supplied both to the loads (AHU's) as well as to two 175 ton screw compressor chillers which operate on a 30-42 F loop. Chillers 3 &4 provide chilled water to the re-cooling coils at each of the Nitrate and Collections Vaults. The Low temperature vaults are also cooled by re-cooling coils however they are supplied by a 5th chiller operating from 10-18 F. Chiller 5 is a 30 ton scroll compressor chiller which rejects heat to the 30-42 degree loop. Each chiller is sized for 100% of the load for redundancy and the entire system is connected to an emergency generator

2.3 Heating Systems

Heating through the building is served by two 600 HP oil fired steam boilers. The steam is provided to the AHU's to re-activate the desiccant systems as well as heat exchangers to heat the hot water for the preheat and reheat coils. Boilers each have dual fuel burners to provide further flexibility and are also connected to the emergency generator.

3 LEED NC 2.2 ASSESSMENT

LEED, a rating system compiled by the US Green Building Council, has been utilized to assess the sustainability of the NAVCC. Since a LEED evaluation has not been preformed on NAVCC, much of the documentation to prove compliance could not be obtained. In cases where the attainment of credits is questionable, the credit has not been counted towards the total. Although it is not analyzed more closely here, it may be reasonable to assume that the NAVCC may accumulate enough credits to earn a LEED rating, especially given the nature of the building.

3.1 LEED Certification

LEED is broken down into 6 major categories:

- Sustainable Sites
- Water Efficiency
- Energy & Atmosphere
- Materials & Resources
- Indoor Environmental Quality
- Innovative Design

Each category as a number of credits that may be obtained by submitting documentation that proves the project meets the LEED requirements. Depending on the number of credits earned the building may obtain certification. Table 4.1-1 breaks down each certification level by the number of credits required.

LEED Certification Categories	
Number of Points	**Rating**
0-26	No Rating
26-32	Certified
32-38	Silver
39-51	Gold
52-69	Platinum

Table 3.1-1 Summary of LEED credit requirements

3.2 LEED Analysis

By comparing the obtained NAVCC documentation to credit requirements, credits were awarded to in the following categories: Sustainable Sites, Water Efficiency, and Indoor Environmental Quality. Although a detailed break down of the obtainable credits is provided in the Appendix, table 4.2-1 provides the distribution of credits earned

per category. The Sustainable Site and Water Efficiency credits were awarded largely due to the fact that much of NAVCC is below grade with a green roof above. The green roof allows the NAVCC to blend seamlessly with the site and has very little impact on the site. In addition the green roof helps with storm water management and the heat island effect. Inside, the choice of finishing materials limit the number of VOC's introduced to the space allowing for points to be obtained for the IEQ section.

LEED NC 2.2 Summary	
Category	**Credits Obtained**
Sustainable Sites	8
Water Efficiency	1
Energy & Atmosphere	0
Materials & Resources	0
Indoor Environmental Quality	5
Innovative Design	0
Total:	**14**
Rating:	**None**

Table 3.2-1 Summary of LEED NC 2.2 obtainable credits

4 ASHRAE STANDARD 90.1 COMPLIANCE

As the energy standard for buildings, ASHRAE 90.1 provides limitations on energy loss and consumption in buildings. This includes energy that is lost through the building envelope, consumed by the mechanical system, and consumed by the lighting & electrical system. This section includes comparisons between the NAVCC design documents and ASHRAE Standard 90.1 – 2004. Through out this analysis it is imperative to recall that the design documents were completed in 2002, before this standard was published. Additionally, all area take-offs were performed by hand and may include some level of error. Inaccuracy of area will primarily affect the lighting power density calculations, many of which were slightly higher than the allowable maximum.

4.1 Building Envelope

Because the envelope load can result in an extremely inefficient mechanical system, ASHRAE 90.1 compliance requires all walls and glazing to provide a minimum resistance to heat transfer. Although the NAVCC is primarily below grade and energy loss is limited because of this, the Conservation building has a large amount of glazing on the North East façade. All opaque elements and glazing of the design were compared to Table 5.5-4 in ASHRAE 90.1 since Culpeper, VA falls into climate zone 4A. This table provides minimum thermal resistances for roofs, walls (above & below grade), floors, slab on grade floors, doors, and glazing as well as a maximum solar heat gain coefficient for glazing. Table 5-1 displays the findings of this comparison.

Building Envelope Compliance Summary

	Component	R-Value	U/C/F Factor	SHGC	Assembly Max	Assembly Min	Compliance
Collections	Roofs	32.2	0.031	-	0.063	15	YES
	Above Grade Walls	12.85	0.078	-	0.151	5.7	YES
	Below Grade Walls	12.85	0.078	-	1.14	-	YES
	Slab on Grade Floors	26	0.039	-	0.107	6.3	YES
	Vertical Glazing	-	-	-	-	-	-
	Skylight	-	-	-	-	-	-
Conservation	Roofs	22.2	0.045	-	0.063	15	YES
	Above Grade Walls	30	0.033		0.151	5.7	YES
	Below Grade Walls	32.8	0.030	-	1.14	-	YES
	Slab on Grade Floors	27.2	0.037	-	0.107	6.3	YES
	Vertical Glazing	2	0.500	0.55	0.46	0.25	NO
	Skylight	2	0.500	0.55	1.17	0.39	NO
Nitrate Vaults	Roofs	34.4	0.029	-	0.063	15	YES
	Above Grade Walls	-	-	-	0.151	5.7	-
	Below Grade Walls	29.6	0.034	-	1.14	-	YES
	Slab on Grade Floors	26.8	0.037	-	0.107	6.3	YES
	Vertical Glazing	-	-	-	-	-	-
	Skylight	-	-	-	-	-	-

*Assume all windows to be Fixed
50% Glazing in Conservation

Table 4.1-1 Building envelope compliance of all three buildings

4.2 Heating, Ventilating, and Air Conditioning

While the façade is required to be designed to prevent heat transfer, mechanical equipment should provide heating or cooling efficiently. Section 6 of ASHRAE 90.1 focuses on minimum equipment efficiencies and power consumption.

4.2.1 Equipment Efficiencies

Because the minimum efficiencies are found through testing at standard conditions, systems do not operate under these conditions cannot be compared to the standard. Since the NAVCC is in many ways a very atypical building, the chilled water system has some complicated demands in which the majority of the chillers do not operate under these conditions. As a result, chillers 3-5 were unable to be compared to the standard however the efficiency data is provided in the tables below.

4.2.1.1 Boiler Efficiency Compliance

The NAVCC is provided heating via two oil fired steam boilers. Table 5.2-1 provides energy efficiency data as compared to the minimum efficiency provided in Table 6.8.1F in the standard.

Boiler Efficiency Compliance

Tag	Capacity MBh	KW	Efficiency	Minimum Efficiency	Compliance
B1-1	20087	266.9	83.30	83	YES
B1-2	20087	266.9	83.30	83	YES

Table 4.2-1 Summary of boiler efficiency compliance calculations

4.2.1.2 Chiller Efficiency Compliance

Since chillers 1 & 2 operate under the test conditions, comparable information from ASHRAE 90.1 Table 6.8.1J is provided. Table 5.2-2 illustrates the comparison as well as efficiency information on the remaining chillers.

Chiller Efficiency Compliance

Tag	Capacity Tons	KW	Efficiency		Minimum Efficiency		Compliance
			COP	NPLV	COP	NPLV	
CH-1	450	266.9	5.93		5.11	5.37	YES
CH-2	450	266.9	5.93		5.11	5.37	YES
CH-3	175	155.2	3.97		*	*	-
CH-4	175	155.2	3.97		*	*	-
CH-5	30	37.6	2.81		*	*	-

*Chiller operates outside of the ARI Standard 550/590 test conditions and are thus not covered by ASHRAE 90.1 Standards

Table 4.2-2 Summary of chiller efficiency compliance calculations

4.2.1.3 Cooling Tower Efficiency Compliance

Four of the five chillers achieve heat rejection through 4 four cell, induced draft, cross flow cooling towers. ASHRAE 90.1 Table 6.8.1G provided minimum efficiency data for towers with axial fans. A summary of the cooling tower performance data is provided in Table 5.2-3.

Cooling Tower Efficiency Compliance						
Tag	Fan Type	GPM	HP	Efficiency GPM/HP	Min Eff GPM/HP	Compliance
CT-1	Axial	905	20	45.25	38.2	YES
CT-2	Axial	905	20	45.25	38.2	YES
CT-3	Axial	905	20	45.25	38.2	YES
CT-4	Axial	905	20	45.25	38.2	YES

Table 4.2-3 Summary of cooling tower efficiency compliance calculations

4.2.2 Fan Power Limitation

Fans consume a large portion of the mechanical system energy usage. For this reason, ASHRAE 90.1 has included Table 6.5.3.1 to provide a cap on the ratio between fan power consumption and supplied airflow. The results of the fan power calculations and comparisons are shown in Table 5.2-4.

Fan Power Limitiation Compliance							
Tag	Fan Type	Control Type	CFM	HP	Power HP/CFM	Max Power HP/CFM	Compliance
RAF 1-1	In-Line	CV	40,000	30	0.75	1.1	YES
RAF 1-2	In-Line	CV	40,000	30	0.75	1.1	YES
RAF 1-3	In-Line	CV	32,700	30	0.92	1.1	YES
RAF 1-4	In-Line	CV	15,760	10	0.63	1.2	YES
RAF 1-5	In-Line	VAV	8,500	2	0.24	1.7	YES
RAF 2-1	In-Line	VAV	20,500	10	0.49	1.5	YES
RAF 2-1A	In-Line	VAV	30,000	15	0.50	1.5	YES
RAF 2-4	In-Line	VAV	12,270	5	0.41	1.7	YES
RAF 2-5	In-Line	VAV	10,400	3	0.29	1.7	YES
RAF 2-6	In-Line	VAV	13,000	5	0.38	1.7	YES
RAF 2-7	In-Line	VAV	13,300	5	0.38	1.7	YES
RAF 2-8	In-Line	CV	3,800	1	0.26	1.2	YES
RAF 3-1	In-Line	CV	18,500	15	0.81	1.2	YES
RAF 3-2	In-Line	CV	18,500	15	0.81	1.2	YES
SF 2-1	In-Line	VAV	620	0.33	0.53	1.7	YES
SF 2-2	In-Line	VAV	420	0.25	0.60	1.7	YES

Table 4.2-4 Summary of fan power limitation compliance calculations

4.3 Lighting

ASHRAE 90.1 section 9 provides maximum lighting power densities for typical spaces and building types. The National Audio Visual Conservation Center was analyzed to determine if the design fell within

the limitations for each room as well as over all buildings. Since the NAVCC is already broken up into 3 buildings by function, each building was analyzed separately. Many spaces including the vaults, lab space, and preparation rooms did not appear in ASHRAE 90.1 so compliance could not be checked. Whenever possible, a close room type has been substituted. While some spaces meet requirements, many individual spaces are over the limit. It is important to note that the NAVCC provides lighting required to work with film and may not fit the generalizations provided. For instance, the Collections vaults are designed at 2.8 W/SF however the storage spaces are only allotted 0.8 W/SF and library stacks are allotted 1.7 W/SF. Clearly the vault requirement is much more than the maximum allotted for either of these spaces. In cases such as this the design density is provided however no comparison has been made. Building area method and space-by-space method comparisons were made to tables 9.5.1 and 9.6.1, respectively, in ASHRAE Standard 90.1 2004.

4.3.1 Collections Building

The collections building houses primarily storage vaults with limited office and support space. A summary of both the building method and the space by space method can be seen in Table 5.3-1. A complete spreadsheet of power densities for each room can be found in the appendix. For the building area method the Collections building has been compared to a library.

Lighting Power Density

Room Description	Floor Area	Total Watts	W/SF	90.1 Max	Comply Y/N
Comm Closet	4652	5496	1.18	1.5	Y
Electrical Room	896	1400	1.56	1.5	N
Office	6315	7616	1.21	1.1	N
Workshop	642	392	0.61	1.9	Y
Storage	2062	1064	0.52	0.8	Y
Unoccupied	22454	2904	0.13	0.3	Y
Vault	71012	95984	1.35	-	Y
Vestibule	1977	1456	0.74	1.1	Y
Total	**110010**	**116312**	**1.06**	**1.3**	**Y**

Table 4.3-1 Summary of The Collections Building lighting power density calculations - both the space by space and building area method were used.

4.3.2 Conservation Building

The conservation building provides space for laboratories, visitor areas, screening rooms, and offices. For the building area method, a performing arts facility has been selected. This is primarily because the laboratory spaces and performing arts building lighting power densities are within 0.2 W/SF of each other, so adding laboratory spaces to a theater would have a small effect on the overall lighting density. The complete calculations for the Conservation Building may be found in the appendix, however a summary is provided in Table 5.3-2.

Lighting Power Density

Room Description	Floor Area	Total Watts	W/SF	90.1 Max	Comply Y/N
A/V Workshop	8763	17162	1.96	1.9	N
Breakroom	3114	4906	1.58	-	Y
Comm Room	1354	1408	1.04	1.5	Y
Conference	2015	4112	2.04	1.3	N
Corridors	15036	12692	0.84	1	Y
Data Center	2260	2944	1.30	-	Y
Electrical Room	1236	1008	0.82	1.5	Y
EMR	1096	448	0.41	1.5	Y
Exam Room	120	192	1.60	1.5	N
Gym - cardio	150	128	0.85	0.9	Y
Kitchen	460	996	2.17	1.2	N
Film Lab	21582	28248	1.31	1.7	Y
Screening Room	6460	13056	2.02	2.6	Y
Loading Platform	600	1218	2.03	-	Y
Lockers	85	128	1.51	-	Y
Mech Room	3400	2408	0.71	1.5	Y
Office	47652	98357	2.06	1.1	N
Pre-Function	1900	3911	2.06	3.3	Y
Printer Room	1440	1152	0.80	1.1	Y
Projection Booth	5548	9272	1.67	-	Y
Shipping & Receiving	3720	4630	1.24	-	Y
Storage	4282	3849	0.90	0.8	N
Collections Holding	2434	4928	2.02	1.9	N
Unocc - Expansion Space	3933	448	0.11	-	Y
Vestibule	5640	6816	1.21	1.3	Y
Total	**144280**	**224417**	**1.56**	**1.6**	**Y**

Table 4.3-2 Summary of the Conservation Building lighting power density calculations – both the space by space and building area method were used.

4.3.3 Nitrate Building

As shown in Table 5.3-3 the Nitrate Building is primarily composed of vaults. Much like the Collections Building, the lighting density in this building is compared to a library. The Nitrate Vaults are designed at a much lower density than the Collection Vaults. A complete spreadsheet of calculations for the Nitrate Building power density may be found in the appendix.

Lighting Power Density

Room Description	Floor Area	Total Watts	W/SF	90.1 Max	Comply Y/N
Corridor	4769	3744	0.79	1	Y
Mech Equip	14885	7000	0.47	1.5	Y
Vault	13300	23552	1.77	-	Y
Vestibule	904	640	0.71	1.1	Y
Total	**33858**	**34936**	**1.03**	**1.3**	**Y**

Table 4.3-3 Summary of the Nitrate Building lighting power density calculations – both the space by space and building area method were used.

5 ENERGY MODEL & ANALYSIS

Using Trane TRACE, an energy model of the NAVCC has been created to determine space heating and cooling loads as well as total annual energy consumption of the building mechanical systems. This section provides a summary of the input data used to model the building, a comparison of the calculated and design loads, and a discussion of the resulting energy model. While an energy analysis was unable to be obtained the calculated peak loads will be compared to the scheduled equipment to determine accuracy of the model.

5.1 Input Data

In addition to space criteria data provided in section 3.1.2, data presented in the previous section, and the detailed room data in the Appendix, Table 6.1-1 summarizes the input data for each space type. Room areas, wall dimensions, and building construction data were collected from the drawings while interior design conditions and equipment data was obtained from documents courtesy of Vanderweil Engineers.

Energy Model Input Data

Space Type	Lighting Levels	Equipment Levels	Occupancy	Ventilation
Office Area	2	3	143 SF/pers	20 CFM/pers
Photographic Lab	2	4	33 SF/pers	100% CFM
Collections Holding	2.8	0	0	0.05 CFM/SF
Collections Storage	2.8	0	0	0.05 CFM/SF
Nitrate Film Storage	2.8	0	0	0.05 CFM/SF
Motion Picture Storage	2.8	0	0	0.05 CFM/SF
A/V Lab	2	6	33 SF/pers	20 CFM/pers
Screening Rooms	3	3	8SF/pers	15 CFM/pers

Table 5.1-1 Summary of energy model input data by space type

5.2 Load Calculation Results

Once essential data was collected, a Trane TRACE energy model was run to determine equipment loading and energy consumption. Where the majority of the calculated data was comparable to the design documents, some systems differed from the provided information. Table 6.2-1 provides a summary of the energy model comparisons. The difference in values may be due to system complexities that were compromised in the energy model. If a more accurate model should

be needed a more advanced program may be required. Additionally, areas and dimensions taken by hand could account for some inaccuracy.

System Energy Model Comparisons

System Tag	Total Area (SF)	Calculated Data					Design Data				
		Cooling Ton	CFM	%OA	CFM/SF	CFM/Ton	Cooling Ton	CFM	%OA	CFM/SF	CFM/Ton
AHU 1-1&2	31,111	35.1	40231	4	1.29	860.3	73.8	40000	15	1.29	542
AHU 1-3&4	31,117	31.4	34521	4	1.11	811.9	73.8	40000	15	1.29	542
AHU 1-5&6	29,768	28.2	30639	5	1.03	783.2	73.8	40000	15	1.34	542
AHU 1-7&8	13,544	18.1	23639	3	1.75	930.5	20	18000	12	1.33	900
AHU 1-9	6,950	13.1	3333	25	0.48	254.9	31	9500	11	1.37	306
AHU 1-10	620	2.2	1242	0	2	573.7	4	2000	0	3.23	500
AHU 2-1	28,561	73.9	18591	27	0.65	251.7	71	22500	25	0.79	317
AHU 2-1A	12,214	39.8	15356	11	1.26	385.5	54	33300	26	2.73	617
AHU 2-2&3	21,629	153.4	23072	100	1.07	150.4	130	60000	100	2.77	462
AHU 2-4	26,587	152.3	25225	69	0.95	165.6	30	14500	17	0.55	483
AHU 2-5	18,002	80.5	21723	38	1.21	269.9	25	12000	13	0.67	480
AHU 2-6	12,771	28.8	14550	12	1.14	504.6	30	14500	17	1.14	483
AHU 2-7	19,190	78.1	23065	30	1.2	295.2	35	16000	19	0.83	457
AHU 2-8	1,955	16.4	2467	100	1.26	150.9	10	4000	79	2.05	400
AHU 3-1&2	33,858	42.9	51348	3	1.52	935.5	64	40000	10	1.18	625
FCU 2-1	900	14.6	2422	83	2.69	166.1	3	1200	69	1.33	400
FCU 2-2	550	8.9	1480	83	2.69	166.1	2.3	700	74	1.27	304
FCU 2-3	100	0.1	58	0	0.58	523.4	2.3	900	0	9.00	391
FCU 2-4	100	0.1	58	0	0.58	523.4	1.13	500	0	5.00	442
FCU 2-6	150	0.2	87	0	0.58	523.4	2.3	900	0	6.00	391
FCU 2-7	150	0.2	87	0	0.58	523.4	1.13	500	0	3.33	442
FCU 2-9	160	0.2	115	0	0.72	507.4	1.82	900	0	5.63	495
FCU 2-10	100	0.1	72	0	0.72	507.4	1.13	500	0	5.00	442
FCU 2-11	110	0.2	79	0	0.72	507.4	2.3	1100	0	10.00	478
FCU 2-12	110	0.2	79	0	0.72	507.4	1.13	500	0	4.55	442
FCU 2-13	324	0.5	234	0	0.72	507.4	1.55	1000	0	3.09	645
FCU 2-14	120	0.2	89	0	0.74	479.9	1.13	500	0	4.17	442
FCU 2-15	290	0.4	210	0	0.72	503	2.35	1200	0	4.14	511
FCU 2-16	150	0.2	108	0	0.72	507.4	0.96	500	0	3.33	521
FCU 2-17	150	0.2	108	0	0.72	507.4	1.82	900	0	6.00	495
FCU 2-18	892	0.7	371	0	0.42	507.3	5.5	2400	0	2.69	436
FCU 2-18A	802	0.7	360	0	0.45	507.3	5.5	2400	0	2.99	436
FCU 2-20	90	0.1	65	0	0.72	507.4	0.97	500	0	5.56	515
FCU 2-21	90	0.1	65	0	0.72	507.4	1.82	900	0	10.00	495
FCU 2-22	90	0.1	65	0	0.72	507.4	0.97	500	0	5.56	515
FCU 2-23	90	0.1	65	0	0.72	507.4	1.82	900	0	10.00	495
Totals	**293,395**					**822.3**					**768.33**

Table 5.2-1 Summary of airside systems comparisons

5.3 Annual Energy Consumption

Annual energy consumption estimates were provided with the Trane TRACE calculations. A quick analysis of the results will confirm what can be expected of the NAVCC. Since the space criterion requires very low temperatures in a large percentage of the building, the chiller consumes 51% of the annual HVAC energy consumption at 1,983,200 KWh. With 1,158,479 KWh, fan energy consumes 30% of the annual mechanical load, All HVAC equipment, totaling 3,885,625 KWh, consumes 30% of the total building annual energy consumption. Table 6.3-1 displays the calculated KWh consumed annually by each equipment category. Graphical representations of the energy distribution are provided in Figures 6.3-1 and 6.3-2. As the NAVCC has a very atypical nature in both design and functionality, the energy costs can be expected to be larger than a typical office building. In a more detailed analysis it would be important to account for the lighting controls in the vaults. Because all of the vaults are on sensors, the lights will only be on when someone enters. Additionally, timers will shut lights off after the occupant has left. Since the lighting load in the vaults is between 1.7 and 2.8 KW this may have an incredible impact on the energy analysis.

Energy Consumption Summary

Equipment	Annual Consumption (KWh)	Annual Consumption (Mbtu)
Fan Equipment	1,158,749	339,610
Chiller/Compressor	1,983,200	581,243
Cooling Towers	365,675	107,173
Cooling Accessories	172,450	50,542
Boiler	200,500	58,763
Htg Accessories	5,051	1,480
HVAC Total	**3,885,625**	**1,138,812**
Lighting	5,094,083	1,492,990
Misc Load	3,922,202	1,149,532
Annual Energy Consumption	**12,901,910**	**3,781,333**
Consumption per Square Foot	**33.62**	**9.85**

Table 5.3-1 Summary of calculated building energy consumption

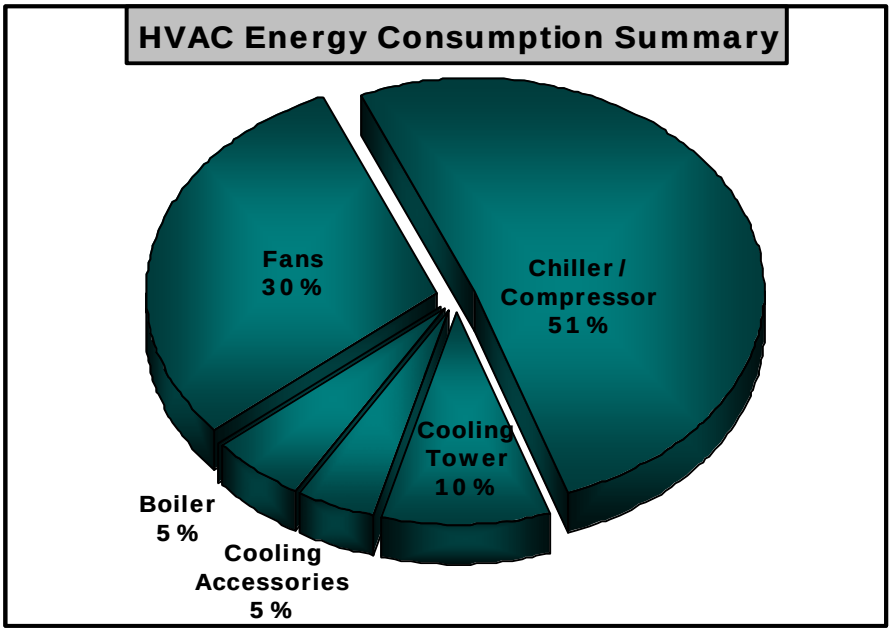

Figure 5.3-1 Illustration of HVAC energy consumption distribution

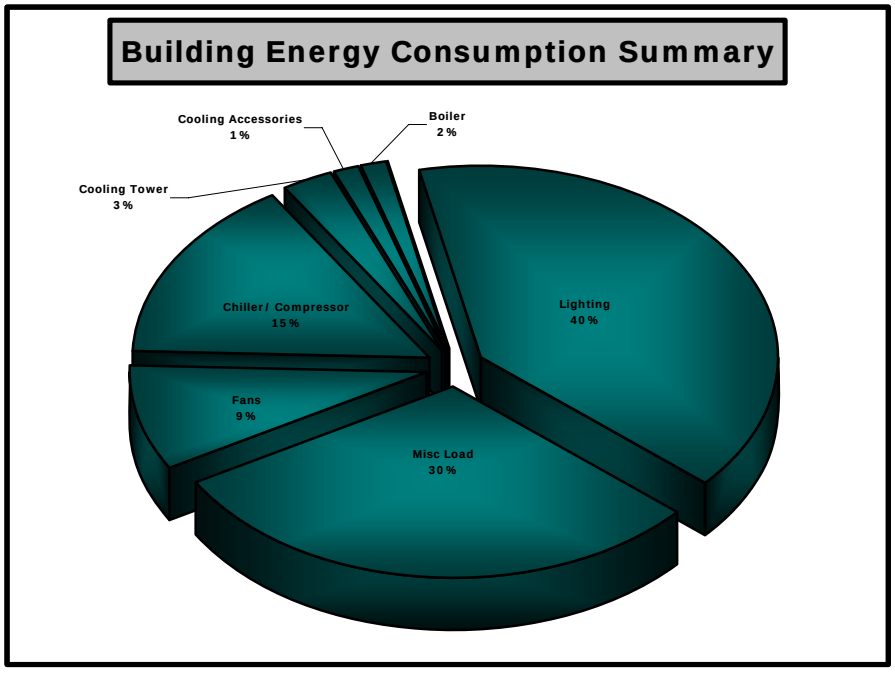

Figure 5.3-2 Illustration of building energy consumption distribution

6 LOST RENTABLE SPACE

6.1 Evaluation

With almost half of its area designated to conserving and storing media, the design of the NAVCC is heavily geared towards the preservation of the contents. Because of this fairly large percentage of the space houses the mechanical equipment. Both the Nitrate and Collections building provide over 20000 square feet each of mechanical space and the conservation building provides 3400. As a result, about 14% of the total building area is mechanical space. A summary of the mechanical space is provided graphically and numerically in Figure 7.1-1 and Table 7.1-1. Since the central utility plant – located in the Collections Building- is essentially carved into the ground and would not be excavated if the plant were not there, its square footage was not included as lost rentable space. Thus the total lost rentable space drops to 7% of the total building area.

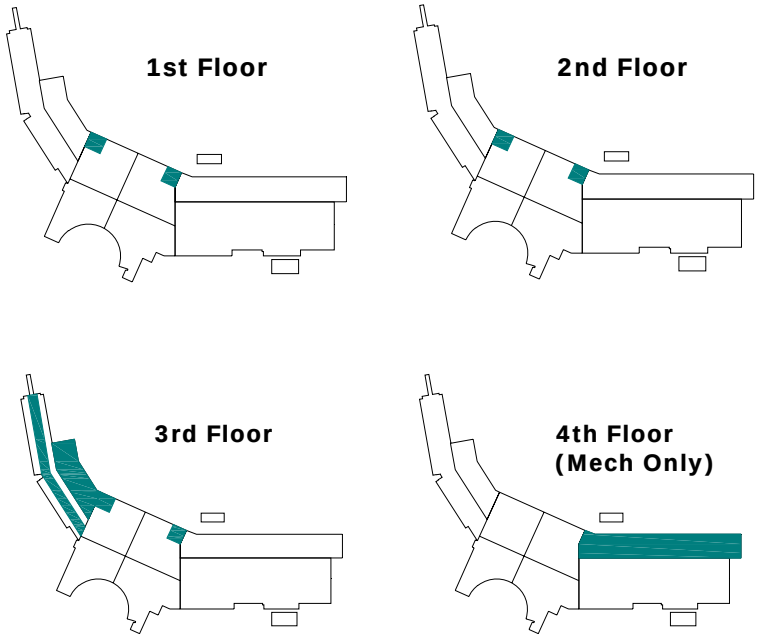

Figure 6.1-1 Graphical representation of mechanical space

Lost Rentable Space			
Location	**Mechanical SF**	**Total SF**	**Percent Mech**
Collections Plant	26320	155867	17%
Nitrate Vaults	24384	53490	46%
Conservation	3400	174453	2%
Total Mechanical	54104	383810	14%
Total Lost Rentable	**27784**	**383810**	**7%**

Table 6.1-1 Numerical break down of mechanical spaces

7 CONCLUSION

Upon completion of the calculations featured in this report, it can be concluded that the NAVCC, with more concentrated study, could garner enough LEED points to earn a rating, complies with ASHRAE Standard 90.1, and has a fairly energy efficient design given the design criterion. For further analysis, it would be beneficial to perform a more intense energy analysis to effectively pinpoint specific problems within the building systems.

8 REFERENCES

- 2005 ASHRAE Handbook of Fundamentals. ASHRAE, Incorporated. Atlanta, GA. 2005.
- ASHRAE/ IESNA Standard 62-2004. ASHRAE Incorporated. Atlanta, GA. 2004
- ASHRAE/ IESNA Standard 90.1-2004. ASHRAE Incorporated. Atlanta, GA. 2004
- LEED NC Green Building Rating System for New Construction & Major Renovations Version 2.2. US Green Building Council. 2005
- LEED NC Reference Guide. Version 2.2. US Green Building Council. 2004
- Vanderweil Engineers, Documents for The National Audio Visual Conservation Center
- The Pennsylvania State University Department of Architectural Engineering Faculty Advisors
- Past Penn State AE Thesis Technical Reports

9 APPENDIX

9.1 LEED Analysis

LEED NC 2.2

	Credit	Title	Status	Points
Sustainable Sites	SSp1	Construction Activity Pollution Prevention	Y	Req
	SSc1	Site Selection	Y	1
	SSc2	Development Density & Community Connectivity	N	0
	SSc3	Brownfield Redevlopment	N	0
	SSc4.1	Alternative Transportation, Public Transportation Access	N	0
	SSc4.2	Alternative Transportation, Bicycle Storage & Changing Rooms	N	0
	SSc4.3	Alternative Transportaion, Low-Emitting & Fuel-Efficient Vehicles	N	0
	SSc4.4	Alternative Transportation, Parking Capacity	N	0
	SSc5.1	Site Development, Protect or Restore Habitat	Y	1
	SSc5.2	Site Development, Maximize Open Space	Y	1
	SSc6.1	Stormwater Management, Quantity Control	Y	1
	SSc6.2	Stormwater Management, Quality Control	Y	1
	SSc7.1	Heat Island Effect, Non-Roof	Y	1
	SSc7.2	Heat Island Effect, Roof	Y	1
	SSc8	Light Pollution Reduction	Y	1
			Total	8
Water Efficiency	WEc1.1	Water Efficient Landscaping: Reduce by 50%	Y	1
	WEc1.2	Water Efficient Landscaping: No Potable Water Use or No Irrigation	N	0
	WEc2	Innovative Wastewater Technologies	N	0
	WEc3.1	Water Use Reduction: 20%	N	0
	WEc3.2	Water Use Reduction: 30%	N	0
			Total	1
Energy & Atmosphere	EAp1	Fundamental Commissioning of the Building Energy Systems	Y	Req
	EAp2	Minimum Energy Performance	Y	Req
	EAp3	Fundamental Refrigerant Management	Y	Req
	EAc1	Optimize Energy Performance	?	0
	EAc2	On-Site Renewable Energy	N	0
	EAc3	Enhanced Comminssioning	N	0
	EAc4	Enhanced Refrigerant Management	N	0
	EAc5	Measurement & Verification	N	0
	EAc6	Green Power	N	0
			Total	0

LEED NC 2.2

	Credit	Title	Status	Points
Materials & Resources	MRp1	Storage & Collection of Recyclables	N	Req
	MRc1.1	Building Reuse, Maintain 75% of Existing Shell	N	0
	MRc1.2	Building Reuse, Maintain 100% of Existing Shell	N	0
	MRc1.3	Building Reuse, Maintain 50% of Interior Non-Structural Elements	N	0
	MRc2	Construction Waste Management	N	0
	MRc3	Resource Reuse	N	0
	MRc4	Recycled Content	N	0
	MRc5	Regional Materials	N	0
	MRc6	Rapidly Renewable Materials	N	0
	MRc7	Certified Wood	N	0
			Total	0
Indoor Environmental Quality	EQp1	Minimum IAQ Performance	Y	Req
	EQp2	Environmental Tobacco Smoke (ETS) Control	Y	Req
	EQc1	Outdoor Air Delivery Monitoring	N	0
	EQc2	Increased Ventilation	N	0
	EQc3.1	Construction IAQ Management Plan, During Construction	N	0
	EQc3.2	Contstruction IAQ Management Plan, Before Occupancy	N	0
	EQc4.1	Low-Emitting Materials, Adhesives & Sealants	Y	1
	EQc4.2	Low-Emitting Materials, Paints & Coatings	Y	1
	EQc4.3	Low-Emitting Materials, Carpet Systems	Y	1
	EQc4.4	Low-Emitting Materials, Composite Wood & Agrifiber	Y	1
	EQc5	Indoor Chemical & Pollutant Source Control	N	0
	EQc6.1	Controllability of Systems, Lighting	N	0
	EQc6.2	Contrallability of Systems, Thermal Comfort	N	0
	EQc7.1	Thermal Comfort, Design	Y	1
	EQc7.2	Thermal Comfort, Verification	N	0
	EQc8.1	Daylighting & Views, Daylight 75% of Spaces	N	0
	EQc8.2	Daylighting & Views, Views for 90% of Spaces	N	0
			Total	**5**

9.2 Lighting Density Calculations

9.2.1 Conservation Building – 1st Floor

Room Name	Room Description	Floor Area	Fixture Type	No Fixtures	Watts/ Fixture	Fixture Type	No Fixtures	Watts/ Fixture	Fixture Type	No Fixtures	Watts/ Fixture	Total Watts	W/SF
CV1-1114	Mecanical Room	380	C	3	56	E	2	56	None		0	280	0.74
CV1-1112	Processing/Rewinding	1280	T1	14	128	None		0	None		0	1792	1.40
CV1-1111	Fixed Shelving	600	T1	6	128	None		0	None		0	768	1.28
CV1-C1100	Corridors	2000	F39	4	18	F6	47	32	None		0	1576	0.79
CV1-1230	Elevator Lobby	240	T	3	64	None		0	None		0	192	0.80
CV1-1120	Support Room	510	T	2	64	T1	3	128	None		0	512	1.00
CV1-1121	Coffee Station	144	F33	6	32	AC	3.5	32	None		0	304	2.11
CV1-1220	Janitor Office	112	AH	2	64	None		0	None		0	128	1.14
CV1-1125	Unit Head	140	F25	2	51	F33A	4	32	None		0	230	1.64
CV1-C1200	Corridors	900	T	10	64	None		0	None		0	640	0.71
CV1-1200	Loading Platform	600	B	6	175	C	3	56	None		0	1218	2.03
CV1-1203	Hazardous Mat	375	D	6	64	None		0	None		0	384	1.02
CV1-1204	Dock Master Security	200	AH	4	64	None		0	None		0	256	1.28
CV1-1206	Shipping & Receiving	380	B	2	175	C	1	56	None		0	406	1.07
CV1-1100A	Open Office	8690	F8	22	900	None		0	None		0	19800	2.28
CV1-1041	Mech Room	1200	C	11	56	E	6	56	None		0	952	0.79
CV1-C1040	Corridors	600	F33	7	32	F39	8	18	None		0	368	0.61
CV1-C1050	Corridors	225	F33	5	32	None		0	None		0	160	0.71
CV1-1055	Lockers	85	AH	2	64	None		0	None		0	128	1.51
CV1-1056	Security Office	180	AH	4	64	AC	2	32	None		0	320	1.78
CV1-1057	Security Equipment	130	T1	3	128	None		0	None		0	384	2.95
CV1-1110	Compact Shelving	660	A	40	56	None		0	None		0	2240	3.39
CV1-C1030	Corridors	300	F33	12	32	None		0	None		0	384	1.28
CV1-1021	Vestibule	100	F24	2	60	None		0	None		0	120	1.20
CV1-1038	Storage	230	C	2	56	None		0	None		0	112	0.49
CV1-1036	Vestibule	150	T	1	64	None		0	None		0	64	0.43
CV1-1035	Storage	150	E	3	56	None		0	None		0	168	1.12
CV1-1037	Control Booth	130	AG	4	50	AL	5	32	None		0	360	2.77
CV1-1032	Projection Booth	400	C	5	56	AG	16	50	None		0	1080	2.70
CV1-1031	Theater Vestibule	400	F37	1	200	F12	19	17	F28	3	25	598	1.50
CV1-1006	Pre-Function	1500	F27D	14	200	F36	3	71	F9A	6	50	3313	2.21
CV-1105	Office Supplies/ Copier	170	F25	4	51	None		0	None		0	204	1.20
CV-1104	Registry Board	140	F25	4	51	F33A	3	32	None		0	300	2.14
CV1-1103	Admin Office	170	F25	4	51	F33A	3	32	None		0	300	1.76
CV1-1102	Section Head	420	F25	2	51	F24	3	60	F33A	8	32	538	1.28
CV1-1101	Conference Room	590	F14	6	350	F12A	17	32	None		0	2644	4.48
CV1-1100B	Open Office	7630	F8	22	900	None		0	None		0	19800	2.60
CV2-2001	Conference Room	900	F14	3	350	F15	2	350	F12	32	17	2294	2.55
CV1-1001	Lobby	2730	F4A	42	100	None		0	None		0	4200	1.54
CV1-1101C	Elevator Machine Room	160	C	2	56	None		0	None		0	112	0.70
CV1-1303A	Lift Machine Room	600	E	4	56	None		0	None		0	224	0.37
CV1-1010	Multi Purpose	900	F11	6	350	F10B	5	100	F12A		32	2600	2.89
CV1-11020	Listening Room	550	F19	34	50	F18	4	50	F16	17	50	2750	5.00
CV1-1027A	Electical Room	100	C	2	56	None		0	None		0	112	1.12
CV1-1027	Comm Room	100	C	2	56	None		0	None		0	112	1.12
CV1-1026	Elevator Machine Room		None		0	None		0	None		0	0	#DIV/0!
CV1-1222	Electrical Room	150	C	2	56	None		0	None		0	112	0.75
CV1-1221	Comm Room	150	C	2	56	None		0	None		0	112	0.75
CV1-1113	Elevator Machine Room	160	C	2	56	None		0	None		0	112	0.70
CV1-1030	Theatre	3000	F30	4	800	F24	32	60	F34	17	4	5188	2.51
CV1-1207	Decontam Room	225	W	4	64	None		0	None		0	256	1.14
CV1-1207A	Ante Room	130	W	2	64	None		0	None		0	128	0.98
CV1-1208	Temp Holding Room	1600	B	7	175	C	2	56	None		0	1337	0.84

9.2.2 Conservation Building – 2nd Floor

Room Name	Room Description	Floor Area	Fixture Type	No Fixtures	Watts/ Fixture	Fixture Type	No Fixtures	Watts/ Fixture	Fixture Type	No Fixtures	Watts/ Fixture	Total Watts	W/SF
CV2-2231	Mechanical Room	570	C	5	56	E	2	56	None		0	392	0.69
CV2-2130A	Cart Storage	350	T	2	64	T1	2	128	None		0	384	1.10
CV2-2123	Project Holding Area	150	T	2	64	T1	2	128	None		0	384	2.56
CV2-2127	Conservation & Cleaning	900	T1	12	128	None		0	None		0	1536	1.71
CV2-2127A	Rewind Room	130	T1	3	128	None		0	None		0	384	2.95
CV2-2128	Disc sorting & Accessioning	1400	T1	10	128	T	6	64	None		0	1664	1.19
CV2-2129	Incoming Dirty Collect	1300	T1	10	128	T	6	64	None		0	1664	1.28
CV2-2130	Collection Storage	1300	T1	10	128	None		0	None		0	1280	0.98
CV2-2131	Engraving	160	AH	4	64	None		0	None		0	256	1.60
CV2-2132	Copyright Room	240	T1	2	128	None		0	None		0	256	1.07
CV32-2230	Elevator Lobby	80	T	1	64	None		0	None		0	64	0.80
CV2-C2100A	Corridors	1200	F39	7	18	F6	27	32	None		0	990	0.83
CV2-2133	Manuscript Collection Processing	550	AH	9	64	None		0	None		0	576	1.05
CV2-C2220	Corridors	420	F33	8	32	None		0	None		0	256	0.61
CV2-2203A	Health Recep	140	AH	3	64	None		0	None		0	192	1.37
CV2-2203B	Exam Room	120	AH	3	64	None		0	None		0	192	1.60
CV2-2203C	Rest	72	AH	2	64	None		0	None		0	128	1.78
CV2-2202A	Womens Bath	190	F39	4	18	AA	2	64	None		0	200	1.05
CV2-2202B	Womens Showers	150	F39	4	18	AE	1	32	None		0	104	0.69
CV2-2205A	Mens Bath	190	F39	4	18	AA	2	64	None		0	200	1.05
CV2-2205B	Mens Showers	150	F39	4	18	AE	1	32	None		0	104	0.69
CV2-2201	Catering Kitchen	260	AA	4	64	AC2	4	17	None		0	324	1.25
CV2-2200	Staff Lounge	1750	F8	4	900	None		0	None		0	3600	2.06
CV2-2200A	Waiting/Foyer	550	F33	9	32	F6	3	32	None		0	384	0.70
CV2-2200B	Kitchen	200	F33	13	32	AC	8	32	None		0	672	3.36
CV2-2204	Exercise Room	150	AH	2	64	None		0	None		0	128	0.85
CV2-C2221	Corridors	80	F33	2	32	None		0	None		0	64	0.80
CV2-2108	Storage	100	AD	2	64	None		0	None		0	128	1.28
CV2-2107	Special Mat Head	140	F25	3	51	F33A	4	32	None		0	281	2.01
CV2-2100B	Rec Sound Open Office	6275	F8	16	900	F9B	3	50	None		0	14550	2.32
NV2-C3201	Corridors	290	D1	2	96	None		0	None		0	192	0.66
NV2-3201	Vault Attendees	300	D	6	64	None		0	None		0	384	1.28
NV2-3202	Shipping & Holding	440	D	8	64	None		0	None		0	512	1.16
NV2-3204	Vestibule	100	D	1	64	None		0	None		0	64	0.64
NV2-3205	Vestibule	130	D	2	64	None		0	None		0	128	0.98
CV2-2011	Cheifs Office	450	F33	10	32	F42A	3	50	None		0	470	1.04
CV2-2012	Admin Asst	160	F2	2	96	None		0	None		0	192	1.20
CV2-2013	Asst Chief	300	F42A	6	50	F2	3	96	None		0	588	1.96
CV2-2010	Reception	350	F33	7	32	F42A	4	50	None		0	424	1.21
CV2-2014	Work Station	190	F2	2	96	None		0	None		0	192	1.01
CV2-2015	Admin Officer	120	F2	2	96	None		0	None		0	192	1.60
CV2-2016	Facility Manager	150	F2	2	96	None		0	None		0	192	1.28
CV2-2017	Work Room	160	F2	3	96	None		0	None		0	288	1.80
CV2-2017A	Storage	120	AD	2	64	None		0	None		0	128	1.07
CV2-2019	Human Res	180	F2	3	96	None		0	None		0	288	1.60
CV2-2020	Cubicles	1000	F2	7	96	F33	7	32	F33A	9	32	1184	1.18
CV2-C2020	Corridors	160	F33	4	32	None		0	None		0	128	0.80
CV2-2021	Found Mgr	180	F2	3	96	None		0	None		0	288	1.60
CV2-2022	Auto Specialist	120	F2	2	96	None		0	None		0	192	1.60
CV2-2023	Auto Specialist	120	F2	2	96	None		0	None		0	192	1.60
CV2-2010	Corridors	240	F11	1	350	None		0	None		0	350	1.46
CV2-2102	Section Head	371	F25	2	51	F33A	9	32	F24	3	60	570	1.54
CV2-2101	Conference Room	300	F40	3	232	F41	1	350	F12A	16	32	1558	5.19
CV2-2100A	Rec Sound Open Off	5780	F8	14	900	F9B	3	50	None		0	12750	2.21
CV2-2103	Asst Sec Head	170	F25	3	51	F33A	6	32	None		0	345	2.03
CV2-2104	Coffee Station	100	F25	2	51	AC	4	32	None		0	230	2.30
CV2-2105	Unit Head	160	F25	3	51	F33A	5	32	None		0	313	1.96
CV2-2106	Digital Personel	260	F2	9	96	None		0	None		0	864	3.32
CV2-C2100B	Corridors	1025	F6	21	32	F39	9	18	None		0	834	0.81
CV2-2042	Mech Room	1250	C	9	56	E	5	56	None		0	784	0.63
CV2-C2050	Corridors	240	F33	5	32	None		0	None		0	160	0.67
CV2-2120	Tele Room	26	None		0	None		0	None		0	0	0.00
CV2-2121A	Data Center Storage	700	T1	8	128	None		0	None		0	1024	1.46
CV2-2121	Data Center	1560	T1	15	128	None		0	None		0	1920	1.23
CV2-2122	Scanning Room	315	T1	3	128	None		0	None		0	384	1.22
CV2-2123	Shipping	1600	T1	16	128	None		0	None		0	2048	1.28
CV2-2124	Listening Room	110	AH	2	64	None		0	None		0	128	1.16
CV2-2125	Listening Room	110	AH	2	64	None		0	None		0	128	1.16
CV2-2126	Listening Room	110	AH	2	64	None		0	None		0	128	1.16
CV2-C2120	Corridors	240	F33	4	32	None		0	None		0	128	0.53
CV2-2206A	Electrical Room	160	C	2	56	None		0	None		0	112	0.70
CV2-2206	Communications	100	C	2	56	None		0	None		0	112	1.12
CV2-2024	Communications	110	C	2	56	None		0	None		0	112	1.02
CV2-2024A	Electrical Room	110	C	2	56	None		0	None		0	112	1.02
CV2-2120	Telephone	324	T1	4	128	None		0	None		0	512	1.58

9.2.3 Conservation Building – 3rd Floor

Room Name	Room Description	Floor Area	Fixture Type	No Fixtures	Watts/ Fixture	Fixture Type	No Fixtures	Watts/ Fixture	Fixture Type	No Fixtures	Watts/ Fixture	Total Watts	W/SF
CV2-2000	Lobby Bridge	1560	F4	16	100	None	0	0	None	0	0	1600	1.03
CV3-3001	Conference	225	F2	4	96	None	0	0	None	0	0	384	1.71
CV3-3000	Open Office	1332	F2	15	96	F33	6	32	None		0	1632	1.23
CV3-3002	Equipment	594	AD	12	64	None		0	None		0	768	1.29
CV3-C3000	Corridor	272	F33B	7	32	None	0	0	None		0	224	0.82
CV3-3101	Section Head	542	F24	3	60	F33A	7	32	F25	2	51	506	0.93
CV3-3004	A/V Maintenance	528	AD	12	64	None		0	None		0	768	1.45
CV3-3100	Open Office	8340	F8	17	900	F9B	14	50	None		0	16000	1.92
CV3-3102	D3	253	F50	3	128	F53	6	50	None		0	684	2.70
CV3-3103	CTO/P	138	F33A	3	32	F25	2	51	None		0	198	1.43
CV3-3104	Lab Head	138	F33A	3	32	F25	2	51	None		0	198	1.43
CV3-3105	Video Edit	410	F53	6	50	F6C	13	32	None		0	716	1.75
CV3-3005	Communication	120	C	2	56	None		0	None		0	112	0.93
CV3-3005A	Electrical	286	C	3	56	None		0	None		0	168	0.59
CV3-3100A	D1	270	F25	10	51	None		0	None		0	510	1.89
CV3-C3100	Corridor	1242	F10	24	100	None		0	None		0	2400	1.93
CV3-3141	Holding Room	220	AD	2	64	None		0	None		0	128	0.58
CV3-3145	Tape Prep	205	AD	3	64	None		0	None		0	192	0.94
CV3-3144	Disc Prep	720	AD	11	64	None		0	None		0	704	0.98
CV3-3145A	Tape Bake	180	AD	3	64	None		0	None		0	192	1.07
CV3-3144A	Clean Holding	110	AD	2	64	None		0	None		0	128	1.16
CV3-3143	Supply	224	C	3	56	None		0	None		0	168	0.75
CV3-C3140	Corridor	320	F33B	7	32	None		0	None		0	224	0.70
CV3-C3150	Corridor	272	F39	6	18	None		0	None		0	108	0.40
CV3-C3130	Corridor	225	F33B	5	32	None		0	None		0	160	0.71
CV3-3135A	Storage	32	C	1	56	None		0	None		0	56	1.75
CV3-C3040	Corridor	480	F33	6	32	F39	6	18	None		0	300	0.63
CV3-3111	Media Prep	625	AK	1	320	AK1	1	384	AA	2	64	832	1.33
CV3-C3280	Corridor	705	T	10	64	None		0	None		0	640	0.91
CV3-3280	Expansion Space	3933	C	8	56	None		0	None		0	448	0.11
CV3-3269	Screening Sound	690	F49A	6	64	F51	2	64	F52	12	50	1112	1.61
CV3-3270A	Projection Booth	322	C	3	56	AG	6	50	None		0	468	1.45
CV3-3271	Screening Sound	690	F49A	6	64	F51	2	64	F52	12	50	1112	1.61
CV3-3271A	Projection Booth	322	C	3	56	AG	6	50	None		0	468	1.45
CV3-3110	Production Room	4374	F45A	17	256	F46	36	60	F45B	3	128	6896	1.58
CV3-3112-3114	V1	1220	F53	18	50	F49B	6	64	F6C	11	32	1636	1.34
CV3-3122	A1	440	F53	8	50	F49A	2	64	F17	6	50	828	1.88
CV3-3123	A1	440	F53	8	50	F49A	2	64	F17	6	50	828	1.88
CV3-3126	A1	440	F53	8	50	F49A	2	64	F17	6	50	828	1.88
CV3-3127	A1	440	F53	8	50	F49A	2	64	F17	6	50	828	1.88
CV3-3130	A1	440	F53	8	50	F49A	2	64	F17	6	50	828	1.88
CV3-3131	A1	440	F53	8	50	F49A	2	64	F17	6	50	828	1.88
CV3-3134	A1	440	F53	8	50	F49A	2	64	F17	6	50	828	1.88
CV3-3139	A1	440	F53	8	50	F49A	2	64	F17	6	50	828	1.88
CV3-3136	A1	440	F53	8	50	F49A	2	64	F17	6	50	828	1.88
CV3-3117	A2	280	F9A	6	50	F53	6	50	None		0	600	2.14
CV3-3116	A2	280	F9A	6	50	F53	6	50	None		0	600	2.14
CV3-3261	Datacine Control	280	F49A	4	64	F53	3	50	None		0	406	1.45
CV3-3263	Datacine Control	280	F49A	4	64	F53	3	50	None		0	406	1.45
CV3-3262	Datacine Equipment	300	F49A	6	64	None		0	None		0	384	1.28
CV3-3268	Paper print & scanner	160	F48C	1	192	None		0	None		0	192	1.20
CV3-3267	Film Recorder	160	F48C	1	192	None		0	None		0	192	1.20
CV3-3266	Film Scan	400	F48C	2	192	F48A	1	128	None		0	512	1.28
CV3-3265	Sound Trans Control	400	F49	4	64	F6B	7	32	None		0	480	1.20
CV3-3264	Sound Trans Equip	126	F49	3	64	None		0	None		0	192	1.52
CV3-3240A	Chem Analysis	144	AF	1	96	AF1	1	192	None		0	288	2.00
CV3-3243	Lab Maint	420	AD	6	64	None		0	None		0	384	0.91
CV3-3240	Chem Sto Mixing	1250	AF1	14	192	AF	2	96	None		0	2880	2.30
CV3-3251	Printer Room	160	AD	2	64	None		0	None		0	128	0.80
CV3-3252	Printer Room	160	AD	2	64	None		0	None		0	128	0.80
CV3-3253	Printer Room	160	AD	2	64	None		0	None		0	128	0.80
CV3-3254	Printer Room	160	AD	2	64	None		0	None		0	128	0.80
CV3-3255	Printer Room	160	AD	2	64	None		0	None		0	128	0.80
CV3-3256	Printer Room	160	AD	2	64	None		0	None		0	128	0.80
CV3-3250	Film Processors	3600	B	30	175	None		0	None		0	5250	1.46
CV3-3257	Printer Room	160	AD	2	64	None		0	None		0	128	0.80
CV3-3258	Printer Room	160	AD	2	64	None		0	None		0	128	0.80
CV3-3259	Printer Room	160	AD	2	64	None		0	None		0	128	0.80
CV3-3260	Film Printing Suite	2400	AK	6	320	None		0	None		0	1920	0.80
CV3-C3251	Corridors	1060	None		0	None		0	None		0	0	0.00
CV3-3210	Office	140	F2	4	96	None		0	None		0	384	2.74
CV3-3211	Office	140	F2	4	96	None		0	None		0	384	2.74
CV3-3212	Office	140	F2	4	96	None		0	None		0	384	2.74
CV3-C3260	Corridors	880	AJ	11	34	F6	6	32	None		0	566	0.64
CV3-3232	Storage	180	D	2	64	None		0	None		0	128	0.71
CV3-3231	Inspection Room	380	F48B	3	128	None		0	None		0	384	1.01
CV3-C3230	Corridors	600	T	6	64	None		0	None		0	384	0.64
CV3-3229	Timing	320	F53	6	50	F55	30	40	None		0	1500	4.69
CV3-3228	Comp Arator	192	F53	3	50	F55	28	40	None		0	1270	6.61
CV3-3227	Timing	270	F53	6	50	F55	30	40	None		0	1500	5.56
CV3-3224	Film Cleaning	192	AD	4	64	None		0	None		0	256	1.33
CV3-3220	Inspection Quality Cont	3675	F48	88	32	F47	26	32	None		0	3648	0.99
CV3-3220A	Outside Loans	280	F26A	1	384	None		0	None		0	384	1.37
CV3-3220B	Lab Work Cleaning	720	F26A	1	384	F26	1	256	None		0	640	0.89
CV3-3221	Flat Bed Screening	640	F48C	4	192	None		0	None		0	768	1.20
CV3-3223	Screening	300	F49	6	64	F6B	18	32	None		0	960	3.20
CV3-C3201	Corridors	250	F6	10	32	None		0	None		0	320	1.28
CV3-3202A	Copier & Supply	200	AD	4	64	None		0	None		0	256	1.28
CV3-3202	Coffee	120	F2	2	96	AC3	4	25	None		0	292	2.43
CV3-3200A	Break Room	116	F57	2	60	None		0	None		0	120	1.03
CV3-3005	Communications	120	C	2	56	None		0	None		0	112	0.93
CV3-3005A	Electrical Room	100	C	3	56	None		0	None		0	168	1.68
CV3-3006	Holding Room	190	AD	4	64	None		0	None		0	256	1.35
CV3-3143B	Communications	150	C	2	56	None		0	None		0	112	0.75
CV3-3143A	Electrical Room	150	C	2	56	None		0	None		0	112	0.75
CV3-C3220	Corridor	450	F10A	4	142	None		0	None		0	568	1.26
CV3-3200B	Break Room	442	F57	3	60	None		0	None		0	180	0.41
CV3-C3210	Corridor	360	F10A	4	142	None		0	None		0	568	1.58
CV3-3200C	Break Room	442	F57	3	60	None		0	None		0	180	0.41
CV3-C3226	Communications	90	C	1	56	None		0	None		0	56	0.62
CV3-C3225	Electrical Room	90	C	1	56	None		0	None		0	56	0.62
CV3-C3214	Communications	90	C	1	56	None		0	None		0	56	0.62
CV3-C3213	Electrical Room	90	C	1	56	None		0	None		0	56	0.62

9.2.4 Collections Building

Room Name	Room Description	Floor Area	Fixture Type	No Fixtures	Watts/ Fixture	Fixture Type	No Fixtures	Watts/ Fixture	Fixture Type	No Fixtures	Watts/ Fixture	Total Watts	W/SF
C1-1113	Vault	2576	A	57	56	None	0	0	None	0	0	3192	1.24
C1-1115	Vault	2240	A	48	56	None	0	0	None	0	0	2688	1.20
C1-1116	Vault	2000	A	47	56	None	0	0	None	0	0	2632	1.32
C1-1117	Vault	1440	A	48	56	None	0	0	None	0	0	2688	1.87
C1-1118	Vault	2000	A	47	56	None	0	0	None	0	0	2632	1.32
C1-1120	Vault	2000	A	47	56	None	0	0	None	0	0	2632	1.32
C1-1122	Vault	2000	A	47	56	None	0	0	None	0	0	2632	1.32
C1-C1107	Corridor	1890	H	39	56	H1	2	42	M	4	26	2372	1.26
C2-0000	Unoccupied	692	None	0	0	None	0	0	None	0	0	0	0.00
C2-1204	Corridor	1890	H	39	56	H1	2	42	M	4	26	2372	1.26
C2-1218	NFPA Vault	2304	A	42	56	None	0	0	None	0	0	2352	1.02
C2-1221	Electric Room	48	C	1	56	None	0	0	None	0	0	56	1.17
C2-1223	NFPA Vault	1760	A	41	56	None	0	0	None	0	0	2296	1.30
C2-1223A	Security Room	48	C	1	56	None	0	0	None	0	0	56	1.17
C2-1225	NFPA Vault	1440	A	39	56	None	0	0	None	0	0	2184	1.52
C2-1227	NFPA Vault	1440	A	40	56	None	0	0	None	0	0	2240	1.56
C3-0000	Future Shell Space	5457	A	14	56	None	0	0	None	0	0	784	0.14
C3-1307	Electric Room	48	A	1	56	None	0	0	None	0	0	56	1.17
C3-1309	Security Room	48	A	1	56	None	0	0	None	0	0	56	1.17
C1-1107	Corridor	1800	None	0	0	None	0	0	None	0	0	0	0.00
C1-1107	Vault 1107	3472	A	87	56	None	0	0	None	0	0	4872	1.40
C1-1109	Vault 1109	2128	A	52	56	None	0	0	None	0	0	2912	1.37
C1-1111	Vault 1111	2296	A	55	56	None	0	0	None	0	0	3080	1.34
C1-1112	Storage	1504	C	13	56	None	0	0	None	0	0	728	0.48
C1-1114	Vault 1114	2300	A	48	56	None	0	0	None	0	0	2688	1.17
C2-0001	Unoccupied	2748	None	0	0	None	0	0	None	0	0	0	0.00
C2-1212	Vault 1212	1368	A	28	56	None	0	0	None	0	0	1568	1.15
C2-1214	Vault 1214	2160	A	49	56	None	0	0	None	0	0	2744	1.27
C2-1215	Vault 1215	1404	A	31	56	None	0	0	None	0	0	1736	1.24
C2-1216	Vault 1216	3100	A	76	56	None	0	0	None	0	0	4256	1.37
C2-1217	Vault 1217	1296	A	31	56	None	0	0	None	0	0	1736	1.34
C2-C1204	Corridor	640	A	0	56	None	0	0	None	0	0	0	0.00
C3-0001	Future Shell Space	6197	A	12	56	None	0	0	None	0	0	672	0.11
C1-1103	Vault	2776	A	75	56	None	0	0	None	0	0	4200	1.51
C1-1105	Vault	2852	A	81	56	None	0	0	None	0	0	4536	1.59
C1-1105A	Electrical Closet	48	C	2	56	None	0	0	None	0	0	112	2.33
C1-C1104	Corridors	1960	None	0	0	None	0	0	None	0	0	0	0.00
C2-1201E	Vestibule	168	K1	1	128	None	0	0	None	0	0	128	0.76
C2-1202	Vault	1840	A	46	56	None	0	0	None	0	0	2576	1.40
C2-1203	Vault	960	A	35	56	None	0	0	None	0	0	1960	2.04
C2-1204	Vault	1584	A	30	56	None	0	0	None	0	0	1680	1.06
C2-1206	Vault	1476	A	34	56	None	0	0	None	0	0	1904	1.29
C2-1207	Vault	1892	A	49	56	None	0	0	None	0	0	2744	1.45
C2-1208	Vault	2220	A	49	56	None	0	0	None	0	0	2744	1.24
C2-1208A	Crawl Space	3976	C	8	56	None	0	0	None	0	0	448	0.11
C2-1209	Electrical Closet	84	C	2	56	None	0	0	None	0	0	112	1.33
C2-1210	Vault	728	A	18	56	None	0	0	None	0	0	1008	1.38
C2-1211	Vault	2088	A	63	56	None	0	0	None	0	0	3528	1.69
C2-C1203	Corridors	1420	None	0	0	None	0	0	None	0	0	0	0.00
C3-0001	Future Shell Space	5596	A	15	56	None	0	0	None	0	0	840	0.15
C3-1305	Electrical Closet	48	A	1	56	None	0	0	None	0	0	56	1.17
C3-1306	Comm Closet	112	A	2	56	None	0	0	None	0	0	112	1.00
C1-C1104	Corridor	312	None	0	0	None	0	0	None	0	0	0	0.00
C1-1102	Low Temp Vault 1102	2552	A	56	56	None	0	0	None	0	0	3136	1.23
C1-1102C	Crawl Space	1120	G	1	32	None	0	0	None	0	0	32	0.03
C1-1104	Low Temp Vault 1104	2816	A	78	56	None	0	0	None	0	0	4368	1.55
C1-1104A	Low Temp Vestibule	60	A	1	56	None	0	0	None	0	0	56	0.93
C1-1106	Low Temp Vault 1106	2848	A	63	56	None	0	0	None	0	0	3528	1.24
C1-1106A	Vestibule	60	A	1	56	None	0	0	None	0	0	56	0.93
C1-1108	Low Temp Vault 1108	1392	A	27	56	None	0	0	None	0	0	1512	1.09
C1-1108A	Vestibule	60	A	1	56	None	0	0	None	0	0	56	0.93
C1-1110	Low Temp Vault 1110	2264	A	50	56	None	0	0	None	0	0	2800	1.24
C1-1110A	Vestibule	60	A	1	56	None	0	0	None	0	0	56	0.93
C1-1101A	Vestibule	140	P	2	52	None	0	0	None	0	0	104	0.74
C1-1101	Control Office	2484	K	14	192	K1	2	128	None	0	0	2944	1.19
C1-1101E	Vestibule	156	P	2	52	None	0	0	None	0	0	104	0.67
C1-1101B	Storage	72	C	1	56	None	0	0	None	0	0	56	0.78
C2-1201	Control Office	2696	K	15	192	K1	3	128	K2	1	64	3328	1.23
C2-1201F	Vestibule	323	K1	1	128	None	0	0	None	0	0	128	0.40
C2-1201B	Storage	80	C	1	56	None	0	0	None	0	0	56	0.70
C2-1201C	Storage	40	C	1	56	None	0	0	None	0	0	56	1.40
C3-1301	Elevator Lobby	950	K	4	192	None	0	0	None	0	0	768	0.81
C3-1301A	Storage	366	C	3	56	None	0	0	None	0	0	168	0.46
C3-C1301	Corridor	288	K	2	192	None	0	0	None	0	0	384	1.33
C3-0001	Unassigned	108	K1	1	128	None	0	0	None	0	0	128	1.19
C3-C1302	Corridor	472	T	1	64	S	3	64	None	0	0	256	0.54
C4-C1402	Corridor	288	None	0	0	None	0	0	None	0	0	0	0.00
C4-1404	Staff Off	774	Q	16	56	None	0	0	None	0	0	896	1.16
C4-1404C	Mngr Off	95	Q	2	56	None	0	0	None	0	0	112	1.18
C4-1404D	AOC FM Office	170	Q	4	56	None	0	0	None	0	0	224	1.32
C4-1405	Shop	642	C	7	56	None	0	0	None	0	0	392	0.61
C4-1403	Electrical Room	620	C	18	56	None	0	0	None	0	0	1008	1.63

9.2.5 Nitrate Building

Room Name	Room Description	Floor Area	Fixture Type	No Fixtures	Watts/ Fixture	Fixture Type	No Fixtures	Watts/ Fixture	Fixture Type	No Fixtures	Watts/ Fixture	Total Watts	W/SF
NV2-001	Vault	85	D	2	64	None	0	0	None	0	0	128	1.51
NV2-002	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-003	Vault	85	D	2	64	None	0	0	None	0	0	128	1.51
NV2-004	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-005	Vault	85	D	2	64	None	0	0	None	0	0	128	1.51
NV2-006	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-007	Vault	85	D	2	64	None	0	0	None	0	0	128	1.51
NV2-008	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-009	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-010	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-011	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-012	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-013	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-014	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-015	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-016	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-017	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-018	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-019	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-020	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-021	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-022	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-023	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-024	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-025	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-026	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-027	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-028	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-029	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-030	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-031	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-032	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-033	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-034	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-035	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-036	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-037	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-038	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-039	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-040	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-041	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-042	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-043	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-044	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-045	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-046	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-047	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-048	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-049	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-050	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-051	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-052	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-053	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-054	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-055	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-056	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-057	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-058	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-059	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-060	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-061	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-062	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-063	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-064	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-065	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-066	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-067	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-068	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-069	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-070	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-071	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-072	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-073	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-074	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-075	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-076	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-077	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-078	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-079	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-080	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-081	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-082	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-083	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-084	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-085	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78

Room Name	Room Description	Floor Area	Fixture Type	No Fixtures	Watts/ Fixture	Fixture Type	No Fixtures	Watts/ Fixture	Fixture Type	No Fixtures	Watts/ Fixture	Total Watts	W/SF
NV2-086	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-087	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-088	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-089	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-090	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-091	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-092	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-093	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-094	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-095	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-096	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-097	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-098	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-099	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-100	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-101	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-102	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-103	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-104	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-105	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-106	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-107	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-108	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-109	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-110	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-111	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-112	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-113	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-114	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-115	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-116	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-117	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-118	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-119	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-120	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-121	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-122	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-123	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-124	Vault	108	D1	2	96	None	0	0	None	0	0	192	1.78
NV2-3207	Vestibule	80	D	1	64	None	0	0	None	0	0	64	0.80
NV2-3206	Vestibule	550	D1	3	96	None	0	0	None	0	0	288	0.52
NV2-C3202	Corridor	2263	D1	18	96	None	0	0	None	0	0	1728	0.76
NV2-C3203	Corridor	2506	D1	21	96	None	0	0	None	0	0	2016	0.80
NV2-3208	Vestibule	108	D	1	64	D1	1	96	None	0	0	160	1.48
NV3-3307	Vestibule	109	D	1	64	None	0	0	None	0	0	64	0.59
NV3-3308	Vestibule	57	D	1	64	None	0	0	None	0	0	64	1.12
NV3-3302	Mech Equip	14885	C1	125	56	None	0	0	None	0	0	7000	0.47

9.3 Room Data – Energy Model Input

9.3.1 Conservation Building 1st Floor AHUs

	Room Name	Room Description	Floor Area	Walls N Type	N Length	N Height	N D/%GI	N Area	Walls E Type	E Length	E Height	E D/%GI	E Area	Walls S Type	S Length	S Height	S D/%GI	S Area	Walls W Type	W Length	W Height	W D/%GI	W Area	Slab Type	Slab Area	Roof Type	Roof Area
AHU 2-6	CV1-1114	Mecanical Room	380							19																	
	CV1-1112	Processing/Rewinding	1280							64																	
	CV1-1111	Fixed Shelving	600							30																	
	CV1-C1100	Corridors	2000																								
	CV1-1230	Elevator Lobby	240		30																						
	CV1-1120	Support Room	510																								
	CV1-1121	Coffee Station	144																								
	CV1-1220	Janitor Office	112																								
	CV1-1125	Unit Head	140																								
	CV1-C1200	Corridors	900		114																						
	CV1-1200	Loading Platform	600		64																10						
	CV1-1203	Hazardous Mat	375											SW	22						16						
	CV1-1204	Dock Master Security	200																								
	CV1-1206	Shipping & Receiving	380																		10						
	CV1-1100A	Open Office	6200												72												
AHU 2-7	CV1-1041	Mech Room	1200						NE	26																	
	CV1-C1040	Corridors	600																								
	CV1-C1050	Corridors	225																								
	CV1-1055	Lockers	85							12																	
	CV1-1056	Security Office	180																								
	CV1-1057	Security Equipment	130							13																	
	CV1-1110	Compact Shelving	660							66																	
	CV1-C1030	Corridors	300																								
	CV1-1021	Vestibule	100																								
	CV1-1038	Storage	230																								
	CV1-1036	Vestibule	150																								
	CV1-1035	Storage	150																								
	CV1-1037	Control Booth	130																								
	CV1-1032	Projection Booth	400																								
	CV1-1031	Theater Vestibule	400																								
	CV1-1006	Pre-Function	1500												19						16						
	CV-1105	Office Supplies/ Copier	170																								
	CV-1104	Registry Board	140																								
	CV1-1103	Admin Office	170																								
	CV1-1102	Section Head	420																								
	CV1-1101	Conference Room	590																		18						
	CV1-1100B	Open Office	7630																		36						
	CV2-2001	Conference Room	900		22										32						30						
	CV1-1001	Lobby	2730		48																						

9.3.2 Conservation Building 1st Floor FCUs

	Room Name	Room Description	Floor Area	Walls																						Slab Type	Slab Area	Roof Type	Roof Area
				N	Type	Length	Height	D/%Gl	Area	E	Type	Length	Height	D/%Gl	Area	S	Type	Length	Height	D/%Gl	Area	W	Type	Length	Height	D/%Gl	Area				
FCU 1-1	CV1-1101C	Elevator Machine Room																											0
FCU 1-2	CV1-1303A	Lift Machine Room																											0
FCU 2-1	CV1-1010	Multi Purpose	900																										900
FCU 2-2	CV1-11020	Listening Room	550																										550
FCU 2-3	CV1-1027A	Electical Room	100																										100
FCU 2-4	CV1-1027	Comm Room	100																										100
FCU 2-5	CV1-1026	Elevator Machine Room																											0
FCU 2-6	CV1-1222	Electrical Room	150																										150
FCU 2-7	CV1-1221	Comm Room	150																										150
FCU 2-8	CV1-1113	Elevator Machine Room																											0
AHU 2-8	CV1-1030	Theatre	3000									19																	
AHU 2-9	CV1-1207	Decontam Room	225																										
	CV1-1207A	Anti Room	130																										
	CV1-1208	Temp Holding Room	1600																				22						

9.3.3 Conservation Building 2nd Floor AHUs

	Room Name	Room Description	Floor Area	Walls N Type	N Length	N Height	N D/%Gl	N Area	Walls E Type	E Length	E Height	E D/%Gl	E Area	Walls S Type	S Length	S Height	S D/%Gl	S Area	Walls W Type	W Length	W Height	W D/%Gl	W Area	Slab Type	Slab Area	Roof Type	Roof Area
AHU 2-4	CV2-2231	Mechanical Room	570							21					30					10							
	CV2-2130A	Cart Storage	350							21					15												
	CV2-2123	Project Holding Area	150							16					25												
	CV2-2127	Conservation & Cleaning	900																								
	CV2-2127A	Rewind Room	130																								
	CV2-2128	Disc sorting & Accessioning	1400							28					10												
	CV2-2129	Incoming Dirty Collect	1300							26					4												
	CV2-2130	Collection Storage	1300							26																	
	CV2-2131	Engraving	160																								
	CV2-2132	Copyright Room	240																								
	CV32-2230	Elevator Lobby	80																								
	CV2-C2100A	Corridors	1200																								
	CV2-2133	Manuscript Collection Processing	550																								
	CV2-C2220	Corridors	420																								
	CV2-2203A	Health Recep	140																								
	CV2-2203B	Exam Room	120																								
	CV2-2203C	Rest	72																								
	CV2-2202A	Womens Bath	190																								
	CV2-2202B	Womens Showers	150																								
	CV2-2205A	Mens Bath	190																								
	CV2-2205B	Mens Showers	150																								
	CV2-2201	Catering Kitchen	260																								
	CV2-2200	Staff Lounge	1750			36														40							
	CV2-2200A	Waiting/Foyer	550			16			NE	20																	
	CV2-2200B	Kitchen	200																								
	CV2-2204	Exercise Room	150																								
	CV2-C2221	Corridors	80																								
	CV2-2108	Storage	100																								
	CV2-2107	Special Mat Head	140																								
	CV2-2100B	Rec Sound Open Office	6275							80																	
	NV2-C3201	Corridors	290																								
	NV2-3201	Vault Attendees	300											SW	24												
	NV2-3202	Shipping & Holding	440	NW	44																						
	NV2-3204	Vestibule	100	NW	7																						
	NV2-3205	Vestibule	130											SW	7												
AHU 2-5	CV2-2011	Cheifs Office	450												30					10							
	CV2-2012	Admin Asst	160												15												
	CV2-2013	Asst Chief	300												25												
	CV2-2010	Reception	350																								
	CV2-2014	Work Station	190																								
	CV2-2015	Admin Officer	120												10												
	CV2-2016	Facility Manager	150												4												
	CV2-2017	Work Room	160																								
	CV2-2017A	Storage	120																								
	CV2-2019	Human Res	180																								
	CV2-2020	Cubicles	1000																								
	CV2-C2020	Corridors	160																								
	CV2-2021	Found Mgr	180																								
	CV2-2022	Auto Specialist	120																								
	CV2-2023	Auto Specialist	120																								
	CV2-2010	Corridors	160																								
	CV2-2102	Section Head	371																								
	CV2-2101	Conference Room	180																								
	CV2-2100A	Rec Sound Open Off	5780																								
	CV2-2103	Asst Sec Head	170																								
	CV2-2104	Coffee Station	100																								
	CV2-2105	Unit Head	160																								
	CV2-2106	Digital Personel	260																								
	CV2-C2100B	Corridors	1025																								
	CV2-2042	Mech Room	1250																								
	CV2-C2050	Corridors	240																								
	CV2-2120	Tele Room	26																								
	CV2-2121A	Data Center Storage	700																								
	CV2-2121	Data Center	1560							50																	
	CV2-2122	Scanning Room	315							38																	
	CV2-2123	Shipping	1600							44																	
	CV2-2124	Listening Room	110																								
	CV2-2125	Listening Room	110																								
	CV2-2126	Listening Room	110																								
	CV2-C2120	Corridors	240																								

9.3.4 Conservation Building 2nd Floor – FCUs

	Room Name	Room Description	Floor Area	Walls																								Slab Type	Slab Area	Roof Type	Roof Area
				N	Type	Length	Height	D/%Gl	Area	E	Type	Length	Height	D/%Gl	Area	S	Type	Length	Height	D/%Gl	Area	W	Type	Length	Height	D/%Gl	Area				
FCU 2-9	CV2-2206A	Electrical Room	160																												160
FCU 2-10	CV2-2206	Communications	100																												100
FCU 2-11	CV2-2024	Communications	110																												110
FCU 2-12	CV2-2024A	Electrical Room	110																												110
FCU 2-13	CV2-2120	Telephone	324																												324

9.3.5 Conservation Building 3rd Floor - AHUs

				Walls																															
	Room Name	Room Description	Floor Area	N	Type	Length	Height	D/%Gl	Area	E	Type	Length	Height	D/%Gl	Area	S	Type	Length	Height	D/%Gl	Area	W	Type	Length	Height	D/%Gl	Area	Slab Type	Slab Area	Roof Type	Roof Area
AHU 2-1	CV2-2000	Lobby Bridge	1560		C	60	15	70%	900	NE	C	12	15	70%	180								C	25	15	20%	375	-	-	C	1560
	CV3-3001	Conference	225		C	15	15	90%	225														C	15	15	90%	225	-	-	C	225
	CV3-3000	Open Office	1332														C	37	15	70%	555		C	10	15	70%	150	-	-	C	1332
	CV3-3002	Equipment	594																				C	22	15	50%	330	-	-	C	594
	CV3-C3000	Corridor	272																									-	-	C	272
	CV3-3101	Section Head	542																											C	542
	CV3-3004	A/V Maintenance	528																											C	528
	CV3-3100	Open Office	8340																											C	8340
	CV3-3102	D3	253																											C	253
	CV3-3103	CTO/P	138																											C	138
	CV3-3104	Lab Head	138																											C	138
	CV3-3105	Video Edit	410																											C	410
	CV3-3005	Communication	120																											C	120
	CV3-3005A	Electrical	286														C	22	15	0	330									C	286
	CV3-3100A	D1	270																											C	270
	CV3-C3100	Corridor	1242																											C	1242
	CV3-3141	Holding Room	220																											C	220
	CV3-3145	Tape Prep	205																											C	205
	CV3-3144	Disc Prep	720		C	20	15	10%	300	W	C	15	15	0	225															C	720
	CV3-3145A	Tape Bake	180	W	C	11	15	0%	165																					C	180
	CV3-3144A	Clean Holding	110																											C	110
	CV3-3143	Supply	224																											C	224
	CV3-C3140	Corridor	320																											C	320
	CV3-C3150	Corridor	272		C	8	15	0%	120																					C	272
	CV3-C3130	Corridor	225																											C	225
	CV3-3135A	Storage	32																											C	32
	CV3-C3040	Corridor	480																											C	480
	CV3-3111	Media Prep	625																											C	625
	CV3-C3280	Corridor	705																											C	705
	CV3-3280	Expansion Space	3933																											C	3933
	CV3-3269	Screening Sound	690																											C	690
	CV3-3270A	Projection Booth	322																											C	322
	CV3-3271	Screening Sound	690																											C	690
	CV3-3271A	Projection Booth	322																											C	322
AHU 2-1a	CV3-3110	Production Room	4374																											C	4374
	CV3-3112-3114	V1	1220																											C	1220
	CV3-3122	A1	440																											C	440
	CV3-3123	A1	440																												440
	CV3-3126	A1	440																												
	CV3-3127	A1	440																												
	CV3-3130	A1	440																												
	CV3-3131	A1	440																												
	CV3-3134	A1	440																												
	CV3-3139	A1	440																												
	CV3-3136	A1	440																												
	CV3-3117	A2	280																												
	CV3-3116	A2	280																												
	CV3-3261	Datacine Control	280																											C	280
	CV3-3263	Datacine Control	280																												
	CV3-3262	Datacine Equipment	300																											C	300
	CV3-3268	Paper print & scanner	160									9																		C	160
	CV3-3267	Film Recorder	160									9																		C	160
	CV3-3266	Film Scan	400									22																		C	400
	CV3-3265	Sound Trans Control	400									14																			400
	CV3-3264	Sound Trans Equip	120									7																		C	120
AHU 2-2 & 2-3	CV3-3240A	Chem Analysis	144																				-	-	-	-	-	C	560	-	-
	CV3-3243	Lab Maint	420																				-	-	-	-	-	C	700	-	-
	CV3-3240	Chem Sto Mixing	1250			44						30											-	-	-	-	-	C	1250	-	-
	CV3-3251	Printer Room	160									14											A	44	18	20	792	C	264	-	-
	CV3-3252	Printer Room	160									14											-	-	-	-	-	-	-	-	-
	CV3-3253	Printer Room	160									14											A	72	4	7	288	-	-	-	-
	CV3-3254	Printer Room	160									14											-	-	-	-	-	C	288	-	-
	CV3-3255	Printer Room	160									14											-	-	-	-	-	-	-	A	352
	CV3-3256	Printer Room	160									14											-	-	-	-	-	-	-	A	328
	CV3-3250	Film Processors	3600																				-	-	-	-	-	C	900	-	-
	CV3-3257	Printer Room	160																				-	-	-	-	-	-	-	A	480
	CV3-3258	Printer Room	160																				A	247	4	6	988	-	-	A	4940
	CV3-3259	Printer Room	160																				-	-	-	-	-	-	-	-	-
	CV3-3260	Film Printing Suite	2400																				A	26	3	8	78	-	-	-	-
	CV3-C3251	Corridors	1060																				-	-	-	-	-	C	1044	-	-
	CV3-3210	Office	140																												
	CV3-3211	Office	140																											-	-
	CV3-3212	Office	140																											A	140
	CV3-C3260	Corridors	880																											A	880
	CV3-3232	Storage	180																												
	CV3-3231	Inspection Room	380																												
	CV3-C3230	Corridors	600			76																									
	CV3-3229	Timing	320																												
	CV3-3228	Comp Arator	192																												
	CV3-3227	Timing	270																												
	CV3-3224	Film Cleaning	192																												
	CV3-3220	Inspection Quality Cont	3675																												
	CV3-3220A	Outside Loans	280																												
	CV3-3220B	Lab Work Cleaning	720																												
	CV3-3221	Flat Bed Screening	640																												
	CV3-3223	Screening	300																												
	CV3-C3201	Corridors	250																												
	CV3-3202A	Copier & Supply	200																												
	CV3-3202	Coffee	120																												
	CV3-3200A	Break Room	116																											Skylight	116

9.3.6 Conservation Building 3rd Floor – FCUs

	Room Name	Room Description	Floor Area	Walls																						Slab Type	Slab Area	Roof Type	Roof Area
				N	Type	Length	Height	D/%Gl	Area	E	Type	Length	Height	D/%Gl	Area	S	Type	Length	Height	D/%Gl	Area	W	Type	Length	Height	D/%Gl	Area				
FCU 2-14	CV3-3005	Communications	120																										120
FCU 2-15	CV3-3005A	Electrical Room	100																										100
	CV3-3006	Holding Room	190																									Skylight	190
FCU 2-16	CV3-3143B	Communications	150			10																							150
FCU 2-17	CV3-3143A	Electrical Room	150			10																							150
FCU 2-18	CV3-C3220	Corridor	450																										450
	CV3-3200B	Break Room	442																									Skylight	442
FCU 2-18A	CV3-C3210	Corridor	360																										360
	CV3-3200C	Control Office	442																									Skylight	442
FCU 2-20	CV3-C3226	Communications	90																										90
FCU 2-21	CV3-C3225	Electrical Room	90																										90
FCU 2-22	CV3-C3214	Communications	90																										90
FCU 2-23	CV3-C3213	Electrical Room	90																										90