ST PETERSBURG CITY COUNCIL
ENERGY, NATURAL RESOURCES & SUSTAINABILITY COMMITTEE

AGENDA

Meeting of December 15, 2016
1:00 p.m. – 2 p.m. – City Hall Room 100

Members & Alternate: Chair, Darden Rice; Vice- Chair Karl Nurse;
Steve Kornell, Ed Montanari, Lisa Wheeler-Bowman (Alternate)

Support Staff: Sharon Wright

A. Call to Order

B. Approval of Agenda

C. Approval of Minutes (attached)

   1. November 21, 2016

D. New/Deferred Business

   1. Knock It Out of the Park! - tobaccoless ban (i.e., chewing tobacco ban) at Tropicana Field and citywide events (resolution attached)
   2. Preliminary District Cooler Plant Analysis (report attached)

E. Continued Business

F. Upcoming Meeting Agenda Tentative Issues

   1. January 19, 2017; 1 p.m.

G. New Business Item Referrals (attached)
H. Adjournment

CITY OF ST. PETERSBURG
ENERGY, NATURAL RESOURCES AND SUSTAINABILITY COMMITTEE MEETING
November 21, 2016

PRESENT: Committee Chair Darden Rice; Vice-Chair Karl Nurse; Ed Montanari, Lisa Wheeler-Bowman (Alternate)

ALSO PRESENT: Councilmember Charles Gerdes, Councilmember James R. Kennedy, Jr., Assistant City Attorney Michael Dema, Assistant City Attorney Heather Judd, Zoning Official Elizabeth Abernethy, Sustainability Manager Sharon Wright, Community Rating Coordinator Noah Taylor and Office Systems Specialist Paul Traci

ABSENT: Committee member Steve Kornell

Committee Chair Rice called the meeting to order at 10:30 a.m. and then undertook a roll call to establish the presence of a quorum. The meeting commenced with the following members present: Ed Montanari, Karl Nurse, Lisa Wheeler-Bowman and Darden Rice. Chair Rice moved for approval of the agenda. All were in favor of the motion. Chair Rice moved for approval of the October 20, 2016 Committee minutes. All were in favor of the motion.

Sustainability Manager Sharon Wright presented the ULI Workshop update. Ms. Wright presented the ULI Resiliency Workshop schedule for December 5 – 6, 2016. The list of members of the technical advisory panel was presented to the Committee. Chair Rice wanted to ensure that the City Council administrative staff were aware of the dates and times of the workshop events. Ms. Wright also spoke regarding the University of South Florida, St. Petersburg Campus, LEED awards. It was noted that Mayor Rick Kriseman was a keynote speaker, and Councilmember Rice received the Local Green Apple Award. This award is a statewide recognition of a local official.

Elizabeth Abernethy, Zoning Official and Manger of Development Review Services and Urban Forester Shane Largent spoke regarding the Tree Removal portion of the agenda. Ms. Abernethy reported that her department is responsible for tree removal permits, and works with the City's Codes Compliance Department upon the discovery of a violation. Current codes allow for a penalty of no more than $1,000 per residential tree and no more than $1,500 per commercial tree regarding after the fact cases. Mr. Largent presented three different commercial sites where fines were imposed by the City for after the fact tree removal. Eighty-five percent of tree removal permits are for Laurel Oaks due to the end of the Laurel Oaks' fifty to seventy year life span.

Vice-Chair Nurse inquired if the City should require permits to remove Laurel Oaks. Ms. Abernathy stated it would help with staff time. Mr. Largent stated it would help if staff can ensure that the tree to be removed is a Laurel Oak and if the tree is really dead. Vice-Chair Nurse asked if a picture of the tree could be sent to the City that would save staff time. Mr. Largent answered Vice-Chair Nurse's inquiry remarking that sending a picture would save a considerable amount of time. Chair Rice reported that she did not want to lose focus of removing healthy trees.

Assistant City Attorney Heather Judd stated that there is a $500 cap that is provided by state statute for code enforcement and also an administrative order through the 6th Judicial Circuit. A recurring violation can be $500 per day. Ms. Judd believes there could be a multiple citation situation if such a case is presented, which would motivate a person to get an after the fact permit. This would increase the penalty. Ms. Judd also encouraged citizens to inform their local investigator as a violation is occurring. The local investigator would then be able to take pictures as the tree is being cut.

Noah Taylor, Community Rating Coordinator presented the CRS update and repetitive loss area analysis. Mr. Taylor reported that as of October 1, 2016 the City achieved a Class 5 rating. A Class 5 rating provides the City with a 25% discount on special flood hazard area policies. Councilmember Gerdes entered the meeting at 11:12 a.m. The City is currently working towards achieving a Class 4 rating. Mr. Taylor discussed the differences between a Class 4 and Class 5 rating. All pre-requisites for a Class 4 rating must be achieved by August 2018.

Mr. Taylor presented the repetitive loss area analysis update. It was reported that Shore Acres had 280 losses and Riviera Bay had 41 losses. A repetitive loss was defined has having two or more claims totaling more than $1,000 in a 10 year rolling period. A severe repetitive loss was defined has having four or more claims totaling more than $5,000 or two claims exceeding the buildings reported value.

In connection with continued business, Vice-Chair Nurse presented questions regarding the 10 year bond program. Vice-Chair Nurse commented that it should be a 10 year loan.

Committee member Montanari moved to approve the Repetitive Loss Area Analysis Reports on the Consent Agenda. The motion passed unanimously.

There being no further business, Chair Rice adjourned the meeting at 11:56 a.m.

AN ORDINANCE OF THE CITY OF ST. PETERSBURG, FLORIDA CREATING A NEW SECTION 20-124, REGULATION OF SMOKELESS TOBACCO PRODUCTS; CREATING DEFINITIONS OF ORGANIZED SPORTING EVENT, ATHLETIC FACILITY, AND SMOKELESS TOBACCO PRODUCT; PROHIBITING THE USE OF SMOKELESS TOBACCO PRODUCTS AT ATHLETIC FACILITIES AND ORGANIZED SPORTING EVENTS; AND PROVIDING AN EFFECTIVE DATE.

WHEREAS, Centers for Disease Control Prevention reports that smokeless tobacco contains nicotine, which is highly addictive, young people who use smokeless tobacco can become addicted to nicotine and may be more likely to also become cigarette smokers; and

WHEREAS, Centers for Disease Control Prevention reports that high school athletes are more likely to use smokeless tobacco than their peers who are non-athletes; and

WHEREAS, children and teens closely observe athletes' actions, including their use of tobacco products, and are influenced by what they see. Adolescents tend to mimic the behaviors of those they look up to and identify with, including baseball players and other athletes.

THE CITY OF ST. PETERSBURG, FLORIDA DOES ORDAIN:

Section 1: The St. Petersburg City Code is hereby amended by adding a new Section 20-124 to read as follows:

Section 20-124- Smokeless Tobacco Products

(a) Purpose and Intent

It is the intent of this section to promote, protect, and improve the health, safety, and general welfare of the citizens of the City of St. Petersburg by discouraging the unhealthy practice of using smokeless tobacco products, especially by young people, through prohibition of the use of smokeless tobacco products at athletic facilities and organized sporting events within the City.

(b) Definitions

(1) *Organized sporting event* means any game of or athletic competition related to baseball, softball, football, basketball, volleyball, tennis, racquetball, badminton, soccer, skating, skateboarding, swimming and diving, and any other event involving a game or other athletic competition organized by a league or association of persons, including but not limited to, professional, amateur, adult recreational, youth recreational, and school sponsored leagues.

(2) *Athletic facility* means an indoor or outdoor basketball court, volleyball court, tennis court, racquetball court, badminton court, baseball field, softball field, soccer field, football field, skate park or rink, swimming pool and any other sporting facility, or any portion thereof, including all sidelines, dugouts, and similar parts of the facility. Athletic facility shall also include the bleachers or any other spectator area, any restroom structure, and any concession and eating area.

(3) *Smokeless tobacco product* means items such as snuff, loose tobacco, or similar goods made with any part of the tobacco plant, which are prepared or used for chewing, dipping, sniffing, or other personal use, not including cigars, cigarettes, pipe tobacco, or any other lighted tobacco product.

(c) Prohibition of Use

(1) A person shall not use or otherwise consume any smokeless tobacco product when attending or participating in any organized sporting event or at any athletic facility.

(2) A person shall not use or otherwise consume any smokeless tobacco product anywhere on a property at which of the following permitted uses (as defined in Chapter 16 of the City Code) exists:

a. Golf course/country club
b. Commercial recreation, outdoor
c. Commercial recreation, indoor
d. Health clubs
e. Park, active
f. Recreation use, accessory to residential use (does not include single family use)
g. Recreation use, accessory to public park

Section 2. The provisions of this ordinance shall be deemed to be severable. If any provision of this ordinance is determined unconstitutional or otherwise invalid, such determination shall not affect the validity of any other provisions of this ordinance.

Section 3. In the event this Ordinance is not vetoed by the Mayor in accordance with the City Charter, it shall become effective upon the expiration of the fifth business day after adoption unless the mayor notifies the City Council through written notice filed with the City Clerk that the mayor will not veto this Ordinance, in which case this Ordinance shall become effective immediately upon filing such written notice with the City Clerk. In the event this Ordinance is vetoed by the mayor in accordance with the City Charter, it shall not become effective unless and until the City Council overrides the veto in accordance with the City Charter, in which case it shall become effective immediately upon a successful vote to override the veto.

Approved as to form and content:

_____

City Attorney (Designee)

ENERGY, NATURAL RESOURCES & SUSTAINABILITY 12-15-2016
PENDING / CONTINUING REFERRALS

TOPIC	***DATE REFERRED***	***REFERRED BY***	***RETURN DATE***	***STAFF RESPONSIBLE***	***SPECIAL NOTES***
Evaluation of the merits and budget considerations of utilizing an ICLEI Membership	5/7/15	Rice	2017	Sharon Wright	ICLEI pending Integrated Sustainability Action Plan (ISAP) moving forward; will determine at time of scoping or data gathering as it makes sense.
City-wide Green Fleets Initiative & Ordinance or Policy	4/7/2016	Rice	12/15/2016	Sharon Wright & Joe Krizen	Internal work in progress.
Change city purchasing policy to require the use of renewable/recyclable products at city facilities and events.	3/17/2016	Nurse	12/15/2016	Sharon Wright & Louis Moore	Administrative policy revised; additional related policies will be reviewed/revised as part of comprehensive ongoing review.
Resiliency planning partnership & ISAP – scope, schedule, budget	7/14/2016	Kennedy/BFT	10/20/2016	Sharon Wright	On 11/21/2016 City Council Agenda for review/approval
Report on District Cooling	7/14/2016	Kennedy/BFT	12/15/2016	Sharon Wright Lisa Glover-Henderson	Final Griner report deliverable: 11/22/2016
(No motion, but request). Receive briefing(s) for the recent emergency management plan.	7/21/2016	Montanari	12/15/2016	Sharon Wright & Chief Dean Adamides	Currently at print shop. Expect delivery end of Nov 2016.
Staff set up a mechanism to capture energy savings to be re-invested in additional energy efficiency projects. Review Green Bond option.	9/15/2016 – updated 11/3/2016	Nurse	2/2017	Sharon Wright Claude Tankersly	Mechanisms will be researched, partly through energy analysis, if approved.

Staff to set up a presentation by local scientists for update on climate change information and efforts	9/4/2016	Kornell	1/19/2017	Sharon Wright	Initiated – contacts and coordination Part of ULI Report Out 2017; Part of Earth Day outreach (April)
Discussion to increase tougher penalties on illegal grand/protected tree removal	8/25/2016	Rice	10/20/2016	Sharon Wright Liz Abernathy	Completed presentation. Review on-going; will meet with working group 2017
Approving the Repetitive Loss Area Analysis documents that evaluate the flooding hazards within the most severely flooded areas of the City of St. Petersburg; and providing an effective date.	10/13/2016	Montanari	11/21/2016	Rick Dunn Noah Taylor	Complete; referred to Consent Agenda Nov 21, 2016
Consider what action the City can take to limit the use of vaping in public buildings and space.	11/2/2016	Nurse	2/2017	Sharon Wright Planning/Legal staff	Most FL bans ban all enclosed workplaces, including restaurants, exempting bars; brief internet research show that states that do not allow smoking in bars also do not allow vaping
Referring to ENRS a new business item to ban smokeless tobacco (i.e., chewing tobacco) at Tropicana Field and ticketed games in the City.	10/20/2016	Rice	12/15/2016	Sharon Wright Planning/Legal staff	Coordinating this item with above vaping item.

PRELIMINARY ANALYSIS FOR A DISTRICT COOLING PLANT FOR THE CITY OF ST. PETERSBURG

City Project No. 16097-110

st.petersburg

Prepared for: The City of St. Petersburg
Department of Engineering
Task Order 12-03-GRI/SEM
One Fourth Street North
St. Petersburg, FL 33701

Prepared by: Griner Engineering, Inc.
1628 First Avenue North
St. Petersburg, FL 33713

November 22, 2016

GEI Project No. 16090

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HAP ENERGY REPORT

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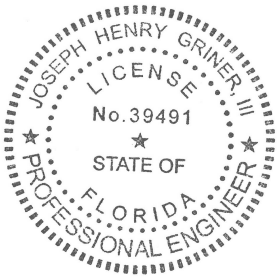
Using HDD & HDPE Goes Deep & Long to Solve Leaks in Miami
By Steve Cooper



1. EXECUTIVE SUMMARY

Background

The City of St. Petersburg is interested in developing sustainable community projects that will stimulate economic development, reduce greenhouse gas emissions and improve the reliability of air conditioning systems within the city. Griner Engineering was commissioned to perform a simple study of the feasibility of a district cooling system for the downtown core. A total of ten (10) government buildings are considered in this study: six (6) City of St. Petersburg buildings, three (3) Pinellas County buildings and one (1) Florida State building. The new City of St. Petersburg Police Complex is also analyzed to be part of the district system.

Approach

The annual cooling use of the considered buildings in the downtown core was simulated using the Carrier Hourly Analysis Program (HAP), Version 4.6 software program. HAP is a true hour-by-hour load analysis program and is approved for calculating and verifying energy use by the U.S. Department of Energy.

Results

The load analysis indicates a 2,000-ton peak load for the buildings simulated; therefore, a 3,000-ton chiller plant was used to estimate the construction cost and annual energy usage of the district system.

A district cooling system is estimated to save $259,885 per year compared to current HVAC equipment. It is estimated to cost $10,518,880 to construct the central plant and transform the existing buildings to be recipients of chilled water. This results in a simple return on investment of 40.5 years, and an internal rate of return is -3.4%.

Conclusions

District cooling systems tend to be more economically viable for large tonnage plants. The relatively small size of the proposed plant does not make a district cooling system a successful solution for the City of St. Petersburg. The City of St. Petersburg should consider expanding the

user base of the district cooling system in order to make the project more economically viable. Unfortunately, the new Police Complex, on its own, does not offer the tonnage required to make this project more attractive. The City should consider expanding the user base to private/commercial building owners. If the future commercial development of the Tropicana Field site is considered for inclusion, the potential for economic viability is greatly increased.

2. INTRODUCTION

District cooling is a long-term investment of capital to improve the physical infrastructure of the community. It is complimentary to the gas and electric utilities and consists of a network of underground pipes that carry chilled water from a central plant to the energy transfer stations in buildings connected to the loop. The energy transfer stations are located within the buildings in order to allow for metering and for effective transfer of the cooling energy from the loop to the buildings heating, ventilating and air conditioning (HVAC) system. The district cooling system takes the place of chillers and cooling towers located within each building. In a typical application, the overall district cooling system is large enough to capitalize on economies of scale since the plant serving the buildings is typically more energy efficient, easier to maintain, more environmentally sound and has improved reliability than individual systems. For district cooling to be successful, the connected buildings must have an existing chilled water HVAC system. If the existing HVAC systems are based on direct expansion (DX), new cooling coils, chilled water piping and other large pieces of HVAC equipment must be added in order to take advantage of district cooling.

This report contains the initial analysis for the implementation of a district cooling system for the City of St. Petersburg. The report focuses on the largest group of publically owned facilities in the eastern core of downtown; however, it also reviews the feasibility of extending the district cooling loop to the west in order to serve the cooling needs of the new Police Complex. Data on public buildings located within the downtown core and the area west, noted as the Police Station, were compiled to create a summary of the cooling energy required by the district cooling systems, the benefits, and the costs.

3. DESCRIPTION OF DISTRICT COOLING PLANT

The District Cooling System would consist of three main components: a central plant, distribution piping and energy transfer stations located within the client buildings. For the buildings that cool with direct expansion (DX), there is a fourth component as well which is to convert the internal heating, ventilating and air-condition (HVAC) equipment to receive chilled water. Other considerations for the new central plant include that plant and piping should be designed to accommodate the current and future chilled water needs of downtown St. Petersburg. For example, the chilled water plant building would include the number of chillers and cooling towers to meet the current projected load but have the space for additional chillers, towers, pumps and electrical equipment. The distribution piping size cannot be easily increased once it is installed underground for the loop of buildings being considered, so including extra capacity for piping within the plant should be considered for growth of additional loops. The district cooling should also include redundancies and emergency preparedness to maintain cooling capacity to the clients in case of hurricanes, power outages, or other plant/system shutdowns common to central Florida. All of these accommodations were accounted for in this estimate cost to install the system.

3.1 CENTRAL PLANT

The peak-connected load of the buildings that were assumed to be on the district cooling plant is roughly 2,000 tons. In order to provide some sort of redundancy, the preliminary design included three, 1,000 ton chillers. This provides N+1 redundancy for the central plant and greatly improves the reliability.

The plant would initially be designed to accommodate three chillers, each with a capacity of 1,000 tons. The chillers would be water-cooled, high-efficiency centrifugal units. They could be located in a building along with the primary pumps, valves, controls, water treatment and other equipment required for distribution of the chilled water to the piping. Cooling towers for the condenser

Figure 1 – Rendition of District Cooling Plant

water could be placed above the chillers, on the roof of the central plant building. Locating the cooling towers above the chillers will save on central plant space and reduce pedestrian noise in the area of the plant.

A rendition of a central plant as described is shown in Figure 1. This plant location minimizes piping and should be used as a place setting only.

3.2 DISTRIBUTION PIPING

The district cooling plant would be connected to each of the buildings on the loop by an underground system of large insulated pipes. These pipes would be directionally bored to provide a termination or branch at each of the buildings served by the loop.

The distribution piping could be installed either by the traditional trench-and-backfill method or by directional drilling. The most common method of installing chilled water pipe is the trench-and-backfill method. In order to use this method for the St. Petersburg district cooling, the surface material would be cut, a trench would be dug, the pipe installed and then the surface condition restored. This is an extremely expensive method to install piping in an urban area. The surface materials are often roadways or sidewalks which require specific, costly replacement. Trenching requires careful coordination with existing building and structure foundations in order to prevent erosion or failures of structures adjacent to the trench. Directional drilling is a steerable, trenchless method of installing underground piping. Its advantages include: less disruption of traffic, lower first costs of installation and shorter installation time. Therefore, directional drilling is recommended to install the distribution piping for the district cooling. The bending radius of the 20” pipe is limited, so some excavation will be required, even with directional drilling. These additional costs are included in the cost estimate as surface restoration. Directional drilling has been used throughout Florida. An article about the use of 20” pipe installed by directional drilling is

included in Appendix B. The pipe estimated for the loop should have a minimum diameter of 20 inches and be insulated to reduce energy loss in the loop. A comprehensive geotechnical investigation should be conducted in order to determine the most efficient installation.

The following buildings shown in Figure 2 were included on the district cooling loop:

NAME	OWNERSHIP	TONS	TYPE
Judicial Building 545 First Avenue North	Pinellas County	400	CHW
501 Building 501 First Avenue North	Pinellas County	400	CHW
Human Services Building 647 First Avenue North	Pinellas County	60	CHW
Sebring Building 525 Mirror Lake Drive North	Florida Department of Management Services	250	CHW
St. Petersburg City Hall 175 Fifth Street North	City of St. Petersburg	250	CHW
Municipal Services Building 1 Fourth Street North	City of St. Petersburg	400	CHW
Mirror Lake Library 280 Fifth Street North	City of St. Petersburg	50	DX
Shuffleboard Club 559 Mirror Lake Drive North	City of St. Petersburg	10	DX
Coliseum 535 Fourth Avenue North	City of St. Petersburg	60	CHW
Sunshine Center 330 Fifth Street North	City of St. Petersburg	70	DX

** DX = Direct Expansion CHW = Chilled Water*

Figure 2 – List of Buildings included in the District Cooling Loop

The buildings in Figure 2 were included in the proposed loop because of their relative proximity to each other, and they are government owned and operated. For buildings farther apart than these, a much larger amount of underground piping would be required in order to connect them to the central plant. For example, the new Police Station was not included in this group because it is approximately 3,425 feet away from the central plant. The cost to install 6,850 feet of underground insulated pipe (supply and return), and the energy cost in pumping chilled water that far makes the return on investment poor for this building complex.

The location of these buildings and a conceptual piping layout is shown in Figure 3. The conceptual piping layout is intended only to show that the buildings are connected to the loop. The total cooling load of all buildings proposed on the loop is only 1,950 tons. This is not a significantly large cooling load to make the district cooling plant practical.

Figure 3 – Map of buildings on the cooling loop for this study
(*The piping path is conceptual and not an actual proposed path.*)

3.3 BUILDING COOLING TRANSFER STATIONS

The buildings, which are candidates for connection to the district cooling system, will connect to the distribution piping loop by cooling transfer stations. A typical piping schematic and picture of a cooling transfer station is shown in Figure 4. Each station is very compact and would include a heat exchanger and a billing (energy) meter. The cooling transfer station will replace the individual building chillers cooling towers that provides cold water for the HVAC systems in the building. The costs of the cooling transfer station are included in the capital cost estimate for the district cooling utility.

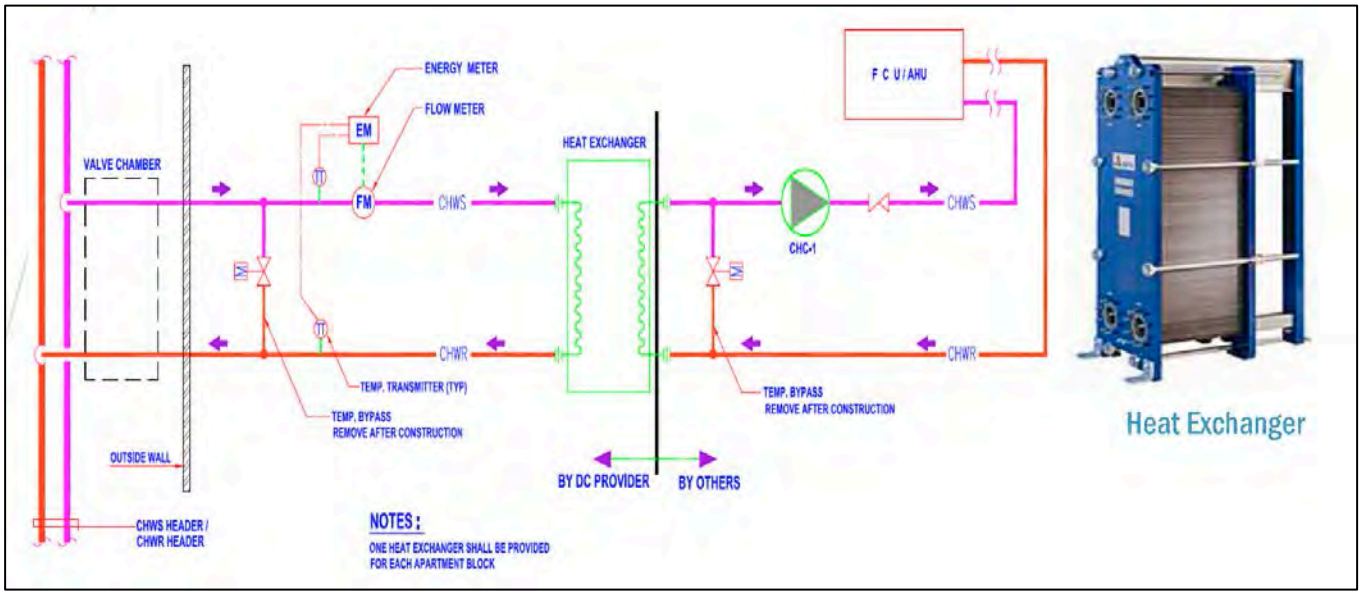


Figure 4 – Cooling transfer station piping schematic and picture

3.4 BUILDING SYSTEMS

Each building connected to the loop would be cooled by the chilled water produced at the central plant. Energy (heat) from the building would then be transferred through the heat exchanger (in the building's cooling transfer station. This requires that all buildings on the loop have a chilled water HVAC system. The chilled water HVAC system must include chilled water piping, chilled water air handlers and hydronic distribution equipment (pumps, valves, etc.) to circulate the chilled water throughout the building. Three of the buildings included on this study, the Mirror Lake Library, the Shuffleboard Club, and the Sunshine Center have direct expansion (DX) HVAC equipment. In order to utilize the central chilled water loop, these building would need their existing DX equipment replaced with chilled water equipment. The costs for modifying these three buildings to accept the chilled water HVAC system are included in the cost estimate.

4. CAPITAL COST ESTIMATE

The preliminary cost estimate for the proposed district cooling system is detailed in Figure 5 and includes: a modest building for the central plant, cooling and distribution equipment, energy transfer stations at each building, distribution piping, and electrical generating equipment to ensure that one chiller would be operational in the event of a power outage. There are several items that should be considered when reviewing the preliminary cost estimate:

1. The construction cost of the central plant building is included but the cost of real estate to build the plant on is not included.

2. The traditional method to install the piping by trenching and backfilling would be extremely disruptive, costly and time consuming. The horizontal directional drilling method was used in this estimate.

3. The pipe that was used in the estimate is 20" high-density polypropylene. A 14 degree Fahrenheit difference between supply and return water was assumed along with a maximum water velocity of 6.0 feet per second. The pipe capacity at these conditions is 3,333 tons. The cooling capacity of the chilled water pipe is limited by its size and the temperature difference between the supply and return chilled water. The temperature difference is critical to the selection and operation of the air handlers and should not be changed once selected. If more capacity in the distribution piping is desired on this loop than a larger pipe would be required and the costs of materials would increase.

4. This estimate is for first cost only and does not include the on-going cost of maintenance and operation. The cost of operation and maintenance would be included in any third party selected to construct and operate the plant.

5. Since reliability is a large factor in the use of district cooling, an emergency electrical generator system was included in this estimate. A single 800kw generator was estimated to provide emergency power for a single 1,000-ton chiller, cooling tower and distribution system.

6. The costs of installing chilled water piping, hydronic accessories and chilled water handlers in three buildings that are currently served with direct expansion (DX) units are included in the cost estimate.

7. Installing sub-surface piping in an urban core can require extensive

rebuilding of the original surface conditions. The restoration costs of roadways, sidewalks, parking lots, etc. are included in the cost estimate on line 12.

8. The soft costs associated with a project like district cooling can be very large. An allocation of the normal overhead and profit tends to be insufficient to cover the costs of legal fees to develop operating agreements and usage permits. There is also likely to be additional permitting, engineering and design fees beyond what would be expected from a typical capital improvement project.

9. There are several issues covered under the miscellaneous line items. For example, some of the buildings connecting to the loop may require interior modifications to install the energy transfer stations. All of the buildings would have chillers and/or cooling towers that would no longer be used and should be removed. The cost of miscellaneous building, roof and structural modifications are included in this line item.

GRINER ENGINEERING INC.
CONSTRUCTION COST ESTIMATE

Project Title: City of St. Petersburg
Estimate For: District Cooling System

Project No.: 16090
Date: 8/15/2016

Line	Item	MATERIAL COST Quantity	Unit of Measure	$/Unit	Total	LABORCOST Hours	Average Rate	Total	Line Total
1	1,000 ton chiller	3	Ea	$400,000	$1,200,000	6,500	$65	$422,500	$1,622,500
2	1,000 ton cooling tower	3	Ea	$200,000	$600,000	2,000	$65	$130,000	$730,000
3	chilled water pumps	6	Ea	$12,000	$72,000	1,500	$65	$97,500	$169,500
4	condenser pumps	3	Ea	$12,000	$36,000	1,000	$65	$65,000	$101,000
5	hydronic accessories	1		$150,000	$150,000	3,000	$65	$195,000	$345,000
6	chilled water piping and insulation at the plant	1		$50,000	$50,000	500	$65	$32,500	$82,500
7	energy transfer stations	9	Ea	$20,000	$180,000	720	$65	$46,800	$226,800
8	controls	1		$150,000	$150,000	1,000	$75	$75,000	$225,000
9	emergency generators/transfer switch (800KW)	1	Ea	$250,000	$250,000	2,000	$75	$150,000	$400,000
10	electrical	3000	SF	$75	$225,000	3,000	$75	$225,000	$450,000
11	directional bored piping (20")	8000		$35	$280,000	8,000	$35	$280,000	$560,000
12	Surface Restoration	1		$42,000	$42,000	1	$42,000	$42,000	$84,000
13	district cooling building	3000	SF	$200	$600,000			$0	$600,000
14	miscellaneous	1		$400,000	$400,000	5,000	$75	$375,000	$775,000
15	Conversion of 3 blds to chilled water	1	Ea	$125,000	$125,000	1,200	$65	$78,000	$203,000
16	subtotal								$6,574,300
17	soft costs (design/permitting @30%)								$1,972,290
18	contingency (30%)								$1,972,290
19	total								$10,518,880
	Property acquisition not included								
	Total								$10,518,880

Figure 5 – Detailed first costs for the district cooling system

5. ENERGY CONSERVATION

To estimate the energy use of the existing systems and the proposed district cooling plant, the Carrier Hourly Analysis Program (HAP) Version 4.60 software program was utilized. This portion of the analysis was broken down into two parts. The first part involved estimating the individual building load analysis. The second part used the building load estimation to run two models. One model represented the average existing building cooling efficiency and the other model represented the proposed district cooling plant. The results of the HAP software are in Appendix 1. The Shuffleboard Club load has been increased to include additional HVAC equipment that will be added to the facility.

Figure 6 summarizes the results of the load analysis and modelling using HAP. This Figure compares the energy in kilowatt hours for the individual systems against the district cooling system. The estimated HVAC load on the buildings remains the same regardless of the type of cooling system (Figure 6 column "HVAC LOAD (TONS)"). However, the increased efficiency of the district cooling system will achieve the same amount of cooling while using less energy. The detailed output of the HAP analysis is located in Appendix A.

BUILDING NAME	HVAC LOAD (TONS)	HVAC ENERGY INDIVIDUAL PLANTS (KWH)	HVAC ENERGY DISTRICT COOLING (KWH)	ENERGY SAVED WITH DISTRICT COOLING (KWH)
Judicial Building 545 First Avenue North	401	985,319	458,981	526,338
501 Building 501 First Avenue North	399	1,075,938	557,602	518,336
Human Services Building 647 First Avenue North	60	155,797	82,940	72,857
Sebring Building 525 Mirror Lake Drive North	249	670,027	348,583	321,444
St. Petersburg City Hall 175 Fifth Street North	248	709,416	363,183	346,233
Municipal Services Building 1 Fourth Street North	399	1,069,178	559,524	509,654
Mirror Lake Library 280 Fifth Street North	50	134,504	68,764	65,740

Figure 6 - continued on next page

BUILDING NAME	HVAC LOAD (TONS)	HVAC ENERGY INDIVIDUAL PLANTS (KWH)	HVAC ENERGY DISTRICT COOLING (KWH)	ENERGY SAVED WITH DISTRICT COOLING (KWH)
Shuffleboard Club 559 Mirror Lake Drive North	45	27,502	15,024	12,478
Coliseum 535 Fourth Avenue North	61	150,895	78,449	72,446
Sunshine Center 330 Fifth Street North	71	182,936	95,466	87,490

Figure 6 - Results of the load analysis and the modelling using HAP

The total electrical usage savings is 2,532,996 kWh. Using the average rate of electricity for the City of St. Petersburg buildings included in this Study at $0.1026/kWh, the total utility savings is $259,885 per year. The project's simple return on investment (ROI) is 40.5 years and the internal rate of return (IRR) is -3.4%, assuming the lifetime of the chillers is 25 years.

6. CONCLUSIONS

There are many benefits to a district cooling system in St. Petersburg. These benefits include:

- **Environmental** – Greenhouse gas emissions would be reduced as well as the use of water and wastewater. A 2,000 ton district cooling plant would reduce CO^2 emissions by 3,732,617 pounds per year.

- **Reliability** – A central cooling plant with N+1 redundancy is considerably more reliable than any other cooling plant currently being used in St. Petersburg.

- **Building Use** –Connection to a district cooling plant would eliminate the need for these buildings to have capital expended for their individual cooling plants. It would also free up space that had been used for chillers, towers and other refrigeration equipment. This benefit would also extend to developers of new projects by increasing space utilization and deferring the capital cost of central plants.

- **Energy Costs** –The energy savings of a 3,000-ton plant is $259,885 has an estimated first cost of $10,518,880. This gives a simple payback of 40.5 years and an IRR of -3.4%. The poor payback of this system is due to the small size and utilization. For example, the *ASHRAE DISTRICT COOLING GUIDE* has three case studies listed in Appendix A. The smallest case study listed is for the City of St. Paul, Minnesota. This district cooling plan has a refrigeration capacity of 24,637 tons.

Only properties in the eastern core of downtown St. Petersburg were included in the economic analysis. The Police Complex was considered for inclusion, however, the costs of the addition of almost 7,000 feet of underground piping and the additional pumping energy required to get the chilled water to the Police Complex and back caused the payback analysis for district cooling to be even less attractive. This applies to the other City of St. Petersburg facilities west of Dr. Martin Luther King Street as well.

7. RECOMMENDATIONS

The size of the proposed central plant seems to be too small to support the first cost of a district cooling system. Increasing the load on the plant by soliciting interest of all public and private building owners in the area will make the project more economically viable.

The limited HVAC load at the new Police Station does not warrant extending the piping from a central plant located near City Hall.

APPENDIX 1

HAP ENERGY REPORT

Annual Cost Summary

COSP Chiller Loop
Griner Engineering, Inc.

10/27/2016
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Table 1. 1 Annual Costs

Component	CHILLER LOOP 1 EXISTING ($)	CHILLER LOOP 1-CITY HALL ($)	CHILLER LOOP 1-COLISUEM ($)	CHILLER LOOP 1-JUDICIAL ($)	CHILLER LOOP 1-MIRROR LAKE LIB ($)
Air System Fans	82,573	12,184	2,599	7,779	2,229
Cooling	347,623	16,393	3,318	25,981	3,108
Heating	1,789	0	139	0	9
Pumps	14,789	6,844	1,596	10,503	1,355
Heat Rejection Fans	17,281	1,842	396	2,829	355
HVAC Sub-Total	**464,055**	**37,262**	**8,049**	**47,092**	**7,055**
Lights	183,929	26,985	7,196	34,621	4,937
Electric Equipment	577,988	101,195	4,797	135,913	16,458
Misc. Electric	0	0	0	0	0
Misc. Fuel Use	0	0	0	0	0
Non-HVAC Sub-Total	**761,917**	**128,181**	**11,994**	**170,535**	**21,395**
Grand Total	**1,225,972**	**165,443**	**20,042**	**217,626**	**28,450**

Table 1. 2 Annual Costs

Component	CHILLER LOOP 1-MUNICIPAL ($)	CHILLER LOOP 1-PC 501 ($)	CHILLER LOOP 1-PC HUMAN ($)	CHILLER LOOP 1-SEBRING ($)	CHILLER LOOP 1-SHUFFLE ($)
Air System Fans	19,494	19,494	2,837	12,268	439
Cooling	23,622	23,961	3,328	14,861	579
Heating	748	86	353	140	174
Pumps	10,780	10,871	1,595	6,759	280
Heat Rejection Fans	2,762	2,796	396	1,736	69
HVAC Sub-Total	**57,407**	**57,209**	**8,510**	**35,764**	**1,541**
Lights	37,420	36,880	5,237	22,644	810
Electric Equipment	100,746	121,435	9,165	72,460	810
Misc. Electric	0	0	0	0	0
Misc. Fuel Use	0	0	0	0	0
Non-HVAC Sub-Total	**138,165**	**158,315**	**14,402**	**95,104**	**1,619**
Grand Total	**195,572**	**215,524**	**22,911**	**130,868**	**3,161**

Table 1. 3 Annual Costs

Component	CHILLER LOOP 1-SUNSHINE ($)	EX CHILLER LOOP 1-CITY HALL ($)	EX CHILLER LOOP 1-COLISUEM ($)	EX CHILLER LOOP 1-JUDICIAL ($)	EX CHILLER LOOP 1-MIRROR LAKE LIB ($)
Air System Fans	3,249	12,184	2,599	7,779	2,229
Cooling	4,019	49,262	10,111	75,856	9,323
Heating	138	0	139	0	9
Pumps	1,911	8,962	2,119	13,771	1,780
Heat Rejection Fans	477	2,377	513	3,689	459
HVAC Sub-Total	**9,795**	**72,785**	**15,482**	**101,095**	**13,800**
Lights	7,196	26,985	7,196	34,621	4,937
Electric Equipment	14,992	101,195	4,797	135,913	16,458
Misc. Electric	0	0	0	0	0
Misc. Fuel Use	0	0	0	0	0
Non-HVAC Sub-Total	**22,188**	**128,181**	**11,994**	**170,535**	**21,395**
Grand Total	**31,983**	**200,966**	**27,475**	**271,629**	**35,195**

Annual Cost Summary

COSP Chiller Loop
Griner Engineering, Inc.

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Table 1. 4 Annual Costs

Component	EX CHILLER LOOP 1-MUNICIPAL ($)	EX CHILLER LOOP 1-PC 501 ($)	EX CHILLER LOOP 1-PC HUMAN ($)	EX CHILLER LOOP 1-SEBRING ($)	EX CHILLER LOOP 1-SHUFFLE ($)
Air System Fans	19,494	19,494	2,837	12,268	439
Cooling	71,662	72,879	10,166	45,185	1,746
Heating	748	86	353	140	174
Pumps	14,219	14,322	2,115	8,909	372
Heat Rejection Fans	3,574	3,611	513	2,243	90
HVAC Sub-Total	**109,698**	**110,393**	**15,985**	**68,745**	**2,822**
Lights	37,420	36,880	5,237	22,644	810
Electric Equipment	100,746	121,435	9,165	72,460	810
Misc. Electric	0	0	0	0	0
Misc. Fuel Use	0	0	0	0	0
Non-HVAC Sub-Total	**138,165**	**158,315**	**14,402**	**95,104**	**1,619**
Grand Total	**247,864**	**268,708**	**30,387**	**163,848**	**4,441**

Table 1. 5 Annual Costs

Component	EX CHILLER LOOP 1-SUNSHINE ($)
Air System Fans	3,249
Cooling	12,236
Heating	138
Pumps	2,529
Heat Rejection Fans	617
HVAC Sub-Total	**18,769**
Lights	7,196
Electric Equipment	14,992
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	**22,188**
Grand Total	**40,957**

Annual Cost Summary

COSP Chiller Loop
Griner Engineering, Inc.

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Table 2. 1 Annual Cost per Unit Floor Area

Component	CHILLER LOOP 1 EXISTING ($/ft²)	CHILLER LOOP 1-CITY HALL ($/ft²)	CHILLER LOOP 1-COLISUEM ($/ft²)	CHILLER LOOP 1-JUDICIAL ($/ft²)	CHILLER LOOP 1-MIRROR LAKE LIB ($/ft²)
Air System Fans	0.148	0.163	0.163	0.081	0.163
Cooling	0.625	0.219	0.207	0.270	0.227
Heating	0.003	0.000	0.009	0.000	0.001
Pumps	0.027	0.091	0.100	0.109	0.099
Heat Rejection Fans	0.031	0.025	0.025	0.029	0.026
HVAC Sub-Total	**0.834**	**0.497**	**0.503**	**0.489**	**0.514**
Lights	0.330	0.360	0.450	0.360	0.360
Electric Equipment	1.038	1.349	0.300	1.413	1.199
Misc. Electric	0.000	0.000	0.000	0.000	0.000
Misc. Fuel Use	0.000	0.000	0.000	0.000	0.000
Non-HVAC Sub-Total	**1.369**	**1.709**	**0.750**	**1.772**	**1.559**
Grand Total	**2.202**	**2.206**	**1.253**	**2.262**	**2.073**
Gross Floor Area (ft²)	556630.0	75000.0	16000.0	96222.0	13722.0
Conditioned Floor Area (ft²)	556630.0	75000.0	16000.0	96222.0	13722.0

Note: Values in this table are calculated using the Gross Floor Area.

Table 2. 2 Annual Cost per Unit Floor Area

Component	CHILLER LOOP 1-MUNICIPAL ($/ft²)	CHILLER LOOP 1-PC 501 ($/ft²)	CHILLER LOOP 1-PC HUMAN ($/ft²)	CHILLER LOOP 1-SEBRING ($/ft²)	CHILLER LOOP 1-SHUFFLE ($/ft²)
Air System Fans	0.163	0.163	0.163	0.163	0.163
Cooling	0.197	0.200	0.191	0.197	0.214
Heating	0.006	0.001	0.020	0.002	0.065
Pumps	0.090	0.091	0.091	0.090	0.104
Heat Rejection Fans	0.023	0.023	0.023	0.023	0.026
HVAC Sub-Total	**0.478**	**0.477**	**0.487**	**0.474**	**0.571**
Lights	0.312	0.307	0.300	0.300	0.300
Electric Equipment	0.840	1.012	0.525	0.960	0.300
Misc. Electric	0.000	0.000	0.000	0.000	0.000
Misc. Fuel Use	0.000	0.000	0.000	0.000	0.000
Non-HVAC Sub-Total	**1.151**	**1.319**	**0.825**	**1.259**	**0.600**
Grand Total	**1.630**	**1.796**	**1.312**	**1.733**	**1.171**
Gross Floor Area (ft²)	120000.0	120000.0	17466.0	75520.0	2700.0
Conditioned Floor Area (ft²)	120000.0	120000.0	17466.0	75520.0	2700.0

Note: Values in this table are calculated using the Gross Floor Area.

Annual Cost Summary

COSP Chiller Loop
Griner Engineering, Inc.

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Table 2. 3 Annual Cost per Unit Floor Area

Component	CHILLER LOOP 1-SUNSHINE ($/ft²)	EX CHILLER LOOP 1-CITY HALL ($/ft²)	EX CHILLER LOOP 1-COLISUEM ($/ft²)	EX CHILLER LOOP 1-JUDICIAL ($/ft²)	EX CHILLER LOOP 1-MIRROR LAKE LIB ($/ft²)
Air System Fans	0.163	0.163	0.163	0.081	0.163
Cooling	0.201	0.657	0.632	0.788	0.679
Heating	0.007	0.000	0.009	0.000	0.001
Pumps	0.096	0.120	0.132	0.143	0.130
Heat Rejection Fans	0.024	0.032	0.032	0.038	0.034
HVAC Sub-Total	**0.490**	**0.971**	**0.968**	**1.051**	**1.006**
Lights	0.360	0.360	0.450	0.360	0.360
Electric Equipment	0.750	1.349	0.300	1.413	1.199
Misc. Electric	0.000	0.000	0.000	0.000	0.000
Misc. Fuel Use	0.000	0.000	0.000	0.000	0.000
Non-HVAC Sub-Total	**1.109**	**1.709**	**0.750**	**1.772**	**1.559**
Grand Total	**1.599**	**2.680**	**1.717**	**2.823**	**2.565**
Gross Floor Area (ft²)	20000.0	75000.0	16000.0	96222.0	13722.0
Conditioned Floor Area (ft²)	20000.0	75000.0	16000.0	96222.0	13722.0

Note: Values in this table are calculated using the Gross Floor Area.

Table 2. 4 Annual Cost per Unit Floor Area

Component	EX CHILLER LOOP 1-MUNICIPAL ($/ft²)	EX CHILLER LOOP 1-PC 501 ($/ft²)	EX CHILLER LOOP 1-PC HUMAN ($/ft²)	EX CHILLER LOOP 1-SEBRING ($/ft²)	EX CHILLER LOOP 1-SHUFFLE ($/ft²)
Air System Fans	0.163	0.163	0.163	0.163	0.163
Cooling	0.597	0.607	0.582	0.598	0.647
Heating	0.006	0.001	0.020	0.002	0.065
Pumps	0.119	0.119	0.121	0.118	0.138
Heat Rejection Fans	0.030	0.030	0.029	0.030	0.033
HVAC Sub-Total	**0.914**	**0.920**	**0.915**	**0.910**	**1.045**
Lights	0.312	0.307	0.300	0.300	0.300
Electric Equipment	0.840	1.012	0.525	0.960	0.300
Misc. Electric	0.000	0.000	0.000	0.000	0.000
Misc. Fuel Use	0.000	0.000	0.000	0.000	0.000
Non-HVAC Sub-Total	**1.151**	**1.319**	**0.825**	**1.259**	**0.600**
Grand Total	**2.066**	**2.239**	**1.740**	**2.170**	**1.645**
Gross Floor Area (ft²)	120000.0	120000.0	17466.0	75520.0	2700.0
Conditioned Floor Area (ft²)	120000.0	120000.0	17466.0	75520.0	2700.0

Note: Values in this table are calculated using the Gross Floor Area.

Annual Cost Summary

COSP Chiller Loop
Griner Engineering, Inc.

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Table 2. 5 Annual Cost per Unit Floor Area

Component	EX CHILLER LOOP 1-SUNSHINE ($/ft²)
Air System Fans	0.163
Cooling	0.612
Heating	0.007
Pumps	0.127
Heat Rejection Fans	0.031
HVAC Sub-Total	**0.939**
Lights	0.360
Electric Equipment	0.750
Misc. Electric	0.000
Misc. Fuel Use	0.000
Non-HVAC Sub-Total	**1.109**
Grand Total	**2.048**
Gross Floor Area (ft²)	20000.0
Conditioned Floor Area (ft²)	20000.0

Note: Values in this table are calculated using the Gross Floor Area.

Table 3. 1 Component Cost as a Percentage of Total Cost

Component	CHILLER LOOP 1 EXISTING (%)	CHILLER LOOP 1-CITY HALL (%)	CHILLER LOOP 1-COLISUEM (%)	CHILLER LOOP 1-JUDICIAL (%)	CHILLER LOOP 1-MIRROR LAKE LIB (%)
Air System Fans	6.7	7.4	13.0	3.6	7.8
Cooling	28.4	9.9	16.6	11.9	10.9
Heating	0.1	0.0	0.7	0.0	0.0
Pumps	1.2	4.1	8.0	4.8	4.8
Heat Rejection Fans	1.4	1.1	2.0	1.3	1.2
HVAC Sub-Total	**37.9**	**22.5**	**40.2**	**21.6**	**24.8**
Lights	15.0	16.3	35.9	15.9	17.4
Electric Equipment	47.1	61.2	23.9	62.5	57.8
Misc. Electric	0.0	0.0	0.0	0.0	0.0
Misc. Fuel Use	0.0	0.0	0.0	0.0	0.0
Non-HVAC Sub-Total	**62.1**	**77.5**	**59.8**	**78.4**	**75.2**
Grand Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Annual Cost Summary

COSP Chiller Loop
Griner Engineering, Inc.

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Table 3. 2 Component Cost as a Percentage of Total Cost

Component	CHILLER LOOP 1-MUNICIPAL (%)	CHILLER LOOP 1-PC 501 (%)	CHILLER LOOP 1-PC HUMAN (%)	CHILLER LOOP 1-SEBRING (%)	CHILLER LOOP 1-SHUFFLE (%)
Air System Fans	10.0	9.0	12.4	9.4	13.9
Cooling	12.1	11.1	14.5	11.4	18.3
Heating	0.4	0.0	1.5	0.1	5.5
Pumps	5.5	5.0	7.0	5.2	8.9
Heat Rejection Fans	1.4	1.3	1.7	1.3	2.2
HVAC Sub-Total	**29.4**	**26.5**	**37.1**	**27.3**	**48.8**
Lights	19.1	17.1	22.9	17.3	25.6
Electric Equipment	51.5	56.3	40.0	55.4	25.6
Misc. Electric	0.0	0.0	0.0	0.0	0.0
Misc. Fuel Use	0.0	0.0	0.0	0.0	0.0
Non-HVAC Sub-Total	**70.6**	**73.5**	**62.9**	**72.7**	**51.2**
Grand Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table 3. 3 Component Cost as a Percentage of Total Cost

Component	CHILLER LOOP 1-SUNSHINE (%)	EX CHILLER LOOP 1-CITY HALL (%)	EX CHILLER LOOP 1-COLISUEM (%)	EX CHILLER LOOP 1-JUDICIAL (%)	EX CHILLER LOOP 1-MIRROR LAKE LIB (%)
Air System Fans	10.2	6.1	9.5	2.9	6.3
Cooling	12.6	24.5	36.8	27.9	26.5
Heating	0.4	0.0	0.5	0.0	0.0
Pumps	6.0	4.5	7.7	5.1	5.1
Heat Rejection Fans	1.5	1.2	1.9	1.4	1.3
HVAC Sub-Total	**30.6**	**36.2**	**56.3**	**37.2**	**39.2**
Lights	22.5	13.4	26.2	12.7	14.0
Electric Equipment	46.9	50.4	17.5	50.0	46.8
Misc. Electric	0.0	0.0	0.0	0.0	0.0
Misc. Fuel Use	0.0	0.0	0.0	0.0	0.0
Non-HVAC Sub-Total	**69.4**	**63.8**	**43.7**	**62.8**	**60.8**
Grand Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table 3. 4 Component Cost as a Percentage of Total Cost

Component	EX CHILLER LOOP 1-MUNICIPAL (%)	EX CHILLER LOOP 1-PC 501 (%)	EX CHILLER LOOP 1-PC HUMAN (%)	EX CHILLER LOOP 1-SEBRING (%)	EX CHILLER LOOP 1-SHUFFLE (%)
Air System Fans	7.9	7.3	9.3	7.5	9.9
Cooling	28.9	27.1	33.5	27.6	39.3
Heating	0.3	0.0	1.2	0.1	3.9
Pumps	5.7	5.3	7.0	5.4	8.4
Heat Rejection Fans	1.4	1.3	1.7	1.4	2.0
HVAC Sub-Total	**44.3**	**41.1**	**52.6**	**42.0**	**63.5**
Lights	15.1	13.7	17.2	13.8	18.2
Electric Equipment	40.6	45.2	30.2	44.2	18.2
Misc. Electric	0.0	0.0	0.0	0.0	0.0
Misc. Fuel Use	0.0	0.0	0.0	0.0	0.0
Non-HVAC Sub-Total	**55.7**	**58.9**	**47.4**	**58.0**	**36.5**
Grand Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Annual Cost Summary

COSP Chiller Loop
Griner Engineering, Inc.

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Table 3. 5 Component Cost as a Percentage of Total Cost

Component	EX CHILLER LOOP 1-SUNSHINE (%)
Air System Fans	7.9
Cooling	29.9
Heating	0.3
Pumps	6.2
Heat Rejection Fans	1.5
HVAC Sub-Total	**45.8**
Lights	17.6
Electric Equipment	36.6
Misc. Electric	0.0
Misc. Fuel Use	0.0
Non-HVAC Sub-Total	**54.2**
Grand Total	**100.0**

Annual Energy and Emissions Summary

COSP Chiller Loop
Griner Engineering, Inc.

10/27/2016
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Table 1. 1 Annual Costs

Component	CHILLER LOOP 1 EXISTING ($)	CHILLER LOOP 1-CITY HALL ($)	CHILLER LOOP 1-COLISUEM ($)	CHILLER LOOP 1-JUDICIAL ($)	CHILLER LOOP 1-MIRROR LAKE LIB ($)
HVAC Components					
Electric	464,040	37,263	8,049	47,091	7,055
Natural Gas	0	0	0	0	0
Fuel Oil	0	0	0	0	0
Propane	0	0	0	0	0
Remote HW	0	0	0	0	0
Remote Steam	0	0	0	0	0
Remote CW	0	0	0	0	0
HVAC Sub-Total	**464,040**	**37,263**	**8,049**	**47,091**	**7,055**
Non-HVAC Components					
Electric	761,899	128,181	11,993	170,534	21,395
Natural Gas	0	0	0	0	0
Fuel Oil	0	0	0	0	0
Propane	0	0	0	0	0
Remote HW	0	0	0	0	0
Remote Steam	0	0	0	0	0
Non-HVAC Sub-Total	**761,899**	**128,181**	**11,993**	**170,534**	**21,395**
Grand Total	**1,225,939**	**165,443**	**20,042**	**217,626**	**28,450**

Table 1. 2 Annual Costs

Component	CHILLER LOOP 1-MUNICIPAL ($)	CHILLER LOOP 1-PC 501 ($)	CHILLER LOOP 1-PC HUMAN ($)	CHILLER LOOP 1-SEBRING ($)	CHILLER LOOP 1-SHUFFLE ($)
HVAC Components					
Electric	57,407	57,210	8,510	35,765	1,541
Natural Gas	0	0	0	0	0
Fuel Oil	0	0	0	0	0
Propane	0	0	0	0	0
Remote HW	0	0	0	0	0
Remote Steam	0	0	0	0	0
Remote CW	0	0	0	0	0
HVAC Sub-Total	**57,407**	**57,210**	**8,510**	**35,765**	**1,541**
Non-HVAC Components					
Electric	138,165	158,315	14,402	95,104	1,619
Natural Gas	0	0	0	0	0
Fuel Oil	0	0	0	0	0
Propane	0	0	0	0	0
Remote HW	0	0	0	0	0
Remote Steam	0	0	0	0	0
Non-HVAC Sub-Total	**138,165**	**158,315**	**14,402**	**95,104**	**1,619**
Grand Total	**195,572**	**215,525**	**22,911**	**130,869**	**3,161**

Annual Energy and Emissions Summary

COSP Chiller Loop
Griner Engineering, Inc.

10/27/2016
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Table 1. 3 Annual Costs

Component	CHILLER LOOP 1-SUNSHINE ($)	EX CHILLER LOOP 1-CITY HALL ($)	EX CHILLER LOOP 1-COLISUEM ($)	EX CHILLER LOOP 1-JUDICIAL ($)	EX CHILLER LOOP 1-MIRROR LAKE LIB ($)
HVAC Components					
Electric	9,795	72,786	15,482	101,094	13,800
Natural Gas	0	0	0	0	0
Fuel Oil	0	0	0	0	0
Propane	0	0	0	0	0
Remote HW	0	0	0	0	0
Remote Steam	0	0	0	0	0
Remote CW	0	0	0	0	0
HVAC Sub-Total	**9,795**	**72,786**	**15,482**	**101,094**	**13,800**
Non-HVAC Components					
Electric	22,188	128,181	11,993	170,534	21,395
Natural Gas	0	0	0	0	0
Fuel Oil	0	0	0	0	0
Propane	0	0	0	0	0
Remote HW	0	0	0	0	0
Remote Steam	0	0	0	0	0
Non-HVAC Sub-Total	**22,188**	**128,181**	**11,993**	**170,534**	**21,395**
Grand Total	**31,983**	**200,967**	**27,475**	**271,628**	**35,195**

Table 1. 4 Annual Costs

Component	EX CHILLER LOOP 1-MUNICIPAL ($)	EX CHILLER LOOP 1-PC 501 ($)	EX CHILLER LOOP 1-PC HUMAN ($)	EX CHILLER LOOP 1-SEBRING ($)	EX CHILLER LOOP 1-SHUFFLE ($)
HVAC Components					
Electric	109,698	110,391	15,985	68,745	2,822
Natural Gas	0	0	0	0	0
Fuel Oil	0	0	0	0	0
Propane	0	0	0	0	0
Remote HW	0	0	0	0	0
Remote Steam	0	0	0	0	0
Remote CW	0	0	0	0	0
HVAC Sub-Total	**109,698**	**110,391**	**15,985**	**68,745**	**2,822**
Non-HVAC Components					
Electric	138,165	158,315	14,402	95,104	1,619
Natural Gas	0	0	0	0	0
Fuel Oil	0	0	0	0	0
Propane	0	0	0	0	0
Remote HW	0	0	0	0	0
Remote Steam	0	0	0	0	0
Non-HVAC Sub-Total	**138,165**	**158,315**	**14,402**	**95,104**	**1,619**
Grand Total	**247,862**	**268,706**	**30,386**	**163,849**	**4,441**

Annual Energy and Emissions Summary

COSP Chiller Loop
Griner Engineering, Inc.

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Table 1. 5 Annual Costs

Component	EX CHILLER LOOP 1-SUNSHINE ($)
HVAC Components	
Electric	18,769
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	**18,769**
Non-HVAC Components	
Electric	22,188
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	**22,188**
Grand Total	**40,957**

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COSP Chiller Loop
Griner Engineering, Inc.

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Table 2. 1 Annual Energy Consumption

Component	CHILLER LOOP 1 EXISTING	CHILLER LOOP 1-CITY HALL	CHILLER LOOP 1-COLISUEM	CHILLER LOOP 1-JUDICIAL	CHILLER LOOP 1-MIRROR LAKE LIB
HVAC Components					
Electric (kWh)	4,522,809	363,183	78,449	458,981	68,764
Natural Gas (na)	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0
Propane (na)	0	0	0	0	0
Remote HW (na)	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0
Remote CW (na)	0	0	0	0	0
Non-HVAC Components					
Electric (kWh)	7,425,912	1,249,326	116,896	1,662,129	208,526
Natural Gas (na)	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0
Propane (na)	0	0	0	0	0
Remote HW (na)	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0
Totals					
Electric (kWh)	11,948,720	1,612,509	195,344	2,121,110	277,291
Natural Gas (na)	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0
Propane (na)	0	0	0	0	0
Remote HW (na)	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0
Remote CW (na)	0	0	0	0	0

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Table 2. 2 Annual Energy Consumption

Component	CHILLER LOOP 1-MUNICIPAL	CHILLER LOOP 1-PC 501	CHILLER LOOP 1-PC HUMAN	CHILLER LOOP 1-SEBRING	CHILLER LOOP 1-SHUFFLE
HVAC Components					
Electric (kWh)	559,524	557,602	82,940	348,583	15,024
Natural Gas (na)	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0
Propane (na)	0	0	0	0	0
Remote HW (na)	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0
Remote CW (na)	0	0	0	0	0
Non-HVAC Components					
Electric (kWh)	1,346,635	1,543,028	140,367	926,939	15,781
Natural Gas (na)	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0
Propane (na)	0	0	0	0	0
Remote HW (na)	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0
Totals					
Electric (kWh)	1,906,159	2,100,630	223,307	1,275,522	30,805
Natural Gas (na)	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0
Propane (na)	0	0	0	0	0
Remote HW (na)	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0
Remote CW (na)	0	0	0	0	0

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Table 2. 3 Annual Energy Consumption

Component	CHILLER LOOP 1-SUNSHINE	EX CHILLER LOOP 1-CITY HALL	EX CHILLER LOOP 1-COLISUEM	EX CHILLER LOOP 1-JUDICIAL	EX CHILLER LOOP 1-MIRROR LAKE LIB
HVAC Components					
Electric (kWh)	95,466	709,416	150,895	985,319	134,504
Natural Gas (na)	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0
Propane (na)	0	0	0	0	0
Remote HW (na)	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0
Remote CW (na)	0	0	0	0	0
Non-HVAC Components					
Electric (kWh)	216,258	1,249,326	116,896	1,662,129	208,526
Natural Gas (na)	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0
Propane (na)	0	0	0	0	0
Remote HW (na)	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0
Totals					
Electric (kWh)	311,724	1,958,742	267,790	2,647,448	343,030
Natural Gas (na)	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0
Propane (na)	0	0	0	0	0
Remote HW (na)	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0
Remote CW (na)	0	0	0	0	0

Annual Energy and Emissions Summary

COSP Chiller Loop
Griner Engineering, Inc.

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Table 2. 4 Annual Energy Consumption

Component	EX CHILLER LOOP 1-MUNICIPAL	EX CHILLER LOOP 1-PC 501	EX CHILLER LOOP 1-PC HUMAN	EX CHILLER LOOP 1-SEBRING	EX CHILLER LOOP 1-SHUFFLE
HVAC Components					
Electric (kWh)	1,069,178	1,075,938	155,797	670,027	27,502
Natural Gas (na)	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0
Propane (na)	0	0	0	0	0
Remote HW (na)	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0
Remote CW (na)	0	0	0	0	0
Non-HVAC Components					
Electric (kWh)	1,346,635	1,543,028	140,367	926,939	15,781
Natural Gas (na)	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0
Propane (na)	0	0	0	0	0
Remote HW (na)	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0
Totals					
Electric (kWh)	2,415,814	2,618,966	296,164	1,596,967	43,283
Natural Gas (na)	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0
Propane (na)	0	0	0	0	0
Remote HW (na)	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0
Remote CW (na)	0	0	0	0	0

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COSP Chiller Loop
Griner Engineering, Inc.

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Table 2. 5 Annual Energy Consumption

Component	EX CHILLER LOOP 1-SUNSHINE
HVAC Components	
Electric (kWh)	182,936
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	216,258
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	399,194
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Table 3. 1 Annual Emissions

Component	CHILLER LOOP 1 EXISTING	CHILLER LOOP 1-CITY HALL	CHILLER LOOP 1-COLISUEM	CHILLER LOOP 1-JUDICIAL	CHILLER LOOP 1-MIRROR LAKE LIB
CO2 Equivalent (lb)	0	0	0	0	0

Table 3. 2 Annual Emissions

Component	CHILLER LOOP 1-MUNICIPAL	CHILLER LOOP 1-PC 501	CHILLER LOOP 1-PC HUMAN	CHILLER LOOP 1-SEBRING	CHILLER LOOP 1-SHUFFLE
CO2 Equivalent (lb)	0	0	0	0	0

Table 3. 3 Annual Emissions

Component	CHILLER LOOP 1-SUNSHINE	EX CHILLER LOOP 1-CITY HALL	EX CHILLER LOOP 1-COLISUEM	EX CHILLER LOOP 1-JUDICIAL	EX CHILLER LOOP 1-MIRROR LAKE LIB
CO2 Equivalent (lb)	0	0	0	0	0

Table 3. 4 Annual Emissions

Component	EX CHILLER LOOP 1-MUNICIPAL	EX CHILLER LOOP 1-PC 501	EX CHILLER LOOP 1-PC HUMAN	EX CHILLER LOOP 1-SEBRING	EX CHILLER LOOP 1-SHUFFLE
CO2 Equivalent (lb)	0	0	0	0	0

Table 3. 5 Annual Emissions

Component	EX CHILLER LOOP 1-SUNSHINE
CO2 Equivalent (lb)	0

Annual Energy and Emissions Summary

COSP Chiller Loop
Griner Engineering, Inc.

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Table 4. 1 Annual Cost per Unit Floor Area

Component	CHILLER LOOP 1 EXISTING ($/ft²)	CHILLER LOOP 1-CITY HALL ($/ft²)	CHILLER LOOP 1-COLISUEM ($/ft²)	CHILLER LOOP 1-JUDICIAL ($/ft²)	CHILLER LOOP 1-MIRROR LAKE LIB ($/ft²)
HVAC Components					
Electric	0.834	0.497	0.503	0.489	0.514
Natural Gas	0.000	0.000	0.000	0.000	0.000
Fuel Oil	0.000	0.000	0.000	0.000	0.000
Propane	0.000	0.000	0.000	0.000	0.000
Remote HW	0.000	0.000	0.000	0.000	0.000
Remote Steam	0.000	0.000	0.000	0.000	0.000
Remote CW	0.000	0.000	0.000	0.000	0.000
HVAC Sub-Total	**0.834**	**0.497**	**0.503**	**0.489**	**0.514**
Non-HVAC Components					
Electric	1.369	1.709	0.750	1.772	1.559
Natural Gas	0.000	0.000	0.000	0.000	0.000
Fuel Oil	0.000	0.000	0.000	0.000	0.000
Propane	0.000	0.000	0.000	0.000	0.000
Remote HW	0.000	0.000	0.000	0.000	0.000
Remote Steam	0.000	0.000	0.000	0.000	0.000
Non-HVAC Sub-Total	**1.369**	**1.709**	**0.750**	**1.772**	**1.559**
Grand Total	**2.203**	**2.206**	**1.253**	**2.262**	**2.073**
Gross Floor Area (ft²)	556630.0	75000.0	16000.0	96222.0	13722.0
Conditioned Floor Area (ft²)	556630.0	75000.0	16000.0	96222.0	13722.0

Note: Values in this table are calculated using the Gross Floor Area.

Table 4. 2 Annual Cost per Unit Floor Area

Component	CHILLER LOOP 1-MUNICIPAL ($/ft²)	CHILLER LOOP 1-PC 501 ($/ft²)	CHILLER LOOP 1-PC HUMAN ($/ft²)	CHILLER LOOP 1-SEBRING ($/ft²)	CHILLER LOOP 1-SHUFFLE ($/ft²)
HVAC Components					
Electric	0.478	0.477	0.487	0.474	0.571
Natural Gas	0.000	0.000	0.000	0.000	0.000
Fuel Oil	0.000	0.000	0.000	0.000	0.000
Propane	0.000	0.000	0.000	0.000	0.000
Remote HW	0.000	0.000	0.000	0.000	0.000
Remote Steam	0.000	0.000	0.000	0.000	0.000
Remote CW	0.000	0.000	0.000	0.000	0.000
HVAC Sub-Total	**0.478**	**0.477**	**0.487**	**0.474**	**0.571**
Non-HVAC Components					
Electric	1.151	1.319	0.825	1.259	0.600
Natural Gas	0.000	0.000	0.000	0.000	0.000
Fuel Oil	0.000	0.000	0.000	0.000	0.000
Propane	0.000	0.000	0.000	0.000	0.000
Remote HW	0.000	0.000	0.000	0.000	0.000
Remote Steam	0.000	0.000	0.000	0.000	0.000
Non-HVAC Sub-Total	**1.151**	**1.319**	**0.825**	**1.259**	**0.600**
Grand Total	**1.630**	**1.796**	**1.312**	**1.733**	**1.171**
Gross Floor Area (ft²)	120000.0	120000.0	17466.0	75520.0	2700.0
Conditioned Floor Area (ft²)	120000.0	120000.0	17466.0	75520.0	2700.0

Note: Values in this table are calculated using the Gross Floor Area.

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COSP Chiller Loop
Griner Engineering, Inc.

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Table 4. 3 Annual Cost per Unit Floor Area

Component	CHILLER LOOP 1-SUNSHINE ($/ft²)	EX CHILLER LOOP 1-CITY HALL ($/ft²)	EX CHILLER LOOP 1-COLISUEM ($/ft²)	EX CHILLER LOOP 1-JUDICIAL ($/ft²)	EX CHILLER LOOP 1-MIRROR LAKE LIB ($/ft²)
HVAC Components					
Electric	0.490	0.971	0.968	1.051	1.006
Natural Gas	0.000	0.000	0.000	0.000	0.000
Fuel Oil	0.000	0.000	0.000	0.000	0.000
Propane	0.000	0.000	0.000	0.000	0.000
Remote HW	0.000	0.000	0.000	0.000	0.000
Remote Steam	0.000	0.000	0.000	0.000	0.000
Remote CW	0.000	0.000	0.000	0.000	0.000
HVAC Sub-Total	**0.490**	**0.971**	**0.968**	**1.051**	**1.006**
Non-HVAC Components					
Electric	1.109	1.709	0.750	1.772	1.559
Natural Gas	0.000	0.000	0.000	0.000	0.000
Fuel Oil	0.000	0.000	0.000	0.000	0.000
Propane	0.000	0.000	0.000	0.000	0.000
Remote HW	0.000	0.000	0.000	0.000	0.000
Remote Steam	0.000	0.000	0.000	0.000	0.000
Non-HVAC Sub-Total	**1.109**	**1.709**	**0.750**	**1.772**	**1.559**
Grand Total	**1.599**	**2.680**	**1.717**	**2.823**	**2.565**
Gross Floor Area (ft²)	20000.0	75000.0	16000.0	96222.0	13722.0
Conditioned Floor Area (ft²)	20000.0	75000.0	16000.0	96222.0	13722.0

Note: Values in this table are calculated using the Gross Floor Area.

Table 4. 4 Annual Cost per Unit Floor Area

Component	EX CHILLER LOOP 1-MUNICIPAL ($/ft²)	EX CHILLER LOOP 1-PC 501 ($/ft²)	EX CHILLER LOOP 1-PC HUMAN ($/ft²)	EX CHILLER LOOP 1-SEBRING ($/ft²)	EX CHILLER LOOP 1-SHUFFLE ($/ft²)
HVAC Components					
Electric	0.914	0.920	0.915	0.910	1.045
Natural Gas	0.000	0.000	0.000	0.000	0.000
Fuel Oil	0.000	0.000	0.000	0.000	0.000
Propane	0.000	0.000	0.000	0.000	0.000
Remote HW	0.000	0.000	0.000	0.000	0.000
Remote Steam	0.000	0.000	0.000	0.000	0.000
Remote CW	0.000	0.000	0.000	0.000	0.000
HVAC Sub-Total	**0.914**	**0.920**	**0.915**	**0.910**	**1.045**
Non-HVAC Components					
Electric	1.151	1.319	0.825	1.259	0.600
Natural Gas	0.000	0.000	0.000	0.000	0.000
Fuel Oil	0.000	0.000	0.000	0.000	0.000
Propane	0.000	0.000	0.000	0.000	0.000
Remote HW	0.000	0.000	0.000	0.000	0.000
Remote Steam	0.000	0.000	0.000	0.000	0.000
Non-HVAC Sub-Total	**1.151**	**1.319**	**0.825**	**1.259**	**0.600**
Grand Total	**2.066**	**2.239**	**1.740**	**2.170**	**1.645**
Gross Floor Area (ft²)	120000.0	120000.0	17466.0	75520.0	2700.0
Conditioned Floor Area (ft²)	120000.0	120000.0	17466.0	75520.0	2700.0

Note: Values in this table are calculated using the Gross Floor Area.

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Table 4. 5 Annual Cost per Unit Floor Area

Component	EX CHILLER LOOP 1-SUNSHINE ($/ft²)
HVAC Components	
Electric	0.939
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Remote CW	0.000
HVAC Sub-Total	**0.939**
Non-HVAC Components	
Electric	1.109
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Non-HVAC Sub-Total	**1.109**
Grand Total	**2.048**
Gross Floor Area (ft²)	20000.0
Conditioned Floor Area (ft²)	20000.0

Note: Values in this table are calculated using the Gross Floor Area.

Table 5. 1 Component Cost as a Percentage of Total Cost

Component	CHILLER LOOP 1 EXISTING (%)	CHILLER LOOP 1-CITY HALL (%)	CHILLER LOOP 1-COLISUEM (%)	CHILLER LOOP 1-JUDICIAL (%)	CHILLER LOOP 1-MIRROR LAKE LIB (%)
HVAC Components					
Electric	37.9	22.5	40.2	21.6	24.8
Natural Gas	0.0	0.0	0.0	0.0	0.0
Fuel Oil	0.0	0.0	0.0	0.0	0.0
Propane	0.0	0.0	0.0	0.0	0.0
Remote HW	0.0	0.0	0.0	0.0	0.0
Remote Steam	0.0	0.0	0.0	0.0	0.0
Remote CW	0.0	0.0	0.0	0.0	0.0
HVAC Sub-Total	**37.9**	**22.5**	**40.2**	**21.6**	**24.8**
Non-HVAC Components					
Electric	62.1	77.5	59.8	78.4	75.2
Natural Gas	0.0	0.0	0.0	0.0	0.0
Fuel Oil	0.0	0.0	0.0	0.0	0.0
Propane	0.0	0.0	0.0	0.0	0.0
Remote HW	0.0	0.0	0.0	0.0	0.0
Remote Steam	0.0	0.0	0.0	0.0	0.0
Non-HVAC Sub-Total	**62.1**	**77.5**	**59.8**	**78.4**	**75.2**
Grand Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

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Table 5. 2 Component Cost as a Percentage of Total Cost

Component	CHILLER LOOP 1-MUNICIPAL (%)	CHILLER LOOP 1-PC 501 (%)	CHILLER LOOP 1-PC HUMAN (%)	CHILLER LOOP 1-SEBRING (%)	CHILLER LOOP 1-SHUFFLE (%)
HVAC Components					
Electric	29.4	26.5	37.1	27.3	48.8
Natural Gas	0.0	0.0	0.0	0.0	0.0
Fuel Oil	0.0	0.0	0.0	0.0	0.0
Propane	0.0	0.0	0.0	0.0	0.0
Remote HW	0.0	0.0	0.0	0.0	0.0
Remote Steam	0.0	0.0	0.0	0.0	0.0
Remote CW	0.0	0.0	0.0	0.0	0.0
HVAC Sub-Total	**29.4**	**26.5**	**37.1**	**27.3**	**48.8**
Non-HVAC Components					
Electric	70.6	73.5	62.9	72.7	51.2
Natural Gas	0.0	0.0	0.0	0.0	0.0
Fuel Oil	0.0	0.0	0.0	0.0	0.0
Propane	0.0	0.0	0.0	0.0	0.0
Remote HW	0.0	0.0	0.0	0.0	0.0
Remote Steam	0.0	0.0	0.0	0.0	0.0
Non-HVAC Sub-Total	**70.6**	**73.5**	**62.9**	**72.7**	**51.2**
Grand Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table 5. 3 Component Cost as a Percentage of Total Cost

Component	CHILLER LOOP 1-SUNSHINE (%)	EX CHILLER LOOP 1-CITY HALL (%)	EX CHILLER LOOP 1-COLISUEM (%)	EX CHILLER LOOP 1-JUDICIAL (%)	EX CHILLER LOOP 1-MIRROR LAKE LIB (%)
HVAC Components					
Electric	30.6	36.2	56.3	37.2	39.2
Natural Gas	0.0	0.0	0.0	0.0	0.0
Fuel Oil	0.0	0.0	0.0	0.0	0.0
Propane	0.0	0.0	0.0	0.0	0.0
Remote HW	0.0	0.0	0.0	0.0	0.0
Remote Steam	0.0	0.0	0.0	0.0	0.0
Remote CW	0.0	0.0	0.0	0.0	0.0
HVAC Sub-Total	**30.6**	**36.2**	**56.3**	**37.2**	**39.2**
Non-HVAC Components					
Electric	69.4	63.8	43.7	62.8	60.8
Natural Gas	0.0	0.0	0.0	0.0	0.0
Fuel Oil	0.0	0.0	0.0	0.0	0.0
Propane	0.0	0.0	0.0	0.0	0.0
Remote HW	0.0	0.0	0.0	0.0	0.0
Remote Steam	0.0	0.0	0.0	0.0	0.0
Non-HVAC Sub-Total	**69.4**	**63.8**	**43.7**	**62.8**	**60.8**
Grand Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

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Table 5. 4 Component Cost as a Percentage of Total Cost

Component	EX CHILLER LOOP 1-MUNICIPAL (%)	EX CHILLER LOOP 1-PC 501 (%)	EX CHILLER LOOP 1-PC HUMAN (%)	EX CHILLER LOOP 1-SEBRING (%)	EX CHILLER LOOP 1-SHUFFLE (%)
HVAC Components					
Electric	44.3	41.1	52.6	42.0	63.5
Natural Gas	0.0	0.0	0.0	0.0	0.0
Fuel Oil	0.0	0.0	0.0	0.0	0.0
Propane	0.0	0.0	0.0	0.0	0.0
Remote HW	0.0	0.0	0.0	0.0	0.0
Remote Steam	0.0	0.0	0.0	0.0	0.0
Remote CW	0.0	0.0	0.0	0.0	0.0
HVAC Sub-Total	**44.3**	**41.1**	**52.6**	**42.0**	**63.5**
Non-HVAC Components					
Electric	55.7	58.9	47.4	58.0	36.5
Natural Gas	0.0	0.0	0.0	0.0	0.0
Fuel Oil	0.0	0.0	0.0	0.0	0.0
Propane	0.0	0.0	0.0	0.0	0.0
Remote HW	0.0	0.0	0.0	0.0	0.0
Remote Steam	0.0	0.0	0.0	0.0	0.0
Non-HVAC Sub-Total	**55.7**	**58.9**	**47.4**	**58.0**	**36.5**
Grand Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table 5. 5 Component Cost as a Percentage of Total Cost

Component	EX CHILLER LOOP 1-SUNSHINE (%)
HVAC Components	
Electric	45.8
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Remote CW	0.0
HVAC Sub-Total	**45.8**
Non-HVAC Components	
Electric	54.2
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Non-HVAC Sub-Total	**54.2**
Grand Total	**100.0**

Air System Sizing Summary for 01 PC JUDICIAL = 400

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

Air System Information

Air System Name	01 PC JUDICIAL = 400		Number of zones	1	
Equipment Class	CW AHU		Floor Area	96222.0	ft²
Air System Type	VAV		Location	Tampa, Florida	

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM	Peak zone sensible load		Calculation Months	Jan to Dec	
Space CFM	Coincident space loads		Sizing Data	Calculated	

Central Cooling Coil Sizing Data

Total coil load	401.1	Tons	Load occurs at	Aug 1500	
Total coil load	4812.8	MBH	OA DB / WB	95.0 / 80.0	°F
Sensible coil load	3591.3	MBH	Entering DB / WB	78.8 / 65.2	°F
Coil CFM at Aug 1500	135046	CFM	Leaving DB / WB	54.2 / 53.0	°F
Max block CFM at Jul 1700	135046	CFM	Coil ADP	51.4	°F
Sum of peak zone CFM	135046	CFM	Bypass Factor	0.100	
Sensible heat ratio	0.746		Resulting RH	46	%
ft²/Ton	239.9		Design supply temp.	55.0	°F
BTU/(hr-ft²)	50.0		Zone T-stat Check	0 of 1	OK
Water flow @ 10.0 °F rise	963.07	gpm	Max zone temperature deviation	0.1	°F

Supply Fan Sizing Data

Actual max CFM at Jul 1700	135046	CFM	Fan motor BHP	44.38	BHP
Standard CFM	134998	CFM	Fan motor kW	35.21	kW
Actual max CFM/ft²	1.40	CFM/ft²	Fan static	2.00	in wg

Outdoor Ventilation Air Data

Design airflow CFM	16273	CFM	CFM/person	7.75	CFM/person
CFM/ft²	0.17	CFM/ft²			

Zone Sizing Summary for 01 PC JUDICIAL = 400

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

Air System Information

Air System Name ..... 01 PC JUDICIAL = 400
Equipment Class ..... CW AHU
Air System Type ..... VAV

Number of zones 1
Floor Area ..... 96222.0 ft²
Location ..... Tampa, Florida

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM ..... Peak zone sensible load
Space CFM ..... Coincident space loads

Calculation Months ..... Jan to Dec
Sizing Data ..... Calculated

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (MBH)	Design Air Flow (CFM)	Minimum Air Flow (CFM)	Time of Peak Load	Maximum Heating Load (MBH)	Zone Floor Area (ft²)	Zone CFM/ft²
Zone 1	2915.9	135046	16273	Jul 1700	411.7	96222.0	1.40

Zone Terminal Sizing Data

Zone Name	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 50.0 °F	Zone Htg Coil Load (MBH)	Zone Htg Water gpm @ 50.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	675.2	-	0.0	0.00	0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
PC JUDICIAL 1ST FL	1	758.1	Jul 1700	35112	93.7	27821.0	1.26
PC JUDICIAL 2ND FL	1	623.2	Jul 1700	28863	89.1	19972.0	1.45
PC JUDICIAL 3RD	1	623.2	Jul 1700	28863	89.1	19972.0	1.45
PC JUDICIAL 4TH	1	623.2	Jul 1700	28863	89.1	19972.0	1.45
PC JUDICIAL 5TH	1	288.2	Jul 1700	13345	50.6	8485.0	1.57

Air System Design Load Summary for 01 PC JUDICIAL = 400

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1500 COOLING OA DB / WB 95.0 °F / 80.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 36.0 °F / 30.3 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	10624 ft²	135070	-	10624 ft²	-	-
Wall Transmission	16684 ft²	38656	-	16684 ft²	70423	-
Roof Transmission	19972 ft²	34118	-	19972 ft²	32678	-
Window Transmission	10624 ft²	147145	-	10624 ft²	288973	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	27821 ft²	0	-	27821 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	115466 W	358430	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	453289 W	1484379	-	0	0	-
People	2100	432694	430500	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	263049	43050	5%	19604	0
>> Total Zone Loads	-	2893541	473550	-	411677	0
Zone Conditioning	-	3147723	473550	-	200045	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	135046 CFM	0	-	16273 CFM	0	-
Ventilation Load	16273 CFM	323447	747791	16273 CFM	479754	0
Supply Fan Load	135046 CFM	120134	-	16273 CFM	-4589	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	3591304	1221341	-	675210	0
Central Cooling Coil	-	3591305	1221472	-	0	0
Terminal Reheat Coils	-	0	-	-	675210	-
>> Total Conditioning	-	3591305	1221472	-	675210	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Air System Sizing Summary for 02 PC 501-400

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

Air System Information

Air System Name	02 PC 501-400		Number of zones	1	
Equipment Class	CW AHU		Floor Area	120000.0	ft²
Air System Type	VAV		Location	Tampa, Florida	

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM	Peak zone sensible load	Calculation Months	Jan to Dec
Space CFM	Coincident space loads	Sizing Data	Calculated

Central Cooling Coil Sizing Data

Total coil load	399.5	Tons	Load occurs at	Jul 1600	
Total coil load	4794.1	MBH	OA DB / WB	94.6 / 79.9	°F
Sensible coil load	3459.1	MBH	Entering DB / WB	78.4 / 66.1	°F
Coil CFM at Jul 1600	144000	CFM	Leaving DB / WB	56.1 / 55.0	°F
Max block CFM at Jan 0000	144000	CFM	Coil ADP	53.6	°F
Sum of peak zone CFM	144000	CFM	Bypass Factor	0.100	
Sensible heat ratio	0.722		Resulting RH	51	%
ft²/Ton	300.4		Design supply temp.	55.0	°F
BTU/(hr-ft²)	40.0		Zone T-stat Check	1 of 1	OK
Water flow @ 10.0 °F rise	959.33	gpm	Max zone temperature deviation	0.0	°F

Supply Fan Sizing Data

Actual max CFM at Jan 0000	144000	CFM	Fan motor BHP	47.32	BHP
Standard CFM	143948	CFM	Fan motor kW	37.54	kW
Actual max CFM/ft²	1.20	CFM/ft²	Fan static	2.00	in wg

Outdoor Ventilation Air Data

Design airflow CFM	18950	CFM	CFM/person	8.06	CFM/person
CFM/ft²	0.16	CFM/ft²			

Zone Sizing Summary for 02 PC 501- 400

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

Air System Information

Air System Name: 02 PC 501- 400
Equipment Class: CW AHU
Air System Type: VAV

Number of zones: 1
Floor Area: 120000.0 ft²
Location: Tampa, Florida

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM: Peak zone sensible load
Space CFM: Coincident space loads

Calculation Months: Jan to Dec
Sizing Data: Calculated

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (MBH)	Design Air Flow (CFM)	Minimum Air Flow (CFM)	Time of Peak Load	Maximum Heating Load (MBH)	Zone Floor Area (ft²)	Zone CFM/ft²
Zone 1	2658.7	144000	144000	Jul 2000	271.2	120000.0	1.20

Zone Terminal Sizing Data

Zone Name	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 50.0 °F	Zone Htg Coil Load (MBH)	Zone Htg Water gpm @ 50.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	2603.1	-	0.0	0.00	0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
PC 501 1ST	1	321.5	Jul 2000	18000	31.3	15000.0	1.20
PC 501 2ND	1	311.0	Jul 2000	18000	31.3	15000.0	1.20
PC 501 3RD	1	311.0	Jul 2000	18000	31.3	15000.0	1.20
PC 501 4TH	1	311.0	Jul 2000	18000	31.3	15000.0	1.20
PC 501 5TH	1	365.6	Jul 2000	19804	31.3	15000.0	1.32
PC 501 6TH	1	365.6	Jul 2000	19804	31.3	15000.0	1.32
PC 501 7TH	1	365.6	Jul 2000	19804	31.3	15000.0	1.32
PC 501 8TH	1	307.4	Jul 2000	18000	52.2	15000.0	1.20

Air System Design Load Summary for 02 PC 501-400

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1600 COOLING OA DB / WB 94.6 °F / 79.9 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 36.0 °F / 30.3 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	3000 ft²	39347	-	3000 ft²	-	-
Wall Transmission	36040 ft²	88717	-	36040 ft²	152124	-
Roof Transmission	15000 ft²	24194	-	15000 ft²	24543	-
Window Transmission	3000 ft²	41239	-	3000 ft²	81600	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	123000 W	384304	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	405000 W	1329902	-	0	0	-
People	2350	490221	481750	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	239792	48175	5%	12913	0
>> Total Zone Loads	-	2637716	529925	-	271180	0
Zone Conditioning	-	2949755	529925	-	265962	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	144000 CFM	0	-	144000 CFM	0	-
Ventilation Load	18950 CFM	381272	804894	18950 CFM	684305	0
Supply Fan Load	144000 CFM	128099	-	144000 CFM	-128099	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	3459126	1334819	-	822168	0
Central Cooling Coil	-	3459126	1334983	-	-135338	0
Terminal Reheat Coils	-	0	-	-	957505	-
>> Total Conditioning	-	3459126	1334983	-	822167	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Air System Sizing Summary for 03 PC HUMAN= 60

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

Air System Information

Air System Name	03 PC HUMAN= 60		Number of zones	1	
Equipment Class	CW AHU		Floor Area	17466.0	ft²
Air System Type	VAV		Location	Tampa, Florida	

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM	Peak zone sensible load		Calculation Months	Jan to Dec	
Space CFM	Coincident space loads		Sizing Data	Calculated	

Central Cooling Coil Sizing Data

Total coil load	60.3	Tons	Load occurs at	Jul 1400	
Total coil load	724.1	MBH	OA DB / WB	94.6 / 79.9	°F
Sensible coil load	477.3	MBH	Entering DB / WB	78.8 / 67.9	°F
Coil CFM at Jul 1400	20959	CFM	Leaving DB / WB	57.7 / 56.8	°F
Max block CFM at Jan 0000	20959	CFM	Coil ADP	55.4	°F
Sum of peak zone CFM	20959	CFM	Bypass Factor	0.100	
Sensible heat ratio	0.659		Resulting RH	57	%
ft²/Ton	289.5		Design supply temp.	55.0	°F
BTU/(hr-ft²)	41.5		Zone T-stat Check	1 of 1	OK
Water flow @ 10.0 °F rise	144.89	gpm	Max zone temperature deviation	0.0	°F

Supply Fan Sizing Data

Actual max CFM at Jan 0000	20959	CFM	Fan motor BHP	6.89	BHP
Standard CFM	20952	CFM	Fan motor kW	5.46	kW
Actual max CFM/ft²	1.20	CFM/ft²	Fan static	2.00	in wg

Outdoor Ventilation Air Data

Design airflow CFM	3548	CFM	CFM/person	7.10	CFM/person
CFM/ft²	0.20	CFM/ft²			

Zone Sizing Summary for 03 PC HUMAN= 60

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

Air System Information

Air System Name ..... 03 PC HUMAN= 60
Equipment Class ..... CW AHU
Air System Type ..... VAV

Number of zones 1
Floor Area ..... 17466.0 ft²
Location ..... Tampa, Florida

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM ..... Peak zone sensible load
Space CFM ..... Coincident space loads

Calculation Months ..... Jan to Dec
Sizing Data ..... Calculated

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (MBH)	Design Air Flow (CFM)	Minimum Air Flow (CFM)	Time of Peak Load	Maximum Heating Load (MBH)	Zone Floor Area (ft²)	Zone CFM/ft²
Zone 1	341.0	20959	20959	Jul 1700	65.5	17466.0	1.20

Zone Terminal Sizing Data

Zone Name	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 50.0 °F	Zone Htg Coil Load (MBH)	Zone Htg Water gpm @ 50.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	404.9	-	0.0	0.00	0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
PC HUMAN 1ST	1	155.9	Jul 1700	10480	25.2	8733.0	1.20
PC HUMAN 2nd	1	185.1	Jul 1700	11377	40.2	8733.0	1.30

Air System Design Load Summary for 03 PC HUMAN= 60

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 94.6 °F / 79.9 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 36.0 °F / 30.3 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	720 ft²	8287	-	720 ft²	-	-
Wall Transmission	6752 ft²	14218	-	6752 ft²	28500	-
Roof Transmission	8733 ft²	15888	-	8733 ft²	14289	-
Window Transmission	720 ft²	9693	-	720 ft²	19584	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	8733 ft²	0	-	8733 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	17466 W	53840	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	30566 W	99797	-	0	0	-
People	500	101652	102500	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	30338	10250	5%	3119	0
>> Total Zone Loads	-	333713	112750	-	65491	0
Zone Conditioning	-	386045	112750	-	64146	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	20959 CFM	0	-	20959 CFM	0	-
Ventilation Load	3548 CFM	72612	134000	3548 CFM	127783	0
Supply Fan Load	20959 CFM	18645	-	20959 CFM	-18645	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	477302	246750	-	173284	0
Central Cooling Coil	-	477302	246763	-	0	0
Terminal Reheat Coils	-	0	-	-	172714	-
>> Total Conditioning	-	477302	246763	-	172714	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Air System Sizing Summary for 04 SEBRING = 250

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

Air System Information

Air System Name	04 SEBRING = 250		Number of zones	1	
Equipment Class	CW AHU		Floor Area	75520.0	ft²
Air System Type	VAV		Location	Tampa, Florida	

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM	Peak zone sensible load	Calculation Months	Jan to Dec
Space CFM	Coincident space loads	Sizing Data	Calculated

Central Cooling Coil Sizing Data

Total coil load	248.9	Tons	Load occurs at	Jun 1400	
Total coil load	2986.4	MBH	OA DB / WB	93.6 / 79.9	°F
Sensible coil load	2130.8	MBH	Entering DB / WB	78.2 / 66.3	°F
Coil CFM at Jun 1400	90624	CFM	Leaving DB / WB	56.4 / 55.4	°F
Max block CFM at Jan 0000	90624	CFM	Coil ADP	54.0	°F
Sum of peak zone CFM	90624	CFM	Bypass Factor	0.100	
Sensible heat ratio	0.714		Resulting RH	52	%
ft²/Ton	303.5		Design supply temp.	55.0	°F
BTU/(hr-ft²)	39.5		Zone T-stat Check	1 of 1	OK
Water flow @ 10.0 °F rise	597.60	gpm	Max zone temperature deviation	0.0	°F

Supply Fan Sizing Data

Actual max CFM at Jan 0000	90624	CFM	Fan motor BHP	29.78	BHP
Standard CFM	90591	CFM	Fan motor kW	23.63	kW
Actual max CFM/ft²	1.20	CFM/ft²	Fan static	2.00	in wg

Outdoor Ventilation Air Data

Design airflow CFM	12031	CFM	CFM/person	8.02	CFM/person
CFM/ft²	0.16	CFM/ft²			

Zone Sizing Summary for 04 SEBRING = 250

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

Air System Information

Air System Name ..... 04 SEBRING = 250
Equipment Class ..... CW AHU
Air System Type ..... VAV

Number of zones 1
Floor Area ..... 75520.0 ft²
Location ..... Tampa, Florida

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM ..... Peak zone sensible load
Space CFM ..... Coincident space loads

Calculation Months ..... Jan to Dec
Sizing Data ..... Calculated

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (MBH)	Design Air Flow (CFM)	Minimum Air Flow (CFM)	Time of Peak Load	Maximum Heating Load (MBH)	Zone Floor Area (ft²)	Zone CFM/ft²
Zone 1	1643.4	90624	90624	Jul 1800	193.8	75520.0	1.20

Zone Terminal Sizing Data

Zone Name	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 50.0 °F	Zone Htg Coil Load (MBH)	Zone Htg Water gpm @ 50.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	1661.3	-	0.0	0.00	0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
SEBRING 1ST	1	368.8	Jul 1800	20338	33.6	15104.0	1.35
SEBRING 2ND	1	314.0	Jul 1800	18125	33.6	15104.0	1.20
SEBRING 3RD	1	314.0	Jul 1800	18125	33.6	15104.0	1.20
SEBRING 4TH	1	314.0	Jul 1800	18125	33.6	15104.0	1.20
SEBRING 5TH	1	332.6	Jul 1800	18341	59.5	15104.0	1.21

Air System Design Load Summary for 04 SEBRING = 250

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jun 1400 COOLING OA DB / WB 93.6 °F / 79.9 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 36.0 °F / 30.3 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	2440 ft²	28295	-	2440 ft²	-	-
Wall Transmission	22140 ft²	43839	-	22140 ft²	93452	-
Roof Transmission	15104 ft²	26900	-	15104 ft²	24713	-
Window Transmission	2440 ft²	30895	-	2440 ft²	66368	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	8733 ft²	0	-	8733 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	75520 W	232794	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	241664 W	789040	-	0	0	-
People	1500	304957	307500	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	145672	30750	5%	9227	0
>> Total Zone Loads	-	1602392	338250	-	193760	0
Zone Conditioning	-	1820017	338250	-	190047	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	90624 CFM	0	-	90624 CFM	0	-
Ventilation Load	12031 CFM	230183	517168	12031 CFM	434307	0
Supply Fan Load	90624 CFM	80617	-	90624 CFM	-80617	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	2130817	855418	-	543737	0
Central Cooling Coil	-	2130817	855592	-	-80371	0
Terminal Reheat Coils	-	0	-	-	624108	-
>> Total Conditioning	-	2130817	855592	-	543737	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Air System Sizing Summary for 05 City Hall= 250 tons

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

Air System Information

Air System Name	05 City Hall= 250 tons		Number of zones	1	
Equipment Class	CW AHU		Floor Area	75000.0	ft²
Air System Type	VAV		Location	Tampa, Florida	

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM	Peak zone sensible load		Calculation Months	Jan to Dec
Space CFM	Coincident space loads		Sizing Data	Calculated

Central Cooling Coil Sizing Data

Total coil load	247.9	Tons	Load occurs at	Jun 1600	
Total coil load	2974.5	MBH	OA DB / WB	93.6 / 79.9	°F
Sensible coil load	2299.3	MBH	Entering DB / WB	78.3 / 64.8	°F
Coil CFM at Jun 1600	90000	CFM	Leaving DB / WB	54.7 / 53.5	°F
Max block CFM at Jan 0000	90000	CFM	Coil ADP	52.1	°F
Sum of peak zone CFM	90000	CFM	Bypass Factor	0.100	
Sensible heat ratio	0.773		Resulting RH	46	%
ft²/Ton	302.6		Design supply temp.	55.0	°F
BTU/(hr-ft²)	39.7		Zone T-stat Check	0 of 1	OK
Water flow @ 10.0 °F rise	595.22	gpm	Max zone temperature deviation	0.1	°F

Supply Fan Sizing Data

Actual max CFM at Jan 0000	90000	CFM	Fan motor BHP	29.58	BHP
Standard CFM	89967	CFM	Fan motor kW	23.46	kW
Actual max CFM/ft²	1.20	CFM/ft²	Fan static	2.00	in wg

Outdoor Ventilation Air Data

Design airflow CFM	9500	CFM	CFM/person	9.50	CFM/person
CFM/ft²	0.13	CFM/ft²			

Zone Sizing Summary for 05 City Hall= 250 tons

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

Air System Information

Air System Name: 05 City Hall= 250 tons
Equipment Class: CW AHU
Air System Type: VAV

Number of zones: 1
Floor Area: 75000.0 ft²
Location: Tampa, Florida

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM: Peak zone sensible load
Space CFM: Coincident space loads

Calculation Months: Jan to Dec
Sizing Data: Calculated

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (MBH)	Design Air Flow (CFM)	Minimum Air Flow (CFM)	Time of Peak Load	Maximum Heating Load (MBH)	Zone Floor Area (ft²)	Zone CFM/ft²
Zone 1	1883.0	90000	90000	Jul 1800	142.7	75000.0	1.20

Zone Terminal Sizing Data

Zone Name	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 50.0 °F	Zone Htg Coil Load (MBH)	Zone Htg Water gpm @ 50.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	1600.2	-	0.0	0.00	0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
City Hall 1st Floor	1	506.3	Jul 1800	24199	36.8	18750.0	1.29
City Hall 2nd Floor	1	506.3	Jul 1800	24199	36.8	18750.0	1.29
City Hall 3rd Floor	1	461.3	Jul 1800	22500	69.0	18750.0	1.20
City Hall UG Floor	1	409.1	Jul 1800	22500	0.0	18750.0	1.20

Air System Design Load Summary for 05 City Hall= 250 tons

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jun 1600 COOLING OA DB / WB 93.6 °F / 79.9 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 36.0 °F / 30.3 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	1560 ft²	20540	-	1560 ft²	-	-
Wall Transmission	14872 ft²	34568	-	14872 ft²	62773	-
Roof Transmission	18750 ft²	29458	-	18750 ft²	30678	-
Window Transmission	1560 ft²	20196	-	1560 ft²	42432	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	18750 ft²	0	-	18750 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	90000 W	281198	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	337500 W	1108252	-	0	0	-
People	1000	208605	205000	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	170282	20500	5%	6794	0
>> Total Zone Loads	-	1873098	225500	-	142677	0
Zone Conditioning	-	2044876	225500	-	139904	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	90000 CFM	0	-	90000 CFM	0	-
Ventilation Load	9500 CFM	174323	449720	9500 CFM	343200	0
Supply Fan Load	90000 CFM	80062	-	90000 CFM	-80062	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	2299261	675220	-	403042	0
Central Cooling Coil	-	2299261	675260	-	-170451	0
Terminal Reheat Coils	-	0	-	-	573493	-
>> Total Conditioning	-	2299261	675260	-	403042	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Air System Sizing Summary for 07 MUNICIPAL 400

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

Air System Information

Air System Name	07 MUNICIPAL 400		Number of zones	1	
Equipment Class	CW AHU		Floor Area	120000.0	ft²
Air System Type	VAV		Location	Tampa, Florida	

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM	Peak zone sensible load	Calculation Months	Jan to Dec
Space CFM	Coincident space loads	Sizing Data	Calculated

Central Cooling Coil Sizing Data

Total coil load	398.7	Tons	Load occurs at	Aug 1500	
Total coil load	4784.1	MBH	OA DB / WB	95.0 / 80.0	°F
Sensible coil load	3406.0	MBH	Entering DB / WB	78.6 / 66.5	°F
Coil CFM at Aug 1500	144000	CFM	Leaving DB / WB	56.6 / 55.6	°F
Max block CFM at Jan 0000	144000	CFM	Coil ADP	54.2	°F
Sum of peak zone CFM	144000	CFM	Bypass Factor	0.100	
Sensible heat ratio	0.712		Resulting RH	52	%
ft²/Ton	301.0		Design supply temp.	55.0	°F
BTU/(hr-ft²)	39.9		Zone T-stat Check	1 of 1	OK
Water flow @ 10.0 °F rise	957.34	gpm	Max zone temperature deviation	0.0	°F

Supply Fan Sizing Data

Actual max CFM at Jan 0000	144000	CFM	Fan motor BHP	47.32	BHP
Standard CFM	143948	CFM	Fan motor kW	37.54	kW
Actual max CFM/ft²	1.20	CFM/ft²	Fan static	2.00	in wg

Outdoor Ventilation Air Data

Design airflow CFM	19700	CFM	CFM/person	7.88	CFM/person
CFM/ft²	0.16	CFM/ft²			

Zone Sizing Summary for 07 MUNICIPAL 400

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

Air System Information

Air System Name ..... 07 MUNICIPAL 400
Equipment Class ..... CW AHU
Air System Type ..... VAV

Number of zones 1
Floor Area ..... 120000.0 ft²
Location ..... Tampa, Florida

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM ..... Peak zone sensible load
Space CFM ..... Coincident space loads

Calculation Months ..... Jan to Dec
Sizing Data ..... Calculated

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (MBH)	Design Air Flow (CFM)	Minimum Air Flow (CFM)	Time of Peak Load	Maximum Heating Load (MBH)	Zone Floor Area (ft²)	Zone CFM/ft²
Zone 1	2600.0	144000	144000	Jul 1700	423.2	120000.0	1.20

Zone Terminal Sizing Data

Zone Name	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 50.0 °F	Zone Htg Coil Load (MBH)	Zone Htg Water gpm @ 50.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	2755.2	-	0.0	0.00	0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
MUNICIPAL 10TH	1	291.9	Jul 1700	16166	60.9	12000.0	1.35
MUNICIPAL 1ST	1	230.0	Jul 1700	14400	40.3	12000.0	1.20
MUNICIPAL 2ND	1	221.7	Jul 1700	14400	40.3	12000.0	1.20
MUNICIPAL 3RD	1	265.2	Jul 1700	14688	40.3	12000.0	1.22
MUNICIPAL 4TH	1	265.2	Jul 1700	14688	40.3	12000.0	1.22
MUNICIPAL 5TH	1	265.2	Jul 1700	14688	40.3	12000.0	1.22
MUNICIPAL 6TH	1	265.2	Jul 1700	14688	40.3	12000.0	1.22
MUNICIPAL 7TH	1	265.2	Jul 1700	14688	40.3	12000.0	1.22
MUNICIPAL 8TH	1	265.2	Jul 1700	14688	40.3	12000.0	1.22
MUNICIPAL 9TH	1	265.2	Jul 1700	14688	40.3	12000.0	1.22

Air System Design Load Summary for 07 MUNICIPAL 400

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1500 COOLING OA DB / WB 95.0 °F / 80.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 36.0 °F / 30.3 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	8640 ft²	109846	-	8640 ft²	-	-
Wall Transmission	35160 ft²	81464	-	35160 ft²	148409	-
Roof Transmission	12000 ft²	20499	-	12000 ft²	19634	-
Window Transmission	8640 ft²	119666	-	8640 ft²	235008	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	12000 ft²	0	-	12000 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	124800 W	387404	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	336000 W	1100294	-	0	0	-
People	2500	515112	512500	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	233429	51250	5%	20153	0
>> Total Zone Loads	-	2567715	563750	-	423204	0
Zone Conditioning	-	2872823	563750	-	415024	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	144000 CFM	0	-	144000 CFM	0	-
Ventilation Load	19700 CFM	405099	813983	19700 CFM	710394	0
Supply Fan Load	144000 CFM	128099	-	144000 CFM	-128099	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	3406022	1377733	-	997318	0
Central Cooling Coil	-	3406021	1378115	-	-101980	0
Terminal Reheat Coils	-	0	-	-	1099298	-
>> Total Conditioning	-	3406021	1378115	-	997318	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Air System Sizing Summary for 08 MIRROR LAKE LIB=50

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

Air System Information

Air System Name	08 MIRROR LAKE LIB=50		Number of zones	1	
Equipment Class	CW AHU		Floor Area	13722.0	ft²
Air System Type	VAV		Location	Tampa, Florida	

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM	Peak zone sensible load	Calculation Months	Jan to Dec
Space CFM	Coincident space loads	Sizing Data	Calculated

Central Cooling Coil Sizing Data

Total coil load	49.7	Tons	Load occurs at	Aug 1500	
Total coil load	595.9	MBH	OA DB / WB	95.0 / 80.0	°F
Sensible coil load	439.9	MBH	Entering DB / WB	78.9 / 65.4	°F
Coil CFM at Aug 1500	16466	CFM	Leaving DB / WB	54.2 / 53.0	°F
Max block CFM at Jan 0000	16466	CFM	Coil ADP	51.4	°F
Sum of peak zone CFM	16466	CFM	Bypass Factor	0.100	
Sensible heat ratio	0.738		Resulting RH	46	%
ft²/Ton	276.3		Design supply temp.	55.0	°F
BTU/(hr-ft²)	43.4		Zone T-stat Check	0 of 1	OK
Water flow @ 10.0 °F rise	119.25	gpm	Max zone temperature deviation	0.0	°F

Supply Fan Sizing Data

Actual max CFM at Jan 0000	16466	CFM	Fan motor BHP	5.41	BHP
Standard CFM	16460	CFM	Fan motor kW	4.29	kW
Actual max CFM/ft²	1.20	CFM/ft²	Fan static	2.00	in wg

Outdoor Ventilation Air Data

Design airflow CFM	2123	CFM	CFM/person	8.17	CFM/person
CFM/ft²	0.15	CFM/ft²			

Zone Sizing Summary for 08 MIRROR LAKE LIB=50

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

Air System Information

Air System Name: 08 MIRROR LAKE LIB=50
Equipment Class: CW AHU
Air System Type: VAV

Number of zones: 1
Floor Area: 13722.0 ft²
Location: Tampa, Florida

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM: Peak zone sensible load
Space CFM: Coincident space loads

Calculation Months: Jan to Dec
Sizing Data: Calculated

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (MBH)	Design Air Flow (CFM)	Minimum Air Flow (CFM)	Time of Peak Load	Maximum Heating Load (MBH)	Zone Floor Area (ft²)	Zone CFM/ft²
Zone 1	353.3	16466	16466	Jul 1800	45.2	13722.0	1.20

Zone Terminal Sizing Data

Zone Name	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 50.0 °F	Zone Htg Coil Load (MBH)	Zone Htg Water gpm @ 50.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	311.8	-	0.0	0.00	0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
MIRROR LAKE LIBRARY	1	176.7	Jul 1800	8233	22.6	6861.0	1.20
MIRROR LAKE LIBRARY 2	1	176.7	Jul 1800	8233	22.6	6861.0	1.20

Air System Design Load Summary for 08 MIRROR LAKE LIB=50

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1500 COOLING OA DB / WB 95.0 °F / 80.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 36.0 °F / 30.3 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	656 ft²	8340	-	656 ft²	-	-
Wall Transmission	5968 ft²	13828	-	5968 ft²	25191	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	656 ft²	9086	-	656 ft²	17843	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	6861 ft²	0	-	6861 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	16466 W	51115	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	54888 W	179741	-	0	0	-
People	260	53572	53300	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	31568	5330	5%	2152	0
>> Total Zone Loads	-	347249	58630	-	45186	0
Zone Conditioning	-	382919	58630	-	44316	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	16466 CFM	0	-	16466 CFM	0	-
Ventilation Load	2123 CFM	42317	97392	2123 CFM	76587	0
Supply Fan Load	16466 CFM	14648	-	16466 CFM	-14648	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	439885	156022	-	106255	0
Central Cooling Coil	-	439885	156038	-	-16455	0
Terminal Reheat Coils	-	0	-	-	122709	-
>> Total Conditioning	-	439885	156038	-	106255	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Air System Sizing Summary for 09 SHUFFLE = 10

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

Air System Information

Air System Name	09 SHUFFLE = 10		Number of zones	1	
Equipment Class	CW AHU		Floor Area	2700.0	ft²
Air System Type	VAV		Location	Tampa, Florida	

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM	Peak zone sensible load		Calculation Months	Jan to Dec
Space CFM	Coincident space loads		Sizing Data	Calculated

Central Cooling Coil Sizing Data

Total coil load	10.9	Tons	Load occurs at	Jul 1500	
Total coil load	130.4	MBH	OA DB / WB	95.0 / 80.0	°F
Sensible coil load	82.4	MBH	Entering DB / WB	79.9 / 68.4	°F
Coil CFM at Jul 1500	3240	CFM	Leaving DB / WB	56.4 / 55.4	°F
Max block CFM at Jan 0000	3240	CFM	Coil ADP	53.7	°F
Sum of peak zone CFM	3240	CFM	Bypass Factor	0.100	
Sensible heat ratio	0.632		Resulting RH	55	%
ft²/Ton	248.5		Design supply temp.	55.0	°F
BTU/(hr-ft²)	48.3		Zone T-stat Check	1 of 1	OK
Water flow @ 10.0 °F rise	26.09	gpm	Max zone temperature deviation	0.0	°F

Supply Fan Sizing Data

Actual max CFM at Jan 0000	3240	CFM	Fan motor BHP	1.06	BHP
Standard CFM	3239	CFM	Fan motor kW	0.84	kW
Actual max CFM/ft²	1.20	CFM/ft²	Fan static	2.00	in wg

Outdoor Ventilation Air Data

Design airflow CFM	662	CFM	CFM/person	6.62	CFM/person
CFM/ft²	0.25	CFM/ft²			

Zone Sizing Summary for 09 SHUFFLE = 10

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

Air System Information

Air System Name ..... 09 SHUFFLE = 10
Equipment Class ..... CW AHU
Air System Type ..... VAV

Number of zones 1
Floor Area ..... 2700.0 ft²
Location ..... Tampa, Florida

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM ..... Peak zone sensible load
Space CFM ..... Coincident space loads

Calculation Months ..... Jan to Dec
Sizing Data ..... Calculated

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (MBH)	Design Air Flow (CFM)	Minimum Air Flow (CFM)	Time of Peak Load	Maximum Heating Load (MBH)	Zone Floor Area (ft²)	Zone CFM/ft²
Zone 1	60.2	3240	3240	Jul 1700	22.1	2700.0	1.20

Zone Terminal Sizing Data

Zone Name	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 50.0 °F	Zone Htg Coil Load (MBH)	Zone Htg Water gpm @ 50.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	74.6	-	0.0	0.00	0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
SHUFFLE 1ST	1	29.1	Jul 1700	1620	9.9	1350.0	1.20
SHUFFLE 2ND	1	31.2	Jul 1700	1676	12.2	1350.0	1.24

Air System Design Load Summary for 09 SHUFFLE = 10

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 95.0 °F / 80.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 36.0 °F / 30.3 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	280 ft²	3460	-	280 ft²	-	-
Wall Transmission	2656 ft²	6050	-	2656 ft²	11211	-
Roof Transmission	1350 ft²	2374	-	1350 ft²	2209	-
Window Transmission	280 ft²	3878	-	280 ft²	7616	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	1350 ft²	0	-	1350 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	2700 W	8381	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	2700 W	8842	-	0	0	-
People	100	20604	20500	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	5359	2050	5%	1052	0
>> Total Zone Loads	-	58948	22550	-	22088	0
Zone Conditioning	-	65921	22550	-	21527	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	3240 CFM	0	-	3240 CFM	0	-
Ventilation Load	662 CFM	13558	25437	662 CFM	23691	0
Supply Fan Load	3240 CFM	2882	-	3240 CFM	-2882	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	82360	47987	-	42336	0
Central Cooling Coil	-	82360	47997	-	0	0
Terminal Reheat Coils	-	0	-	-	42323	-
>> Total Conditioning	-	82360	47997	-	42323	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Air System Sizing Summary for 10 COLISUEM =60

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

Air System Information

Air System Name	10 COLISUEM =60		Number of zones	1	
Equipment Class	CW AHU		Floor Area	16000.0	ft²
Air System Type	VAV		Location	Tampa, Florida	

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM	Peak zone sensible load	Calculation Months	Jan to Dec
Space CFM	Coincident space loads	Sizing Data	Calculated

Central Cooling Coil Sizing Data

Total coil load	61.1	Tons	Load occurs at	Aug 1600	
Total coil load	732.7	MBH	OA DB / WB	94.6 / 79.9	°F
Sensible coil load	455.1	MBH	Entering DB / WB	79.7 / 68.9	°F
Coil CFM at Aug 1600	19200	CFM	Leaving DB / WB	57.7 / 56.8	°F
Max block CFM at Jan 0000	19200	CFM	Coil ADP	55.3	°F
Sum of peak zone CFM	19200	CFM	Bypass Factor	0.100	
Sensible heat ratio	0.621		Resulting RH	58	%
ft²/Ton	262.0		Design supply temp.	55.0	°F
BTU/(hr-ft²)	45.8		Zone T-stat Check	1 of 1	OK
Water flow @ 10.0 °F rise	146.62	gpm	Max zone temperature deviation	0.0	°F

Supply Fan Sizing Data

Actual max CFM at Jan 0000	19200	CFM	Fan motor BHP	6.31	BHP
Standard CFM	19193	CFM	Fan motor kW	5.01	kW
Actual max CFM/ft²	1.20	CFM/ft²	Fan static	2.00	in wg

Outdoor Ventilation Air Data

Design airflow CFM	3960	CFM	CFM/person	6.60	CFM/person
CFM/ft²	0.25	CFM/ft²			

Zone Sizing Summary for 10 COLISUEM =60

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

Air System Information

Air System Name ..... 10 COLISUEM =60
Equipment Class ..... CW AHU
Air System Type ..... VAV

Number of zones 1
Floor Area ..... 16000.0 ft²
Location ..... Tampa, Florida

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM ..... Peak zone sensible load
Space CFM ..... Coincident space loads

Calculation Months ..... Jan to Dec
Sizing Data ..... Calculated

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (MBH)	Design Air Flow (CFM)	Minimum Air Flow (CFM)	Time of Peak Load	Maximum Heating Load (MBH)	Zone Floor Area (ft²)	Zone CFM/ft²
Zone 1	321.4	19200	19200	Jul 2000	49.0	16000.0	1.20

Zone Terminal Sizing Data

Zone Name	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 50.0 °F	Zone Htg Coil Load (MBH)	Zone Htg Water gpm @ 50.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	359.9	-	0.0	0.00	0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
COLLISEUM 1	1	160.7	Jul 2000	9600	24.5	8000.0	1.20
COLLISEUM 2	1	160.7	Jul 2000	9600	24.5	8000.0	1.20

Air System Design Load Summary for 10 COLISUEM =60

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1600 COOLING OA DB / WB 94.6 °F / 79.9 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 36.0 °F / 30.3 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	718 ft²	9386	-	718 ft²	-	-
Wall Transmission	6434 ft²	16171	-	6434 ft²	27158	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	718 ft²	9870	-	718 ft²	19530	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	8000 ft²	0	-	8000 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	24000 W	74986	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	16000 W	52539	-	0	0	-
People	600	125163	123000	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	28811	12300	5%	2334	0
>> Total Zone Loads	-	316926	135300	-	49022	0
Zone Conditioning	-	357987	135300	-	47852	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	19200 CFM	0	-	19200 CFM	0	-
Ventilation Load	3960 CFM	80065	142266	3960 CFM	142278	0
Supply Fan Load	19200 CFM	17080	-	19200 CFM	-17080	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	455132	277566	-	173049	0
Central Cooling Coil	-	455132	277600	-	0	0
Terminal Reheat Coils	-	0	-	-	172940	-
>> Total Conditioning	-	455132	277600	-	172940	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Air System Sizing Summary for 11 SUNSHINE=70

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

Air System Information

Air System Name	11 SUNSHINE=70		Number of zones	1	
Equipment Class	CW AHU		Floor Area	20000.0	ft²
Air System Type	VAV		Location	Tampa, Florida	

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM	Peak zone sensible load	Calculation Months	Jan to Dec
Space CFM	Coincident space loads	Sizing Data	Calculated

Central Cooling Coil Sizing Data

Total coil load	71.4	Tons	Load occurs at	Jul 1500	
Total coil load	857.3	MBH	OA DB / WB	95.0 / 80.0	°F
Sensible coil load	590.8	MBH	Entering DB / WB	78.8 / 66.8	°F
Coil CFM at Jul 1500	24000	CFM	Leaving DB / WB	56.0 / 55.0	°F
Max block CFM at Jan 0000	24000	CFM	Coil ADP	53.5	°F
Sum of peak zone CFM	24000	CFM	Bypass Factor	0.100	
Sensible heat ratio	0.689		Resulting RH	52	%
ft²/Ton	280.0		Design supply temp.	55.0	°F
BTU/(hr-ft²)	42.9		Zone T-stat Check	1 of 1	OK
Water flow @ 10.0 °F rise	171.54	gpm	Max zone temperature deviation	0.0	°F

Supply Fan Sizing Data

Actual max CFM at Jan 0000	24000	CFM	Fan motor BHP	7.89	BHP
Standard CFM	23991	CFM	Fan motor kW	6.26	kW
Actual max CFM/ft²	1.20	CFM/ft²	Fan static	2.00	in wg

Outdoor Ventilation Air Data

Design airflow CFM	3700	CFM	CFM/person	7.40	CFM/person
CFM/ft²	0.19	CFM/ft²			

Zone Sizing Summary for 11 SUNSHINE=70

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

Air System Information

Air System Name ..... 11 SUNSHINE=70
Equipment Class ..... CW AHU
Air System Type ..... VAV

Number of zones 1
Floor Area ..... 20000.0 ft²
Location ..... Tampa, Florida

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM ..... Peak zone sensible load
Space CFM ..... Coincident space loads

Calculation Months ..... Jan to Dec
Sizing Data ..... Calculated

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (MBH)	Design Air Flow (CFM)	Minimum Air Flow (CFM)	Time of Peak Load	Maximum Heating Load (MBH)	Zone Floor Area (ft²)	Zone CFM/ft²
Zone 1	437.8	24000	24000	Jul 1700	70.5	20000.0	1.20

Zone Terminal Sizing Data

Zone Name	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 50.0 °F	Zone Htg Coil Load (MBH)	Zone Htg Water gpm @ 50.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	459.2	-	0.0	0.00	0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
SUNHINE	1	211.3	Jul 1700	12000	26.7	10000.0	1.20
SUNHINE(1)	1	226.6	Jul 1700	12420	43.8	10000.0	1.24

Air System Design Load Summary for 11 SUNSHINE=70

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 08:20AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 95.0 °F / 80.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 36.0 °F / 30.3 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	740 ft²	9039	-	740 ft²	-	-
Wall Transmission	7260 ft²	16541	-	7260 ft²	30644	-
Roof Transmission	10000 ft²	17584	-	10000 ft²	16362	-
Window Transmission	740 ft²	10249	-	740 ft²	20128	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	8000 ft²	0	-	8000 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	24000 W	74501	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	50000 W	163734	-	0	0	-
People	500	103022	102500	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	39467	10250	5%	3357	0
>> Total Zone Loads	-	434138	112750	-	70491	0
Zone Conditioning	-	492950	112750	-	69128	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	24000 CFM	0	-	24000 CFM	0	-
Ventilation Load	3700 CFM	76514	153680	3700 CFM	133425	0
Supply Fan Load	24000 CFM	21350	-	24000 CFM	-21350	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	590814	266430	-	181203	0
Central Cooling Coil	-	590814	266444	-	0	0
Terminal Reheat Coils	-	0	-	-	183176	-
>> Total Conditioning	-	590814	266444	-	183176	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Annual Cost Summary

COSP Chiller Loop
Griner Engineering, Inc.

10/27/2016
08:18AM

Table 1. Annual Costs

Component	CHILLER LOOP 1 ($)	CHILLER LOOP 1 EXISTING ($)
Air System Fans	82,573	82,573
Cooling	117,787	347,623
Heating	1,789	1,789
Pumps	28,827	14,789
Heat Rejection Fans	13,568	17,281
HVAC Sub-Total	**244,544**	**464,055**
Lights	183,929	183,929
Electric Equipment	577,988	577,988
Misc. Electric	0	0
Misc. Fuel Use	0	0
Non-HVAC Sub-Total	**761,917**	**761,917**
Grand Total	**1,006,461**	**1,225,972**

Table 2. Annual Cost per Unit Floor Area

Component	CHILLER LOOP 1 ($/ft²)	CHILLER LOOP 1 EXISTING ($/ft²)
Air System Fans	0.148	0.148
Cooling	0.212	0.625
Heating	0.003	0.003
Pumps	0.052	0.027
Heat Rejection Fans	0.024	0.031
HVAC Sub-Total	**0.439**	**0.834**
Lights	0.330	0.330
Electric Equipment	1.038	1.038
Misc. Electric	0.000	0.000
Misc. Fuel Use	0.000	0.000
Non-HVAC Sub-Total	**1.369**	**1.369**
Grand Total	**1.808**	**2.202**
Gross Floor Area (ft²)	556630.0	556630.0
Conditioned Floor Area (ft²)	556630.0	556630.0

Note: Values in this table are calculated using the Gross Floor Area.

Table 3. Component Cost as a Percentage of Total Cost

Component	CHILLER LOOP 1 (%)	CHILLER LOOP 1 EXISTING (%)
Air System Fans	8.2	6.7
Cooling	11.7	28.4
Heating	0.2	0.1
Pumps	2.9	1.2
Heat Rejection Fans	1.3	1.4
HVAC Sub-Total	**24.3**	**37.9**
Lights	18.3	15.0
Electric Equipment	57.4	47.1
Misc. Electric	0.0	0.0
Misc. Fuel Use	0.0	0.0
Non-HVAC Sub-Total	**75.7**	**62.1**
Grand Total	**100.0**	**100.0**

Annual Energy and Emissions Summary

COSP Chiller Loop
Griner Engineering, Inc.

10/27/2016
08:18AM

Table 1. Annual Costs

Component	CHILLER LOOP 1 ($)	CHILLER LOOP 1 EXISTING ($)
HVAC Components		
Electric	244,544	464,040
Natural Gas	0	0
Fuel Oil	0	0
Propane	0	0
Remote HW	0	0
Remote Steam	0	0
Remote CW	0	0
HVAC Sub-Total	**244,544**	**464,040**
Non-HVAC Components		
Electric	761,899	761,899
Natural Gas	0	0
Fuel Oil	0	0
Propane	0	0
Remote HW	0	0
Remote Steam	0	0
Non-HVAC Sub-Total	**761,899**	**761,899**
Grand Total	**1,006,442**	**1,225,939**

Table 2. Annual Energy Consumption

Component	CHILLER LOOP 1	CHILLER LOOP 1 EXISTING
HVAC Components		
Electric (kWh)	2,383,466	4,522,809
Natural Gas (na)	0	0
Fuel Oil (na)	0	0
Propane (na)	0	0
Remote HW (na)	0	0
Remote Steam (na)	0	0
Remote CW (na)	0	0
Non-HVAC Components		
Electric (kWh)	7,425,912	7,425,912
Natural Gas (na)	0	0
Fuel Oil (na)	0	0
Propane (na)	0	0
Remote HW (na)	0	0
Remote Steam (na)	0	0
Totals		
Electric (kWh)	9,809,378	11,948,720
Natural Gas (na)	0	0
Fuel Oil (na)	0	0
Propane (na)	0	0
Remote HW (na)	0	0
Remote Steam (na)	0	0
Remote CW (na)	0	0

Annual Energy and Emissions Summary

COSP Chiller Loop
Griner Engineering, Inc.

10/27/2016
08:18AM

Table 3. Annual Emissions

Component	CHILLER LOOP 1	CHILLER LOOP 1 EXISTING
CO2 Equivalent (lb)	0	0

Table 4. Annual Cost per Unit Floor Area

Component	CHILLER LOOP 1 ($/ft²)	CHILLER LOOP 1 EXISTING ($/ft²)
HVAC Components		
Electric	0.439	0.834
Natural Gas	0.000	0.000
Fuel Oil	0.000	0.000
Propane	0.000	0.000
Remote HW	0.000	0.000
Remote Steam	0.000	0.000
Remote CW	0.000	0.000
HVAC Sub-Total	**0.439**	**0.834**
Non-HVAC Components		
Electric	1.369	1.369
Natural Gas	0.000	0.000
Fuel Oil	0.000	0.000
Propane	0.000	0.000
Remote HW	0.000	0.000
Remote Steam	0.000	0.000
Non-HVAC Sub-Total	**1.369**	**1.369**
Grand Total	**1.808**	**2.203**
Gross Floor Area (ft²)	556630.0	556630.0
Conditioned Floor Area (ft²)	556630.0	556630.0

Note: Values in this table are calculated using the Gross Floor Area.

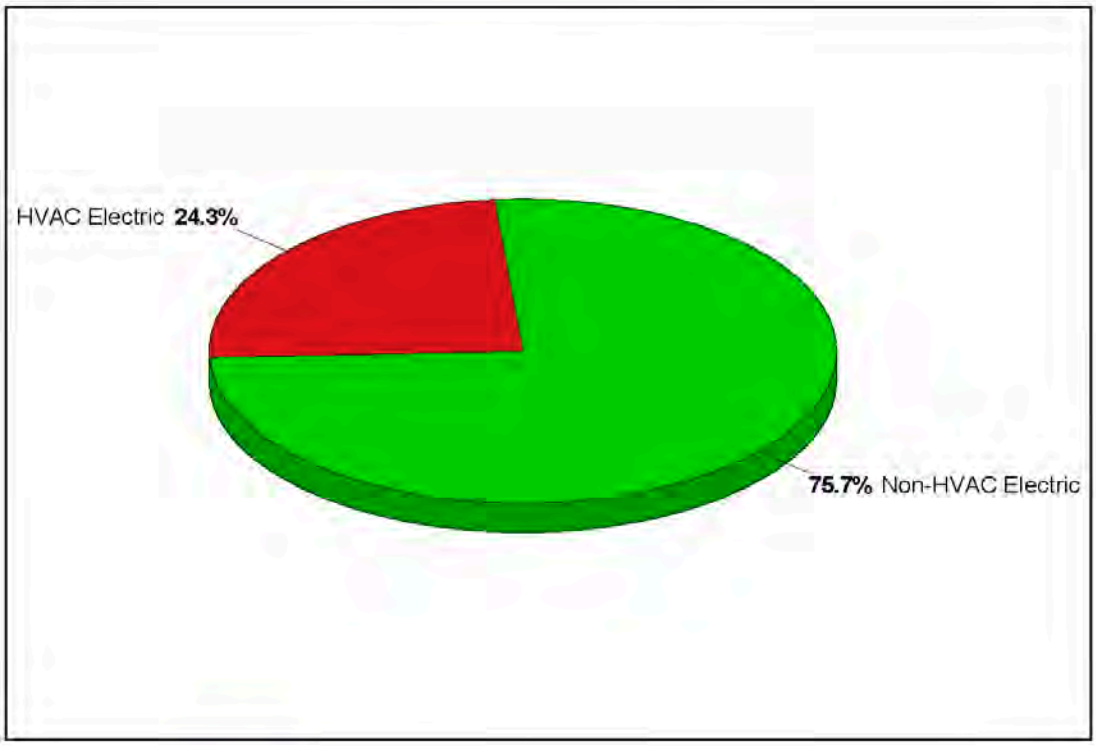
Table 5. Component Cost as a Percentage of Total Cost

Component	CHILLER LOOP 1 (%)	CHILLER LOOP 1 EXISTING (%)
HVAC Components		
Electric	24.3	37.9
Natural Gas	0.0	0.0
Fuel Oil	0.0	0.0
Propane	0.0	0.0
Remote HW	0.0	0.0
Remote Steam	0.0	0.0
Remote CW	0.0	0.0
HVAC Sub-Total	**24.3**	**37.9**
Non-HVAC Components		
Electric	75.7	62.1
Natural Gas	0.0	0.0
Fuel Oil	0.0	0.0
Propane	0.0	0.0
Remote HW	0.0	0.0
Remote Steam	0.0	0.0
Non-HVAC Sub-Total	**75.7**	**62.1**
Grand Total	**100.0**	**100.0**

Annual Energy Costs - CHILLER LOOP 1

COSP Chiller Loop
Griner Engineering, Inc.

10/27/2016
08:18AM

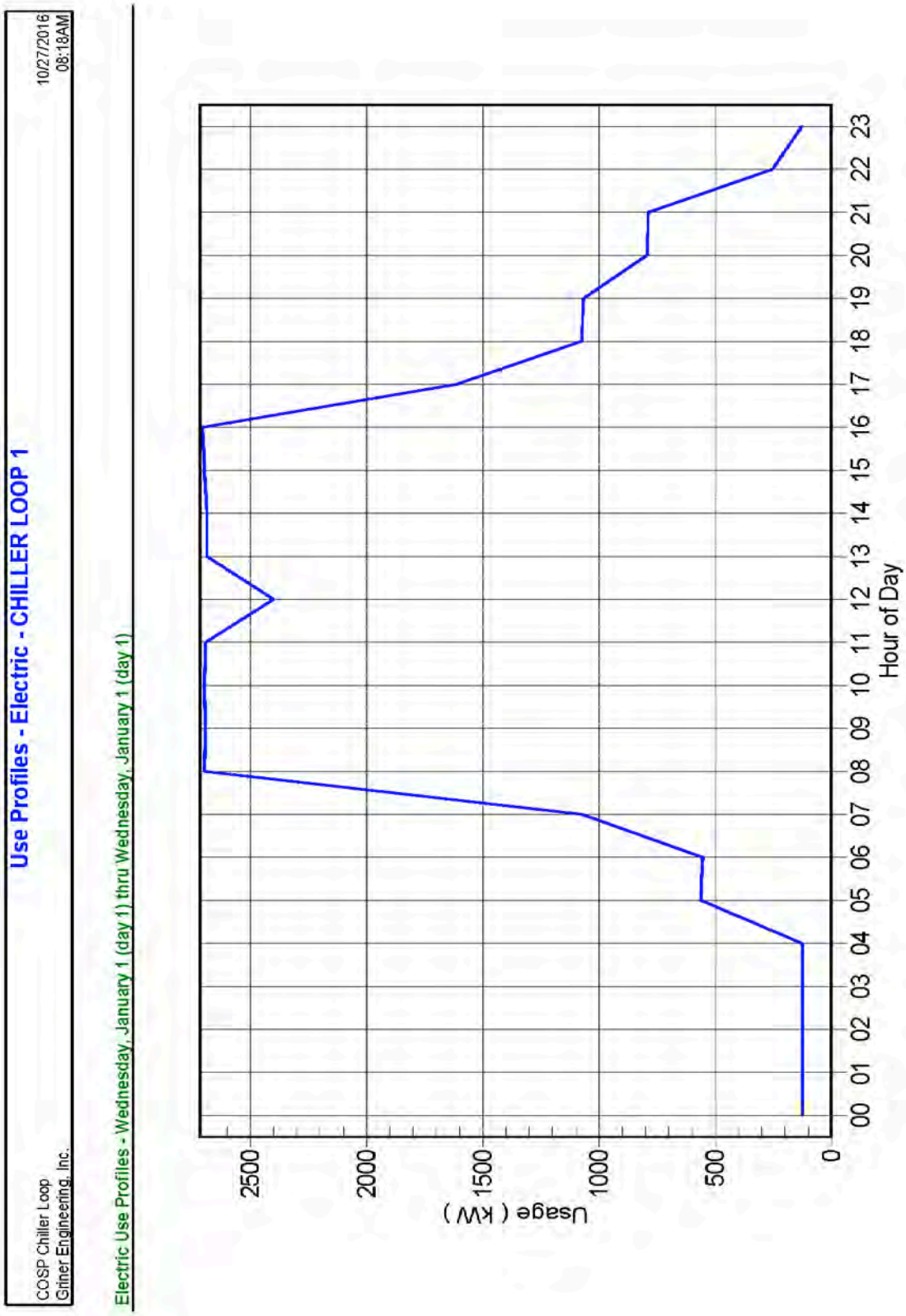


1. Annual Costs

Component	Annual Cost ($/yr)	($/ft²)	Percent of Total (%)
HVAC Components			
Electric	244,544	0.439	24.3
Natural Gas	0	0.000	0.0
Fuel Oil	0	0.000	0.0
Propane	0	0.000	0.0
Remote Hot Water	0	0.000	0.0
Remote Steam	0	0.000	0.0
Remote Chilled Water	0	0.000	0.0
HVAC Sub-Total	**244,544**	**0.439**	**24.3**
Non-HVAC Components			
Electric	761,899	1.369	75.7
Natural Gas	0	0.000	0.0
Fuel Oil	0	0.000	0.0
Propane	0	0.000	0.0
Remote Hot Water	0	0.000	0.0
Remote Steam	0	0.000	0.0
Non-HVAC Sub-Total	**761,899**	**1.369**	**75.7**
Grand Total	**1,006,442**	**1.808**	**100.0**

Note: Cost per unit floor area is based on the gross building floor area.

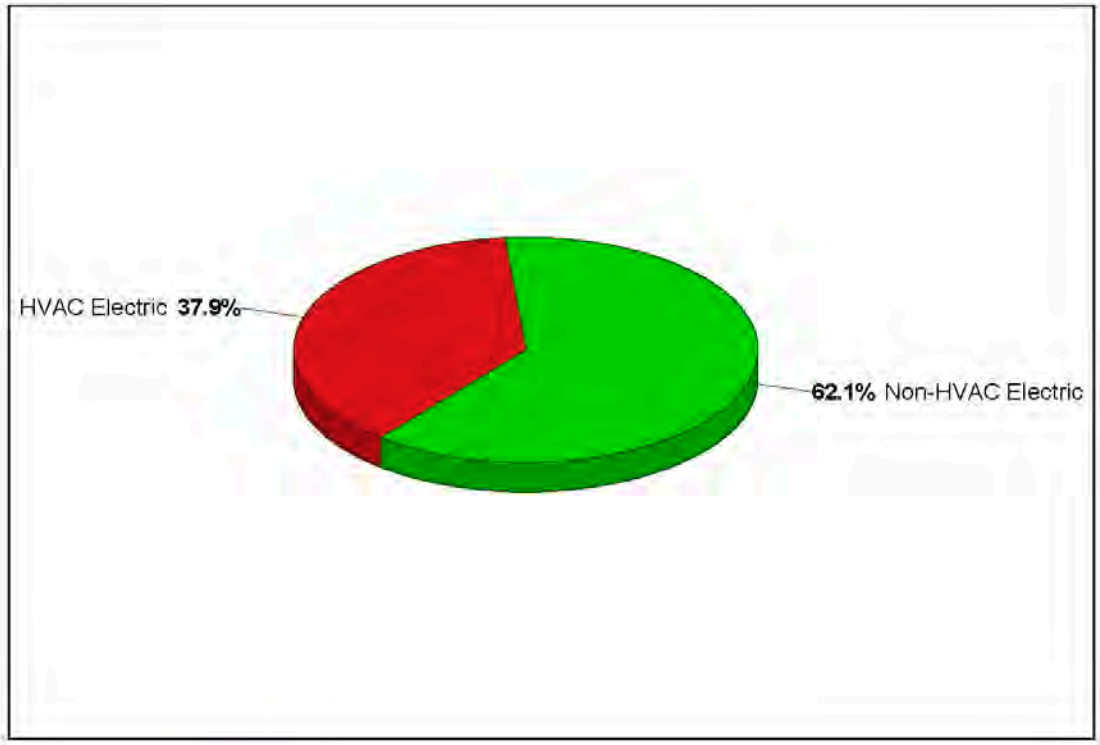
Gross Floor Area ..... **556630.0** ft²
Conditioned Floor Area ..... **556630.0** ft²


COSP Chiller Loop
Griner Engineering, Inc.
Use Profiles - Electric - CHILLER LOOP 1
10/27/2016
08:18AM
Electric Use Profiles - Wednesday, January 1 (day 1) thru Wednesday, January 1 (day 1)
Usage (kW)
2500
2000
1500
1000
500
0
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour of Day

Annual Energy Costs - CHILLER LOOP 1 EXISTING

COSP Chiller Loop
Griner Engineering, Inc.

10/27/2016
08:18AM

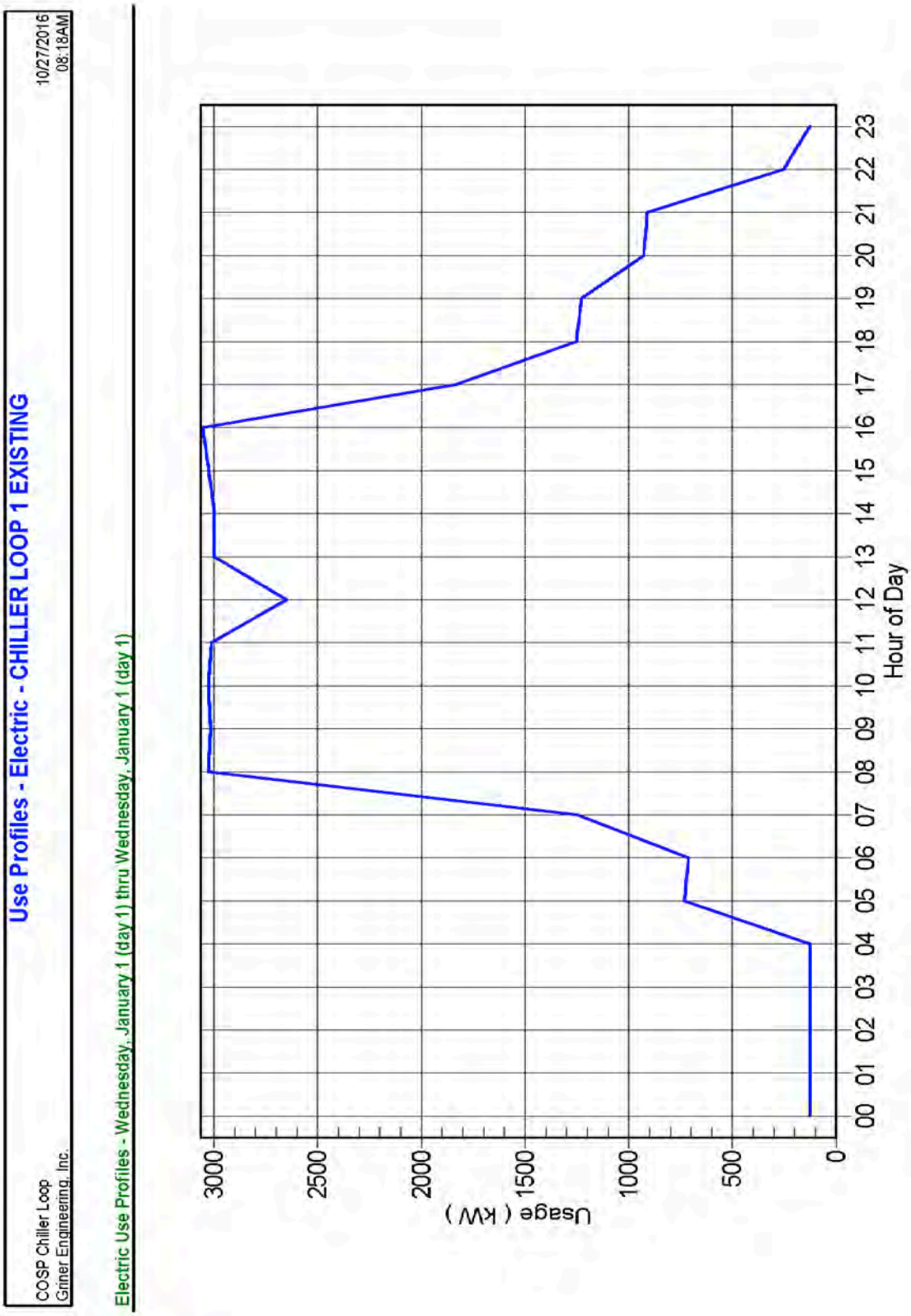


1. Annual Costs

Component	Annual Cost ($/yr)	($/ft²)	Percent of Total (%)
HVAC Components			
Electric	464,040	0.834	37.9
Natural Gas	0	0.000	0.0
Fuel Oil	0	0.000	0.0
Propane	0	0.000	0.0
Remote Hot Water	0	0.000	0.0
Remote Steam	0	0.000	0.0
Remote Chilled Water	0	0.000	0.0
HVAC Sub-Total	**464,040**	**0.834**	**37.9**
Non-HVAC Components			
Electric	761,899	1.369	62.1
Natural Gas	0	0.000	0.0
Fuel Oil	0	0.000	0.0
Propane	0	0.000	0.0
Remote Hot Water	0	0.000	0.0
Remote Steam	0	0.000	0.0
Non-HVAC Sub-Total	**761,899**	**1.369**	**62.1**
Grand Total	**1,225,939**	**2.203**	**100.0**

Note: Cost per unit floor area is based on the gross building floor area.

Gross Floor Area ..... **556630.0** ft²
Conditioned Floor Area ..... **556630.0** ft²


Use Profiles - Electric - CHILLER LOOP 1 EXISTING
COSP Chiller Loop
Griner Engineering, Inc.
10/27/2016
08:18AM
Electric Use Profiles - Wednesday, January 1 (day 1) thru Wednesday, January 1 (day 1)
Usage (kW)
3000
2500
2000
1500
1000
500
0
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour of Day

01 PC JUDICIAL = 400 Input Data

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 10:20AM

1. General Details:

Air System Name ..... 01 PC JUDICIAL = 400
Equipment Type ..... Chilled Water AHU
Air System Type ..... VAV
Number of zones 1

2. System Components:

Ventilation Air Data:

Airflow Control ..... Constant Ventilation Airflow
Ventilation Sizing Method ..... Sum of Space OA Airflows
Unocc. Damper Position ..... Closed
Damper Leak Rate ..... 0 %
Outdoor Air CO2 Level ..... 400 ppm

Central Cooling Data:

Supply Air Temperature ..... 55.0 °F
Coil Bypass Factor 0.100
Cooling Source ..... Chilled Water
Schedule ..... JFMAMJJASOND
Capacity Control ..... Temperature Reset by Greatest Zone Demand
Max. Supply Temperature ..... 65.0 °F

Supply Fan Data:

Fan Type ..... ASHRAE 90.1 App G Fan Curve
Configuration ..... Draw-thru
Fan Performance ..... 2.00 in wg
Overall Efficiency ..... 90 %

% Airflow	100	90	80	70	60	50
% kW	100	83	68	54	41	30

% Airflow	40	30	20	10	0
% kW	21	13	7	3	0

Duct System Data:

Supply Duct Data:

Duct Heat Gain ..... 0 %
Duct Leakage ..... 0 %

Return Duct or Plenum Data:

Return Air Via ..... Ducted Return

3. Zone Components:

Space Assignments:

Zone 1: Zone 1	
PC JUDICIAL 1ST FL	x1
PC JUDICIAL 2ND FL	x1
PC JUDICIAL 3RD	x1
PC JUDICIAL 4TH	x1
PC JUDICIAL 5TH	x1

Thermostats and Zone Data:

Zone ..... All
Cooling T-stat: Occ. ..... 75.0 °F
Cooling T-stat: Unocc. ..... 85.0 °F
Heating T-stat: Occ. ..... 70.0 °F
Heating T-stat: Unocc. ..... 60.0 °F
T-stat Throttling Range ..... 1.50 °F
Diversity Factor ..... 100 %
Direct Exhaust Airflow ..... 0.0 CFM
Direct Exhaust Fan kW ..... 0.0 kW

Thermostat Schedule ..... 90.1 Office Thermostat
Unoccupied Cooling is ..... Available

Supply Terminals Data:

Zone ..... All
Terminal Type ..... VAV box with RH

01 PC JUDICIAL = 400 Input Data

Project Name: COSP Chiller Loop
Prepared by: Griner Engineering, Inc.

10/27/2016
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Minimum Airflow ..... 0.00 CFM/ft²

Reheat Coil Source ..... Electric Resistance
Reheat Coil Schedule ..... JFMAMJJASOND

Zone Heating Units:
Zone ..... All
Zone Heating Unit Type ..... None

Zone Unit Heat Source ..... Hot Water
Zone Heating Unit Schedule ..... JFMAMJJASOND

4. Sizing Data (Computer-Generated):
System Sizing Data:
Cooling Supply Temperature ..... 55.0 °F
Supply Fan Airflow ..... 135046.3 CFM
Ventilation Airflow ..... 16273.3 CFM

Hydronic Sizing Specifications:
Chilled Water Delta-T ..... 10.0 °F
Hot Water Delta-T ..... 50.0 °F

Safety Factors:
Cooling Sensible ..... 10 %
Cooling Latent ..... 10 %
Heating ..... 5 %

Zone Sizing Data:
Zone Airflow Sizing Method ..... Peak zone sensible load
Space Airflow Sizing Method ..... Coincident space loads

Zone	Supply Airflow (CFM)	Zone Htg Unit (MBH)	Reheat Coil (MBH)	- (CFM)
1	135046.3	-	675.2	

5. Equipment Data
No Equipment Data required for this system.

02 PC 501- 400 Input Data

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 10:20AM

1. General Details:

Air System Name ..... 02 PC 501- 400
Equipment Type ..... Chilled Water AHU
Air System Type ..... VAV
Number of zones 1

2. System Components:

Ventilation Air Data:

Airflow Control ..... Constant Ventilation Airflow
Ventilation Sizing Method ..... Sum of Space OA Airflows
Unocc. Damper Position ..... Closed
Damper Leak Rate ..... 0 %
Outdoor Air CO2 Level ..... 400 ppm

Central Cooling Data:

Supply Air Temperature ..... 55.0 °F
Coil Bypass Factor 0.100
Cooling Source ..... Chilled Water
Schedule ..... JFMAMJJASOND
Capacity Control ..... Temperature Reset by Greatest Zone Demand
Max. Supply Temperature ..... 65.0 °F

Supply Fan Data:

Fan Type ..... ASHRAE 90.1 App G Fan Curve
Configuration ..... Draw-thru
Fan Performance ..... 2.00 in wg
Overall Efficiency ..... 90 %

% Airflow	100	90	80	70	60	50
% kW	100	83	68	54	41	30

% Airflow	40	30	20	10	0
% kW	21	13	7	3	0

Duct System Data:

Supply Duct Data:

Duct Heat Gain ..... 0 %
Duct Leakage ..... 0 %

Return Duct or Plenum Data:

Return Air Via ..... Ducted Return

3. Zone Components:

Space Assignments:

Zone 1: Zone 1	
PC 501 1ST	x1
PC 501 2ND	x1
PC 501 3RD	x1
PC 501 4TH	x1
PC 501 5TH	x1
PC 501 6TH	x1
PC 501 7TH	x1
PC 501 8TH	x1

Thermostats and Zone Data:

Zone ..... All
Cooling T-stat: Occ. ..... 75.0 °F
Cooling T-stat: Unocc. ..... 85.0 °F
Heating T-stat: Occ. ..... 70.0 °F
Heating T-stat: Unocc. ..... 60.0 °F
T-stat Throttling Range ..... 1.50 °F
Diversity Factor ..... 100 %
Direct Exhaust Airflow ..... 0.0 CFM
Direct Exhaust Fan kW ..... 0.0 kW

Thermostat Schedule ..... 90.1 Office Thermostat
Unoccupied Cooling is ..... Available

02 PC 501- 400 Input Data

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 10:20AM

Supply Terminals Data:

Zone	All	
Terminal Type	VAV box with RH	
Minimum Airflow	1.20	CFM/ft²
Reheat Coil Source	Electric Resistance	
Reheat Coil Schedule	JFMAMJJASOND	

Zone Heating Units:

Zone	All	
Zone Heating Unit Type	None	
Zone Unit Heat Source	Hot Water	
Zone Heating Unit Schedule	JFMAMJJASOND	

4. Sizing Data (Computer-Generated):

System Sizing Data:

Cooling Supply Temperature	55.0	°F
Supply Fan Airflow	144000.0	CFM
Ventilation Airflow	18950.0	CFM

Hydronic Sizing Specifications:

Chilled Water Delta-T	10.0	°F
Hot Water Delta-T	50.0	°F

Safety Factors:

Cooling Sensible	10	%
Cooling Latent	10	%
Heating	5	%

Zone Sizing Data:

Zone Airflow Sizing Method	Peak zone sensible load
Space Airflow Sizing Method	Coincident space loads

Zone	Supply Airflow (CFM)	Zone Htg Unit (MBH)	Reheat Coil (MBH)	- (CFM)
1	144000.0	-	2603.1	

5. Equipment Data

No Equipment Data required for this system.

03 PC HUMAN= 60 Input Data

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 10:20AM

1. General Details:

Air System Name	03 PC HUMAN= 60	
Equipment Type	Chilled Water AHU	
Air System Type	VAV	
Number of zones	1	

2. System Components:

Ventilation Air Data:

Airflow Control	Constant Ventilation Airflow	
Ventilation Sizing Method	Sum of Space OA Airflows	
Unocc. Damper Position	Closed	
Damper Leak Rate	0	%
Outdoor Air CO2 Level	400	ppm

Central Cooling Data:

Supply Air Temperature	55.0	°F
Coil Bypass Factor	0.100	
Cooling Source	Chilled Water	
Schedule	JFMAMJJASOND	
Capacity Control	Temperature Reset by Greatest Zone Demand	
Max. Supply Temperature	65.0	°F

Supply Fan Data:

Fan Type	ASHRAE 90.1 App G Fan Curve	
Configuration	Draw-thru	
Fan Performance	2.00	in wg
Overall Efficiency	90	%

% Airflow	100	90	80	70	60	50
% kW	100	83	68	54	41	30

% Airflow	40	30	20	10	0
% kW	21	13	7	3	0

Duct System Data:

Supply Duct Data:

Duct Heat Gain	0	%
Duct Leakage	0	%

Return Duct or Plenum Data:

Return Air Via	Ducted Return

3. Zone Components:

Space Assignments:

Zone 1: Zone 1	
PC HUMAN 1ST	x1
PC HUMAN 2nd	x1

Thermostats and Zone Data:

Zone	All	
Cooling T-stat: Occ.	75.0	°F
Cooling T-stat: Unocc.	85.0	°F
Heating T-stat: Occ.	70.0	°F
Heating T-stat: Unocc.	60.0	°F
T-stat Throttling Range	1.50	°F
Diversity Factor	100	%
Direct Exhaust Airflow	0.0	CFM
Direct Exhaust Fan kW	0.0	kW
Thermostat Schedule	90.1 Office Thermostat	
Unoccupied Cooling is	Available	

Supply Terminals Data:

Zone	All	
Terminal Type	VAV box with RH	
Minimum Airflow	1.20	CFM/ft²
Reheat Coil Source	Electric Resistance	
Reheat Coil Schedule	JFMAMJJASOND	

03 PC HUMAN= 60 Input Data

Project Name: COSP Chiller Loop
Prepared by: Griner Engineering, Inc.

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Zone Heating Units:

Zone ..... All
Zone Heating Unit Type ..... None

Zone Unit Heat Source ..... Hot Water
Zone Heating Unit Schedule ..... JFMAMJJASOND

4. Sizing Data (Computer-Generated):

System Sizing Data:

Cooling Supply Temperature ..... 55.0 °F
Supply Fan Airflow ..... 20959.2 CFM
Ventilation Airflow ..... 3548.0 CFM

Hydronic Sizing Specifications:

Chilled Water Delta-T ..... 10.0 °F
Hot Water Delta-T ..... 50.0 °F

Safety Factors:

Cooling Sensible ..... 10 %
Cooling Latent ..... 10 %
Heating ..... 5 %

Zone Sizing Data:

Zone Airflow Sizing Method ..... Peak zone sensible load
Space Airflow Sizing Method ..... Coincident space loads

Zone	Supply Airflow (CFM)	Zone Htg Unit (MBH)	Reheat Coil (MBH)	- (CFM)
1	20959.2	-	404.9	

5. Equipment Data

No Equipment Data required for this system.

04 SEBRING = 250 Input Data

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 10:20AM

1. General Details:

Air System Name	04 SEBRING = 250
Equipment Type	Chilled Water AHU
Air System Type	VAV
Number of zones	1

2. System Components:

Ventilation Air Data:

Airflow Control	Constant Ventilation Airflow	
Ventilation Sizing Method	Sum of Space OA Airflows	
Unocc. Damper Position	Closed	
Damper Leak Rate	0	%
Outdoor Air CO2 Level	400	ppm

Central Cooling Data:

Supply Air Temperature	55.0	°F
Coil Bypass Factor	0.100	
Cooling Source	Chilled Water	
Schedule	JFMAMJJASOND	
Capacity Control	Temperature Reset by Greatest Zone Demand	
Max. Supply Temperature	65.0	°F

Supply Fan Data:

Fan Type	ASHRAE 90.1 App G Fan Curve	
Configuration	Draw-thru	
Fan Performance	2.00	in wg
Overall Efficiency	90	%

% Airflow	100	90	80	70	60	50
% kW	100	83	68	54	41	30

% Airflow	40	30	20	10	0
% kW	21	13	7	3	0

Duct System Data:

Supply Duct Data:

Duct Heat Gain	0	%
Duct Leakage	0	%

Return Duct or Plenum Data:

Return Air Via	Ducted Return

3. Zone Components:

Space Assignments:

Zone 1: Zone 1	
SEBRING 1ST	x1
SEBRING 2ND	x1
SEBRING 3RD	x1
SEBRING 4TH	x1
SEBRING 5TH	x1

Thermostats and Zone Data:

Zone	All	
Cooling T-stat: Occ.	75.0	°F
Cooling T-stat: Unocc.	85.0	°F
Heating T-stat: Occ.	70.0	°F
Heating T-stat: Unocc.	60.0	°F
T-stat Throttling Range	1.50	°F
Diversity Factor	100	%
Direct Exhaust Airflow	0.0	CFM
Direct Exhaust Fan kW	0.0	kW
Thermostat Schedule	90.1 Office Thermostat	
Unoccupied Cooling is	Available	

Supply Terminals Data:

Zone	All
Terminal Type	VAV box with RH

04 SEBRING = 250 Input Data

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 10:20AM

Minimum Airflow ..... 1.20 CFM/ft²

Reheat Coil Source ..... Electric Resistance
Reheat Coil Schedule ..... JFMAMJJASOND

Zone Heating Units:
Zone ..... All
Zone Heating Unit Type ..... None

Zone Unit Heat Source ..... Hot Water
Zone Heating Unit Schedule ..... JFMAMJJASOND

4. Sizing Data (Computer-Generated):
System Sizing Data:
Cooling Supply Temperature ..... 55.0 °F
Supply Fan Airflow ..... 90624.0 CFM
Ventilation Airflow ..... 12031.2 CFM

Hydronic Sizing Specifications:
Chilled Water Delta-T ..... 10.0 °F
Hot Water Delta-T ..... 50.0 °F

Safety Factors:
Cooling Sensible ..... 10 %
Cooling Latent ..... 10 %
Heating ..... 5 %

Zone Sizing Data:
Zone Airflow Sizing Method ..... Peak zone sensible load
Space Airflow Sizing Method ..... Coincident space loads

Zone	Supply Airflow (CFM)	Zone Htg Unit (MBH)	Reheat Coil (MBH)	- (CFM)
1	90624.0	-	1661.3	

5. Equipment Data
No Equipment Data required for this system.

05 City Hall= 250 tons Input Data

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 10:20AM

1. General Details:

Air System Name ..... 05 City Hall= 250 tons
Equipment Type ..... Chilled Water AHU
Air System Type ..... VAV
Number of zones 1

2. System Components:

Ventilation Air Data:

Airflow Control ..... Constant Ventilation Airflow
Ventilation Sizing Method ..... Sum of Space OA Airflows
Unocc. Damper Position ..... Closed
Damper Leak Rate ..... 0 %
Outdoor Air CO2 Level ..... 400 ppm

Central Cooling Data:

Supply Air Temperature ..... 55.0 °F
Coil Bypass Factor 0.100
Cooling Source ..... Chilled Water
Schedule ..... JFMAMJJASOND
Capacity Control ..... Temperature Reset by Greatest Zone Demand
Max. Supply Temperature ..... 65.0 °F

Supply Fan Data:

Fan Type ..... ASHRAE 90.1 App G Fan Curve
Configuration ..... Draw-thru
Fan Performance ..... 2.00 in wg
Overall Efficiency ..... 90 %

% Airflow	100	90	80	70	60	50
% kW	100	83	68	54	41	30

% Airflow	40	30	20	10	0
% kW	21	13	7	3	0

Duct System Data:

Supply Duct Data:

Duct Heat Gain ..... 0 %
Duct Leakage ..... 0 %

Return Duct or Plenum Data:

Return Air Via ..... Ducted Return

3. Zone Components:

Space Assignments:

Zone 1: Zone 1	
City Hall 1st Floor	x1
City Hall 2nd Floor	x1
City Hall 3rd Floor	x1
City Hall UG Floor	x1

Thermostats and Zone Data:

Zone ..... All
Cooling T-stat: Occ. ..... 75.0 °F
Cooling T-stat: Unocc. ..... 85.0 °F
Heating T-stat: Occ. ..... 70.0 °F
Heating T-stat: Unocc. ..... 60.0 °F
T-stat Throttling Range ..... 1.50 °F
Diversity Factor ..... 100 %
Direct Exhaust Airflow ..... 0.0 CFM
Direct Exhaust Fan kW ..... 0.0 kW

Thermostat Schedule ..... 90.1 Office Thermostat
Unoccupied Cooling is ..... Available

Supply Terminals Data:

Zone ..... All
Terminal Type ..... VAV box with RH
Minimum Airflow ..... 1.20 CFM/ft²

05 City Hall= 250 tons Input Data

Project Name: COSP Chiller Loop
Prepared by: Griner Engineering, Inc.

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Reheat Coil Source ..... **Electric Resistance**
Reheat Coil Schedule ..... **JFMAMJJASOND**

Zone Heating Units:
Zone ..... **All**
Zone Heating Unit Type ..... **None**

Zone Unit Heat Source ..... **Hot Water**
Zone Heating Unit Schedule ..... **JFMAMJJASOND**

4. Sizing Data (Computer-Generated):
System Sizing Data:
Cooling Supply Temperature ..... **55.0** °F
Supply Fan Airflow ..... **90000.0** CFM
Ventilation Airflow ..... **9500.0** CFM

Hydronic Sizing Specifications:
Chilled Water Delta-T ..... **10.0** °F
Hot Water Delta-T ..... **50.0** °F

Safety Factors:
Cooling Sensible ..... **10** %
Cooling Latent ..... **10** %
Heating ..... **5** %

Zone Sizing Data:
Zone Airflow Sizing Method ..... **Peak zone sensible load**
Space Airflow Sizing Method ..... **Coincident space loads**

Zone	Supply Airflow (CFM)	Zone Htg Unit (MBH)	Reheat Coil (MBH)	- (CFM)
1	90000.0	-	1600.2	

5. Equipment Data
No Equipment Data required for this system.

07 MUNICIPAL 400 Input Data

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 10:20AM

1. General Details:

Air System Name	07 MUNICIPAL 400
Equipment Type	Chilled Water AHU
Air System Type	VAV
Number of zones	1

2. System Components:

Ventilation Air Data:

Airflow Control	Constant Ventilation Airflow	
Ventilation Sizing Method	Sum of Space OA Airflows	
Unocc. Damper Position	Closed	
Damper Leak Rate	0	%
Outdoor Air CO2 Level	400	ppm

Central Cooling Data:

Supply Air Temperature	55.0	°F
Coil Bypass Factor	0.100	
Cooling Source	Chilled Water	
Schedule	JFMAMJJASOND	
Capacity Control	Temperature Reset by Greatest Zone Demand	
Max. Supply Temperature	65.0	°F

Supply Fan Data:

Fan Type	ASHRAE 90.1 App G Fan Curve	
Configuration	Draw-thru	
Fan Performance	2.00	in wg
Overall Efficiency	90	%

% Airflow	100	90	80	70	60	50
% kW	100	83	68	54	41	30

% Airflow	40	30	20	10	0
% kW	21	13	7	3	0

Duct System Data:

Supply Duct Data:

Duct Heat Gain	0	%
Duct Leakage	0	%

Return Duct or Plenum Data:

Return Air Via	Ducted Return

3. Zone Components:

Space Assignments:

Zone 1: Zone 1	
MUNICIPAL 10TH	x1
MUNICIPAL 1ST	x1
MUNICIPAL 2ND	x1
MUNICIPAL 3RD	x1
MUNICIPAL 4TH	x1
MUNICIPAL 5TH	x1
MUNICIPAL 6TH	x1
MUNICIPAL 7TH	x1
MUNICIPAL 8TH	x1
MUNICIPAL 9TH	x1

Thermostats and Zone Data:

Zone	All	
Cooling T-stat: Occ.	75.0	°F
Cooling T-stat: Unocc.	85.0	°F
Heating T-stat: Occ.	70.0	°F
Heating T-stat: Unocc.	60.0	°F
T-stat Throttling Range	1.50	°F
Diversity Factor	100	%
Direct Exhaust Airflow	0.0	CFM
Direct Exhaust Fan kW	0.0	kW

07 MUNICIPAL 400 Input Data

Project Name: COSP Chiller Loop
Prepared by: Griner Engineering, Inc.

10/27/2016
10:20AM

Thermostat Schedule ..... 90.1 Office Thermostat
Unoccupied Cooling is ..... Available

Supply Terminals Data:
Zone ..... All
Terminal Type ..... VAV box with RH
Minimum Airflow ..... 1.20 CFM/ft²

Reheat Coil Source ..... Electric Resistance
Reheat Coil Schedule ..... JFMAMJJASOND

Zone Heating Units:
Zone ..... All
Zone Heating Unit Type ..... None

Zone Unit Heat Source ..... Hot Water
Zone Heating Unit Schedule ..... JFMAMJJASOND

4. Sizing Data (Computer-Generated):
System Sizing Data:
Cooling Supply Temperature ..... 55.0 °F
Supply Fan Airflow ..... 144000.0 CFM
Ventilation Airflow ..... 19700.0 CFM

Hydronic Sizing Specifications:
Chilled Water Delta-T ..... 10.0 °F
Hot Water Delta-T ..... 50.0 °F

Safety Factors:
Cooling Sensible ..... 10 %
Cooling Latent ..... 10 %
Heating ..... 5 %

Zone Sizing Data:
Zone Airflow Sizing Method ..... Peak zone sensible load
Space Airflow Sizing Method ..... Coincident space loads

Zone	Supply Airflow (CFM)	Zone Htg Unit (MBH)	Reheat Coil (MBH)	- (CFM)
1	144000.0	-	2755.2	

5. Equipment Data
No Equipment Data required for this system.

08 MIRROR LAKE LIB=50 Input Data

Project Name: COSP Chiller Loop
Prepared by: Griner Engineering, Inc.

10/27/2016
10:20AM

1. General Details:

Air System Name ..... 08 MIRROR LAKE LIB=50
Equipment Type ..... Chilled Water AHU
Air System Type ..... VAV
Number of zones 1

2. System Components:

Ventilation Air Data:

Airflow Control ..... Constant Ventilation Airflow
Ventilation Sizing Method ..... Sum of Space OA Airflows
Unocc. Damper Position ..... Closed
Damper Leak Rate ..... 0 %
Outdoor Air CO2 Level ..... 400 ppm

Central Cooling Data:

Supply Air Temperature ..... 55.0 °F
Coil Bypass Factor 0.100
Cooling Source ..... Chilled Water
Schedule ..... JFMAMJJASOND
Capacity Control ..... Temperature Reset by Greatest Zone Demand
Max. Supply Temperature ..... 65.0 °F

Supply Fan Data:

Fan Type ..... ASHRAE 90.1 App G Fan Curve
Configuration ..... Draw-thru
Fan Performance ..... 2.00 in wg
Overall Efficiency ..... 90 %

% Airflow	100	90	80	70	60	50
% kW	100	83	68	54	41	30

% Airflow	40	30	20	10	0
% kW	21	13	7	3	0

Duct System Data:

Supply Duct Data:

Duct Heat Gain ..... 0 %
Duct Leakage ..... 0 %

Return Duct or Plenum Data:

Return Air Via ..... Ducted Return

3. Zone Components:

Space Assignments:

Zone 1: Zone 1	
MIRROR LAKE LIBRARY	x1
MIRROR LAKE LIBRARY 2	x1

Thermostats and Zone Data:

Zone ..... All
Cooling T-stat: Occ. ..... 75.0 °F
Cooling T-stat: Unocc. ..... 85.0 °F
Heating T-stat: Occ. ..... 70.0 °F
Heating T-stat: Unocc. ..... 60.0 °F
T-stat Throttling Range ..... 1.50 °F
Diversity Factor ..... 100 %
Direct Exhaust Airflow ..... 0.0 CFM
Direct Exhaust Fan kW ..... 0.0 kW

Thermostat Schedule ..... 90.1 Office Thermostat
Unoccupied Cooling is ..... Available

Supply Terminals Data:

Zone ..... All
Terminal Type ..... VAV box with RH
Minimum Airflow ..... 1.20 CFM/ft²

Reheat Coil Source ..... Electric Resistance
Reheat Coil Schedule ..... JFMAMJJASOND

08 MIRROR LAKE LIB=50 Input Data

Project Name: COSP Chiller Loop
Prepared by: Griner Engineering, Inc.

10/27/2016
10:20AM

Zone Heating Units:

Zone ..... All
Zone Heating Unit Type ..... None

Zone Unit Heat Source ..... Hot Water
Zone Heating Unit Schedule ..... JFMAMJJASOND

4. Sizing Data (Computer-Generated):

System Sizing Data:

Cooling Supply Temperature ..... 55.0 °F
Supply Fan Airflow ..... 16466.4 CFM
Ventilation Airflow ..... 2123.3 CFM

Hydronic Sizing Specifications:

Chilled Water Delta-T ..... 10.0 °F
Hot Water Delta-T ..... 50.0 °F

Safety Factors:

Cooling Sensible ..... 10 %
Cooling Latent ..... 10 %
Heating ..... 5 %

Zone Sizing Data:

Zone Airflow Sizing Method ..... Peak zone sensible load
Space Airflow Sizing Method ..... Coincident space loads

Zone	Supply Airflow (CFM)	Zone Htg Unit (MBH)	Reheat Coil (MBH)	- (CFM)
1	16466.4	-	311.8	

5. Equipment Data

No Equipment Data required for this system.

09 SHUFFLE = 10 Input Data

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 10:20AM

1. General Details:

Air System Name	09 SHUFFLE = 10	
Equipment Type	Chilled Water AHU	
Air System Type	VAV	
Number of zones	1	

2. System Components:

Ventilation Air Data:

Airflow Control	Constant Ventilation Airflow	
Ventilation Sizing Method	Sum of Space OA Airflows	
Unocc. Damper Position	Closed	
Damper Leak Rate	0	%
Outdoor Air CO2 Level	400	ppm

Central Cooling Data:

Supply Air Temperature	55.0	°F
Coil Bypass Factor	0.100	
Cooling Source	Chilled Water	
Schedule	JFMAMJJASOND	
Capacity Control	Temperature Reset by Greatest Zone Demand	
Max. Supply Temperature	65.0	°F

Supply Fan Data:

Fan Type	ASHRAE 90.1 App G Fan Curve	
Configuration	Draw-thru	
Fan Performance	2.00	in wg
Overall Efficiency	90	%

% Airflow	100	90	80	70	60	50
% kW	100	83	68	54	41	30

% Airflow	40	30	20	10	0
% kW	21	13	7	3	0

Duct System Data:

Supply Duct Data:

Duct Heat Gain	0	%
Duct Leakage	0	%

Return Duct or Plenum Data:

Return Air Via	Ducted Return

3. Zone Components:

Space Assignments:

Zone 1: Zone 1	
SHUFFLE 1ST	x1
SHUFFLE 2ND	x1

Thermostats and Zone Data:

Zone	All	
Cooling T-stat: Occ.	75.0	°F
Cooling T-stat: Unocc.	85.0	°F
Heating T-stat: Occ.	70.0	°F
Heating T-stat: Unocc.	60.0	°F
T-stat Throttling Range	1.50	°F
Diversity Factor	100	%
Direct Exhaust Airflow	0.0	CFM
Direct Exhaust Fan kW	0.0	kW
Thermostat Schedule	90.1 Office Thermostat	
Unoccupied Cooling is	Available	

Supply Terminals Data:

Zone	All	
Terminal Type	VAV box with RH	
Minimum Airflow	1.20	CFM/ft²
Reheat Coil Source	Electric Resistance	
Reheat Coil Schedule	JFMAMJJASOND	

09 SHUFFLE = 10 Input Data

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 10:20AM

Zone Heating Units:

Zone ..... All
Zone Heating Unit Type ..... None

Zone Unit Heat Source ..... Hot Water
Zone Heating Unit Schedule ..... JFMAMJJASOND

4. Sizing Data (Computer-Generated):

System Sizing Data:

Cooling Supply Temperature ..... 55.0 °F
Supply Fan Airflow ..... 3240.0 CFM
Ventilation Airflow ..... 662.0 CFM

Hydronic Sizing Specifications:

Chilled Water Delta-T ..... 10.0 °F
Hot Water Delta-T ..... 50.0 °F

Safety Factors:

Cooling Sensible ..... 10 %
Cooling Latent ..... 10 %
Heating ..... 5 %

Zone Sizing Data:

Zone Airflow Sizing Method ..... Peak zone sensible load
Space Airflow Sizing Method ..... Coincident space loads

Zone	Supply Airflow (CFM)	Zone Htg Unit (MBH)	Reheat Coil (MBH)	- (CFM)
1	3240.0	-	74.6	

5. Equipment Data

No Equipment Data required for this system.

10 COLISUEM =60 Input Data

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 10:20AM

1. General Details:

Air System Name	10 COLISUEM =60	
Equipment Type	Chilled Water AHU	
Air System Type	VAV	
Number of zones	1	

2. System Components:

Ventilation Air Data:

Airflow Control	Constant Ventilation Airflow	
Ventilation Sizing Method	Sum of Space OA Airflows	
Unocc. Damper Position	Closed	
Damper Leak Rate	0	%
Outdoor Air CO2 Level	400	ppm

Central Cooling Data:

Supply Air Temperature	55.0	°F
Coil Bypass Factor	0.100	
Cooling Source	Chilled Water	
Schedule	JFMAMJJASOND	
Capacity Control	Temperature Reset by Greatest Zone Demand	
Max. Supply Temperature	65.0	°F

Supply Fan Data:

Fan Type	ASHRAE 90.1 App G Fan Curve	
Configuration	Draw-thru	
Fan Performance	2.00	in wg
Overall Efficiency	90	%

% Airflow	100	90	80	70	60	50
% kW	100	83	68	54	41	30

% Airflow	40	30	20	10	0
% kW	21	13	7	3	0

Duct System Data:

Supply Duct Data:

Duct Heat Gain	0	%
Duct Leakage	0	%

Return Duct or Plenum Data:

Return Air Via	Ducted Return

3. Zone Components:

Space Assignments:

Zone 1: Zone 1	
COLLISEUM 1	x1
COLLISEUM 2	x1

Thermostats and Zone Data:

Zone	All	
Cooling T-stat: Occ.	75.0	°F
Cooling T-stat: Unocc.	85.0	°F
Heating T-stat: Occ.	70.0	°F
Heating T-stat: Unocc.	60.0	°F
T-stat Throttling Range	1.50	°F
Diversity Factor	100	%
Direct Exhaust Airflow	0.0	CFM
Direct Exhaust Fan kW	0.0	kW
Thermostat Schedule	90.1 Office Thermostat	
Unoccupied Cooling is	Available	

Supply Terminals Data:

Zone	All	
Terminal Type	VAV box with RH	
Minimum Airflow	1.20	CFM/ft²
Reheat Coil Source	Electric Resistance	
Reheat Coil Schedule	JFMAMJJASOND	

10 COLISUEM =60 Input Data

Project Name: COSP Chiller Loop
Prepared by: Griner Engineering, Inc.

10/27/2016
10:20AM

Zone Heating Units:

Zone ..... All
Zone Heating Unit Type ..... None

Zone Unit Heat Source ..... Hot Water
Zone Heating Unit Schedule ..... JFMAMJJASOND

4. Sizing Data (Computer-Generated):

System Sizing Data:

Cooling Supply Temperature ..... 55.0 °F
Supply Fan Airflow ..... 19200.0 CFM
Ventilation Airflow ..... 3960.0 CFM

Hydronic Sizing Specifications:

Chilled Water Delta-T ..... 10.0 °F
Hot Water Delta-T ..... 50.0 °F

Safety Factors:

Cooling Sensible ..... 10 %
Cooling Latent ..... 10 %
Heating ..... 5 %

Zone Sizing Data:

Zone Airflow Sizing Method ..... Peak zone sensible load
Space Airflow Sizing Method ..... Coincident space loads

Zone	Supply Airflow (CFM)	Zone Htg Unit (MBH)	Reheat Coil (MBH)	- (CFM)
1	19200.0	-	359.9	

5. Equipment Data

No Equipment Data required for this system.

11 SUNSHINE=70 Input Data

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 10:20AM

1. General Details:

Air System Name	11 SUNSHINE=70	
Equipment Type	Chilled Water AHU	
Air System Type	VAV	
Number of zones	1	

2. System Components:

Ventilation Air Data:

Airflow Control	Constant Ventilation Airflow	
Ventilation Sizing Method	Sum of Space OA Airflows	
Unocc. Damper Position	Closed	
Damper Leak Rate	0	%
Outdoor Air CO2 Level	400	ppm

Central Cooling Data:

Supply Air Temperature	55.0	°F
Coil Bypass Factor	0.100	
Cooling Source	Chilled Water	
Schedule	JFMAMJJASOND	
Capacity Control	Temperature Reset by Greatest Zone Demand	
Max. Supply Temperature	65.0	°F

Supply Fan Data:

Fan Type	ASHRAE 90.1 App G Fan Curve	
Configuration	Draw-thru	
Fan Performance	2.00	in wg
Overall Efficiency	90	%

% Airflow	100	90	80	70	60	50
% kW	100	83	68	54	41	30

% Airflow	40	30	20	10	0
% kW	21	13	7	3	0

Duct System Data:

Supply Duct Data:

Duct Heat Gain	0	%
Duct Leakage	0	%

Return Duct or Plenum Data:

Return Air Via	Ducted Return	

3. Zone Components:

Space Assignments:

Zone 1: Zone 1	
SUNHINE	x1
SUNHINE(1)	x1

Thermostats and Zone Data:

Zone	All	
Cooling T-stat: Occ.	75.0	°F
Cooling T-stat: Unocc.	85.0	°F
Heating T-stat: Occ.	70.0	°F
Heating T-stat: Unocc.	60.0	°F
T-stat Throttling Range	1.50	°F
Diversity Factor	100	%
Direct Exhaust Airflow	0.0	CFM
Direct Exhaust Fan kW	0.0	kW
Thermostat Schedule	90.1 Office Thermostat	
Unoccupied Cooling is	Available	

Supply Terminals Data:

Zone	All	
Terminal Type	VAV box with RH	
Minimum Airflow	1.20	CFM/ft²
Reheat Coil Source	Electric Resistance	
Reheat Coil Schedule	JFMAMJJASOND	

11 SUNSHINE=70 Input Data

Project Name: COSP Chiller Loop — 10/27/2016
Prepared by: Griner Engineering, Inc. — 10:20AM

Zone Heating Units:

Zone ..... All
Zone Heating Unit Type ..... None

Zone Unit Heat Source ..... Hot Water
Zone Heating Unit Schedule ..... JFMAMJJASOND

4. Sizing Data (Computer-Generated):

System Sizing Data:

Cooling Supply Temperature ..... 55.0 °F
Supply Fan Airflow ..... 24000.0 CFM
Ventilation Airflow ..... 3700.0 CFM

Hydronic Sizing Specifications:

Chilled Water Delta-T ..... 10.0 °F
Hot Water Delta-T ..... 50.0 °F

Safety Factors:

Cooling Sensible ..... 10 %
Cooling Latent ..... 10 %
Heating ..... 5 %

Zone Sizing Data:

Zone Airflow Sizing Method ..... Peak zone sensible load
Space Airflow Sizing Method ..... Coincident space loads

Zone	Supply Airflow (CFM)	Zone Htg Unit (MBH)	Reheat Coil (MBH)	- (CFM)
1	24000.0	-	459.2	

5. Equipment Data

No Equipment Data required for this system.

Chiller Input Data

COSP Chiller Loop — 10/27/2016
Griner Engineering, Inc. — 10:18AM

CHILLER 1

General Details

Chiller Name	CHILLER 1
Chiller Type	W/C Centrifugal
Data Source	User Input

Notes:

Design Inputs

Full Load LCHWT	42.0	°F
Full Load ECWT	85.0	°F
Full Load Capacity	Auto-Sized	
Full Load Power	0.558	kW/Ton
Cooler Flow Rate	1.714	gpm/Ton
Condenser Flow Rate	3.000	gpm/Ton
Minimum ECWT Setpoint	85.0	°F
Minimum Load	25.0	%

Chiller Performance (kW/Ton)

ECWT (°F)	Max Cap	100%	75%	50%	25%
85.0	0.558	0.558	0.413	0.286	0.264

Performance LCHWT Factor a	-0.00880	1/F
Performance LCHWT Factor b	0.00000	1/F²
Capacity LCHWT Factor a	0.00000	1/F
Capacity LCHWT Factor b	0.00000	1/F²

Chiller Input Data

COSP Chiller Loop
Griner Engineering, Inc.

10/27/2016
10:18AM

CHILLER 1 EXISTING

General Details

Chiller Name	CHILLER 1 EXISTING
Chiller Type	W/C Centrifugal
Data Source	User Input

Notes:

Design Inputs

Full Load LCHWT	42.0	°F
Full Load ECWT	85.0	°F
Full Load Capacity	Auto-Sized	
Full Load Power	1.150	kW/Ton
Cooler Flow Rate	2.570	gpm/Ton
Condenser Flow Rate	3.000	gpm/Ton
Minimum ECWT Setpoint	85.0	°F
Minimum Load	25.0	%

Chiller Performance (kW/Ton)

ECWT (°F)	Max Cap	100%	75%	50%	25%
85.0	1.150	1.150	1.000	0.900	0.800

Performance LCHWT Factor a	-0.00880	1/F
Performance LCHWT Factor b	0.00000	1/F²
Capacity LCHWT Factor a	0.00000	1/F
Capacity LCHWT Factor b	0.00000	1/F²

Cooling Tower Input Data

COSP Chiller Loop
Griner Engineering, Inc.

10/27/2016
08:12AM

CT-1

Modeling Method

Modeling Method	**Cooling Tower Model**	

General Details

Condenser Water Flow Rate	**3.000**	gpm/Ton

Cooling Tower Model

Design Wet Bulb	**80.0**	°F
Range At Design	**10.0**	°F
Design Approach	**7.0**	°F
Full Load Fan kW	**0.075**	kW/Ton
Cooling Tower Control	**Variable Speed Fan**	
Fan Electrical Efficiency	**94.0**	%

CT-1 EXISTING

Modeling Method

Modeling Method	**Cooling Tower Model**	

General Details

Condenser Water Flow Rate	**3.000**	gpm/Ton

Cooling Tower Model

Design Wet Bulb	**80.0**	°F
Range At Design	**10.0**	°F
Design Approach	**7.0**	°F
Full Load Fan kW	**0.075**	kW/Ton
Cooling Tower Control	**Variable Speed Fan**	
Fan Electrical Efficiency	**94.0**	%

CT-2

Modeling Method

Modeling Method	**Cooling Tower Model**	

General Details

Condenser Water Flow Rate	**3.000**	gpm/Ton

Cooling Tower Model

Design Wet Bulb	**80.0**	°F
Range At Design	**10.0**	°F
Design Approach	**7.0**	°F
Full Load Fan kW	**0.075**	kW/Ton
Cooling Tower Control	**Variable Speed Fan**	
Fan Electrical Efficiency	**94.0**	%

Cooling Tower Input Data

COSP Chiller Loop — 10/27/2016
Griner Engineering, Inc — 08:12AM

CT-2 EXISTING

Modeling Method

Modeling Method	**Cooling Tower Model**	

General Details

Condenser Water Flow Rate	**3.000**	gpm/Ton

Cooling Tower Model

Design Wet Bulb	**80.0**	°F
Range At Design	**10.0**	°F
Design Approach	**7.0**	°F
Full Load Fan kW	**0.075**	kW/Ton
Cooling Tower Control	**Variable Speed Fan**	
Fan Electrical Efficiency	**94.0**	%

Electric Rate Input Data

COSP Chiller Loop
Griner Engineering, Inc.

10/27/2016
08:11AM

DUKE ENERGY

General Details

Rate Name	DUKE ENERGY	
Rate Type	Simple	
Energy Units	kWh	
Conversion	1.00000	kWh/kWh
Demand Units	kW	
Flat Price	0.10260	$/kWh
Customer Charge	0.00	$
Minimum Charge	0.00	$
Tax Rate	0.00	%

PLANT 1 Input Data

COSP Chiller Loop
Griner Engineering, Inc.

10/27/2016
08:19AM

1. General Details:

Plant Name ..... **PLANT 1**
Plant Type ..... **Chiller Plant**

2. Air Systems served by Plant:

Air System Name	Mult.
01 PC JUDICIAL = 400	1
02 PC 501- 400	1
03 PC HUMAN= 60	1
04 SEBRING = 250	1
05 City Hall= 250 tons	1
07 MUNICIPAL 400	1
08 MIRROR LAKE LIB=50	1
09 SHUFFLE = 10	1
10 COLISUEM =60	1
11 SUNSHINE=70	1

3. Configuration

Chiller Sizing ..... **Auto-Size Chiller Capacities**
Number of Chillers **3**
Plant Sizing ..... **Equally Sized**
Capacity Oversizing Factor ..... **15** %
Cooling Tower Configuration ..... **One tower for each W/C chiller**
Plant Control ..... **Equal Unloading**
LCHWT Control ..... **Constant LCHWT**
Design LCHWT ..... **42.0** °F
Free Cooling ..... **Not Used**

4. Schedule of Equipment

Sequence	Chiller Name	Full Load Capacity (Tons)	Cooler Flow Rate	Condenser Flow Rate	Cooling Tower Name	Tower Flow Rate
CH-1	CHILLER 1	<auto-sized>	1.714 gpm/Ton	3.000 gpm/Ton	CT-1	3.000 gpm/Ton
CH-2	CHILLER 1 A	<auto-sized>	1.714 gpm/Ton	3.000 gpm/Ton	CT-1	3.000 gpm/Ton
CH-3	CHILLER 1 B	<auto-sized>	1.714 gpm/Ton	3.000 gpm/Ton	CT-1	3.000 gpm/Ton
	Totals:	n/a	n/a	n/a	Totals:	n/a

Est. Max Load ..... **1942.9** Tons

5. Distribution

Distribution System

Type ..... **Primary/Secondary, Variable Speed Secondary**
Coil Delta-T at Design ..... **14.0** °F
Pipe Heat Gain Factor ..... **2.0** %
Pump Performance ..... **ft wg**

Fluid Properties

Name ..... **Fresh Water**
Density ..... **62.4** lb/ft^3
Specific Heat ..... **1.00** BTU / (lb - °F)

Primary Loop

Pump for...	Flow	Head (ft wg)	Mechanical Efficiency (%)	Electrical Efficiency (%)
CH-1	1.714 gpm/Ton	35.0	80.0	94.0

PLANT 1 Input Data

COSP Chiller Loop
Griner Engineering, Inc.

10/27/2016
08:19AM

CH-2	1.714 gpm/Ton	0.0	80.0	94.0
CH-3	1.714 gpm/Ton	0.0	80.0	94.0

Secondary Loop

	Flow	Head (ft wg)	Mechanical Efficiency (%)	Electrical Efficiency (%)
Design	<auto-sized>	85.0	80.0	94.0

Control Head ..... **45.0** ft wg
Minimum Pump Flow ..... **50.0** %

6. Condenser Water

Condenser Water System

Pump Control ..... **Variable Flow / Variable Speed**
Pump Performance ..... **ft wg**

Minimum Pump Flow ..... **80** %
Static Head ..... **15.0** ft wg

Condenser Water Loop

Pump for...	Flow	Head (ft wg)	Mechanical Efficiency (%)	Electrical Efficiency (%)
CH-1	3.000 gpm/Ton	35.0	80.0	94.0
CH-2	3.000 gpm/Ton	0.0	80.0	94.0
CH-3	3.000 gpm/Ton	0.0	80.0	94.0

PLANT 1 EXISTING Input Data

COSP Chiller Loop
Griner Engineering, Inc.

10/27/2016
08:19AM

1. General Details:

Plant Name ..... **PLANT 1 EXISTING**
Plant Type ..... **Chiller Plant**

2. Air Systems served by Plant:

Air System Name	Mult.
01 PC JUDICIAL = 400	1
02 PC 501- 400	1
03 PC HUMAN= 60	1
04 SEBRING = 250	1
05 City Hall= 250 tons	1
07 MUNICIPAL 400	1
08 MIRROR LAKE LIB=50	1
09 SHUFFLE = 10	1
10 COLISUEM =60	1
11 SUNSHINE=70	1

3. Configuration

Chiller Sizing ..... **Auto-Size Chiller Capacities**
Number of Chillers **3**
Plant Sizing ..... **Equally Sized**
Capacity Oversizing Factor ..... **15** %
Cooling Tower Configuration ..... **One tower for each W/C chiller**
Plant Control ..... **Equal Unloading**
LCHWT Control ..... **Constant LCHWT**
Design LCHWT ..... **42.0** °F
Free Cooling ..... **Not Used**

4. Schedule of Equipment

Sequence	Chiller Name	Full Load Capacity (Tons)	Cooler Flow Rate	Condenser Flow Rate	Cooling Tower Name	Tower Flow Rate
CH-1	CHILLER 1 EXISTING	<auto-sized>	2.570 gpm/Ton	3.000 gpm/Ton	CT-1 EXISTING	3.000 gpm/Ton
CH-2	CHILLER 1 EXISTING(1)	<auto-sized>	2.570 gpm/Ton	3.000 gpm/Ton	CT-1 EXISTING	3.000 gpm/Ton
CH-3	CHILLER 1 EXISTING(2)	<auto-sized>	2.570 gpm/Ton	3.000 gpm/Ton	CT-1 EXISTING	3.000 gpm/Ton
	Totals:	n/a	n/a	n/a	Totals:	n/a

Est. Max Load ..... **1942.9** Tons

5. Distribution

Distribution System

Type ..... **Primary Only, Constant Speed**
Coil Delta-T at Design ..... **14.0** °F
Pipe Heat Gain Factor ..... **2.0** %
Pump Performance ..... **ft wg**

Fluid Properties

Name ..... **Fresh Water**
Density ..... **62.4** lb/ft³
Specific Heat ..... **1.00** BTU / (lb - °F)

Primary Loop

Pump for...	Flow	Head (ft wg)	Mechanical Efficiency (%)	Electrical Efficiency (%)
CH-1	2.570 gpm/Ton	35.0	80.0	94.0

PLANT 1 EXISTING Input Data

COSP Chiller Loop
Griner Engineering, Inc.

10/27/2016
08:19AM

CH-2	2.570 gpm/Ton	0.0	80.0	94.0
CH-3	2.570 gpm/Ton	0.0	80.0	94.0

6. Condenser Water

Condenser Water System

Pump Control ..... **Variable Flow / Variable Speed**
Pump Performance ..... **ft wg**

Minimum Pump Flow ..... **80** %
Static Head ..... **15.0** ft wg

Condenser Water Loop

Pump for...	Flow	Head (ft wg)	Mechanical Efficiency (%)	Electrical Efficiency (%)
CH-1	3.000 gpm/Ton	35.0	80.0	94.0
CH-2	3.000 gpm/Ton	0.0	80.0	94.0
CH-3	3.000 gpm/Ton	0.0	80.0	94.0

CHILLER LOOP 1 Input Data

COSP Chiller Loop
Griner Engineering, Inc.

10/27/2016
08:17AM

1. General Details:

Building Name ..... CHILLER LOOP 1

2. Plants Included in this Building:

Plant Name
PLANT 1

3. Air Systems Included in this Building:

System Name	Mult.
01 PC JUDICIAL = 400	1
02 PC 501- 400	1
03 PC HUMAN= 60	1
04 SEBRING = 250	1
05 City Hall= 250 tons	1
07 MUNICIPAL 400	1
08 MIRROR LAKE LIB=50	1
09 SHUFFLE = 10	1
10 COLISUEM =60	1
11 SUNSHINE=70	1

4: Miscellaneous Energy

(no items defined)

5: Meters

Electric ..... DUKE ENERGY

6: Miscellaneous Data

Average Building Power Factor ..... 100.00 %
Source Electric Generating Efficiency ..... 28.00 %
Additional Floor Area ..... 0.0 ft²

CHILLER LOOP 1 EXISTING Input Data

COSP Chiller Loop
Griner Engineering, Inc.

10/27/2016
08:17AM

1. General Details:

Building Name ..... **CHILLER LOOP 1 EXISTING**

2. Plants Included in this Building:

Plant Name
PLANT 1 EXISTING

3. Air Systems Included in this Building:

System Name	Mult.
01 PC JUDICIAL = 400	1
02 PC 501- 400	1
03 PC HUMAN= 60	1
04 SEBRING = 250	1
05 City Hall= 250 tons	1
07 MUNICIPAL 400	1
08 MIRROR LAKE LIB=50	1
09 SHUFFLE = 10	1
10 COLISUEM =60	1
11 SUNSHINE=70	1

4: Miscellaneous Energy

(no items defined)

5: Meters

Electric ..... **DUKE ENERGY**

6: Miscellaneous Data

Average Building Power Factor ..... **100.00 %**
Source Electric Generating Efficiency ..... **28.00 %**
Additional Floor Area ..... **0.0 ft²**

APPENDIX 2

Using HDD & HDPE Goes Deep & Long to Solve Leaks in Miami

By Steve Cooper

Horizontal Directional Drilling Guide

Using HDD & HDPE Goes Deep & Long to Solve Leaks in Miami

By Steve Cooper

The goals were straightforward. Replace a leaking potable water line. Protect the environment. Provide customers with reliable water for many generations. The path to success, however, for Miami-Dade Water and Sewer Department's (MDWASD) Infrastructure Assessment and Replacement Program (IAARP) wasn't as straightforward as the goals.

The project was necessary to maintain the reliability of water availability and adequate pressure during peak flow demands. The line was rupturing at least a few times a year.

The new water pipeline would need to be embedded some 60 ft under the bottom of the Biscayne Bay and consist of one, 4,000-ft long line. The environment was fragile. Plus, the new line had to be leak-free and have a 100-year projected life span — the old one was just 25 years old. These issues were resolved because the county elected to use high-density polyethylene (HDPE) pipe for this trenchless installation, which it has also been using in its 2-in. water line replacement program for several decades.

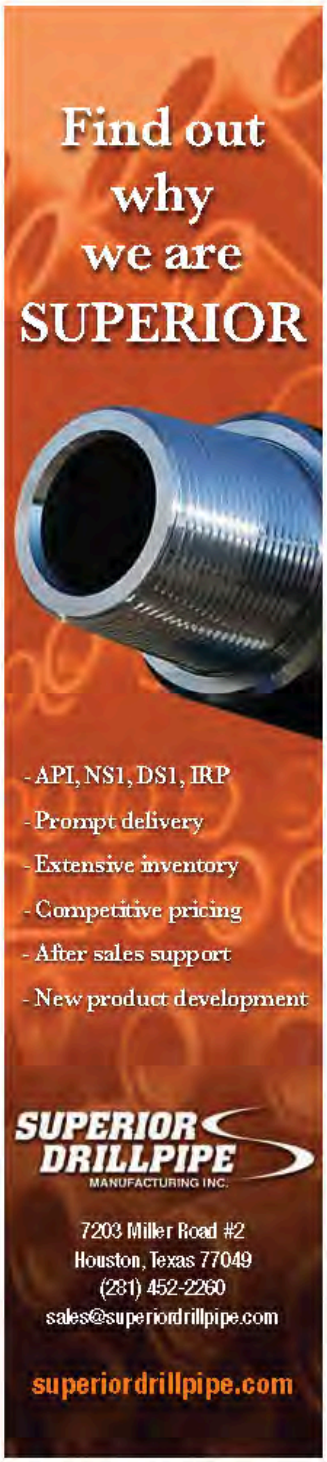
The Miami-Dade Water and Sewer Department operates and maintains the largest water and sewer utility in the southeastern United States, providing drinking water to more than 2 million customers.

The project used a 20-in. diameter HDPE pipeline that was installed using horizontal directional drilling (HDD) to replace a 12-in. deteriorated cast iron transmission line attached to the Rickenbacker Causeway Intracoastal Waterway Bridge between Hobie Island and Virginia Key. This main delivers water to the Port of Miami, Fisher Island, Virginia Key and Key Biscayne. The project was necessary to maintain the reliability of water availability and adequate pressure during peak flow demands. Typical pressure is 60 to 80 psi.

"This line was rupturing at least a couple of times a year and we estimated that every time this happened, we lose at least 2 million gallons of water," stated Ralph Terrero, assistant director water, Miami-Dade Water and Sewer Department.

"Our study showed that by replacing the existing line, we'll easily conserve 4 million gallons of water a year. Additional benefits include reductions in unnecessary pumping and operational and maintenance expenditures and eliminating potential health hazards associated with waterborne pathogens entering the distribution system. Based on our calculations that include the cost of water and energy savings, we estimate we will save our customers $156,416 annually by replacing the existing 12-in. pipeline with the new 20-in. HDPE line."

"Miami-Dade has always been a leader in finding ways to improve the water service to its customers," said Tony Radoszewski, executive director of the Plastics Pipe Institute Inc. (PPI). "The MDWASD has an ongoing program of replacing water lines by



using HDD and HDPE pipe. They found that this method is efficient and pleases its customers mainly because there is very little digging. The Rickenbacker project is basically the same, but using pipe that is 10 times larger and is still as efficient and easy to install with very little disturbance to the environment."

The new HDPE pipeline was completed in March 2010 and used one 4,000-ft long length of pipe made up of 50-ft sections that were heat-fused together using a McElroy T-900 self-contained fusion unit. The JM Eagle HDPE pipe used was PE 3608/PE 3408 HDPE, DR9 with a 2.7-in. wall thickness and a 20-in. inside diameter and supplied by ISCO Industries, Louisville, Ky.

For Chris Lamb, who has 20 years of HDD work to his credit and his crew at Utility Service Authority (USA), which did the drill, the project was "about average."

"It was difficult but typical for the projects we undertake at USA," Lamb said. "We were concerned about salt water intrusion and the varying subsurface conditions like limestone, coral and voids in the geological formation. I would say that the logistics of the project was our biggest concern. We had to lay out more than 4,000 ft of pipe, keep the traffic open during the prime season which is January until April, and we had a very small area for staging. The bore took two months — we had a crew of 16 split into shifts working around the clock. All of our concerns with the subsurface conditions were discounted, however, due to our pre-bore planning and we were able to just roll with the punches that Mother Nature gave us."

The project used a 20-in. diameter HDPE pipeline that was installed using HDD to replace a 12-in. deteriorated cast iron transmission line attached to the Rickenbacker Causeway Intracoastal Waterway Bridge between Hobie Island and Virginia Key. This main delivers water to the Port of Miami, Fisher Island, Virginia Key and Key Biscayne.

The installation was done on a 10-degree entry angle starting from the entrance pit on Hobie Island. Lamb's crew used an American Augers DD-440T drill rig with 440,000 lbs of pull back, which uses 30-in. drill pipe and a Tulsa MC-1000 recycler. The crew installed a wash-over pipe to complete the pilot hole due to the softer formation in the shallow waters and back reamer to the size required for the product pipe. This back reaming process was done by push reaming to the limited work space available.

Along with the pipe, ISCO provided technical and fusion assistance on the project. "It was a great installation and team approach between USA and ISCO," according to Bryan Fletcher, ISCO sales manager for Florida. "The project went very smoothly. And what most impressed me was the percentage of pull back force that USA was able use compared to the safe pull strength of HDPE. With HDPE being a very conservative industry, our safe pull is approximately 40 percent of yield, and on 20-in. DR 9, PE 3608 pipe that equates to 165,000 lbs. USA's pull, because of its expertise and planning was less than 50,000 lbs for the entire 4,000-lf pullback. With PE 4710 material coming into the marketplace, the safe pull strength would have been 192,000 lbs. It just goes to show that using an experienced driller that understands his equipment, the job and all facets of the HDD installation, it doesn't necessarily mean having to use the biggest equipment to make this kind of pull. Sure, there are some materials that have higher tensile yields, but at the end of the day the most important factor is using experienced, qualified HDD contractors."

"HDD is the preferred method used in large scale crossings such as rivers or large bodies of water such as this project in Miami," explained Radoszewski. "But the pipe must be able to withstand the force necessary to pull it through the bore and the resulting earth and groundwater forces applied after bore stabilization. As a result, it's important to specify the appropriate strength pipe. To help design engineers and contractors in this critical step, we created an online tool called the

BoreAid Analysis Software Program specifically for HDD applications."

The BoreAid program can be used to make a preliminary evaluation of polyethylene pipe for use in a directional bore and can be found at the PPI website at *www.plasticpipe.org*.

"Miami-Dade continues to accomplish major water improvement goals that are cost-effective and will be long-lasting," stated Radoszewski. "There are always many HDD projects under way here, keeping Luis Aguiar and his crews busy. This run of 4,000 ft is just one extremely long one that they consider 'average.' I want to know what they consider a challenge."

Steve Cooper has been reporting on the water and pipe industries for several decades.

The USA crew used an American Augers DD-440T drill rig with 440,000 lbs of pull back, which uses 30-in. drill pipe and a Tulsa MC-1000 recycler.

CONVERT YOUR DRILL INTO A ROCK DRILL

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