



Capitol Area Development Study

Thermal Utility Master Plan

Austin, Texas

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*Prepared for the Texas Facilities Commission and
Page*

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1 Executive Summary

The Texas Facilities Commission (TFC) Capitol Complex Thermal Utility Master Plan was commissioned to identify the utility infrastructure upgrades necessary to support the projected office building development growth on the Capitol Complex.

The study includes review of existing utility conditions, concepts for the future proposed utility distribution systems, and opinions of probable construction cost. This study incorporates phasing of the future infrastructure upgrades required. The trigger points when additional central plant and distribution assets are required are based on the sequence of building square footage (SF) that is projected to be constructed.

The Central Utility Plant Annex (CUPX) currently being designed and constructed in Phase 1 of the Capitol Complex growth will support the first 1.3 million square feet of new buildings. With the addition of chillers, cooling towers, pumps, and associated piping, the CUPX is sized for expansion to support Capitol Complex Phase 2 (525,000SF) and Phase 3 (530,000SF) growth.

During future Phase A, the construction of two additional chiller plants will be necessary. The proposed South Central Plant (SCP) is necessary to support the planned building growth along 11th Street. The SCP will be relatively small at approximately 2,100 tons of cooling to handle approximately 655,000 square feet of office buildings. The plant will initially be equipped with chilled water production capacity to serve initial new building loads with future provisions to allow build-out with additional chilled water production capacity as the buildings that surround it are developed.

The second chiller plant that would be necessary during Phase A is the proposed North Central Plant (NCP). The proposed NCP is necessary to support the planned building growth along San Jacinto Blvd. The NCP will also be sized to support the lost chilled water production capacity of the existing central plants at Stephen F. Austin building (SFA) and William P. Clements building (WPC) after they are demolished and replaced with new buildings. The NCP will be large at approximately 12,500 tons of cooling to handle 3,759,882 square feet of office buildings. The NCP would connect to the existing chilled water distribution at the CUPX located at 14th Street and San Jacinto Blvd. The plant will initially be equipped with chilled water production capacity to serve initial new building loads with future provisions to allow build-out with additional chilled water production capacity as the buildings that surround it are developed.

The opinion of probable cost including design, construction, and commissioning for each individual phase is summarized in Table 1-1 below.

Table 1-1. Opinion of Probable Costs per Phase

Phase	Opinion of Probable Cost (\$ Mil)
Phase 2: Install additional chilled water production in CUPX, new tunnels and chilled water distribution	\$35.6
Phase 2: Thermal Storage System	\$22
Phase 3: Install additional chilled water production in CUPX, new tunnels and chilled water distribution	\$8.1
Phase A: Install additional chilled water production in CUPX, new tunnels and chilled water distribution	\$10.2
Phase A: Construct North Central Plant (NCP), new tunnels and chilled water distribution	\$63.4
Phase A: Construct South Central Plant (SCP), new tunnels and chilled water distribution	\$22

The implementation of the utility infrastructure upgrades outlined in this report will support the Texas Facilities Commission’s goals to optimize the efficiency, reliability and capacity of the utility infrastructure serving the Capitol Complex, now and with the projected growth from the Facilities Master Plan.

2 Capitol Complex Thermal Utility Master Plan

Primary goals of the Texas Facilities Commission (TFC) Capitol Complex Thermal Utility Master Plan include the following:

1. Assessing existing chilled water, steam, and hot water utility infrastructure pursuant to the identification and conceptual design of solutions to utility distribution deficiencies.
2. Identification of the steps necessary to serve all TFC buildings on the Capitol Complex campus by the chilled water production and distribution system.
3. Provide an overview of the existing electrical distribution system.
4. Provide opinions of probable construction costs.

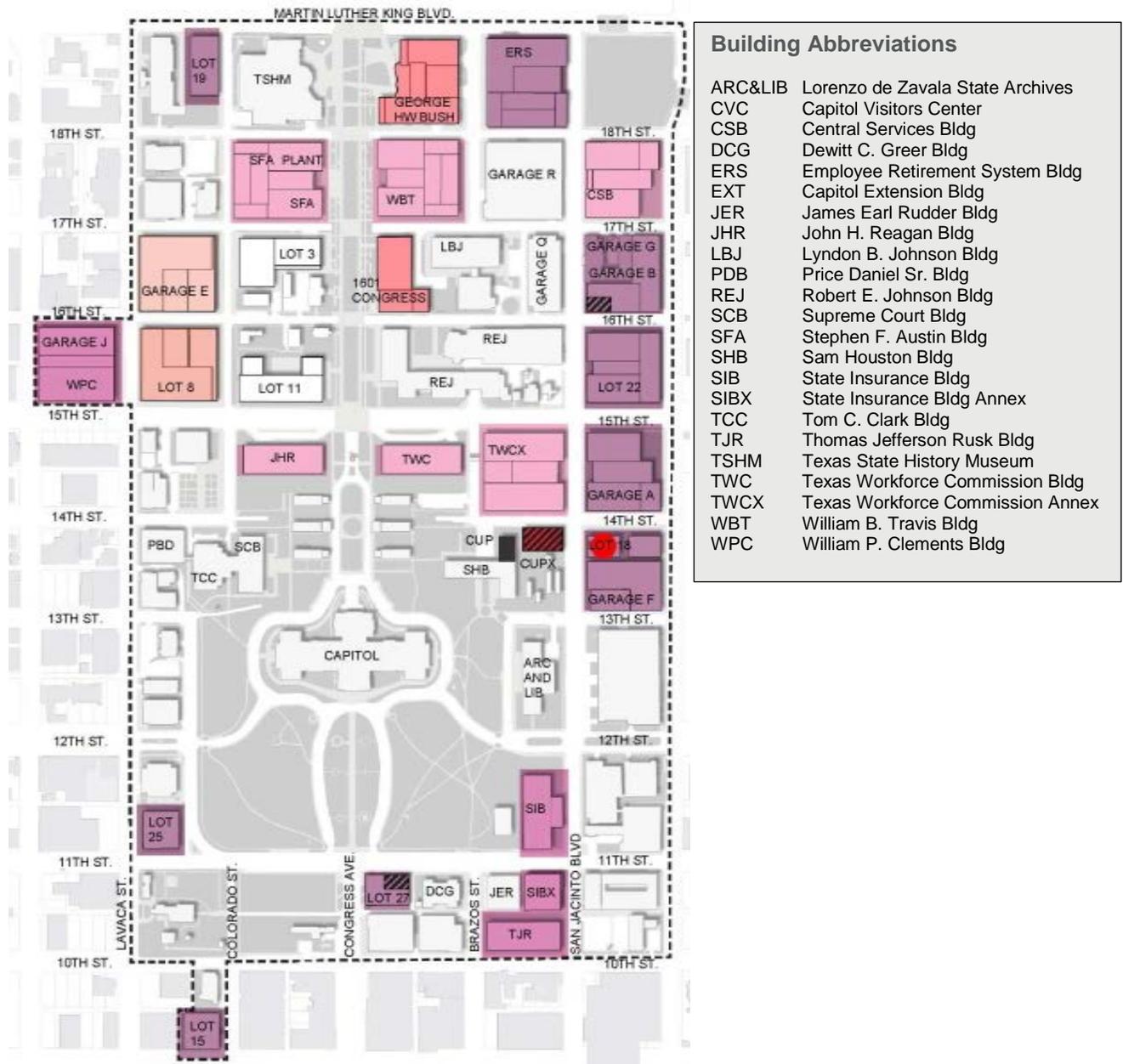
The study of the utility distribution systems began with an assessment of the current utility system's components and abilities, coverage areas, and existing operational issues. The analysis continued by projecting the chilled water loads based on the master plan campus development and conceptually planning the future chilled water production provisions to support the campus growth. The chilled water production provisions include future chilled water utility tunnels and central chilled water production plants.

This report is intended to support TFC's decision making process and procurement activities pursuant to the Capitol Complex future building development and the future Capitol Complex utility distribution system requirement to support growth of the complex.

3 Existing Capitol Complex Infrastructure

A condition assessment of existing Capitol Complex utility infrastructure systems was performed by HDR during the course of the master plan. This assessment detailed operational problems and deficiencies within the campus's utility distribution system that need to be addressed as part of an overall TFC campus utility service improvement initiative. The Capitol Complex campus map is shown in Figure 3-1.

Figure 3-1. Capitol Complex Map



3.1 Chilled Water System

The chilled water system serving the Capitol Complex is used to serve the cooling systems within each building. The chilled water systems located throughout the Capitol Complex consist of buildings with stand-alone internal chilled water plants as well as buildings connected to one of the chilled water plants which serve multiple buildings by chilled water distribution through the use of tunnels and direct buried piping. Central plants are more efficient to operate, provide greater reliability and lower maintenance costs. Most large campuses utilize central plants instead of individual chilled water systems in each building.

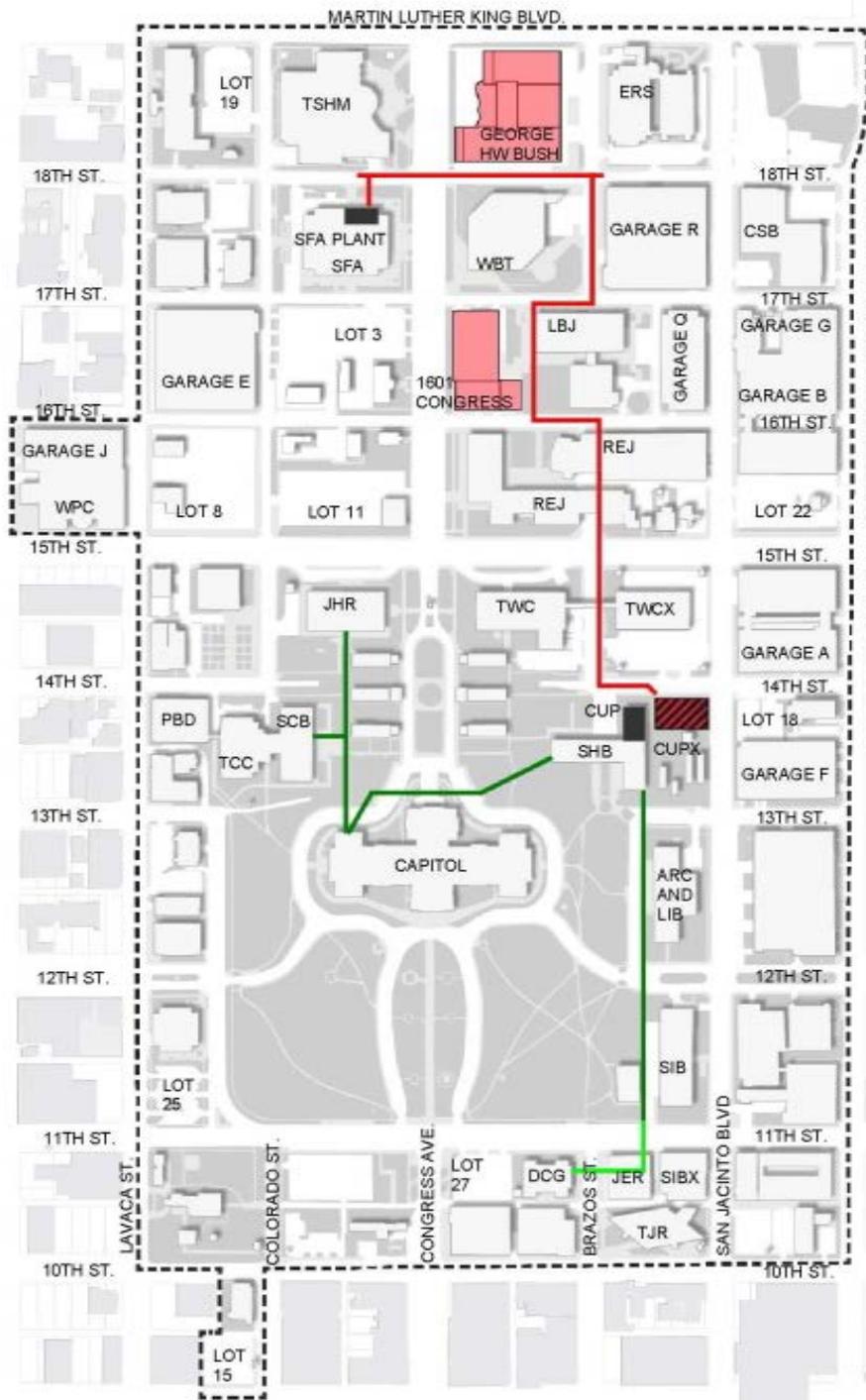
The campus is served by two existing chiller plants. The Central Utility Plant (CUP) is located in the Sam Houston Building (SHB) on the east side of the campus at 14th Street and San Jacinto Boulevard. The CUP consists for chillers that produce chilled water serving multiple buildings on the Capitol campus south of 15th Street through the use of tunnels and direct buried piping. The Stephen F. Austin (SFA) chiller plant is located north of 15th Street at Congress Avenue and 17th Street. SFA serves multiple buildings through the use of direct-buried piping.

There is also the new Central Utility Plant Annex (CUPX) located adjacent to the CUP at the Sam Houston building (SHB) that is being designed and constructed as part of the Phase 1 Capitol Complex project. The CUPX will have combined capacity of 12,500 tons with a firm capacity (available capacity accounting for the loss of the largest redundant chiller) of 10,000 tons.

Robert E. Johnson (REJ) and William P. Clements (WPC) have dedicated chilled water plants that serve only those buildings.

Figure 3-2 shows the overall location of the campus chiller plants and distribution piping.

Figure 3-2. Existing and Phase 1 Capitol Complex Chilled Water System Overview

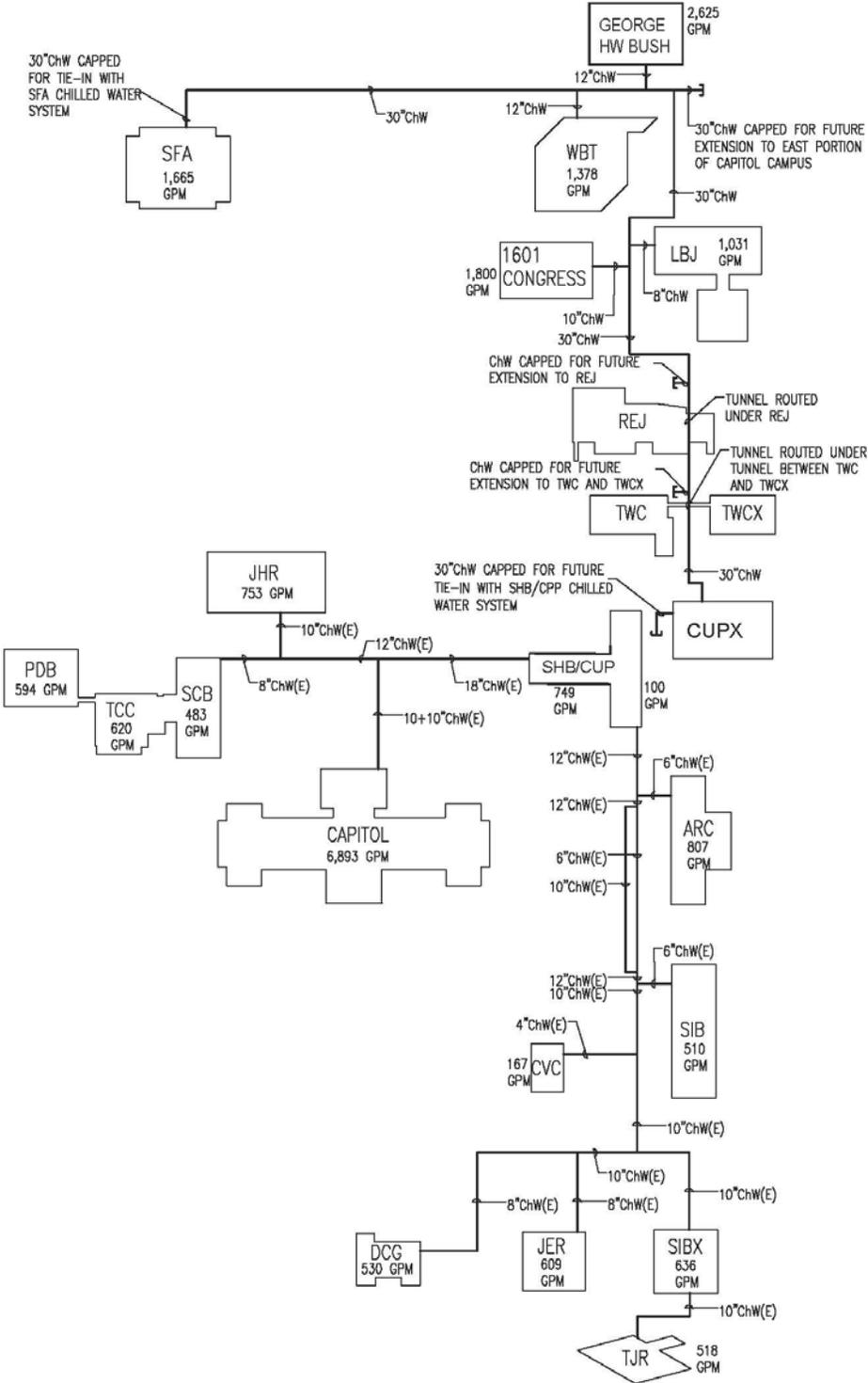


Existing and Phase 1 Chilled Water Distribution

- Existing tunnel served by SHB Central Utility Plant (CUP)
- Existing direct buried pipe served by CUP
- Phase 1 tunnel served by Phase 1 CUPX
- Existing chiller plant
- Future chiller plant

Figure 3-3 details the existing chilled water pipe sizes as well as the building chilled water service sizes.

Figure 3-3. Existing Capitol Complex Chilled Water Pipe Routing/Sizes and Approximate Load per Building



3.1.1 Central Utility Plant (CUP)

The CUP is located on the ground floor of the Sam Houston building (SHB) on the east side of the Capitol Complex. The CUP contains four electric centrifugal water cooled chillers with a combined cooling capacity of 5,470 tons. The firm capacity is 4,000 tons. The chiller ages vary, with installation dates ranging from 1994 to 2013.

Table 3-1. CUP Chiller Inventory

Plant	Manufacturer	Chiller ID	Tonnage	Install Date
CUP	Trane	Chiller 1	1,470	2001
CUP	Trane	Chiller 2	1,470	2010
CUP	Trane	Chiller 3	1,250	2013
CUP	Trane	Chiller 4	1,280	1994

Heat rejection at the CUP is accomplished by two cooling towers located in the east yard/parking area of the CUP. Each cooling tower includes three cells. The total heat rejection capacity of the plant is 6,080 tons with each cooling tower cell having a capacity of 1,013 tons.

Table 3-2. CUP Cooling Tower Inventory

Plant	Manufacturer	Tower ID	Tonnage	Install Date
CUP	Evapco	CT-1	3,040	2002
CUP	Evapco	CT-2	3,040	2002

CUP Chilled Water Service

The CUP provides chilled water to approximately 2,200,000 square feet of facilities, roughly 53 percent of the Capitol Complex, through its existing underground distribution system. The buildings served by the CUP are shown in Table 3-3.

CUP Chilled Water Distribution System:

The CUP currently transmits utilities through two tunnels: the south tunnel and the west tunnel. The south tunnel takes utilities to the Library, Visitors Center, Insurance building, Insurance Annex, and the Greer and Rusk buildings. The west tunnel takes utilities to the Capitol and Capitol Extension as well as the Supreme Court, Reagan, Clark, and Price Daniel buildings.

Table 3-3. CUP Chilled Water Customers

Building Name	Gross Area (ft ²)
Lorenzo De Zavala Archives & Library	111,244
Capitol Visitors Center	19,458
Capitol	360,000
Capitol Extension	667,000
Dewitt C. Greer	84,039
Insurance	86,029
Insurance Annex	59,757
James E. Rudder	77,880
John H. Reagan	161,787
Price Daniel, Sr.	135,926
Supreme Court	69,253
Sam Houston	170,967
Tom C. Clark	101,299
Thomas Jefferson Rusk	99,971

CUP South Tunnel Chilled Water Distribution

The south tunnel is one of the older tunnels still in service on the campus. The south tunnel is constructed of cast concrete and was built in sections between 1958 and 2006. The oldest section of the tunnel, routed from the Sam Houston building to serve the Library, is relatively narrow. It measures 72” x 78” and contains chilled water, steam and condensate piping.

The next section of the south tunnel extends from the Library to the Insurance building, serving the Visitor Center en-route. It carries two sets of chilled water, steam and condensate lines. It was completed in 1960 and is constructed of cast concrete. It contains a vault for a steam expansion loop measuring 352” x 215” approximately half way between the Library and the Visitors Center. The second set of chilled water lines was added to help reduce the overall velocity through the chilled water piping between the Library and the Insurance building.

The chilled water distribution in the south tunnel begins with secondary chilled water pumps (SCHP-11&12) located in the boiler room of CUP at the entrance to the south tunnel. The 12” distribution piping extends to the Library. Chilled water distribution velocity in this section of pipe reaches 12.7 fps, which is faster than the recommended maximum chilled water transmission speed of 10 fps. The Library is served by a 6” chilled water service that is adequately sized for the prescribed flow and building demand. Following the Library service the tunnel chilled water lines are reduced to a 10” diameter and 6” diameter service running in parallel. These parallel services were installed in an attempt to reduce the velocity through the chilled water piping. Chilled

water distribution velocities in these sections of pipe are an acceptable 8.5 fps. The two parallel chilled water pipes converge briefly into a single 12" pipe directly upstream of the Insurance building's 6" chilled water service.

Downstream of the Insurance building service, the chilled water pipe diameter is reduced to 10" diameter. The 10" chilled water line size continues from the Insurance building to serve the Visitors Center and then to the Insurance Annex. Distribution velocities in this section of pipe reach 11.6 fps, which exceeds the maximum recommended velocity. From the Insurance building, the 10" chilled water piping is direct buried across 11th Street to the Insurance Annex and then to the Rusk and Greer buildings.

CUP West Tunnel Chilled Water Distribution

The west tunnel is a new tunnel that replaces the original Capitol utility tunnel, which was sealed and abandoned in place. Most portions of the tunnel are spacious and in good condition. The west tunnel consists of a walkable utility tunnel and utilities routed through basement portions of buildings. It serves steam and chilled water to the Capitol, Capitol Extension, Supreme Court building, JHR building, Price Daniel building and the Clark building.

The west tunnel originates from the Sam Houston building basement as a cast-in-place concrete tunnel. It carries chilled water, steam, and condensate piping, and runs directly west for approximately 150 ft. before intersecting the Capitol Extension. At the Capitol Extension, the utilities are routed through the underground areas within the Extension, until they meet the northeast corner of the Capitol building basement. The thermal utilities continue on across the length of the Capitol basement to the furthest west portion of the basement. A cast concrete utility tunnel conveys the thermal utilities from the Capitol basement to a vault where the tunnel branches. From the vault, thermal services for JHR are split from the thermal services bound for the Supreme Court, Tom Clark and Price Daniel buildings.

The chilled water distribution in the west tunnel off of the CUP starts with secondary chilled water pumps (SCHP-6&7) located in a mechanical room at the very west end of SHB adjacent to the tunnel. The chilled water pipes at the beginning of the tunnel are 18" diameter. The chilled water velocity can reach 11.5 fps, which is faster than the recommended maximum chilled water transmission speed. This can cause premature erosion of the piping. Two adequately sized 10" diameter chilled water services for the Capitol and Capitol Extension tie into the 18" line in the basement of the Capitol. After the second 10" tie-in, the pipe is reduced to 10". Chilled water transmission velocity in this 10" section of pipe can reach 12 fps. The west tunnel chilled water supply terminates at a "Y" where it splits into two adequately sized services; an 8" service serving the JHR building and a 6" service supplying the SCB, TCC, and PBD buildings.

Observed CUP Chilled Water System Deficiencies

The CUP is currently operating beyond its maximum design capacity. The plant contains enough chiller capacity to adequately serve its connected loads; however, portions of the distribution piping system are operating above recommended velocities.

Also, the primary chilled water header and associated lack of valving appear to be inhibiting all of the chilled water being produced from the plant to be sent out to the

various buildings being served by this plant. Currently, it appears the primary chilled water pumps pull chilled water from a common header and then discharge chilled water supply back into the same header in various locations between the chillers. It appears the same header delivers water to each of the chillers without any valving to ensure only chillers operating have chilled water going through the chiller. This configuration will cause chilled water supply temperatures to vary greatly out of the plant and cause issues with pressures within the header. Typically all the primary chilled water pumps discharge into a common manifold prior to the water being supplied to each chiller with valving provided at each chiller to ensure water only flows through chillers operating. Another common operation is a dedicated primary chilled water pump for each chiller with cross connections between pumps to allow any pump to operate with any chiller. This setup would be difficult in this plant considering not all chillers are the same tonnage.

The primary chilled water supply header in the CUP is also not sized appropriately for the total tonnage of the plant. Over the years, new loads have been added to the system, and this has placed greater demand on the main piping in the plant. Plant piping was never up-sized to accommodate these added loads. To help overcome the header deficiencies, an express chilled water pipe from chiller #4 was installed to bypass the chilled water header and distribute water to other parts of the system. This bypass line supplies the south utility tunnel, which serves the Lorenzo De Zavala Archives and Library building, Insurance building, Capitol Visitors Center, Insurance Building Annex, James E. Rudder building, Thomas J. Rusk building and the Dewitt C. Greer building. Since chiller #4 is not connected to the main supply header, its capacity cannot be adequately dispatched to serve loads connected to the west tunnel, which includes the Capitol and Capitol Annex buildings.

Currently, supplemental pumps must be used to help distribute chilled water in the tunnels and help overcome the excessive pressure losses associated with the high flow velocities. The CUP has no remaining capacity to serve new or expanded loads through the south tunnel. Also, under peak cooling conditions, velocities in sections of the tunnel exceed 10 feet per second, which exceeds the maximum recommended velocity. These velocities in the south tunnel could lead to flow-accelerated corrosion problems in the piping, and ultimately result in catastrophic piping system failure. In addition to pipe erosion, high system velocities require more pumping energy to distribute water through the piping system, increasing the overall cost of operation. A piping failure in the south tunnel would mean loss of chilled water service to over 530,000 square feet of state office facilities for an extended period of time, severely impacting building function and state operations. New upsized piping would allow additional future building loads to be served in the south sector of the campus, while reducing operating costs and removing a potential failure liability.

The distribution piping in the west tunnel is also limited to the point where additional or future chilled water loads cannot be reliably served. Eventually, chilled water service to the west portion of the campus, including the Capitol and Capitol Annex could be impacted.

Well maintained centrifugal chillers have a typical service life of approximately 25 years; one of the chillers in the CUP is nearing the end of its service life. Chiller 4 was installed in 1994 and should be slated for replacement in the near future. Continual reinvestments

are required for existing chilled water production assets as units expire or reach the end of their useful service life. A baseline chiller replacement schedule based on service life was established for this study and is presented in a later section of this report.

3.1.2 SFA Chiller Water Plant (SFA)

The SFA plant is the second centralized chilling plant on the Capitol Complex and is located in the basement of the Stephen F. Austin office building. The SFA plant contains three electric centrifugal water-cooled chillers with a combined cooling capacity of 4,410 tons, 2,940 tons firm. The chillers are all 1,470 ton Trane models installed between 2003 and 2009.

Table 3-4. SFA Chiller Inventory

Plant	Manufacturer	Tower ID	Tonnage	Install Date
SFA	Trane	Chiller 1	1,470	2009
SFA	Trane	Chiller 2	1,470	2003
SFA	Trane	Chiller 3	1,470	2009

Heat rejection from the SFA plant chillers is accomplished using two cooling towers located on the roof of the Stephen F. Austin building. Each cooling tower consists of four cells. The total heat rejection capacity of the plant is 5,000 tons, with each cooling tower cell accounting for 625 tons.

Table 3-5. SFA Cooling Tower Inventory

Plant	Manufacturer	Tower ID	Tonnage	Install Date
SFA	Evapco	CT-1	2,500	2004
SFA	Evapco	CT-2	2,500	2004

SFA Chilled Water Service

The SFA Plant supplies chilled water to three buildings totaling approximately 1,200,000 square feet, 28 percent of the Capitol Complex, through its existing underground distribution system. The buildings served by the SFA plant include:

Table 3-6. SFA Chilled Water Customers

Building Name	Gross Area (ft ²)
Lyndon B. Johnson	299,512
Stephen F. Austin	418,103
William B. Travis	466,440

SFA Chilled Water Distribution System

Chilled water distribution from the SFA plant to WBT is a 12" direct bury chilled water line exiting SFA in the northeast corner of the plant. Chilled water distribution from the SFA plant to LBJ is an 8" chilled water line exiting the SFA in the southwest corner into a tunnel which goes south underneath 17th Street and then leaves the tunnel on the south side of 17th Street and is direct buried heading east to LBJ.

As part of the CUPX and tunnel project currently being designed and constructed, SFA will be tied into the new 30" distribution loop in the northeast corner of the plant; WBT will be connected to the distribution loop in 18th Street just north of the existing chilled water pipe entry into WBT; and LBJ will be connected to the distribution loop on the northwest side of LBJ where the loop passes by the building.

Observed SFA Chilled Water System Deficiencies

The SFA plant is currently supplying chilled water in excess of 125 PSIG. Reports from plant operators indicate that the pressures must be maintained to help ensure that chiller #3 can be hydraulically loaded (due to its proximity to the chilled water header decouple line). The high supply pressures are necessary to supply chilled water to serve air handling equipment within the LBJ. It is also reported that even at these high pressures, chiller #3 cannot be loaded beyond 35 percent of its rated capacity.

The previous utility master plan mentioned that the chilled water lines from SFA to LBJ were undersized and the flow was exceeding the capacity of the pipe. Since the last report, TFC performed testing on the chilled water lines and the flow readings were within the acceptable range for 8" pipe.

As part of the CUPX and tunnel project, the SFA chilled water plant will be tied directly into the new 30" distribution loop in the northeast corner of the plant. This tie-in will require revision of the existing piping and pumps to decouple the existing service to the SFA building for the existing plant.

3.1.3 Central Utility Plant Annex (CUPX) Project

The Central Utility Plant (CUP) currently under design and construction as part of Phase 1 will be located adjacent to the CUP plant. The CUPX contains five electric centrifugal water-cooled chillers with a combined cooling capacity of 12,500 tons and 10,000 tons firm. The chillers are all 2,500 ton with two chillers planned for installed in 2019.

Table 3-7. CUPX Chiller Inventory

Plant	Manufacturer	Tower ID	Tonnage	Install Date
CUPX	TBD	Chiller 1	2,500	2019
CUPX	TBD	Chiller 2	2,500	2019
CUPX	TBD	Chiller 3	2,500	Note 1.
CUPX	TBD	Chiller 4	2,500	Note 2.
CUPX	TBD	Chiller 5	2,500	Note 3.

Notes:

1. Install during Phase 2 or sooner depending on number/size of existing/new buildings being connected to the CUPX main loop.
2. Install during Phase 3 or sooner depending on number/size of existing/new buildings being connected to the CUPX main loop.
3. Install during Phase A or sooner depending on number/size of existing/new buildings being connected to the CUPX main loop.

Heat rejection from the CUPX plant chillers is accomplished using five cooling towers located on the roof of the CUPX. Each cooling tower consists of four cells. The total heat rejection capacity of the plant is 12,500 tons, with each cooling tower cell accounting for 2,500 tons.

Table 3-8. CUPX Cooling Tower Inventory

Plant	Manufacturer	Tower ID	Tonnage	Install Date
CUPX	TBD	CT-1	2,500	2019
CUPX	TBD	CT-2	2,500	2019
CUPX	TBD	CT-3	2,500	Note 1.
CUPX	TBD	CT-4	2,500	Note 2.
CUPX	TBD	CT-5	2,500	Note 3.

Notes:

1. Install during Phase 2 or sooner depending on number/size of existing/new buildings being connected to the CUPX main loop.
2. Install during Phase 3 or sooner depending on number/size of existing/new buildings being connected to the CUPX main loop.
3. Install during Phase A or sooner depending on number/size of existing/new buildings being connected to the CUPX main loop.

CUPX Chilled Water Service

The CUPX supplies chilled water to eleven buildings totaling approximately 3,237,031 square feet. The buildings served by the CUPX plant include:

Table 3-9. Anticipated CUPX Chilled Water Customers

Building Name	Gross Area (ft ²)
1601 Congress	420,000
George HW Bush	605,000
Employment Retirement Services (ERS)	375,641
Texas State History Museum (TSHM)	185,000
Robert E. Johnson (REJ)	307,090
15 th Street	165,000
Lavaca Street	360,000
Colorado Street	360,000
17 th Street	170,000
Lot 19	82,800
Texas Workforce Commission	206,500

CUPX Chilled Water Distribution System

Chilled water distribution from the CUPX will be 30” pipes in a walkable tunnel from the CUPX at 14th Street northerly to 18th Street. Refer to the tunnel routing exhibit for the proposed route (Figure 3-2).

As part of the CUPX and tunnel project, SFA will be tied into the new 30” distribution loop in the northeast corner of the plant; WBT will be connected to the distribution loop in 18th Street just north of the existing chilled water pipe entry into WBT; LBJ will be connected to the distribution loop on the northwest side of LBJ where the loop passes by the building; 1601 Congress will be connected to the distribution loop between 16th and 17th streets; and George HW Bush will be connected to the distribution loop in 18th street.

3.1.4 REJ and WPC Cooling Plants

REJ and WPC Cooling Equipment

The REJ plant contains three electric centrifugal water-cooled chillers and one small pony chiller with a combined capacity of 1,655 tons, and 1,105 tons firm.

The WPC plant contains three electric centrifugal water-cooled chillers with a combined capacity of 1,950 tons and 1,150 tons firm.

Table 3-10. WPC and REJ Chiller Inventory

Plant	Manufacturer	Chiller ID	Tonnage	Install Date
REJ	Trane	Chiller 1	550	1998
REJ	Trane	Chiller 2	550	1998
REJ	Trane	Chiller 3	485	1998
REJ	Trane	Chiller 4	70	1998
WPC	Trane	Chiller 1	800	1985
WPC	Trane	Chiller 2	800	1985
WPC	York	Chiller 3	350	1985

Heat rejection at the REJ plant is accomplished using a two-cell Marley Model F400 fiberglass cooling tower located on the roof of the building. Heat rejection at the WPC plant is accomplished by three two cell Evapco Model REP 217-611 stainless steel cooling towers located in the building’s penthouse. The cooling towers exhaust upward thru screened openings in the barrel vaulted penthouse roof.

Observed REJ and WPC Chilled Water System Deficiencies

All the chillers in the WPC building have exceeded their expected useful service life and should be replaced soon. Both plants are isolated from the SHB and SFA centralized distribution systems, which limits their ability to share redundant equipment or maximize system operational efficiencies.

Regarding the REJ plant, the Phase 1 CUP and tunnel project chilled water distribution piping will be routed adjacent to the REJ plant with the intention that in the future REJ would be connected to the distribution loop and the plant be retired.

Regarding the WPC plant, it will likely be many years before the chilled water distribution loop is extended to the point where it is close enough to provide service to WPC. In the meantime, a chiller replacement project should be considered for WPC.

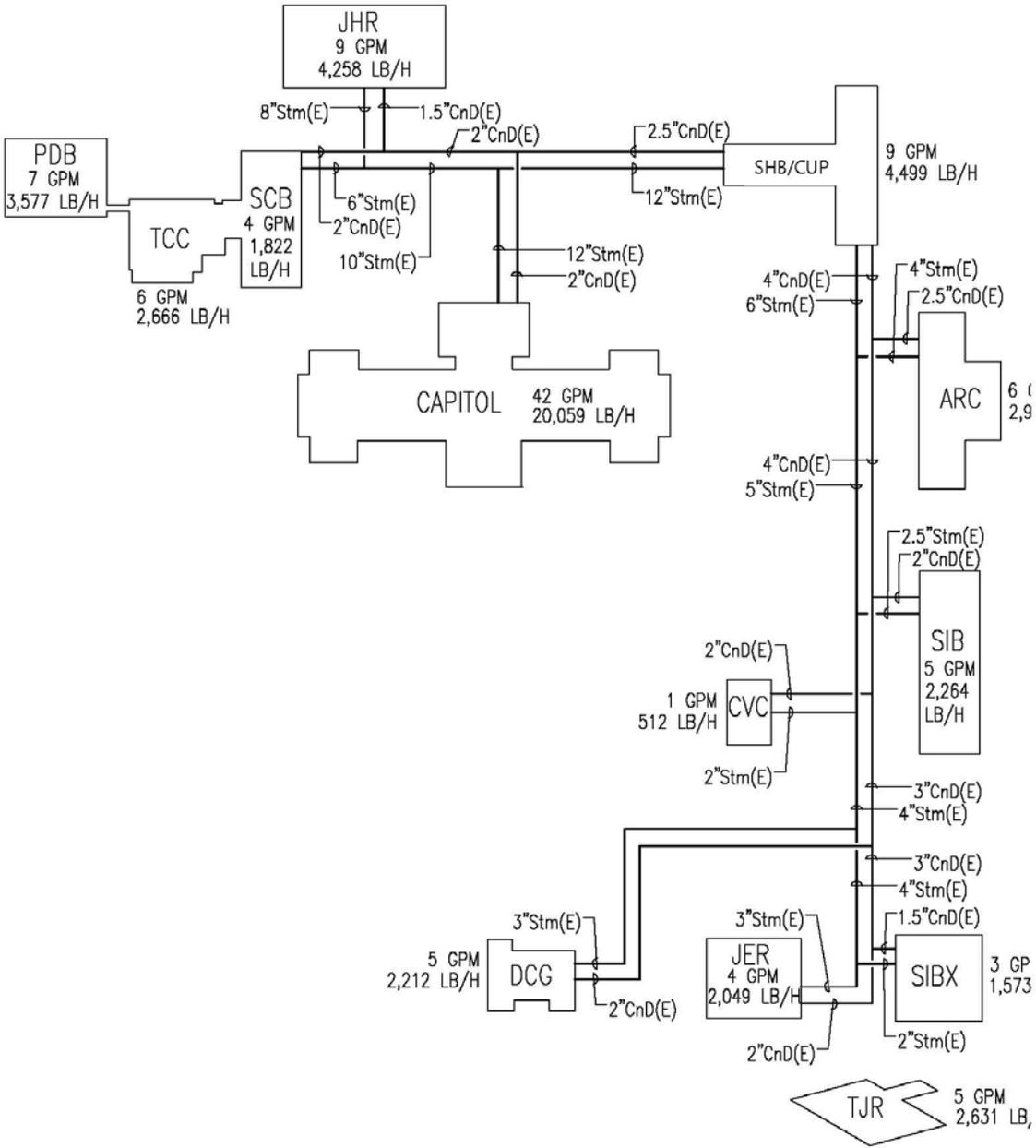
3.2 Heating System

The Capitol Complex currently uses a mixture of medium pressure steam and in-building dedicated hot water boilers to provide comfort heating service. The CUP serves multiple buildings with medium pressure steam (100 PSIG) through the south and west tunnels as described below as well as in the chilled water analysis above. All other buildings on the Capitol Complex are served by dedicated hot water boilers installed in the buildings they serve.

Figure 3-4 details the existing steam and condensate pipe routing/sizes as well as the approximate load for each building.



Figure 3-4. Capitol Complex Steam and Condensate Pipe Routing/Sizes and Approximate Load per Building



3.2.1 CUP Heating Plant

Steam is generated at the CUP by three fire-tube boilers, located in the boiler room in the southern portion of the SHB basement area. All boilers were installed in 1991.

Table 3-11. CUP Boiler Inventory

Plant	Manufacturer	Boiler ID	Capacity (MBH)	Install Date
CUP	Kewaunee	B-1	8,364	1991
CUP	Kewaunee	B-1	16,738	1991
CUP	Kewaunee	B-1	16,738	1991

CUP Heating Plant

The only plant with a heating distribution system on the Capitol Complex is the CUP steam distribution system. The CUP serves approximately 2,100,000 square feet, or 50 percent of the Capitol Complex with medium pressure steam generated by its lineup of steam boilers. The CUP provides steam to the following:

Table 3-12. CUP Steam Customers

Building Name	Gross Area (ft ²)
Lorenzo De Zavala Archives & Library	111,244
Capitol Visitors Center	19,458
Capitol	360,000
Capitol Extension	667,000
Dewitt C. Greer	84,039
Insurance	86,029
Insurance Annex	59,757
James E. Rudder	77,880
John H. Reagan	161,787
Price Daniel, Sr.	135,926
Supreme Court	69,253
Sam Houston	170,967
Tom C. Clark	101,299

To conserve energy, the steam service to all buildings south of 11th Street and the Sam Houston building is turned off during the summer months, from June to September. This is not recommended as it significantly reduces the heating, ventilation, and air conditioning (HVAC) systems ability to maintain suitable relative humidity levels within these buildings.

CUP Heating Distribution

Two tunnels house piping used to distribute steam from the CUP to the connected buildings. The south tunnel extends south from the CUP along the west side of the Library and Archives and runs to the Insurance building, terminating in the Insurance building basement. A series of small (non-walkable) tunnels extend south of the Insurance building reaching the Insurance Annex, Rusk and Greer buildings. The Rusk building now utilizes a dedicated heating water plant.

A west tunnel extends from the CUP, west towards the Capitol and Capitol Extension. The tunnel intersects with and continues from the basement area of the Capitol to serve the Supreme Court building, Clark building, and Daniel building before terminating in the basement of the Reagan building. Steam is continuously supplied to the buildings connected to this tunnel with the exception of Reagan building, which discontinues steam service during summer months. This is not recommended as it significantly reduces the heating, ventilation, and air conditioning (HVAC) systems ability to maintain suitable relative humidity levels within the building.

Observed CUP Heating System Deficiencies

Currently, the heating system in the CUP is adequate for its connected loads. The age and construction of the steam distribution system means the likelihood of the presence of asbestos-containing materials is high, though abatement activities in 2006 removed asbestos south of 11th Street, but it is unknown if this included removal of any potential asbestos associated with the steam distribution system.

3.2.2 SFA Heating Plant

Heating hot water is generated by a pair of 8,369 MBH fire tube boilers, located in the SFA central plant.

Table 3-13. SFA Boiler Inventory

Plant	Manufacturer	Boiler ID	Capacity (MBH)	Install Date
SFA	Cleaver Brooks	B-1	8,369 MBH	1973
SFA	Cleaver Brooks	B-2	8,369 MBH	1973

The SFA plant previously supplied heating hot water to SFA and WBT buildings but the lines to WBT have been abandoned and stand-alone hot water boilers have been installed in WBT.

3.3 Electrical Distribution

Austin Energy (AE) is the source of electrical service to State of Texas owned buildings around the Capitol Complex. The area of the Capitol Complex is in Austin Energy's network area where the majority of electrical distribution is underground and building transformers are located in vaults.

3.3.1 Existing Electrical Infrastructure

The SHB has a 15kV primary switchgear that is fed from two primary 12.47kV (500MCM) circuits from AE. There is also a third back-up circuit from AE with an automatic transfer switch that will back-up one of the primary circuits in case of a failure or outage. The State owns the primary (12.47kV) distribution on the Capitol Complex serving SHB, Capitol, EXT, ARC & LIB. The distribution system is underground and the buildings have electrical vaults with switches and 12.47kV-480/277V transformers.

The state also owns the primary (12.47kV) distribution serving the Stephen F. Austin (SFA) building. This is primarily due to the central plant in the basement of the building.

The remainder of the Capitol complex buildings are served directly from AE as 480/277V secondary electric services. For each of these buildings, there are electrical vaults that house AE owned and maintained primary service equipment. This primary service equipment consists of 15 kV switches and step down transformers. The vaults are not accessible to State employees and their configuration could not be verified.

In most cases, the AE vaults have dual feeds from separate substations. This configuration is used to provide a level of redundancy to the buildings. In the event of a power outage from one substation, power can be transferred to the alternate supply by AE. Because the AE vaults were not accessible, it is unknown if the power transfer is automatic or manual.

The existing configuration of dual feeds require that both substations feeding each building have capacity on reserve to allow for a smooth transition if and when power is needed from either side. This reserved capacity usually has a premium cost and it is transferred to the end user. The cost of the reserved capacity for each feed was not made available and it is not evaluated herein.

An inventory of the electrical services is shown in Table 3-14. The current buildings being designed and constructed have been included in the list.

Table 3-14. Capitol Complex Electrical Service

Building	ABR	Power Source	Voltage	Design Capacity	Redundancy	Peak Demand KVA
Stephen F. Austin	SFA	AE	12470	2-2000 KVA 2-1500 KVA	Yes	3312
William B. Travis	WBT	AE	480/277	1-3750 KVA 1-2000 KVA	No	1650

Table 3-14. Capitol Complex Electrical Service

Building	ABR	Power Source	Voltage	Design Capacity	Redundancy	Peak Demand KVA
Lyndon B. Johnson	LBJ	AE	480/277	2-3750 KVA	No*	1280
Sam Houston/Central Utility Plant	SHB/CUP	AE	12470	2-2500 KVA 2-3750 KVA	Yes	5088
Archives and Library	ARC	SHB	480/277	1-2000 KVA	No	Not Known
Capitol	-	SHB	480/277	2-1500/2000 KVA	Yes	Not Known
Capitol Extension	EXP	SHB	480/277	2-2000/3000 KVA	Not Known	Not Known
William P. Clemens	WPC	AE	480/277	2-3750 KVA	No*	2580 87
Robert E. Johnson	REJ	AE	480/277	2-3780 KVA	Yes	1300
Price Daniel	PDB	AE	480/277	1-3750 KVA	No	790
Supreme Court	SCB	PDB	480/277	1200A	No	Not Known
Tom C. Clark	TCC	PDB	480/277	1600A	No	Not Known
John H. Reagan	JHR	AE	480/277	2-2500 KVA	Yes	300
Capitol Visitor's Center	CVC	AE	480/277	300 KVA	No	67
Insurance	SIB	AE	480/277	1-2000 KVA	No	240
James E. Rudder	JER	AE	480/277	1-1500 KVA	No	360
Insurance Annex	SIBX	EA	480/277	1-1000 KVA	No	152
Thomas J. Rusk	TJR	AE	480/277	1-1500 KVA	No	400
Dewitt C. Greer	DCG	AE	Not Known	Not Known	Not Known	Not Known
1601 Congress	-	AE	480/277	TBD	Yes	TBD
George HW Bush	-	AE	480/277	TBD	Yes	TBD
Underground Parking Garage	TXM	AE	480/277	TBD	Yes	TBD
Central Utility Plant Annex	CUPX	SHB	12470	2-10 MVA	Yes	TBD

* Building has dual feeds from AE but the buses are not tied.

In a few cases, some of the buildings have low voltage distribution equipment which subsequently provides 480/277 volts, 3-phase power to other buildings in the vicinity. Price Daniel feeds the Supreme Court building and the Clark building. In the case of the Capitol Visitors Center, the transformer is located in the electrical room of the Insurance building.

The peak demand shown in Table 3-14 was provided by the State from their utility data base. It should be noted that this peak value does not represent the peak coincident

power that the equipment is exposed to when the largest amount of current flows into the equipment for an instant of time. The provided data is typical 15 minute interval peak average demand kVA. The peak demand data indicates that the switchgear is not burdened and that there is room for growth. However, when the CUPX is fully built-out, it is anticipated that there will not be any more capacity for future growth on the SHB primary distribution.

3.3.2 Conversion to Ownership of all Primary Electric Distribution

Previous electrical planning concepts addressed expanding the primary electrical distribution system owned and operated by the State. The concept was to construct new primary distribution including concrete duct banks and conductors to all the Capitol Complex buildings; remove the AE owned equipment (switchgear and transformers) in each building's electric vault and replace with new equipment (or arrange a purchase from AE); construct a new 15kV switchgear yard; and construct an electric power generating facility; and purchase AE electricity at a primary rate as one of the power sources with the State owned electric power generating facility being the second source.

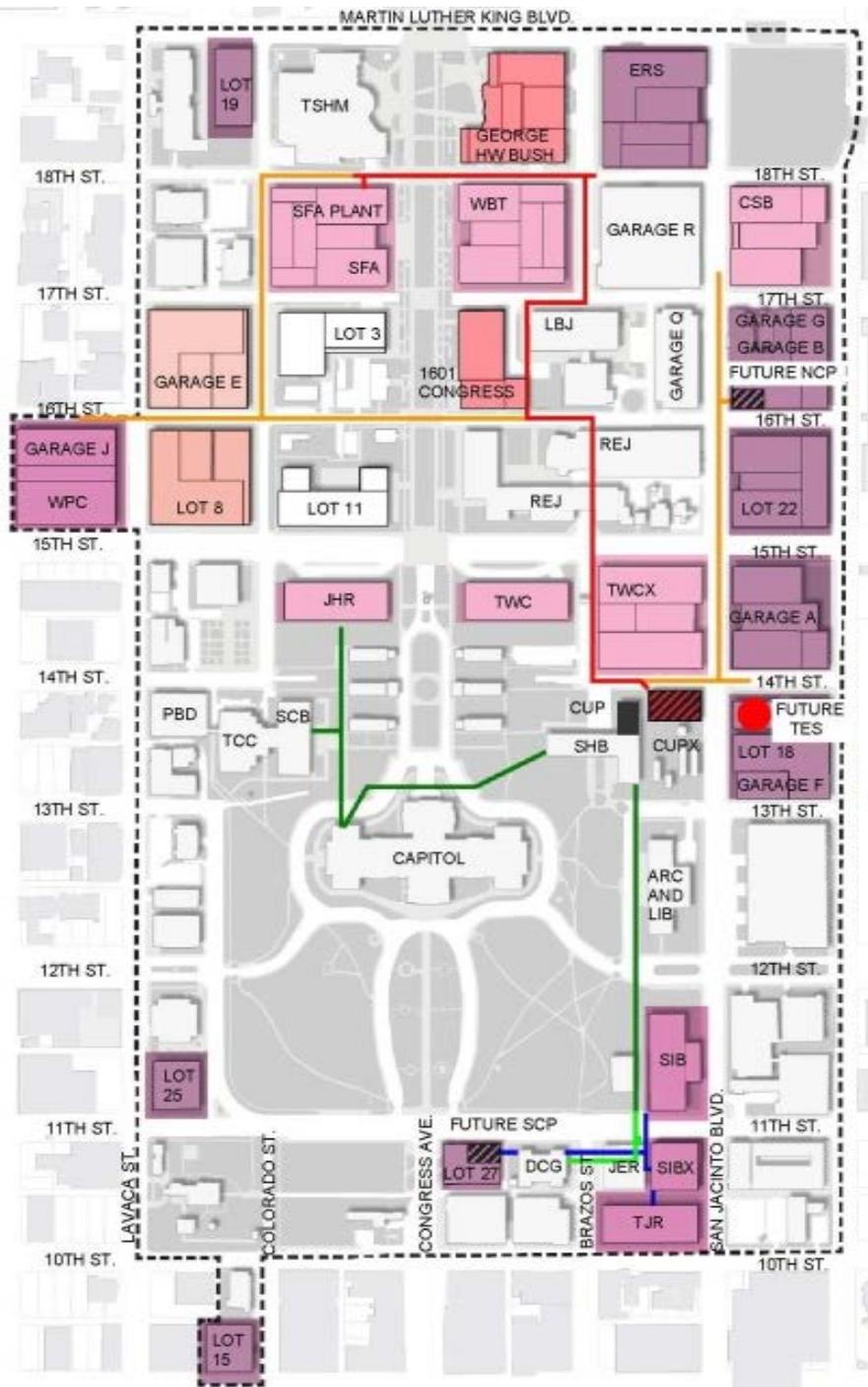
Based on financial resource allocation to implement this concept, no identification of land, taking into consideration the highest and best use of land on the Capitol Complex, and taking into consideration the technical expertise to properly operate a power generation facility, it seems that more office buildings for the governance and functions of the State are a higher and best use than building and operating an electric utility.

4 Future Expansion in Support of the Master Plan Growth

4.1 Utility Distribution

The majority of master planned growth will be served from the north tunnel currently being designed and constructed. The present tunnel configuration is routed on the east side of Congress Ave. except for the portion of the tunnel crossing Congress Ave. at 18th Street to make the distribution loop to the SFA plant. As illustrated in Figure 4.1, the future development of the tunnel will extend from 18th Street to Colorado Street, then south on Colorado Street to 16th Street, then east on 16th Street until the tunnel connects to the underground parking garage where the piping will connect to the existing chilled water piping on the east side of 16th street.

Figure 4-1. Utility Tunnels



Full Build-out Chilled Water Distribution

- Existing tunnel served by SHB Central Utility Plant (CUP)
- Existing direct buried pipe served by CUP
- Phase 1 tunnel served by Phase 1 CUPX
- Future tunnel served by SFA plant, CUPX, and NCP
- Future tunnel served by CUP and SCP
- Existing chiller plant
- Future chiller plant
- Future thermal energy storage (TES) tank

4.2 Thermal Storage

The review of thermal storage was done in past thermal utility master plans and should be reviewed for implementation in the near future. Preliminary implementation would include the installation of a large cylindrical thermal storage tank located on Lot 18 across San Jacinto Street from the CUPX. The tank will be connected to the secondary side of the chilled water system via a utility tunnel that will cross San Jacinto Street just south of 14th Street.

To receive the greatest financial benefit from the consolidation of the utility infrastructure, a Thermal Energy Storage (TES) system should be utilized. A TES system is utilized to store thermal energy created at a convenient time for use at another time which allows a facility to purchase the electricity necessary for chilled water production at times when electricity prices are at their lowest.

The TES system will need to be able to supply chilled water to the Capitol Complex for four (4) consecutive hours during the highest demand interval. The use of this system will be rewarded with a peak demand deferral of approximately 6 MW and the availability of the lower Austin Energy Thermal Storage Time-of-Use rate.

The TES system would be comprised of a large approximately 100' X 110' tank with low velocity water diffusers in the top and bottom. The tank will be attached to the secondary side of the chilled water loop. Utilizing control valves the tank will act as a chilled water load and plant during different portions of the day. During off-peak electrical intervals, the tank will act as a load and be charged with chilled water from the chilling plant. During on-peak electrical intervals, the chillers will be de-energized and the chilled water demands of the facility will be met by the TES system.

Thermal energy storage allows the State to reap significant financial benefit by shifting electrical load away from the peak hours of a day to off-peak hours. Although TES is implementable on a smaller scale (such as on the building or satellite plant level), it would require individual tanks at each building or plant. By consolidating all of the chilling equipment and distribution, the implementation of TES is simplified and costs are reduced.

4.3 Capitol Complex Master Plan Growth

The table below (Table 4.1) indicates how the CUPX and future central plants support the chilled water needs of the planned future buildings. The table justifies the requirements for the future additional central plants described in sections 4.4 and 4.5 of the report. Based on the sequence of building construction and quantity of square feet built, the table also indicates when additional chiller capacity is needed in each plant.

Table 4-1. Capitol Complex Growth and Proposed Future Central Plant Additions

Phase	Site	New Building SF	CHW Tons at 350 SF/Ton	CUP Installed Chiller Tonnage (Plus N+1)	CUPX Tonnage Usage	Future South CUP Installed Chiller Tonnage (Plus N+1)	Future South CUP Tonnage Usage	Future North CUP Installed Chiller Tonnage (Plus N+1)	Future North CUP Tonnage Usage	Comments
1	1601 Congress	420,000	1,200	2,500	1,200					
	George HW Bush	605,000	1,729	-	2,929					429 Tons made -up by SFA plant
2	15th Street	165,000	471	5,000	3,400					
	Lavaca	360,000	1,029	-	4,429					
3	Colorado	360,000	1,029	7,500	5,457					
	17th Street	170,000	486	-	5,943					
A	Lot 19	82,800	237	-	6,179					
	ERS	375,641	1,073	-	7,253					
	REJ	307,090	877	10,000	8,130					
	TSHM	185,000	529	-	8,659					
	Lot 15	122,885	351	X	X					Not included because its off campus & developer RFP.
	Lot 27	155,352	444			700	444			Also connect to DCG/JER/SIBX/TJR
	Lot 25	57,342	164			X	X			Distance from SCP and issues with installation on complex is cost prohibitive to provide chilled water.
	Lot 22/Half B	316,706	905					2,500	905	
	Garage G/Half B	236,148	675					-	1,580	
	Garage A	483,298	1,381					5,000	2,960	
	Garage F/CSX/Lot 18	125,446	358					-	3,319	
B	SIBX	82,985	237			1,400	681			
	TJR/Garage K	131,065	374			-	1,056			
	SIB	122,908	351			2,100	1,407			
	WPC/Garage J	685,468	1,958					7,500	5,277	
C	CSB	417,391	1,193					-	6,470	
	SFA	558,711	1,596					10,000	8,066	
	WBT	477,378	1,364					-	9,430	
	TWCX	459,336	1,312					12,500	10,743	
	TWC	206,500	590		9,249					
	JHR	216,000	617	X	X					Served by SHB. SHB is helped by the new SCP which takes load off SHB.
Other	JER	77880	223			-	1,629			
	DCG	84309	241			-	1,870			
				5-2500 ton Chillers 10,000 ton Firm Capacity 3,237,031 SF		4-700 ton Chillers 2,100 ton Firm Capacity 654,499 SF		6-2,500 ton Chillers 12,500 ton Firm Capacity 3,759,882 SF		

4.4 Future North Central Plant

A future North Central Plant (NCP) will be required during future Phase A development. The proposed location for the plant is to integrate it into the future Lot 22 building on San Jacinto Blvd. and 16th Street. The plant will initially be serving building loads along the San Jacinto Blvd. development, however it is sized to provide the chilled water production tonnage that will be lost when the existing SFA plant is demolished and redeveloped during future Phase C. The NCP would contain six electric centrifugal water-cooled chillers with a combined cooling capacity of 15,000 tons and 12,500 tons firm. Each chiller is 2,500 tons.

Table 4-2. Future NCP Chiller Inventory

Plant	Manufacturer	Tower ID	Tonnage	Install Date
NCP	TBD	Chiller 1	2,500	TBD
NCP	TBD	Chiller 2	2,500	TBD
NCP	TBD	Chiller 3	2,500	TBD
NCP	TBD	Chiller 4	2,500	TBD
NCP	TBD	Chiller 5	2,500	TBD
NCP	TBD	Chiller 6	2,500	TBD

Heat rejection from the NCP plant chillers is accomplished using six cooling towers located on the roof of the building. Each cooling tower consists of four cells. The total heat rejection capacity of the plant is 15,000 tons, with each cooling tower cell accounting for 2,500 tons.

Table 4-3. Future NCP Cooling Tower Inventory

Plant	Manufacturer	Tower ID	Tonnage	Install Date
NCP	TBD	CT-1	2,500	TBD
NCP	TBD	CT-2	2,500	TBD
NCP	TBD	CT-3	2,500	TBD
NCP	TBD	CT-4	2,500	TBD
NCP	TBD	CT-5	2,500	TBD
NCP	TBD	CT-6	2,500	TBD

NCP Chilled Water Service

The NCP plant would supply chilled water to seven buildings totaling approximately 3,759,882 square feet. The buildings served by the NCP plant include:

Table 4-4. Anticipated Future NCP Chilled Water Customers

Building Name	Gross Area (ft ²)
Lot 22/Half Garage B	316,706
Garage G/Half Garage B	236,148
Garage A	483,298
Garage F/CSX/Lot 18	125,446
WPC/Garage J	685,468
Central Services (CSB)	417,391
Stephan F Austin (SFA)	558,711
William B Travis (WBT)	477,378
Texas Workforce Commission Annex (TWCX)	459,336

North Central Plant Chilled Water Distribution System

Chilled water distribution from the NCP will be 30" pipes in a walkable tunnel using existing tunnel distribution as well as new tunnels in San Jacinto Blvd. Refer to the Figure 4-1 tunnel routing exhibit for the proposed route.

Conceptual Plant Configuration

The NCP will be integrated into the building development at Garage B located at San Jacinto Boulevard and 16th Street. The chillers and associated pumps would be located within the basement or ground floor and cooling towers located on the roof.

4.5 Future South Central Plant

A future South Central Plant (SCP) will be required during future Phase A development. The proposed location for the plant is to integrate it into the future Lot 27 building on 11th Street and Congress Avenue. The SCP would contain four electric centrifugal water-cooled chillers with a combined cooling capacity of 2,800 tons and 2,100 tons firm. Each chiller is 700 tons.

Table 4-5. Future SCP Chiller Inventory

Plant	Manufacturer	Tower ID	Tonnage	Install Date
NCP	TBD	Chiller 1	700	TBD
NCP	TBD	Chiller 2	700	TBD
NCP	TBD	Chiller 3	700	TBD
NCP	TBD	Chiller 4	700	TBD

Heat rejection from the SCP plant chillers is accomplished using four cooling towers located on the roof of the building. Each cooling tower consists of two cells. The total heat rejection capacity of the plant is 2,800 tons, with each cooling tower cell accounting for 700 tons.

Table 4-6. Future SCP Cooling Tower Inventory

Plant	Manufacturer	Tower ID	Tonnage	Install Date
NCP	TBD	CT-1	700	TBD
NCP	TBD	CT-2	700	TBD
NCP	TBD	CT-3	700	TBD
NCP	TBD	CT-4	700	TBD

SCP Chilled Water Service

The SCP plant would supply chilled water to seven buildings totaling approximately 655,000 square feet. The buildings served by the SCP plant include:

Table 4-7. Anticipated Future SCP Chilled Water Customers

Building Name	Gross Area (ft ²)
Lot 27	155,352
State Insurance Annex (SIBX)	82,985
Thomas J Rusk (TJR)	131,065
State Insurance (SIB)	122,908
James E Rudder (JER)	77,880
Dewitt C Greer (DCG)	84,309

South Central Plant Chilled Water Distribution System

Chilled water distribution from the SCP will be 18" pipes in a walkable tunnel along 11th Street, through basements of DCG, JER, SIBX, TJR, and connecting to the existing south tunnel from SHB at SIB. Refer to the Figure 4-1 tunnel routing exhibit for the proposed route.

Conceptual Plant Configuration

The SCP will be integrated into the building development at Lot 27 located at Congress Avenue and 11th Street. The chillers and associated pumps would be located within the basement or ground floor and cooling towers located on the roof.

4.6 Utilities Distribution System Improvement Justification

The measures and recommendations made in this report are necessary and prudent. The Capitol facility is a unique facility in that it is expected to serve as the seat of the State government indefinitely. To ensure that the facility is capable of meeting this expectation continuously, the facility and its supporting infrastructure must be maintained in a method that supports complete continuity of service.

5 Opinions of Probable Cost

This section provides an overview of the probable costs for each of the following phases or work. Each of the phases is priced as though it were a stand-alone project and no economy of scale was included for executing or contracting the phases simultaneously. All of the prices are in current (2017) dollars and have not been inflated to show the effects of project duration or other potential delays.

The total cost of the six phases of the project is expected to reach \$161,081,246.

Cost by Phase Summary

Below are the budgetary probable costs of each phase. More detailed budgetary probable cost breakdowns can be found in the appendix.

5.1 Phase 2: Install Additional Chilled Water Production in CUPX, New Tunnels and Thermal Utilities Piping

\$35.6 Million total cost:

- \$5.5 Million – Chiller Addition
- \$30.1 Million – Tunnels and Distribution

5.2 Phase 2: Install New Thermal Energy Storage Tank

\$22 Million total cost:

- \$18.4 Million – Thermal Energy Storage Tank
- \$3.6 Million – Tunnel and Distribution

5.3 Phase 3: Install Additional Chilled Water Production in CUPX, New Tunnels and Thermal Utilities Piping

\$8.1 Million total cost:

- \$5.5 Million – Chiller Addition
- \$2.6 Million – Tunnels and Distribution

5.4 Phase A: Install Additional Chilled Water Production in CUPX, New Tunnels and Thermal Utilities Piping

\$10.2 Million total cost

- \$5.5 Million – Chiller Addition
- \$4.7 Million – Tunnels and Distribution

5.5 Phase A: Construct North Central Plant, New Tunnels and Chilled Water Distribution

\$63.4 Million total cost:

- \$39.3 Million – North Central Plant
- \$24.1 Million – Tunnels and Distribution

5.6 Phase A: Construct South Central Plant, New Tunnels and Chilled Water Distribution

\$22 Million total cost:

- \$15.8 Million – South Central Plant
- \$6.2 Million – Tunnels and Distribution

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Appendix A

Cost Estimates

1. Probable Cost Compilation Worksheet
2. Additional 2500 Ton Chiller
3. Thermal Storage Tank
4. North Central Plant
5. South Central Plant
6. Utility Tunnel – Service 12” Pipe
7. Utility Tunnel – Distribution 30” Pipe



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Probable Cost Compilation Worksheet

	Feet	\$/100FT (1)	Cost	Comments
Phase 2 CUPX Chiller Addition				
Chilled Water Capacity Addition 2500 Tons (2)	-	-	\$ 5,473,675	18th St., Colorado St., 16th St. WPC, Garage E, Lot 3
Distribution Tunnels	1788	\$ 1,304,764	\$ 23,329,180	
Service Tunnels	650	\$ 1,034,422	\$ 6,723,743	
Total Cost (6)			\$ 35,526,598	
Phase 2 Thermal Energy Storage (TES) System				
TES System (5)	-	-	\$ 18,402,131	Length from Phase 1 tunnel to TES site
Distribution Tunnel	275	\$ 1,304,764	\$ 3,588,101	
Total Cost (6)			\$ 21,990,232	
Phase 3 CUPX Chiller Addition				
Chilled Water Capacity Addition 2500 Tons (2)	-	-	\$ 5,473,675	Lot 8, Lot 11
Service Tunnels	250	\$ 1,034,422	\$ 2,586,055	
Total Cost (6)			\$ 8,059,730	
Phase A CUPX Chiller Addition				
Chilled Water Capacity Addition 2500 Tons (2)	-	-	\$ 5,473,675	Lot 19, ERS, TSHM, TWC
Misc Service Tunnels	450	\$ 1,034,422	\$ 4,654,899	
Total Cost (6)			\$ 10,128,574	
Phase A North Central Plant				
North Central Plant (NCP) (3)	-	-	\$ 39,242,875	CSB, Lot 22, Garage A, Garage F, TWCX
San Jacinto Blvd. Distribution Tunnel	1651	\$ 1,304,764	\$ 21,541,654	
San Jacinto Blvd. Service Tunnels	250	\$ 1,034,422	\$ 2,586,055	
Total Cost (6)			\$ 63,370,584	
Phase A South Central Plant				
South Central Plant (SCP) (4)	-	-	\$ 15,798,996	Lot 7, DCG, JER, SIBX, TJR, SIB
11th Street Service Tunnels	600	\$ 1,034,422	\$ 6,206,532	
Total Cost (6)			\$ 22,005,528	
Summation of Costs (6)			\$ 161,081,246	
Notes (#):				
1. Refer to tunnel cost estimates in the appendix.				
2. Refer to 2500 Ton Chiller Addition cost estimates in the appendix.				
3. Refer to the North Central Plant cost estimate in the appendix.				
4. Refer to the South Central Plant cost estimate in the appendix.				
5. Refer to the Thermal Storage cost estimate in the appendix.				
6. Project costs are in current 2017 prices. Project costs should be escalated for market conditions once projected construction dates are known.				

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RATIONALE COVER SHEET

ESTIMATE OF PROBABLE CONSTRUCTION COST



PROJECT

**Texas State Capitol Complex, Utility Infrastructure DA
Option: Add 2500 Ton Chiller**

Location **Austin Texas**
 Estimator: **Keith Kothmann**
 Project CODE:
 Report Date **9-Nov-17**
 Status of Design: **Concept/Design**
 Construction Start Date: **To Be Determined**
 Cost Basis: **All costs are based on competitive bid procurement methods**
All Costs are escalated to 2018
 Building Gross Sq.. Ft.
 Construction Cost Limitation **Not Given**

	BLDG SF	COST / SF	COST
ESTIMATED BUILDING CONTRACT COST		#DIV/0!	\$ 4,585,739
TOTAL DESIGN BUILD PROJECT COST		#DIV/0!	\$ 4,860,884
Commissioning			\$ 250,000
Owner's Construction Contingency			\$ 229,287
Owner's administration Cost			\$ 133,504
TOTAL COST TO OWNER			\$ 5,473,675

NOTES:

- 1 No Hazardous materials expected
- 2 Institutional grade concrete and steel frame structure
- 3 Clear Height inside is 18 FT



Keith Kothmann CPE CCC CCI
Certified Professional Estimator

Opinion of Probable Cost The opinion of probable project cost is made on the basis of information available and represents the judgments and experienced of a certified professional cost estimator. However, the estimator has no contrc over the cost of labor, materials, equipment or services furnished by others, or over other market conditions, or over the methodology used for procurement. The Estimator does not guarantee that proposals, or bids for construction will not vary from the opinion of probable cost.

<u>Construction</u> <u>Cost</u> <u>Management Co.</u> FT. WORTH TX, 76163	Texas State Capitol Complex, Utility Infrastructure DA Option: Add 2500 Ton Chiller	ESTIMATE OF PROBABLE CONSTRUCTION COST	
DESCRIPTION: New Construction	DATE:	9-Nov-17	
LOCATION : Austin Texas	ESTIMATOR:	K KOTHMANN	
STATUS OF DESIGN Concept Budget	CHECKED BY:		
RECAPITULATION		TOTAL	
General Conditions SITE PREPARATION EARTHWORK SITE CONCRETE SITE IMPROVEMENTS SITE ELECTRICAL MECHANICAL SITE UTILITIES		\$780,000	
FOUNDATION SYSTEM		\$7,290	
EXTERIOR WALL SYSYEM SUPERSTRUCTURE		\$82,218	
INTERIOR CONSTRUCTION ROOFING AND MOISTURE PROTECTION EXTERIOR OPENINGS		\$4,790	
FINISHES SPECIALTIES EQUIPMENT		\$4,790	
PLUMBING MECHANICAL SYSTEMS FIRE SUPPRESSION	NOT USED	\$2,582,677	
ELECTRICAL SYSTEMS		\$152,130	
SUBTOTAL DIRECT COSTS		\$3,609,105	
DESIGN CONTINGENCY	10.00%	\$360,911	
Escalation Allowance to 2018	3.00%	\$119,100	
Bond and Insurance	1.95%	\$79,738	
PRIME CONTRACTOR OH & P	10.00%	\$416,885	
Texas Sales Tax Exempt			
ESTIMATED BUILDING CONTRACT COST		\$4,585,739	
Design Cost	6.00%	\$275,144	
TOTAL DESIGN BUILD PROJECT COST		\$4,860,884	
Commissioning	SUM	\$250,000	
Owner's Construction Contingency	5.00%	\$229,287	
Owner's administration Cost	2.50%	\$133,504	
TOTAL COST TO OWNER		\$5,473,675	

Construction Cost Management Co.		Texas State Capitol Complex, Utility Infra Option: Add 2500 Ton Chiller Austin Texas		ESTIMATE OF PROBABLE CONSTRUCTION COST	
DESCRIPTION:				DATE:	9-Nov-17
LOCATION				ESTIMATOR:	K KOTHMANN
STATUS OF DESIGN		Concept Budget		CHECKED BY:	
	DESCRIPTION	Quantity	UNIT	UNIT PRICE	TOTAL ESTIMATE
Some Items are Intentional left as Zero Quantities					
2A	<u>SITE PREPARATION</u>				
	None Required				
	Subcontractor OH & P	20%			
	SUBTOTAL				
2B	<u>EARTHWORK</u>				
	None Required				
	Subcontractor OH & P	20%			
	SUBTOTAL				
2C	<u>SITE CONCRETE</u>				
	None Required				
	Subcontractor OH & P	20%			
	SUBTOTAL				
2D	<u>SITE IMPROVEMENTS</u>				
	None Required				
	SUBTOTAL				
2E	<u>SITE ELECTRICAL</u>				
	None Required				
	Subcontractor OH & P	20%			
	SUBTOTAL				
2F	<u>MECHANICAL SITE UTILITIES</u>				
	None Required				

	DESCRIPTION			UNIT	TOTAL
		Quantity	UNIT	PRICE	ESTIMATE
	Subcontractor OH & P	20%			
	SUBTOTAL				
3	<u>FOUNDATION SYSTEM</u>				
	6" Equipment Pad w/ Rnfg Complete. Includes Future Equipment and Isolation. Add cost to 8" SOG	400	SF	\$11.50	\$4,600.00
	Set Embeds	1	SUM	\$275.00	\$275.00
	Misc Forming and Block Outs	1	Sum	\$1,200.00	\$1,200.00
	Subcontractor OH & P	20%			\$1,215.00
	SUBTOTAL				\$7,290.00
4	<u>EXTERIOR WALL SYSYTEM</u>				
	No Work				
	Subcontractor OH & P	20%			
	SUBTOTAL				
5	<u>SUPERSTRUCTURE</u>				
	Galv Grate Deck at Tower Platform	2150	SF	\$22.00	\$47,300.00
	Industrial Handrail Galv.	300.00	LF	\$54.00	\$16,200.00
	Steel Stair with handrail	17	TRD	\$295.00	\$5,015.00
	Subcontractor OH & P	20%			\$13,703.00
	SUBTOTAL				\$82,218.00
6	<u>INTERIOR CONSTRUCTION</u>		BSF		
	No Work				
	Subcontractor OH & P	20%			
	SUBTOTAL				
7	<u>ROOFING AND MOISTURE PROTECTION</u>				
	No Work				
	SUBTOTAL				
8	<u>EXTERIOR OPENINGS</u>				

	DESCRIPTION			UNIT	TOTAL
		Quantity	UNIT	PRICE	ESTIMATE
	No Work				
	Subcontractor OH & P	20%			
	SUBTOTAL				
9	<u>FINISHES</u>				
	Paint Equipment and Piping	1	Job	\$4,400.00	\$4,400.00
	Misc Painting	3000	BSF	\$0.13	\$390.00
	Subcontractor OH & P Included in Unit Price				
	SUBTOTAL				\$4,790.00
10	<u>SPECIALTIES</u>				
	No Work				
	Subcontractor OH & P	20%			
	SUBTOTAL				
11	<u>EQUIPMENT</u>				
	No Work				
	SUBTOTAL				
15A	<u>PLUMBING</u>				
	No Work				
	Subcontractor OH & P Included in Unit Price				
	SUBTOTAL				
15B	<u>MECHANICAL SYSTEMS</u>				
	Centrifugal Chiller	2500	TON	\$426.00	\$1,065,000.00
	Cooling Tower	2500	TON	\$175.00	\$437,500.00
	Basin Heaters	2	EA	\$1,575.00	\$3,150.00
	All Pump Prices Include valves and Fit-up				
	Secondary Chilled Water Pump 400 HP	1	EA	\$97,300.00	\$97,300.00
	Primary Chilled Water Pump 75 HP	1	EA	\$37,500.00	\$37,500.00
	Condenser Water Pump 200 HP	1	EA	\$56,150.00	\$56,150.00
	Steel Pipe Sch 40 Weld w/ Ftgs and Hngrs				
	16"	125	LF	\$211.69	\$26,461.25

DESCRIPTION	UNIT		PRICE	TOTAL ESTIMATE
	Quantity	UNIT		
14"	80	LF	\$148.13	\$11,850.40
10"	25	LF	\$122.27	\$3,056.75
6"	30	LF	\$63.75	\$1,912.50
3"	20	LF	\$27.60	\$552.00
Steel Pipe Sch 40 Weld Fittings				
30"	2	EA	\$5,722.00	\$11,444.00
20"	4	EA	\$3,005.00	\$12,020.00
16"	8	EA	\$2,145.00	\$17,160.00
14"	3	EA	\$1,875.00	\$5,625.00
10"	5	EA	\$812.00	\$4,060.00
6"	4	EA	\$420.00	\$1,680.00
20" Valve Iron Body Butterfly	1	EA	\$7,620.00	\$7,620.00
16" Valve Iron Body Butterfly	1	EA	\$4,535.00	\$4,535.00
14" Valve Iron Body Butterfly		EA	\$3,135.00	
10" Valve Iron Body Butterfly		EA	\$1,235.00	
20" Valve Iron Body Gate OS&Y	2	EA	\$28,505.00	\$57,010.00
16" Valve Iron Body Gate OS&Y	4	EA	\$16,850.00	\$67,400.00
14" Valve Iron Body Gate OS&Y	4	EA	\$11,915.00	\$47,660.00
10" Valve Iron Body Gate OS&Y		EA	\$4,100.00	
6" Valve Iron Body Gate OS&Y	2	EA	\$1,360.00	\$2,720.00
3" Valve Iron Body Gate OS&Y	1	EA	\$973.00	\$973.00
20" Valve Iron Body Two Way	1	EA	\$11,500.00	\$11,500.00
14" Valve Iron Body Two Way	2	EA	\$9,500.00	\$19,000.00
20 Flexible Connectors	2	EA	\$2,000.00	\$4,000.00
16" Flexible Connectors	3	EA	\$1,500.00	\$4,500.00
14" Flexible Connectors	4	EA	\$1,250.00	\$5,000.00
3" Flexible Connectors	3	EA	\$125.00	\$375.00
Insulate Steel Pipe, Foam Glass				
16" 3"	125	LF	\$44.00	\$5,500.00
12" 2"	80	LF	\$34.00	\$2,720.00
10" 2"	25	LF	\$24.80	\$620.00
16" Add for All Weather Jacket	50	LF	\$14.60	\$730.00
Pressure Gauge Dial Type w/ ball valve				
	2	EA	\$53.00	\$106.00
Thermometer Stem Type				
	4	EA	\$80.00	\$320.00
Temperature Sensor				
	4	EA	\$140.00	\$560.00
Pneumatic pressure test for CHWS & CHWR				
	1	EA	\$605.00	\$605.00
Pneumatic pressure test for CWS & CWR				
	1	EA	\$605.00	\$605.00
Pipe Stanchion Assembly				
	2	EA	\$375.00	\$750.00
Misc Plant Room Piping and Vessels				
	1	SUM	\$2,500.00	\$2,500.00
DDC EMCS system				
	50	point	\$2,250.00	\$112,500.00

	DESCRIPTION			UNIT	TOTAL
		Quantity	UNIT	PRICE	ESTIMATE
	Subcontractor OH & P	20%			\$430,446.18
	SUBTOTAL				\$ 2,582,677
15C	<u>FIRE SUPPRESSION</u>				
	Wet Pipe System Complete		NIC		
	SUBTOTAL				
16	<u>ELECTRICAL SYSTEMS</u>				
	Add circuits brkrs to existing panel	1	SUM	\$3,570.00	\$3,570.00
	Add FS Sw to Existing MSB	1	SUM	\$7,440.00	\$7,440.00
	DISC SWITCH 100 AMP N-1 NFS	1	EA	\$380.00	\$380.00
	DISC SWITCH 175 AMP N-1 NFS	6	EA	\$560.00	\$3,360.00
	DISC SWITCH 250 AMP N-1 NFS	1	EA	\$1,120.00	\$1,120.00
	DISC SWITCH 600 AMP N-1 NFS	1	EA	\$1,960.00	\$1,960.00
	DISC SWITCH 1200 AMP N-1 NFS	1	EA	\$5,365.00	\$5,365.00
	VFD 400 HP Furnish and Install	1	EA	\$39,636.00	\$39,636.00
	VFD 200 HP Furnish and Install	1	EA	\$28,185.00	\$28,185.00
	VFD 75 HP Furnish and Install	1	EA	\$14,980.00	\$14,980.00
	Equipment Feeders & Connections	1	Sum	\$10,465.00	\$10,465.00
	Power Devices & Branch Circuits				
	DUPLEX RECPT	2	EA	\$33.00	\$66.00
	DUPLEX RECPT GFI	2	EA	\$61.00	\$122.00
	SWITCH SP	2	EA	\$31.00	\$62.00
	LIGHTING:				
	HIGH BAY SURFACE MOUNTED	8	EA	\$550.00	\$4,400.00
	1X4 INDUSTRIAL FIXTURE	6	EA	\$180.00	\$1,080.00
	Branch Circuits	700	LF	\$5.12	\$3,584.00
	Grounding system	1	Sum	\$1,000.00	\$1,000.00
	Subcontractor OH & P	20%			\$25,355.00
	SUBTOTAL				\$152,130.00

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RATIONALE COVER SHEET

ESTIMATE OF PROBABLE CONSTRUCTION COST

**CONSTRUCTION
COST
MANAGEMENT Co.**

PROJECT

**Texas State Capitol Complex, Utility Infrastructure DA
Proposed Thermal Storage Tank**

Location **Austin Texas**
 Estimator: **Keith Kothmann**
 Project CODE:
 Report Date **2-Nov-17**
 Status of Design: **Concept/Design**
 Construction Start Date: **To Be Determined**
 Cost Basis: **All costs are based on competitive bid procurement methods**
All Costs are escalated to 2018
 Capacity Gallon **5,750,000**
 Construction Cost Limitation **Not Given**

	Gallons	COST / GAL		COST
ESTIMATED BUILDING CONTRACT COST	5,750,000	\$2.80	\$	16,084,053
TOTAL DESIGN BUILD PROJECT COST	5,750,000	\$2.97	\$	17,049,096
Commissioning			\$	100,000
Owner's Construction Contingency			\$	804,203
Owner's administration Cost			\$	448,832
TOTAL COST TO OWNER			\$	18,402,131

NOTES:

- 1 No Hazardous materials expected
- 2 Institutional grade concrete and steel frame structure
- 3 Clear Height inside is 18 FT



Keith Kothmann CPE CCC CCI
Certified Professional Estimator

Opinion of Probable Cost The opinion of probable project cost is made on the basis of information available and represents the judgments and experienced of a certified professional cost estimator. However, the estimator has no contrc over the cost of labor, materials, equipment or services furnished by others, or over other market conditions, or over the methodology used for procurement. The Estimator does not guarantee that proposals, or bids for construction will not vary from the opinion of probable cost.

Construction Cost Management Co. FT. WORTH TX, 76163	Texas State Capitol Complex, Utility Infrastructure DA Proposed Thermal Storage Tank	ESTIMATE OF PROBABLE CONSTRUCTION COST	
DESCRIPTION: New Construction	DATE:	2-Nov-17	
LOCATION : Austin Texas	ESTIMATOR:	K KOTHMANN	
STATUS OF DESIGN Concept Budget	CHECKED BY:		
RECAPITULATION	BLDG SF 1,600 SF	Cost	
	PERIMETER 80 LF	Per Sq. Ft.	TOTAL
General Conditions		\$780,000	
SITE PREPARATION	\$ 33.66	\$53,856	
EARTHWORK	\$ 2.98	\$4,767	
SITE CONCRETE	\$ 4.17	\$6,674	
SITE IMPROVEMENTS	\$ 14.12	\$22,597	
SITE ELECTRICAL	\$ 38.21	\$61,140	
MECHANICAL SITE UTILITIES	\$ 14.28	\$22,853	
FOUNDATION SYSTEM	\$ 46.71	\$74,742	
EXTERIOR WALL SYSYEM	\$ -		
SUPERSTRUCTURE	\$ -		
INTERIOR CONSTRUCTION	\$ -		
ROOFING AND MOISTURE PROTECTION	\$ -		
EXTERIOR OPENINGS	\$ -		
FINISHES	\$ 9.59	\$15,340	
SPECIALTIES	\$ 2.18	\$3,480	
EQUIPMENT	\$ -		
PLUMBING	\$ 6.79	\$10,870	
MECHANICAL SYSTEMS	\$ 6,944.52	\$11,111,237	
FIRE SUPPRESSION	\$ -		
 	NOT USED		
ELECTRICAL SYSTEMS	\$ 306.90	\$491,043	
SUBTOTAL DIRECT COSTS	\$ 7,911.62	\$12,658,599	
DESIGN CONTINGENCY	10.00%	\$1,265,860	
Escalation Allowance to 2018	3.00%	\$417,734	
Bond and Insurance	1.95%	\$279,673	
PRIME CONTRACTOR OH & P	10.00%	\$1,462,187	
Texas Sales Tax Exempt			
ESTIMATED BUILDING CONTRACT COST		\$16,084,053	
Design Cost	6.00%	\$965,043	
TOTAL DESIGN BUILD PROJECT COST		\$17,049,096	
Commissioning	SUM	\$100,000	
Owner's Construction Contingency	5.00%	\$804,203	
Owner's administration Cost	2.50%	\$448,832	
TOTAL COST TO OWNER	Cost / Gal	\$18,402,131	

Construction Cost Management Co.		Texas State Capitol Complex, Utility Infra Proposed Thermal Storage Tank Austin Texas		ESTIMATE OF PROBABLE CONSTRUCTION COST	
DESCRIPTION: NEW 2 STORY			1,600 Bldg SF	DATE:	2-Nov-17
LOCATION			5750000 Gal	ESTIMATOR:	K KOTHMANN
STATUS OF DESIGN		Concept Budget		CHECKED BY:	
	DESCRIPTION	Quantity	UNIT	UNIT PRICE	TOTAL ESTIMATE
		Some Items are Intentional left as Zero Quantities			
2A	<u>SITE PREPARATION</u>				
	Misc Erosion Control Measures	1	SUM	\$2,900.00	\$2,900.00
	Building and Site Demolition and disposal	3000	SF	\$5.66	\$16,980.00
	Survey and Stake	4	Day	\$1,250.00	\$5,000.00
	Traffic Control	1	SUM	\$20,000.00	\$20,000.00
	Subcontractor OH & P	20%			\$8,976.00
	SUBTOTAL				\$53,856.00
2B	<u>EARTHWORK</u>				
	Excavate Load Haul and Waste	118	CY	\$9.03	\$1,069.15
	Excavate Footings and Beams Neat	142	CY	\$9.07	\$1,288.67
	Fine Grade Pad	1600	SF	\$0.23	\$368.00
	Aggregate Base and Compact	30	CY	\$34.50	\$1,021.20
	Fine Grade Site	178	SY	\$1.27	\$225.78
	Subcontractor OH & P	20%			\$794.56
	SUBTOTAL				\$4,767.35
2C	<u>SITE CONCRETE</u>				
	Sidewalk	NONE	SF	\$2.75	
	Replace 6" Concrete Pavement W/ Rnfg	1100	SF	\$4.44	\$4,884.00
	Integral Curb	90	LF	\$7.53	\$677.70
	Subcontractor OH & P	20%			\$1,112.34
	SUBTOTAL				\$6,674.04
2D	<u>SITE IMPROVEMENTS</u>				
	Security Fence	200	LF	\$36.00	\$7,200.00
	Mech Yard Personnel Gate	1	EA	\$900.00	\$900.00
	Mech Yard Service Gate	1	EA	\$1,350.00	\$1,350.00
	Add for Elect Lock	2	EA	\$980.00	\$1,960.00
	Add for Card Reader	2	EA	\$575.00	\$1,150.00

	DESCRIPTION			UNIT	TOTAL
		Quantity	UNIT	PRICE	ESTIMATE
	Post Mount Sign Info / Directional	2	EA	\$122.00	\$244.00
	Pipe Bollard	6	EA	\$210.00	\$1,260.00
	Paint Pavement Striping and Site painting	1	SUM	\$2,900.00	\$2,900.00
	Misc Landscaping Repair	1	LS	\$5,000.00	\$5,000.00
	Sod	150	SY	\$4.22	\$633.00
	SUBTOTAL				\$22,597.00
2E	<u>SITE ELECTRICAL</u>				
	Electrical primary service	1	SUM	\$9,750.00	\$9,750.00
	Electrical Manhole Complete	1	EA	\$10,800.00	\$10,800.00
	Secondary Service	50	LF	\$138.00	\$6,900.00
	Site Lighting	1	SUM	\$15,000.00	\$15,000.00
	Comm service and distribution	1	SUM	\$8,500.00	\$8,500.00
	Subcontractor OH & P	20%			\$10,190.00
	SUBTOTAL				\$61,140.00
2F	<u>MECHANICAL SITE UTILITIES</u>				
	Water Distribution From Existing Plant		NA		
	SANITARY SEWER				
	6" sanitary line PVC TR & BF	100	LF	\$24.50	\$2,450.00
	Connect To Existing Sanitary	1	Sum	\$750.00	\$750.00
	Sanitary Manhole	1	EA	\$3,453.00	\$3,453.00
	STORM SEWER				
	12" RCP Trench and Backfill	100	LF	\$36.00	\$3,600.00
	Connect To Existing Storm Utility or Outfall	1	Sum	\$1,267.00	\$1,267.00
	Connect to Drain Lateral	4	EA	\$266.00	\$1,064.00
	Catch Basin and Grate w/ lateral	4	EA	\$1,615.00	\$6,460.00
	Subcontractor OH & P	20%			\$3,808.80
	SUBTOTAL				\$22,852.80
3	<u>FOUNDATION SYSTEM</u>	9916			
	Tank Foundation	178	CY	\$301.21	\$53,494.90
	Equipment Pad w/ Rnfg Complete. Includes Future Equipment and Isolation.	400	SF	\$11.50	\$4,600.00
	Set Embeds	1	SUM	\$2,750.00	\$2,750.00

	DESCRIPTION			UNIT	TOTAL
		Quantity	UNIT	PRICE	ESTIMATE
	Misc Forming and Block Outs	1	Sum	\$1,440.00	\$1,440.00
	Subcontractor OH & P	20%			\$12,456.98
	SUBTOTAL				\$74,741.88
4	<u>EXTERIOR WALL SYSYTEM</u>				
	Subcontractor OH & P	20%			
	SUBTOTAL				
5	<u>SUPERSTRUCTURE</u>				
	Subcontractor OH & P	20%			
	SUBTOTAL				
6	<u>INTERIOR CONSTRUCTION</u>	1600	BSF		
	Subcontractor OH & P	20%			
	SUBTOTAL				
7	<u>ROOFING AND MOISTURE PROTECTION</u>				
	SUBTOTAL				
8	<u>EXTERIOR OPENINGS</u>				
	Subcontractor OH & P	20%			
	SUBTOTAL				
9	<u>FINISHES</u>				
	Paint Equipment and Piping	1	Job	\$15,340.00	\$15,340.00
	Subcontractor OH & P Included in Unit Price				
	SUBTOTAL				\$15,340.00
10	<u>SPECIALTIES</u>				
	Facility ID Sign Allowance	1	Sum	\$2,900.00	\$2,900.00
	Subcontractor OH & P	20%			\$580.00
	SUBTOTAL				\$3,480.00

	DESCRIPTION			UNIT	TOTAL
		Quantity	UNIT	PRICE	ESTIMATE
11	<u>EQUIPMENT</u>				
	SUBTOTAL				
15A	<u>PLUMBING</u>				
	Wall Hydrant Non Freeze	3	EA	\$475.00	\$1,425.00
	Domestic Water Piping				
	Copper piping for domestic use	1	SUM	\$5,000.00	\$5,000.00
	Insulation on piping for domestic use	1	SUM	\$3,000.00	\$3,000.00
	Valves and fittings for domestic use	1	SUM	\$600.00	\$600.00
	Hydraulic test for Sanitary piping	1	EA	\$530.00	\$530.00
	Pneumatic pressure test for Domestic Water	1	EA	\$315.00	\$315.00
	Interior Nat Gas Piping		NONE		
	Subcontractor OH & P Included in Unit Price				
	SUBTOTAL				\$10,870.00
15B	<u>MECHANICAL SYSTEMS</u>				
	Thermal Storage Tank Insulated	5,750,000	GAL	\$1.43	\$8,222,500.00
	Tank Control accessories	1	SUM	\$39,850.00	\$39,850.00
	Basin Heaters	2	EA	\$1,575.00	\$3,150.00
	Side Stream Filter	1	EA	\$9,500.00	\$9,500.00
	Shot Chemical Feeder for CHWS	1	EA	\$2,250.00	\$2,250.00
	All Pump Prices Include valves and Fit-up				
	Secondary Chilled Water Pump 100 HP	2	EA	\$47,300.00	\$94,600.00
	Primary Chilled Water Pump 75 HP	2	EA	\$37,500.00	\$75,000.00
	Heat exchanger	2	EA	\$48,000.00	\$96,000.00
	Steel Pipe Sch 40 Weld w/ Ftgs and Hngrs				
	40"	300	LF	\$485.00	\$145,500.00
	30"	300	LF	\$343.74	\$103,122.00
	10"	100	LF	\$122.27	\$12,227.00
	Steel Pipe Sch 40 Weld Fittings				
	40"	6	EA	\$12,250.00	\$73,500.00
	30"	6	EA	\$5,722.00	\$34,332.00
	10"	10	EA	\$812.00	\$8,120.00
	40" Valve Iron Body Butterfly	2	EA	\$15,995.00	\$31,990.00
	30" Valve Iron Body Butterfly	2	EA	\$12,990.00	\$25,980.00
	10" Valve Iron Body Gate OS&Y	4	EA	\$4,100.00	\$16,400.00

	DESCRIPTION			UNIT	TOTAL
		Quantity	UNIT	PRICE	ESTIMATE
	10" Flexible Connectors	4	EA	\$1,250.00	\$5,000.00
	Insulate Steel Pipe, Foam Glass				
	40" 3"	330	ELF	\$89.20	\$29,436.00
	30" 3"	330	ELF	\$82.50	\$27,225.00
	10" 2"	1501	ELF	\$24.80	\$37,224.80
	40" Add for All Weather Jacket	330	LF	\$45.00	\$14,850.00
	30" Add for All Weather Jacket	330	LF	\$22.32	\$7,365.60
	10" Add for All Weather Jacket	120	LF	\$11.90	\$1,428.00
	Pressure Gauge Dial Type w/ ball valve	4	EA	\$53.00	\$212.00
	Thermometer Stem Type	4	EA	\$80.00	\$320.00
	Temperature Sensor	4	EA	\$140.00	\$560.00
	Flow Meter	2	EA	\$14,250.00	\$28,500.00
	Water Meter	1	EA	\$3,010.00	\$3,010.00
	Backflow preventer for HVAC	1	EA	\$16,550.00	\$16,550.00
	Pneumatic pressure test for CHWS & CHWR	1	EA	\$1,650.00	\$1,650.00
	Pipe Stanchion Assembly	20	EA	\$975.00	\$19,500.00
	Misc Piping and Vessels	1	SUM	\$26,000.00	\$26,000.00
	DDC EMCS system	36	point	\$1,292.00	\$46,512.00
	Subcontractor OH & P	20%			\$1,851,872.88
	SUBTOTAL				\$ 11,111,237
15C	<u>FIRE SUPPRESSION</u>				
			NIC		
	Subcontractor OH & P Included in Unit Price				
	SUBTOTAL				
16	<u>ELECTRICAL SYSTEMS</u>				
	Switchgear 5KV, 2500A,5KV,3PH,3W	1	EA	\$27,500.00	\$27,500.00
	500KVA Transformer 4160v PRI 480v SEC	1	EA	\$38,570.00	\$38,570.00
	480V Panel MCB 400 A W/ BRKRS '42 SPC	1	EA	\$6,500.00	\$6,500.00
	TRANSFORMER DRY TYPE				
	30 KVA	1	EA	\$7,200.00	\$7,200.00
	POWER PANEL 208/120V 3P 4W MCB 225 A W/ BRKRS	1	EA	\$3,768.00	\$3,768.00
	TVSS	1	SUM	\$7,440.00	\$7,440.00
	Distribution Feeders	1	SUM	\$14,500.00	\$14,500.00
	DISC SWITCH 100 AMP N-1 NFS	4	EA	\$380.00	\$1,520.00
	VFD 75 HP Furnish and Install	4	EA	\$14,980.00	\$59,920.00

	DESCRIPTION			UNIT	TOTAL
		Quantity	UNIT	PRICE	ESTIMATE
	DISC SWITCH 30 AMP NF	2	EA	\$278.00	\$556.00
	Equipment Feeders & Connections	1	Sum	\$181,500.00	\$181,500.00
	Power Devices & Branch Circuits				
	DUPLEX RECPT GFI WP	8	EA	\$62.00	\$496.00
	LIGHTING:				
	HID WALL PACK	6	EA	\$585.00	\$3,510.00
	POLE MOUNTED LIGHT FIXTURE	4	EA	\$3,900.00	\$15,600.00
	Branch Circuits	630	LF	\$6.02	\$3,792.60
	Grounding system	1	Sum	\$12,000.00	\$12,000.00
	Lightning Protection System	1	Sum	\$3,580.00	\$3,580.00
	Security SYSTEM	1	SUM	\$21,250.00	\$21,250.00
	Subcontractor OH & P	20%			\$81,840.52
	SUBTOTAL				\$491,043.12

RATIONALE COVER SHEET

ESTIMATE OF PROBABLE CONSTRUCTION COST

**CONSTRUCTION
COST
MANAGEMENT Co.**

PROJECT

**Texas State Capitol Complex, Utility Infrastructure DA
Proposed North Chiller Plant**

Location **Austin Texas**
 Estimator: **Keith Kothmann**
 Project CODE:
 Report Date **11-Oct-17**
 Status of Design: **Concept/Design**
 Construction Start Date: **To Be Determined**
 Cost Basis: **All costs are based on competitive bid procurement methods**
All Costs are escalated to 2018
 Building Gross Sq.. Ft. **27,824**
 Construction Cost Limitation **Not Given**

	BLDG SF	COST / SF		COST
ESTIMATED BUILDING CONTRACT COST	27,824	\$1,231.54	\$	34,266,425
TOTAL DESIGN BUILD PROJECT COST	27,824	\$1,305.43	\$	36,322,410
Commissioning			\$	250,000
Owner's Construction Contingency			\$	1,713,321
Owner's administration Cost			\$	957,143
TOTAL COST TO OWNER			\$	39,242,875

NOTES:

- 1 No Hazardous materials expected
- 2 Institutional grade concrete and steel frame structure
- 3 Clear Height inside is 18 FT



Keith Kothmann CPE CCC CCI
Certified Professional Estimator

Opinion of Probable Cost The opinion of probable project cost is made on the basis of information available and represents the judgments and experienced of a certified professional cost estimator. However, the estimator has no contrc over the cost of labor, materials, equipment or services furnished by others, or over other market conditions, or over the methodology used for procurement. The Estimator does not guarantee that proposals, or bids for construction will not vary from the opinion of probable cost.

Construction Cost Management Co. FT. WORTH TX, 76163	Texas State Capitol Complex, Utility Infrastructure DA Proposed North Chiller Plant			ESTIMATE OF PROBABLE CONSTRUCTION COST	
	DESCRIPTION: New Construction			DATE:	11-Oct-17
LOCATION : Austin Texas			ESTIMATOR:	K KOTHMANN	
STATUS OF DESIGN Concept Budget			CHECKED BY:		
		BLDG SF	27,824	Gross SF	Cost
RECAPITULATION		PERIMETER	524	LF	Per Sq. Ft.
					TOTAL
General Conditions					\$780,000
SITE PREPARATION					\$ 2.21 \$61,423
EARTHWORK					\$ 8.45 \$235,244
SITE CONCRETE					\$ 0.39 \$10,816
SITE IMPROVEMENTS					\$ 0.09 \$2,587
SITE ELECTRICAL					\$ -
MECHANICAL SITE UTILITIES					\$ 0.61 \$17,039
FOUNDATION SYSTEM					\$ 14.58 \$405,666
EXTERIOR WALL SYSYEM					\$ 57.14 \$1,589,875
SUPERSTRUCTURE					\$ 59.67 \$1,660,138
INTERIOR CONSTRUCTION					\$ 7.63 \$212,363
ROOFING AND MOISTURE PROTECTION					\$ 5.59 \$155,637
EXTERIOR OPENINGS					\$ 2.28 \$63,524
FINISHES					\$ 3.65 \$101,540
SPECIALTIES					\$ 0.43 \$11,846
EQUIPMENT					\$ 2.12 \$59,000
PLUMBING					\$ 4.73 \$131,719
MECHANICAL SYSTEMS					\$ 634.92 \$17,666,132
FIRE SUPPRESSION					\$ - NOT USED
ELECTRICAL SYSTEMS					\$ 136.72 \$3,804,085
SUBTOTAL DIRECT COSTS					\$ 969.26 \$26,968,635
DESIGN CONTINGENCY					10.00% \$2,696,864
Escalation Allowance to 2018					3.00% \$889,965
Bond and Insurance					1.95% \$595,832
PRIME CONTRACTOR OH & P					10.00% \$3,115,130
Texas Sales Tax Exempt					
ESTIMATED BUILDING CONTRACT COST				\$ 1,231.54	\$34,266,425
Design Cost					6.00% \$2,055,985
TOTAL DESIGN BUILD PROJECT COST					\$36,322,410
Commissioning					SUM \$250,000
Owner's Construction Contingency					5.00% \$1,713,321
Owner's administration Cost					2.50% \$957,143
TOTAL COST TO OWNER					\$ 1,410.40 \$39,242,875

Construction Cost Management Co.		Texas State Capitol Complex, Utility Infra Proposed North Chiller Plant Austin Texas		ESTIMATE OF PROBABLE CONSTRUCTION COST	
DESCRIPTION: NEW 2 STORY			27,824 Bldg SF	DATE:	11-Oct-17
LOCATION				ESTIMATOR:	K KOTHMANN
STATUS OF DESIGN		Concept Budget		CHECKED BY:	
	DESCRIPTION	Quantity	UNIT	UNIT PRICE	TOTAL ESTIMATE
Some Items are Intentional left as Zero Quantities					
2A	<u>SITE PREPARATION</u>				
	Misc Erosion Control Measures	1	SUM	\$2,900.00	\$2,900.00
	Abatement Allowance	NOT ANTICIPATED			
	Building and Site Demolition and disposal	8000	SF	\$5.66	\$45,280.00
	Misc Off Site Demolition	1	SUM	\$3,006.00	\$3,006.00
	Subcontractor OH & P	20%			\$10,237.20
	SUBTOTAL				\$61,423.20
2B	<u>EARTHWORK</u>				
	Clearance	1	SUM	\$3,000.00	\$3,000.00
	Excavate Load Haul and Waste	18531	CY	\$9.03	\$167,332.98
	Excavate and Stockpile		CY	\$5.90	
	Excavate Footings and Beams Neat		CY	\$9.07	
	Fine Grade Bldg Pad	27824	SF	\$0.23	\$6,399.52
	Aggregate Base and Compact	515	CY	\$34.50	\$17,758.67
	Fine Grade Site	3092	SY	\$0.50	\$1,545.78
	Subcontractor OH & P	20%			\$39,207.39
	SUBTOTAL				\$235,244.33
2C	<u>SITE CONCRETE</u>				
	Sidewalk	NONE	SF	\$2.75	
	6" Concrete Pavement W/ Rnfg	1100	SF	\$4.44	\$4,884.00
	Integral Curb	90	LF	\$7.53	\$677.70
	Transformer Pad	400	SF	\$8.63	\$3,452.00
	Subcontractor OH & P	20%			\$1,802.74
	SUBTOTAL				\$10,816.44
2D	<u>SITE IMPROVEMENTS</u>				
	Security Fence	NONE	LF	\$36.00	
	Mech Yard Personnel Gate		EA	\$900.00	

	DESCRIPTION			UNIT	TOTAL
		Quantity	UNIT	PRICE	ESTIMATE
	Mech Yard Service Gate		EA	\$1,350.00	
	Post Mount Sign Info / Directional	2	EA	\$122.00	\$244.00
	Pipe Bollard	6	EA	\$210.00	\$1,260.00
	Paint Pavement Striping	1	LF	\$0.30	\$0.30
	Misc Landscaping Repair	1	LS	\$450.00	\$450.00
	Sod	150	SY	\$4.22	\$633.00
	SUBTOTAL				\$2,587.30
2E	<u>SITE ELECTRICAL</u>				
	UG Duct Bank Primary Conc Encase		NIC		
	Electrical Manhole Complete		NIC	\$10,800.00	
	Primary Conductor		NIC		
	Site Lighting	NOT ANTICIPATED			
	Comm Duct Bank Conc Encase		NIC		
	Data Comm Cable Primary service		NIC		
	Subcontractor OH & P	20%			
	SUBTOTAL				
2F	<u>MECHANICAL SITE UTILITIES</u>				
	Water Distribution From Existing Plant	SEE PLUMBING			
	Remove underground water utility	NOT ANTICIPATED			
	Fire water loop	NOT ANTICIPATED			
	SANITARY SEWER				
	6" sanitary line PVC TR & BF	100	LF	\$24.50	\$2,450.00
	Connect To Existing Sanitary	1	Sum	\$750.00	\$750.00
	Sanitary Manhole	1	EA	\$3,453.00	\$3,453.00
	Remove Sanitary	NOT ANTICIPATED			
	STORM SEWER				
	Remove Storm Line	NOT ANTICIPATED			
	12" RCP Trench and Backfill	100	LF	\$36.00	\$3,600.00
	Connect To Existing Storm Utility or Outfall	1	Sum	\$1,267.00	\$1,267.00
	Connect to Roof Drain Lateral	4	EA	\$266.00	\$1,064.00
	Catch Basin and Grate w/ lateral	1	EA	\$1,615.00	\$1,615.00
	Subcontractor OH & P	20%			\$2,839.80
	SUBTOTAL				\$17,038.80

	DESCRIPTION			UNIT	TOTAL
		Quantity	UNIT	PRICE	ESTIMATE
3	<u>FOUNDATION SYSTEM</u>	9916			
	Drilled Piers w/ Concrete and Rnfg				
	24" assume 25' 24 Each	600	LF	\$36.00	\$21,600.00
	Pier Caps w/ Forms and Rnfg	42	CY	\$340.00	\$14,280.00
	Grade Beam w/ Rnfg on Carton Forms	350	CY	\$296.00	\$103,600.00
	Vapor Barrier	13912	SF	\$0.11	\$1,530.32
	8" SOG w/ Rnfg Complete	13912	SF	\$5.55	\$77,211.60
	8" Stem Wall w/ Forms and Rnfg Complete Form I Side	2858	SF	\$9.65	\$27,576.61
	6" Equipment Pad w/ Rnfg Complete. Includes Future Equipment and Isolation. Add cost to 8" SOG	6956	SF	\$11.50	\$79,994.00
	Set Embeds	1	SUM	\$4,750.00	\$4,750.00
	Misc Forming and Block Outs	1	Sum	\$7,512.48	\$7,512.48
	Subcontractor OH & P	20%			\$67,611.00
	SUBTOTAL				\$405,666.01
4	<u>EXTERIOR WALL SYSYTEM</u>				
	CMU Back-Up	10480	SF	\$11.12	\$116,537.60
	Add for Vertical Rnfg and grout fill	10480	SF	\$1.48	\$15,510.40
	Add for 12" Bond Beam	1572	LF	\$7.17	\$11,271.24
	8" CMU Back up at Parapet	2096	SF	\$8.67	\$18,172.32
	Add for 8" Bond Beam	524	LF	\$5.32	\$2,787.68
	Granit veneer 8"	1703	SF	\$78.12	\$133,058.83
	Pre-Patina Zink Louver System	10690	SF	\$65.50	\$700,168.80
	Architectural feature	1	SUM	\$92,000.00	\$92,000.00
	EFIS System	4150	SF	\$5.56	\$23,074.44
	Basement wall	9432	SF	\$22.51	\$212,314.32
	Subcontractor OH & P	20%			\$264,979.13
	SUBTOTAL				\$1,589,874.76
5	<u>SUPERSTRUCTURE</u>				
	Elevated concrete Slab System	55648	SF	\$18.55	\$1,032,270.40
	Galv Grate Deck at Tower Platform	4395	SF	\$22.00	\$96,691.61
	Industrial Handrail Galv.	896.00	LF	\$54.00	\$48,384.00
	Roof Structure and deck	13912	SF	\$13.50	\$187,812.00
	Steel Stair with handrail	62	TRD	\$295.00	\$18,290.00

	DESCRIPTION			UNIT	TOTAL
		Quantity	UNIT	PRICE	ESTIMATE
	Subcontractor OH & P	20%			\$276,689.60
	SUBTOTAL				\$1,660,137.61
6	<u>INTERIOR CONSTRUCTION</u>	27824	BSF		
	Int HM Door & Frame w/ Hdrw Sngl	5	EA	\$989.00	\$4,945.00
	Int HM Door & Frame w/ Hdrw Dbl	2	PR	\$13.50	\$27.00
	CMU Interior Partition	18048	SF	\$9.53	\$171,997.44
	Subcontractor OH & P	20%			\$35,393.89
	SUBTOTAL				\$212,363.33
7	<u>ROOFING AND MOISTURE PROTECTION</u>				
	Moisture Barrier Wall	10480	SF	\$0.78	\$8,174.40
	Caulking & Sealants	1	Sum	\$2,000.00	\$2,000.00
	Wood Blocking Treat Bolt	546	BF	\$2.46	\$1,343.16
	2" Rigid Insulate Roof	13912	SF	\$1.61	\$22,398.32
	Built Up Roof 3-Ply Mod Bit	13912	SF	\$7.75	\$107,818.00
	Set Equipment Curb	3	EA	\$175.00	\$525.00
	Flashing and Reglet	524	LF	\$7.50	\$3,930.00
	Parapet Cap	524	LF	\$16.00	\$8,384.00
	Overflow scupper	4	EA	\$63.00	\$252.00
	Downspout	80	LF	\$8.50	\$680.00
	PC Conc Splash Block	4	EA	\$33.00	\$132.00
	Subcontractor OH & P Included in Unit Price				
	SUBTOTAL				\$155,636.88
8	<u>EXTERIOR OPENINGS</u>				
	OH Door and Track 10X12 Insulated	7	EA	\$5,184.00	\$36,288.00
	Overhead Door Frames	7	EA	\$600.00	\$4,200.00
	Exterior HM Door & Frame w/ Hdrw Sngl	4	EA	\$1,353.00	\$5,412.00
	Exterior HM Door & Frame w/ Hdrw Dbl	1	PR	\$1,905.00	\$1,905.00
	Add for Closure	4	EA	\$193.00	\$772.00
	Add for Panic Device	2	EA	\$625.00	\$1,250.00
	Add for Elect Lock	2	EA	\$980.00	\$1,960.00
	Add for Card Reader	2	EA	\$575.00	\$1,150.00
	Subcontractor OH & P	20%			\$10,587.40
	SUBTOTAL				\$63,524.40

	DESCRIPTION			UNIT	TOTAL
		Quantity	UNIT	PRICE	ESTIMATE
9	<u>FINISHES</u>				
	Paint Equipment and Piping	1	Job	\$23,400.00	\$23,400.00
	Paint Exposed Structure	27824	SF	\$0.56	\$15,581.44
	Text Paint Interior Masonry Surface	28528	SF	\$0.95	\$27,101.60
	Epoxy Paint Floor	13912	SF	\$1.75	\$24,346.00
	Paint Door & Frame	4	EA	\$42.00	\$168.00
	Paint Epoxy Floor	3700	SF	\$1.98	\$7,326.00
	Misc Painting	27824	BSF	\$0.13	\$3,617.12
	Subcontractor OH & P Included in Unit Price				
	SUBTOTAL				\$101,540.16
10	<u>SPECIALTIES</u>				
	Facility ID Sign Allowance	1	Sum	\$2,900.00	\$2,900.00
	Building Graphics Interior	1	Sum	\$1,500.00	\$1,500.00
	Misc Building Specialties	27824	BSF	\$0.16	\$4,451.84
	Fire Extinguisher	3	EA	\$340.00	\$1,020.00
	Subcontractor OH & P	20%			\$1,974.37
	SUBTOTAL				\$11,846.21
11	<u>EQUIPMENT</u>				
	Crane and hoisting	1	Sum	\$59,000.00	\$59,000.00
	SUBTOTAL				\$59,000.00
15A	<u>PLUMBING</u>				
	Roof Drain w/ Leader	4	EA	\$1,590.00	\$6,360.00
	Connect to RCP	4	EA	\$500.00	\$2,000.00
	12" Wide Heavy Duty Galvanized Grate	91	LF	\$130.00	\$11,830.00
	6" dia deep seal trap for trench drain	13	EA	\$527.00	\$6,851.00
	Floor Drain w/ Lateral	19	EA	\$527.00	\$10,013.00
	6" Dia Floor Clean Out	7	EA	\$740.00	\$5,180.00
	6" dia CI Sanitary Main Under floor	400	LF	\$53.00	\$21,200.00
	4" dia CI Sanitary Main Under floor	100	LF	\$44.00	\$4,400.00
	6" CI Sanitary Waste and Vent Piping	320	LF	\$49.00	\$15,680.00
	4" CI Sanitary Waste and Vent Piping	200	LF	\$42.00	\$8,400.00
	Vent Thru Roof	12	EA	\$145.00	\$1,740.00
	Wall Hydrant Non Freeze	1	EA	\$475.00	\$475.00

DESCRIPTION			UNIT	TOTAL
	Quantity	UNIT	PRICE	ESTIMATE
Duplex sewage ejector pumps w/ controls	1	EA	\$2,800.00	\$2,800.00
Sump Pump w/ controls & alarm	2	EA	\$2,050.00	\$4,100.00
Water Closet w/flush valve including rough in	1	EA	\$2,250.00	\$2,250.00
Lavatory including rough in	1	EA	\$700.00	\$700.00
Emergency Shower, eye/face wash combinatio	1	EA	\$1,350.00	\$1,350.00
Stainless Steel Utility Sink including rough in	2	EA	\$4,500.00	\$9,000.00
Mop Sink including rough in	2	EA	\$1,340.00	\$2,680.00
Electric Water Cooler	1	EA	\$1,200.00	\$1,200.00
Electric Water Heater	1	EA	\$900.00	\$900.00
Hose Bibb	6	EA	\$92.00	\$552.00
Domestic Water Piping				
2" dia Backflow preventer for Domestic use	1	EA	\$1,768.00	\$1,768.00
Copper piping for domestic use	1	SUM	\$5,000.00	\$5,000.00
Insulation on piping for domestic use	1	SUM	\$3,000.00	\$3,000.00
Valves and fittings for domestic use	1	SUM	\$600.00	\$600.00
Hydraulic test for Sanitary piping	2	EA	\$530.00	\$1,060.00
Pneumatic pressure test for CWS & HWS	2	EA	\$315.00	\$630.00
Interior Nat Gas Piping		NONE		
Subcontractor OH & P Included in Unit Price				
SUBTOTAL				\$131,719.00
15B MECHANICAL SYSTEMS				
Centrifugal Chiller	15000	TON	\$426.00	\$6,390,000.00
Cooling Tower	15000	TON	\$175.00	\$2,625,000.00
Basin Heaters	24	EA	\$1,575.00	\$37,800.00
Side Stream Filter	4	EA	\$9,500.00	\$38,000.00
Shot Chemical Feeder for CHWS	1	EA	\$2,250.00	\$2,250.00
All Pump Prices Include valves and Fit-up				
Secondary Chilled Water Pump 400 HP	6	EA	\$97,300.00	\$583,800.00
Primary Chilled Water Pump 75 HP	6	EA	\$37,500.00	\$225,000.00
Condenser Water Pump 200 HP	6	EA	\$56,150.00	\$336,900.00
Steel Pipe Sch 40 Weld w/ Ftgs and Hngrs				
42"	450	LF	\$485.00	\$218,250.00
36"	780	LF	\$415.00	\$323,700.00
30"		LF	\$343.74	
24"		LF	\$276.00	
20"	750	LF	\$225.00	\$168,750.00

	DESCRIPTION			UNIT	TOTAL
		Quantity	UNIT	PRICE	ESTIMATE
	16"	750	LF	\$211.69	\$158,767.50
	14"	480	LF	\$148.13	\$71,102.40
	12"		LF	\$136.99	
	10"	150	LF	\$122.27	\$18,340.50
	6"	180	LF	\$63.75	\$11,475.00
	3"	120	LF	\$27.60	\$3,312.00
	Steel Pipe Sch 40 Weld Fittings				
	42"	39	EA	\$12,250.00	\$477,750.00
	36"	33	EA	\$10,745.00	\$354,585.00
	30"		EA	\$5,722.00	
	24"		EA	\$4,481.00	
	20"	33	EA	\$3,005.00	\$99,165.00
	16"	32	EA	\$2,145.00	\$68,640.00
	14"	12	EA	\$1,875.00	\$22,500.00
	12"		EA	\$1,062.00	
	10"	21	EA	\$812.00	\$17,052.00
	6"	20	EA	\$420.00	\$8,400.00
	36" Valve Iron Body Butterfly	2	EA	\$15,995.00	\$31,990.00
	30" Valve Iron Body Butterfly		EA	\$14,894.10	
	24" Valve Iron Body Butterfly		EA	\$12,730.00	
	20" Valve Iron Body Butterfly	6	EA	\$7,620.00	\$45,720.00
	16" Valve Iron Body Butterfly	6	EA	\$4,535.00	\$27,210.00
	14" Valve Iron Body Butterfly		EA	\$3,135.00	
	10" Valve Iron Body Butterfly		EA	\$1,235.00	
	20" Valve Iron Body Gate OS&Y	12	EA	\$28,505.00	\$342,060.00
	16" Valve Iron Body Gate OS&Y	24	EA	\$16,850.00	\$404,400.00
	14" Valve Iron Body Gate OS&Y	36	EA	\$11,915.00	\$428,940.00
	12" Valve Iron Body Gate OS&Y		EA	\$5,570.00	
	10" Valve Iron Body Gate OS&Y		EA	\$4,100.00	
	6" Valve Iron Body Gate OS&Y	15	EA	\$1,360.00	\$20,400.00
	3" Valve Iron Body Gate OS&Y	12	EA	\$973.00	\$11,676.00
	20" Valve Iron Body Two Way	6	EA	\$11,500.00	\$69,000.00
	14" Valve Iron Body Two Way	12	EA	\$9,500.00	\$114,000.00
	20 Flexible Connectors	12	EA	\$2,000.00	\$24,000.00
	16" Flexible Connectors	18	EA	\$1,500.00	\$27,000.00
	14" Flexible Connectors	30	EA	\$1,250.00	\$37,500.00
	3" Flexible Connectors	12	EA	\$125.00	\$1,500.00
	Insulate Steel Pipe, Foam Glass				
	36" 3"	780	LF	\$89.20	\$69,576.00
	30" 3"		LF	\$82.50	
	24" 3"		LF	\$66.00	
	16" 3"	750	LF	\$44.00	\$33,000.00
	12" 2"		LF	\$34.00	
	10" 2"		LF	\$24.80	

	DESCRIPTION			UNIT	TOTAL
		Quantity	UNIT	PRICE	ESTIMATE
	30" Add for All Weather Jacket		LF	\$22.32	
	16" Add for All Weather Jacket		LF	\$14.60	
	12" Add for All Weather Jacket		LF	\$11.90	
	Pressure Gauge Dial Type w/ ball valve	12	EA	\$53.00	\$636.00
	Thermometer Stem Type	24	EA	\$80.00	\$1,920.00
	Temperature Sensor	24	EA	\$140.00	\$3,360.00
	Flow Meter	1	EA	\$14,250.00	\$14,250.00
	6" dia Water Meter	1	EA	\$3,010.00	\$3,010.00
	6" dia Backflow preventer for HVAC	1	EA	\$6,310.00	\$6,310.00
	Pneumatic pressure test for CHWS & CHWR	2	EA	\$605.00	\$1,210.00
	Pneumatic pressure test for CWS & CWR	2	EA	\$605.00	\$1,210.00
	Pipe Stanchion Assembly	6	EA	\$375.00	\$2,250.00
	Misc Plant Room Piping and Vessels	1	SUM	\$6,500.00	\$6,500.00
	Exhaust Duct and Devices	12000	LB	\$6.22	\$74,640.00
	Supply Fan Chiller Room 15 HP	1	EA	\$13,000.00	\$13,000.00
	Supply Fan Pump Room 7.5 HP	1	EA	\$6,600.00	\$6,600.00
	Exhaust Fan Chiller Room 7.5 HP	1	EA	\$6,600.00	\$6,600.00
	Exhaust Fan Pump Room 7.5 HP	1	EA	\$6,600.00	\$6,600.00
	Exhaust Fan Restroom	1	EA	\$475.00	\$475.00
	Filter for Ventilation Air 33000 CFM	2	EA	\$7,425.00	\$14,850.00
	Aluminum Louver 192"X90"=120SF Ea	2	EA	\$12,000.00	\$24,000.00
	Aluminum Louver 216"X80"=120SF Ea	2	EA	\$12,000.00	\$24,000.00
	Motorized Damper 192"X90"	2	EA	\$4,811.00	\$9,622.00
	Motorized Damper 216"X80"	2	EA	\$4,811.00	\$9,622.00
	Motorized Fire Damper 84"X60"	1	EA	\$1,405.00	\$1,405.00
	Electric Unit Heater	8	EA	\$2,500.00	\$20,000.00
	Electric Cabinet Heater	1	EA	\$2,445.00	\$2,445.00
	Electric Duct Heater 70KW	1	EA	\$3,050.00	\$3,050.00
	Blower Coil Unit Chilled Water/Electric Reheat	6	EA	\$2,700.00	\$16,200.00
	DDC EMCS system	222	point	\$2,250.00	\$499,500.00
	Subcontractor OH & P	20%			\$2,944,355.28
	SUBTOTAL				\$ 17,666,132
15C	<u>FIRE SUPPRESSION</u>				
	Wet Pipe System Complete		NIC		
	Subcontractor OH & P Included in Unit Price				
	SUBTOTAL				

	DESCRIPTION			UNIT	TOTAL
		Quantity	UNIT	PRICE	ESTIMATE
16	<u>ELECTRICAL SYSTEMS</u>				
	Primary Feeder and Tap		NIC		
	Secondary Feeders	1	SUM	\$120,000.00	\$120,000.00
	Switchgear 15KV, 1200A,5KV,3PH,3W	3	EA	\$87,500.00	\$262,500.00
	10MVA Pad Mnt Transformer 12.4v/4160v	3	EA	\$46,320.00	\$138,960.00
	Switchgear 5KV, 2500A,5KV,3PH,3W	2	EA	\$47,500.00	\$95,000.00
	1200 A Circuit Breaker 5 Kv	5	EA	\$26,400.00	\$132,000.00
MSE	Main Distribution Gear 480V 6000A MCB	3	EA	\$85,750.00	\$257,250.00
	6000 A Tie Main Tie Circuit Breaker	2	EA	\$31,540.00	\$63,080.00
	3750KVA Transformer 4160v PRI 480v SEC	3	EA	\$145,600.00	\$436,800.00
	MCC-A,B,C 480V MCB 3200 A W/ BRKRS, F	3	EA	\$64,800.00	\$194,400.00
	3200 A Tie Main Tie In Circuit Breaker	2	EA	\$24,535.00	\$49,070.00
	MCC-D,E 480V MCB 3000 A W/ BRKRS, FVM	2	EA	\$60,750.00	\$121,500.00
	3000 A Tie Main Tie In Circuit Breaker	1	EA	\$21,750.00	\$21,750.00
	480V Panel MLO 400 A W/ BRKRS '42 SPC	3	EA	\$6,500.00	\$19,500.00
	Distribution Feeders	1	SUM	\$18,500.00	\$18,500.00
	Emergency Power		NIC		
	POWER PANEL 208/120V 3P 4W 42 SPC MCB 225 A W/ BRKRS	3	EA	\$3,570.00	\$10,710.00
	TVSS	1	SUM	\$7,440.00	\$7,440.00
	DISC SWITCH 100 AMP N-1 NFS	6	EA	\$380.00	\$2,280.00
	DISC SWITCH 175 AMP N-1 NFS	24	EA	\$560.00	\$13,440.00
	DISC SWITCH 250 AMP N-1 NFS	6	EA	\$1,120.00	\$6,720.00
	DISC SWITCH 600 AMP N-1 NFS	6	EA	\$1,960.00	\$11,760.00
	DISC SWITCH 1200 AMP N-1 NFS	6	EA	\$5,365.00	\$32,190.00
	VFD 400 HP Furnish and Install	6	EA	\$39,636.00	\$237,816.00
	VFD 200 HP Furnish and Install	6	EA	\$28,185.00	\$169,110.00
	VFD 75 HP Furnish and Install	6	EA	\$14,980.00	\$89,880.00
	VFD 50 HP Furnish and Install	24	EA	\$10,685.00	\$256,440.00
	DISC SWITCH 30 AMP NF	26	EA	\$278.00	\$7,228.00
	TRANSFORMER DRY TYPE				
	30 KVA	3	EA	\$6,200.00	\$18,600.00
	Equipment Feeders & Connections	1	Sum	\$181,500.00	\$181,500.00

DESCRIPTION			UNIT	TOTAL
	Quantity	UNIT	PRICE	ESTIMATE
Power Devices & Branch Circuits				
DUPLEX RECPT	48	EA	\$33.00	\$1,584.00
DUPLEX RECPT GFI	2	EA	\$61.00	\$122.00
DUPLEX RECPT GFI WP	8	EA	\$62.00	\$496.00
SWITCH SP	24	EA	\$31.00	\$744.00
SWITCH 3-WAY	4	EA	\$36.00	\$144.00
SWITCH 4-WAY	2	EA	\$40.00	\$80.00
LIGHTING:				
HID WALL PACK	10	EA	\$585.00	\$5,850.00
HIGH BAY SURFACE MOUNTED	54	EA	\$550.00	\$29,700.00
1X4 INDUSTRIAL FIXTURE	31	EA	\$180.00	\$5,580.00
POLE MOUNTED LIGHT FIXTURE	7	EA	\$3,000.00	\$21,000.00
EXIT LIGHT	4	EA	\$110.00	\$440.00
Branch Circuits	6790	LF	\$5.12	\$34,764.80
Grounding system	1	Sum	\$12,000.00	\$12,000.00
Lightning Protection System	30056	SF	\$0.47	\$14,126.32
Fire Alarm System Includes Security	30056	BSF	\$1.75	\$52,598.00
Refrigerant Detection and relay panel	4	EA	\$1,450.00	\$5,800.00
DATA COMM System Raceway	30056	BSF	\$0.32	\$9,617.92
Telephone Devices & Cable	1	By Owner		
Subcontractor OH & P	20%			\$634,014.21
SUBTOTAL				\$3,804,085.25

RATIONALE COVER SHEET

ESTIMATE OF PROBABLE CONSTRUCTION COST



PROJECT

**Texas State Capitol Complex, Utility Infrastructure DA
Proposed South Chiller Plant**

Location **Austin Texas**
 Estimator: **Keith Kothmann**
 Project CODE:
 Report Date **11-Oct-17**
 Status of Design: **Concept/Design**
 Construction Start Date: **To Be Determined**
 Cost Basis: **All costs are based on competitive bid procurement methods**
All Costs are escalated to 2018
 Building Gross Sq.. Ft. **19,832**
 Construction Cost Limitation **Not Given**

	BLDG SF	COST / SF		COST
ESTIMATED BUILDING CONTRACT COST	19,832	\$693.38	\$	13,751,040
TOTAL DESIGN BUILD PROJECT COST	19,832	\$734.98	\$	14,576,103
Commissioning			\$	150,000
Owner's Construction Contingency			\$	687,552
Owner's administration Cost			\$	385,341
TOTAL COST TO OWNER			\$	15,798,996

NOTES:

- 1 No Hazardous materials expected
- 2 Institutional grade concrete and steel frame structure
- 3 Clear Height inside is 18 FT

Keith Kothmann CPE CCC CCI
 Certified Professional Estimator



Opinion of Probable Cost The opinion of probable project cost is made on the basis of information available and represents the judgments and experienced of a certified professional cost estimator. However, the estimator has no control over the cost of labor, materials, equipment or services furnished by others, or over other market conditions, or over the methodology used for procurement. The Estimator does not guarantee that proposals, or bids for construction will not vary from the opinion of probable cost.

Construction Cost Management Co. FT. WORTH TX, 76163	Texas State Capitol Complex, Utility Infrastructure DA Proposed South Chiller Plant			ESTIMATE OF PROBABLE CONSTRUCTION COST	
	DESCRIPTION: New Construction			DATE:	11-Oct-17
LOCATION : Austin Texas			ESTIMATOR:	K KOTHMANN	
STATUS OF DESIGN Concept Budget			CHECKED BY:		
		BLDG SF	19,832	Gross SF	Cost
RECAPITULATION		PERIMETER	416	LF	Per Sq. Ft.
					TOTAL
General Conditions					\$780,000
SITE PREPARATION				\$ 3.10	\$61,423
EARTHWORK				\$ 9.10	\$180,551
SITE CONCRETE				\$ 0.77	\$15,316
SITE IMPROVEMENTS				\$ 0.42	\$8,397
SITE ELECTRICAL				\$ -	
MECHANICAL SITE UTILITIES				\$ 0.86	\$17,039
FOUNDATION SYSTEM				\$ 17.24	\$341,883
EXTERIOR WALL SYSYEM				\$ 65.81	\$1,305,109
SUPERSTRUCTURE				\$ 62.50	\$1,239,599
INTERIOR CONSTRUCTION				\$ 10.71	\$212,363
ROOFING AND MOISTURE PROTECTION				\$ 6.81	\$135,141
EXTERIOR OPENINGS				\$ 2.15	\$42,702
FINISHES				\$ 4.47	\$88,561
SPECIALTIES				\$ 2.75	\$54,522
EQUIPMENT				\$ 2.97	\$59,000
				\$ -	
PLUMBING				\$ 5.29	\$104,857
MECHANICAL SYSTEMS				\$ 218.35	\$4,330,269
FIRE SUPPRESSION			NOT USED		
ELECTRICAL SYSTEMS				\$ 69.34	\$1,375,180
				\$ -	
SUBTOTAL DIRECT COSTS				\$ 521.98	\$10,351,912
DESIGN CONTINGENCY		15.00%			\$1,552,787
Escalation Allowance to 2018		3.00%			\$357,141
Bond and Insurance		1.95%			\$239,106
PRIME CONTRACTOR OH & P		10.00%			\$1,250,095
Texas Sales Tax Exempt					
ESTIMATED BUILDING CONTRACT COST				\$ 693.38	\$13,751,040
Design Cost		6.00%			\$825,062
TOTAL DESIGN BUILD PROJECT COST					\$14,576,103
Commissioning		SUM			\$150,000
Owner's Construction Contingency		5.00%			\$687,552
Owner's administration Cost		2.50%			\$385,341
TOTAL COST TO OWNER				\$ 796.64	\$15,798,996

Construction Cost Management Co.		Texas State Capitol Complex, Utility Infra Proposed South Chiller Plant Austin Texas			ESTIMATE OF PROBABLE CONSTRUCTION COST	
DESCRIPTION: NEW 2 STORY				19,832 Bldg SF	DATE:	11-Oct-17
LOCATION				ESTIMATOR:		K KOTHMANN
STATUS OF DESIGN		Concept Budget		CHECKED BY:		
DESCRIPTION	Quantity	UNIT	UNIT		TOTAL	
			PRICE	ESTIMATE		
Some Items are Intentional left as Zero Quantities						
2A	<u>SITE PREPARATION</u>					
	Misc Erosion Control Measures	1	SUM	\$2,900.00	\$2,900.00	
	Abatement Allowance	NOT ANTICIPATED				
	Building and Site Demolition and disposal	8000	SF	\$5.66	\$45,280.00	
	Misc Off Site Demolition	1	SUM	\$3,006.00	\$3,006.00	
	Subcontractor OH & P	20%			\$10,237.20	
	SUBTOTAL				\$61,423.20	
2B	<u>EARTHWORK</u>					
	Clearance	1	SUM	\$3,000.00	\$3,000.00	
	Excavate Load Haul and Waste	13208	CY	\$9.03	\$119,269.25	
	Excavate and Stockpile	1247	CY	\$5.90	\$7,355.84	
	Excavate Footings and Beams Neat	277	CY	\$9.07	\$2,512.90	
	Fine Grade Bldg Pad	19832	SF	\$0.23	\$4,561.36	
	Aggregate Base and Compact	367	CY	\$34.50	\$12,657.77	
	Fine Grade Site	2204	SY	\$0.50	\$1,101.78	
	Subcontractor OH & P	20%			\$30,091.78	
	SUBTOTAL				\$180,550.68	
2C	<u>SITE CONCRETE</u>					
	Sidewalk	1000	SF	\$3.75	\$3,750.00	
	6" Concrete Pavement W/ Rnfg	1100	SF	\$4.44	\$4,884.00	
	Integral Curb	90	LF	\$7.53	\$677.70	
	Transformer Pad	400	SF	\$8.63	\$3,452.00	
	Subcontractor OH & P	20%			\$2,552.74	
	SUBTOTAL				\$15,316.44	
2D	<u>SITE IMPROVEMENTS</u>					
	Security Fence	NONE	60	LF	\$36.00	\$2,160.00
	Mech Yard Personnel Gate		1	EA	\$900.00	\$900.00

DESCRIPTION	UNIT		TOTAL ESTIMATE
	Quantity	UNIT	
Mech Yard Service Gate	1	EA	\$1,350.00
Post Mount Sign Info / Directional	2	EA	\$122.00
Pipe Bollard	6	EA	\$210.00
Paint Pavement Striping	1	LF	\$0.30
Misc Landscaping Repair	1	LS	\$450.00
Sod	150	SY	\$4.22
Subcontractor OH & P	20%		
SUBTOTAL			\$8,396.76
2E SITE ELECTRICAL			
UG Duct Bank Primary Conc Encase		NIC	
Electrical Manhole Complete		NIC	
Primary Conductor		NIC	
Site Lighting	NOT ANTICIPATED		
Comm Duct Bank Conc Encase		NIC	
Data Comm Cable Primary service		NIC	
Subcontractor OH & P	20%		
SUBTOTAL			
2F MECHANICAL SITE UTILITIES			
Water Distribution From Existing Plant	SEE PLUMBING		
Remove underground water utility	NOT ANTICIPATED		
Fire water loop	NOT ANTICIPATED		
SANITARY SEWER			
6" sanitary line PVC TR & BF	100	LF	\$24.50
Connect To Existing Sanitary	1	Sum	\$750.00
Sanitary Manhole	1	EA	\$3,453.00
Remove Sanitary	NOT ANTICIPATED		
STORM SEWER			
Remove Storm Line	NOT ANTICIPATED		
12" RCP Trench and Backfill	100	LF	\$36.00
Connect To Existing Storm Utility or Outfall	1	Sum	\$1,267.00
Connect to Roof Drain Lateral	4	EA	\$266.00
Catch Basin and Grate w/ lateral	1	EA	\$1,615.00
Subcontractor OH & P	20%		
SUBTOTAL			\$17,038.80

	DESCRIPTION			UNIT	TOTAL
		Quantity	UNIT	PRICE	ESTIMATE
3	<u>FOUNDATION SYSTEM</u>	9916			
	Drilled Piers w/ Concrete and Rnfg				
	24" assume 25' 18 Each	450	LF	\$36.00	\$16,200.00
	Pier Caps w/ Forms and Rnfg	42	CY	\$340.00	\$14,280.00
	Grade Beam w/ Rnfg on Carton Forms	350	CY	\$296.00	\$103,600.00
	Vapor Barrier	9916	SF	\$0.11	\$1,090.76
	8" SOG w/ Rnfg Complete	9916	SF	\$5.55	\$55,033.80
	8" Stem Wall w/ Forms and Rnfg Complete Form I Side	2858	SF	\$9.65	\$27,576.61
	6" Equipment Pad w/ Rnfg Complete. Includes Future Equipment and Isolation. Add cost to 8" SOG	4958	SF	\$11.50	\$57,017.00
	Set Embeds	1	SUM	\$4,750.00	\$4,750.00
	Misc Forming and Block Outs	1	Sum	\$5,354.64	\$5,354.64
	Subcontractor OH & P	20%			\$56,980.56
	SUBTOTAL				\$341,883.37
4	<u>EXTERIOR WALL SYSYTEM</u>				
	12" CMU Back-Up	9984	SF	\$11.12	\$111,022.08
	Add for Vertical Rnfg and grout fill	9984	SF	\$1.48	\$14,776.32
	Add for 12" Bond Beam	1248	LF	\$7.17	\$8,948.16
	8" CMU Back up at Parapet	1664	SF	\$8.67	\$14,426.88
	Add for 8" Bond Beam	416	LF	\$5.32	\$2,213.12
	Granit veneer 8"	1352	SF	\$78.12	\$105,634.49
	Pre-Patina Zink Louver System	8486	SF	\$65.50	\$555,859.20
	Architectural features	1	SUM	\$92,000.00	\$92,000.00
	EFIS System	2546	SF	\$5.56	\$14,155.32
	Basement wall	7488	SF	\$22.51	\$168,554.88
	Subcontractor OH & P	20%			\$217,518.09
	SUBTOTAL				\$1,305,108.53
5	<u>SUPERSTRUCTURE</u>				
	Elevated concrete Slab System	39664	SF	\$18.55	\$735,767.20
	Galv Grate Deck at Tower Platform	4395	SF	\$22.00	\$96,691.61
	Industrial Handrail Galv.	896.00	LF	\$54.00	\$48,384.00
	Roof Structure and deck	9916	SF	\$13.50	\$133,866.00
	Steel Stair with handrail	62	TRD	\$295.00	\$18,290.00
	Subcontractor OH & P	20%			\$206,599.76

	DESCRIPTION			UNIT	TOTAL
		Quantity	UNIT	PRICE	ESTIMATE
	SUBTOTAL				\$1,239,598.57
6	<u>INTERIOR CONSTRUCTION</u>	19832	BSF		
	Int HM Door & Frame w/ Hdrw Sngl	5	EA	\$989.00	\$4,945.00
	Int HM Door & Frame w/ Hdrw Dbl	2	PR	\$13.50	\$27.00
	CMU Interior Partition	18048	SF	\$9.53	\$171,997.44
	Subcontractor OH & P	20%			\$35,393.89
	SUBTOTAL				\$212,363.33
7	<u>ROOFING AND MOISTURE PROTECTION</u>				
	Moisture Barrier Wall	9984	SF	\$0.78	\$7,787.52
	Caulking & Sealants	1	Sum	\$2,000.00	\$2,000.00
	Wood Blocking Treat Bolt	546	BF	\$2.46	\$1,343.16
	2" Rigid Insulate Roof	9916	SF	\$1.61	\$15,964.76
	Built Up Roof 3-Ply Mod Bit	9916	SF	\$9.75	\$96,681.00
	Set Equipment Curb	3	EA	\$175.00	\$525.00
	Flashing and Reglet	416	LF	\$7.50	\$3,120.00
	Parapet Cap	416	LF	\$16.00	\$6,656.00
	Overflow scupper	4	EA	\$63.00	\$252.00
	Downspout	80	LF	\$8.50	\$680.00
	PC Conc Splash Block	4	EA	\$33.00	\$132.00
	Subcontractor OH & P Included in Unit Price				
	SUBTOTAL				\$135,141.44
8	<u>EXTERIOR OPENINGS</u>				
	OH Door and Track 10X12 Insulated	4	EA	\$5,184.00	\$20,736.00
	Overhead Door Frames	4	EA	\$600.00	\$2,400.00
	Exterior HM Door & Frame w/ Hdrw Sngl	4	EA	\$1,353.00	\$5,412.00
	Exterior HM Door & Frame w/ Hdrw Dbl	1	PR	\$1,905.00	\$1,905.00
	Add for Closure	4	EA	\$193.00	\$772.00
	Add for Panic Device	2	EA	\$625.00	\$1,250.00
	Add for Elect Lock	2	EA	\$980.00	\$1,960.00
	Add for Card Reader	2	EA	\$575.00	\$1,150.00
	Subcontractor OH & P	20%			\$7,117.00
	SUBTOTAL				\$42,702.00
9	<u>FINISHES</u>				

	DESCRIPTION			UNIT	TOTAL
		Quantity	UNIT	PRICE	ESTIMATE
	Paint Equipment and Piping	1	Job	\$23,400.00	\$23,400.00
	Paint Exposed Structure	19832	SF	\$0.56	\$11,105.92
	Text Paint Interior Masonry Surface	28032	SF	\$0.95	\$26,630.40
	Epoxy Paint Floor	9916	SF	\$1.75	\$17,353.00
	Paint Door & Frame	4	EA	\$42.00	\$168.00
	Paint Epoxy Floor	3700	SF	\$1.98	\$7,326.00
	Misc Painting	19832	BSF	\$0.13	\$2,578.16
	Subcontractor OH & P Included in Unit Price				
	SUBTOTAL				\$88,561.48
10	<u>SPECIALTIES</u>				
	Facility ID Sign Allowance	1	Sum	\$2,900.00	\$2,900.00
	Building Graphics Exterior	1	Sum	\$35,000.00	\$35,000.00
	Building Graphics Interior	2	Sum	\$1,501.00	\$3,002.00
	Misc Building Specialties	19832	BSF	\$0.16	\$3,173.12
	Fire Extinguisher	4	EA	\$340.00	\$1,360.00
	Subcontractor OH & P	20%			\$9,087.02
	SUBTOTAL				\$54,522.14
11	<u>EQUIPMENT</u>				
	Crane and hoisting	1	Sum	\$59,000.00	\$59,000.00
	SUBTOTAL				\$59,000.00
15A	<u>PLUMBING</u>				
	Roof Drain w/ Leader	3	EA	\$1,590.00	\$4,770.00
	Connect to RCP	3	EA	\$500.00	\$1,500.00
	12" Wide Heavy Duty Galvanized Grate	64	LF	\$130.00	\$8,320.00
	6" dia deep seal trap for trench drain	9	EA	\$527.00	\$4,743.00
	Floor Drain w/ Lateral	13	EA	\$527.00	\$6,851.00
	6" Dia Floor Clean Out	7	EA	\$740.00	\$5,180.00
	6" dia CI Sanitary Main Under floor	300	LF	\$53.00	\$15,900.00
	4" dia CI Sanitary Main Under floor	60	LF	\$44.00	\$2,640.00
	6" CI Sanitary Waste and Vent Piping	220	LF	\$49.00	\$10,780.00
	4" CI Sanitary Waste and Vent Piping	120	LF	\$42.00	\$5,040.00
	Vent Thru Roof	8	EA	\$145.00	\$1,160.00
	Wall Hydrant Non Freeze	1	EA	\$475.00	\$475.00

DESCRIPTION			UNIT	TOTAL
	Quantity	UNIT	PRICE	ESTIMATE
Hose Bibb	5	EA	\$92.00	\$460.00
Duplex sewage ejector pumps w/ controls	1	EA	\$2,800.00	\$2,800.00
Sump Pump w/ controls & alarm	2	EA	\$2,050.00	\$4,100.00
Water Closet w/flush valve including rough in	1	EA	\$2,250.00	\$2,250.00
Lavatory including rough in	1	EA	\$700.00	\$700.00
Emergency Shower, eye/face wash combinatio	1	EA	\$1,350.00	\$1,350.00
Stainless Steel Utility Sink including rough in	2	EA	\$4,500.00	\$9,000.00
Mop Sink including rough in	2	EA	\$1,340.00	\$2,680.00
Electric Water Cooler	1	EA	\$1,200.00	\$1,200.00
Electric Water Heater	1	EA	\$900.00	\$900.00
Domestic Water Piping				
2" dia Backflow preventer for Domestic use	1	EA	\$1,768.00	\$1,768.00
Copper piping for domestic use	1	SUM	\$5,000.00	\$5,000.00
Insulation on piping for domestic use	1	SUM	\$3,000.00	\$3,000.00
Valves and fittings for domestic use	1	SUM	\$600.00	\$600.00
Hydraulic test for Sanitary piping	2	EA	\$530.00	\$1,060.00
Pneumatic pressure test for CWS & HWS	2	EA	\$315.00	\$630.00
Interior Nat Gas Piping		NONE		
Subcontractor OH & P Included in Unit Price				
SUBTOTAL				\$104,857.00
15B MECHANICAL SYSTEMS				
Centrifugal Chiller	2800	TON	\$426.00	\$1,192,800.00
Cooling Tower	2800	TON	\$175.00	\$490,000.00
Basin Heaters	8	EA	\$1,575.00	\$12,600.00
Side Stream Filter	2	EA	\$9,500.00	\$19,000.00
Shot Chemical Feeder for CHWS	1	EA	\$2,250.00	\$2,250.00
All Pump Prices Include valves and Fit-up				
Secondary Chilled Water Pump 150 HP	4	EA	\$44,577.00	\$178,308.00
Primary Chilled Water Pump 25 HP	4	EA	\$19,900.00	\$79,600.00
Condenser Water Pump 60 HP	4	EA	\$34,500.00	\$138,000.00
Steel Pipe Sch 40 Weld w/ Ftgs and Hngrs				
30"		LF	\$345.00	
24"	300	LF	\$276.00	\$82,800.00
16"	520	LF	\$211.69	\$110,078.80
14"	240	LF	\$148.13	\$35,551.20
12"		LF	\$136.99	

	DESCRIPTION			UNIT	TOTAL
		Quantity	UNIT	PRICE	ESTIMATE
	10"	660	LF	\$122.27	\$80,698.20
	6"	120	LF	\$63.75	\$7,650.00
	3"	80	LF	\$27.60	\$2,208.00
	Steel Pipe Sch 40 Weld Fittings				
	30"		EA	\$5,722.00	
	24"	15	EA	\$4,481.00	\$67,215.00
	16"	24	EA	\$2,145.00	\$51,480.00
	14"	22	EA	\$1,875.00	\$41,250.00
	12"		EA	\$1,062.00	
	10"	21	EA	\$812.00	\$17,052.00
	6"	12	EA	\$420.00	\$5,040.00
	30" Valve Iron Body Butterfly		EA	\$14,894.10	
	24" Valve Iron Body Butterfly		EA	\$12,730.00	
	16" Valve Iron Body Butterfly	2	EA	\$4,535.00	\$9,070.00
	14" Valve Iron Body Butterfly	4	EA	\$3,135.00	\$12,540.00
	10" Valve Iron Body Butterfly	4	EA	\$1,235.00	\$4,940.00
	16" Valve Iron Body Gate OS&Y		EA	\$16,845.00	
	14" Valve Iron Body Gate OS&Y	8	EA	\$11,915.00	\$95,320.00
	12" Valve Iron Body Gate OS&Y		EA	\$5,570.00	
	10" Valve Iron Body Gate OS&Y	44	EA	\$4,100.00	\$180,400.00
	6" Valve Iron Body Gate OS&Y	7	EA	\$1,360.00	\$9,520.00
	3" Valve Iron Body Gate OS&Y	8	EA	\$973.00	\$7,784.00
	10" Valve Iron Body Two Way	8	EA	\$6,900.00	\$55,200.00
	14" Valve Iron Body Two Way	4	EA	\$9,500.00	\$38,000.00
	14" Flexible Connectors	8	EA	\$1,250.00	\$10,000.00
	10" Flexible Connectors	32	EA	\$700.00	\$22,400.00
	3" Flexible Connectors	8	EA	\$125.00	\$1,000.00
	Insulate Steel Pipe, Foam Glass				
	30" 3"		LF	\$82.50	
	24" 3"		LF	\$66.00	
	16" 3"	520	LF	\$44.00	\$22,880.00
	12" 2"		LF	\$34.00	
	10" 2"	480	LF	\$24.80	\$11,904.00
	30" Add for All Weather Jacket		LF	\$22.32	
	16" Add for All Weather Jacket		LF	\$14.60	
	12" Add for All Weather Jacket		LF	\$11.90	
	Pressure Gauge Dial Type w/ ball valve	8	EA	\$53.00	\$424.00
	Thermometer Stem Type	16	EA	\$80.00	\$1,280.00
	Temperature Sensor	16	EA	\$140.00	\$2,240.00
	Flow Meter	1	EA	\$8,975.00	\$8,975.00
	6" dia Water Meter	1	EA	\$3,010.00	\$3,010.00
	6" dia Backflow preventer for HVAC	1	EA	\$6,310.00	\$6,310.00
	Pneumatic pressure test for CHWS & CHWR	2	EA	\$605.00	\$1,210.00

	DESCRIPTION			UNIT	TOTAL
		Quantity	UNIT	PRICE	ESTIMATE
	Pneumatic pressure test for CWS & CWR	2	EA	\$605.00	\$1,210.00
	Pipe Stanchion Assembly	6	EA	\$375.00	\$2,250.00
	Misc Plant Room Piping and Vessels	1	SUM	\$6,500.00	\$6,500.00
	Exhaust Duct and Devices	12000	LB	\$6.22	\$74,640.00
	Supply Fan Chiller Room 15 HP	1	EA	\$13,000.00	\$13,000.00
	Supply Fan Pump Room 7.5 HP	1	EA	\$6,600.00	\$6,600.00
	Exhaust Fan Chiller Room 7.5 HP	1	EA	\$6,600.00	\$6,600.00
	Exhaust Fan Pump Room 7.5 HP	1	EA	\$6,600.00	\$6,600.00
	Exhaust Fan Restroom	1	EA	\$475.00	\$475.00
	Filter for Ventilation Air 33000 CFM	2	EA	\$7,425.00	\$14,850.00
	Aluminum Louver 192"X90"=120SF Ea	2	EA	\$12,000.00	\$24,000.00
	Aluminum Louver 216"X80"=120SF Ea	2	EA	\$12,000.00	\$24,000.00
	Motorized Damper 192"X90"	2	EA	\$4,811.00	\$9,622.00
	Motorized Damper 216"X80"	2	EA	\$4,811.00	\$9,622.00
	Motorized Fire Damper 84"X60"	1	EA	\$1,405.00	\$1,405.00
	Electric Unit Heater	8	EA	\$2,500.00	\$20,000.00
	Electric Cabinet Heater	1	EA	\$2,445.00	\$2,445.00
	Electric Duct Heater 70KW	1	EA	\$3,050.00	\$3,050.00
	Blower Coil Unit Chilled Water/Electric Reheat	6	EA	\$2,700.00	\$16,200.00
	DDC EMCS system	110	point	\$2,250.00	\$247,500.00
	Subcontractor OH & P	20%			\$721,711.44
	SUBTOTAL				\$ 4,330,269
15C	<u>FIRE SUPPRESSION</u>				
	Wet Pipe System Complete		NIC		
	Subcontractor OH & P Included in Unit Price				
	SUBTOTAL				
16	<u>ELECTRICAL SYSTEMS</u>				
	Primary Feeder and Tap		NIC		
	Secondary Feeders	1	SUM	\$80,000.00	\$80,000.00
MSE	Main Distribution Gear 480V 4000A MCB	2	EA	\$58,500.00	\$117,000.00
	4000 A Tie Main Tie Circuit Breaker	1	EA	\$27,885.00	\$27,885.00
	MCC-A,B 480V MCB 2000 A W/ BRKRS, FVN	2	EA	\$40,500.00	\$81,000.00
	MCC-C,D 480V MCB 1000 A W/ BRKRS, FVN	2	EA	\$20,250.00	\$40,500.00
	2000 A Tie Main Tie Circuit Breaker	1	EA	\$17,570.00	\$17,570.00
	1000 A Tie Main Tie Circuit Breaker	1	EA	\$6,935.00	\$6,935.00

DESCRIPTION	UNIT		TOTAL ESTIMATE
	Quantity	UNIT	
480V Panel MLO 400 A W/ BRKRS '42 SPC	2	EA	\$6,500.00
Distribution Feeders	1	SUM	\$11,500.00
Emergency Power		NIC	
POWER PANEL 208/120V 3P 4W 42 SPC MCB 225 A W/ BRKRS	2	EA	\$3,570.00
TVSS	1	SUM	\$7,440.00
DISC SWITCH 100 AMP N-1 NFS	10	EA	\$380.00
DISC SWITCH 175 AMP N-1 NFS	16	EA	\$560.00
DISC SWITCH 200 AMP N-1 NFS	5	EA	\$560.00
DISC SWITCH 450 AMP N-1 NFS	5	EA	\$1,960.00
VFD 150 HP Furnish and Install	5	EA	\$21,635.00
VFD 60 HP Furnish and Install	21	EA	\$13,175.00
VFD 25 HP Furnish and Install	5	EA	\$5,990.00
DISC SWITCH 30 AMP NF	26	EA	\$278.00
TRANSFORMER DRY TYPE 30 KVA	2	EA	\$6,200.00
Equipment Feeders & Connections	1	Sum	\$125,000.00
Power Devices & Branch Circuits			
DUPLEX RECPT	48	EA	\$33.00
DUPLEX RECPT GFI	2	EA	\$61.00
DUPLEX RECPT GFI WP	6	EA	\$62.00
SWITCH SP	24	EA	\$31.00
SWITCH 3-WAY	4	EA	\$36.00
SWITCH 4-WAY	2	EA	\$40.00
LIGHTING:			
HID WALL PACK	10	EA	\$585.00
HIGH BAY SURFACE MOUNTED	38	EA	\$550.00
1X4 INDUSTRIAL FIXTURE	31	EA	\$180.00
POLE MOUNTED LIGHT FIXTURE	7	EA	\$3,000.00
EXIT LIGHT	4	EA	\$110.00
Branch Circuits	6160	LF	\$5.12
Grounding system	1	Sum	\$10,000.00
Lightning Protection System	21668	SF	\$0.47

	DESCRIPTION			UNIT	TOTAL
		Quantity	UNIT	PRICE	ESTIMATE
	Fire Alarm System Includes	21668	BSF	\$1.75	\$37,919.00
	Refrigerant Detection and relay panel				
	DATA COMM System Raceway	21668	BSF	\$0.22	\$4,766.96
	Telephone Devices & Cable	1	By Owner		
	Subcontractor OH & P	20%			\$229,196.62
	SUBTOTAL				\$1,375,179.74

<u>Construction</u> <u>Cost</u> <u>Management Co.</u> FT. WORTH TX, 76163	Texas State Capitol Complex, Utility Infrastructure DA Utility Tunnel - Service 12" Pipe	ESTIMATE OF PROBABLE CONSTRUCTION COST	
DESCRIPTION: Utility Tunnel	DATE:	11-Oct-17	
LOCATION : Austin Texas	ESTIMATOR:	K KOTHMANN	
STATUS OF DESIGN Concept Budget PER 100'	CHECKED BY:		
		Cost	
RECAPITULATION	PERIMETER 100 LF	Per LF	TOTAL
TUNNEL CONSTRUCTION		\$ 5,600.00	\$560,000
PLUMBING		\$ 174.91	\$17,491
MECHANICAL SYSTEMS		\$ 697.67	\$69,767
FIRE SUPPRESSION		\$ -	
		\$ -	
ELECTRICAL SYSTEMS		\$ 43.25	\$4,325
		\$ -	
SUBTOTAL DIRECT COSTS		\$ 6,515.82	\$651,582
DESIGN CONTINGENCY		10.00%	\$65,158
General Conditions		11.00%	\$71,674
Escalation Allowance to 2018		3.00%	\$21,502
Bond and Insurance		1.95%	\$15,793
PRIME CONTRACTOR OH & P		10.00%	\$82,571
Texas Sales Tax Exempt			
ESTIMATED TUNNEL CONTRACT COST PER 100'		\$ 9,082.81	\$908,281
Design Cost		6.00%	\$54,497
TOTAL DESIGN BUILD PROJECT COST			\$962,778
Commissioning		SUM	\$1,000
Owner's Construction Contingency		5.00%	\$45,414
Owner's administration Cost		2.50%	\$25,230
TOTAL COST TO OWNER PER 100'		\$ 10,344.22	\$1,034,422

Construction Cost Management Co.		Texas State Capitol Complex, Utility Infra Proposed North Chiller Plant Austin Texas		ESTIMATE OF PROBABLE CONSTRUCTION COST	
DESCRIPTION: Utility Tunnel				DATE:	11-Oct-17
LOCATION				ESTIMATOR:	K KOTHMANN
STATUS OF DESIGN		Concept Budget PER 100'		CHECKED BY:	
	DESCRIPTION	Quantity	UNIT	UNIT PRICE	TOTAL ESTIMATE
Some Items are Intentional left as Zero Quantities					
2C	<u>TUNNEL CONSTRUCTION</u>				
	Boring 12' Diameter and CIP Concrete	100	LF	\$5,600.00	\$560,000.00
	SUBTOTAL				\$560,000.00
15A	<u>PLUMBING</u>				
	Connect Force Main drainage to existing Storm Drain System	1	EA	\$500.00	\$500.00
	6" Wide Heavy Duty Galvanized Grate	200	LF	\$62.00	\$12,400.00
	Sump Pump w/ controls & alarm	1	EA	\$2,050.00	\$2,050.00
	2 1/2" dia Pressurized Steel Drain pipe	50	LF	\$24.20	\$1,210.00
	2 1/2" dia Drilling in Earth for drain pipe	50	LF	\$26.62	\$1,331.00
	Subcontractor OH & P Included in Unit Price				
	SUBTOTAL				\$17,491.00
15B	<u>MECHANICAL SYSTEMS</u>				
	Steel Pipe Sch 40 Weld w/ Ftgs and Hngrs				
	12"	200	LF	\$136.00	\$27,200.00
	Steel Pipe Sch 40 Weld Fittings				
	12"	2	EA	\$1,062.00	\$2,124.00
	12" Valve Iron Body Butterfly	0.43	EA	\$5,570.00	\$2,395.10
	Insulate Steel Pipe, Foam Glass				
	12" 3"	200	LF	\$36.00	\$7,200.00
	Pneumatic pressure test for CHWS & CHWR	0.20	EA	\$1,600.00	\$320.00
	Pipe Rack Support Assembly	10	EA	\$1,890.00	\$18,900.00
	Subcontractor OH & P				20%
					\$11,627.82

	DESCRIPTION			UNIT	TOTAL
		Quantity	UNIT	PRICE	ESTIMATE
	SUBTOTAL				\$ 69,767
15C	<u>FIRE SUPPRESSION</u>				
	Wet Pipe System Complete		NIC		
	Subcontractor OH & P Included in Unit Price				
	SUBTOTAL				
16	<u>ELECTRICAL SYSTEMS</u>				
	Ejector Pump Equipment Apparatus, Feeders & Connections per 100'	1	Sum	\$825.00	\$825.00
	Power Devices & Branch Circuits				
	DUPLEX RECPT GFI WP 50' OC	2	EA	\$82.00	\$164.00
	LIGHTING:				
	WALL MOUNTED LED FIXTURE 25' OC	4	EA	\$155.00	\$620.00
	EXIT LIGHT w/ battery pack, 1 per 100'	1	EA	\$128.00	\$128.00
	Branch Circuits rigid conduit	100	LF	\$11.80	\$1,180.00
	Intercom System 1 Station 150' OC	0.67	EA	\$1,025.00	\$686.75
	Subcontractor OH & P	20%			\$720.75
	SUBTOTAL				\$4,324.50

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<u>Construction</u> <u>Cost</u> <u>Management Co.</u> FT. WORTH TX, 76163	Texas State Capitol Complex, Utility Infrastructure DA Utility Tunnel - Distribution 30" Pipe	ESTIMATE OF PROBABLE CONSTRUCTION COST	
DESCRIPTION: Utility Tunnel	DATE:	11-Oct-17	
LOCATION : Austin Texas	ESTIMATOR:	K KOTHMANN	
STATUS OF DESIGN Concept Budget PER 100'	CHECKED BY:		
		Cost	
RECAPITULATION	PERIMETER 100 LF	Per LF	TOTAL
TUNNEL CONSTRUCTION		\$ 6,000.00	\$600,000
PLUMBING		\$ 174.91	\$17,491
MECHANICAL SYSTEMS		\$ 2,002.24	\$200,224
FIRE SUPPRESSION		\$ -	
ELECTRICAL SYSTEMS		\$ 43.25	\$4,325
SUBTOTAL DIRECT COSTS		\$ 8,220.40	\$822,040
DESIGN CONTINGENCY 10.00%			\$82,204
General Conditions 11.00%			\$90,424
Escalation Allowance to 2018 3.00%			\$27,127
Bond and Insurance 1.95%			\$19,925
PRIME CONTRACTOR OH & P 10.00%			\$104,172
Texas Sales Tax Exempt			
ESTIMATED TUNNEL CONTRACT COST PER 100'		\$ 11,458.92	\$1,145,892
Design Cost 6.00%			\$68,754
TOTAL DESIGN BUILD PROJECT COST			\$1,214,646
Commissioning SUM			\$1,000
Owner's Construction Contingency 5.00%			\$57,295
Owner's administration Cost 2.50%			\$31,824
TOTAL COST TO OWNER PER 100'		\$ 13,047.64	\$1,304,764

Construction Cost Management Co.		Texas State Capitol Complex, Utility Infra Proposed North Chiller Plant Austin Texas		ESTIMATE OF PROBABLE CONSTRUCTION COST	
DESCRIPTION: Utility Tunnel				DATE:	11-Oct-17
LOCATION				ESTIMATOR:	K KOTHMANN
STATUS OF DESIGN		Concept Budget PER 100'		CHECKED BY:	
	DESCRIPTION	Quantity	UNIT	UNIT PRICE	TOTAL ESTIMATE
	Some Items are Intentional left as Zero Quantities				
2C	<u>TUNNEL CONSTRUCTION</u>				
	Boring 14' Diameter and CIP Concrete	100	LF	\$6,000.00	\$600,000.00
	SUBTOTAL				\$600,000.00
15A	<u>PLUMBING</u>				
	Connect Force Main drainage to existing	1	EA	\$500.00	\$500.00
	6" Wide Heavy Duty Galvanized Grate	200	LF	\$62.00	\$12,400.00
	Sump Pump w/ controls & alarm	1	EA	\$2,050.00	\$2,050.00
	2 1/2" dia Pressurized Steel Drain pipe	50	LF	\$24.20	\$1,210.00
	2 1/2" dia Drilling in Earth for drain pipe	50	LF	\$26.62	\$1,331.00
	Subcontractor OH & P Included in Unit Price				
	SUBTOTAL				\$17,491.00
15B	<u>MECHANICAL SYSTEMS</u>				
	Steel Pipe Sch 40 Weld w/ Ftgs and Hngrs				
	36"	200	LF	\$456.50	\$91,300.00
	Steel Pipe Sch 40 Weld Fittings				
	36"	2	EA	\$11,522.00	\$23,044.00
	36" Valve Iron Body Butterfly	0.43	EA	\$17,594.00	\$7,565.42
	Insulate Steel Pipe, Foam Glass				
	36" 3"	200	LF	\$98.12	\$19,624.00
	Pneumatic pressure test for CHWS & CHWR	0.20	EA	\$1,600.00	\$320.00
	Pipe Rack Support Assembly	10	EA	\$2,500.00	\$25,000.00

	DESCRIPTION			UNIT	TOTAL
		Quantity	UNIT	PRICE	ESTIMATE
	Subcontractor OH & P	20%			\$33,370.68
	SUBTOTAL				\$ 200,224
15C	<u>FIRE SUPPRESSION</u>				
	Wet Pipe System Complete		NIC		
	Subcontractor OH & P Included in Unit Price				
	SUBTOTAL				
16	<u>ELECTRICAL SYSTEMS</u>				
	Ejector Pump Equipment Apparatus, Feeders	1	Sum	\$825.00	\$825.00
	Power Devices & Branch Circuits				
	DUPLEX RECPT GFI WP 50' OC	2	EA	\$82.00	\$164.00
	LIGHTING:				
	WALL MOUNTED LED FIXTURE 25' OC	4	EA	\$155.00	\$620.00
	EXIT LIGHT w/ battery pack, 1 per 100'	1	EA	\$128.00	\$128.00
	Branch Circuits rigid conduit	100	LF	\$11.80	\$1,180.00
	Intercom System 1 Station 150' OC	0.67	EA	\$1,025.00	\$686.75
	Subcontractor OH & P	20%			\$720.75
	SUBTOTAL				\$4,324.50