UTILITIES MASTER PLAN

SPRING 2015

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EXECUTIVE SUMMARY

The Utilities Master Plan for the University of Tennessee Knoxville is intended to provide a comprehensive overview of the existing utilities required to serve the current needs of the UTK and UTIA campuses and the future growth to support the Top 25 Vision and 2011 Campus Master Plan.

The utilities required to serve UTK can be grouped into the following five disciplines described in this master plan:

- Electrical Distribution
- Steam Plant
- Underground Piped Systems
- Mechanical Systems
- Energy Conservation

These utility disciplines are continually monitored to determine maintenance, replacement and upgrades required to provide continuous and reliable utility service to campus. As such, the need for capital improvement projects is required. Through this analysis, current, short, mid and long term capital projects were identified. This Utility Master Plans lists the following projects:

CURRENT CAPITAL PROJECTS:

Main Substation Replacement	$4,000,000
Replacement of Overhead Power Lines (Circuit 7 and 8)	$3,000,000
Campus Metering and Monitoring Project	$2,000,000
Steam Plant Conversion Project	$25,000,000
Cumberland Avenue Steam Line Replacement	$1,200,000
Steam Distribution System Improvements	$6,000,000
Chiller System Replacements: The Hill	$5,000,000
Science Engineering System Improvements, Phase 1	$9,000,000
Laurel Substation Upgrades (13th and Cumberland)	$5,000,000
ESTIMATED TOTAL:	**$60.2M**

SHORT TERM CAPITAL PROJECTS (2-5 YEARS):

Fire Safety Upgrades	$15,000,000

Executive Summary

Various Chiller Replacement Projects	$3,000,000
HVAC Controls Systems Consolidation and Upgrades	$9,000,000
Multi-Purpose Mechanical Building- Caledonia Avenue	$TBD
Estimated Total:	**$27M+**

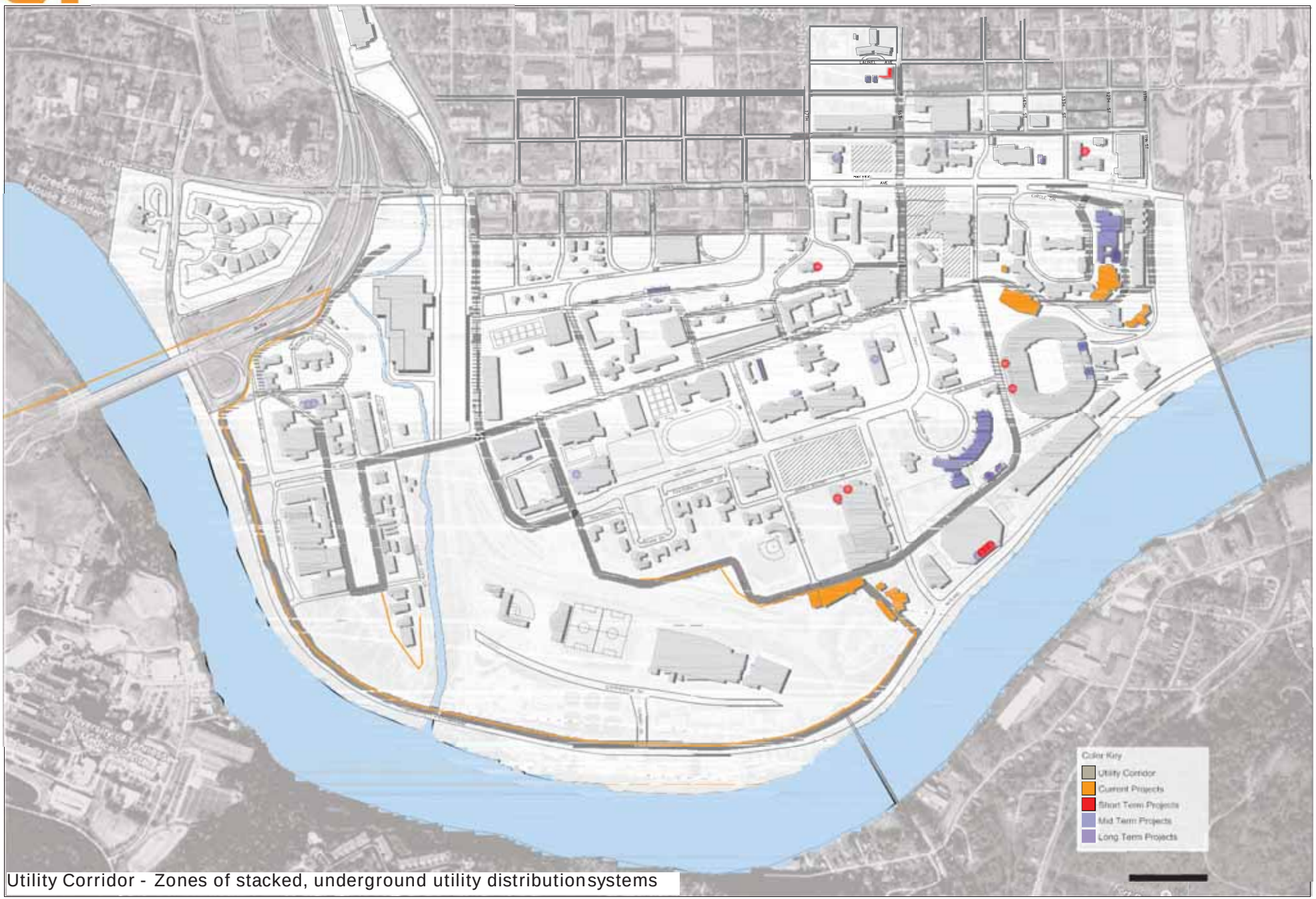
Mid Term Capital Projects (5-10 years):

Regional Generator Emergency Power Supply
Steam Distribution Upgrades
Improvements to the Water Distribution System
Sanitary Sewer and Storm Water Improvements
Multi-Purpose Mechanical Building- Temple Hall
Various Chiller Replacement Projects
Dabney/Buehler Systems Upgrade Phase 1
Andy Holt Tower Systems Upgrades/Controls & Equipment
Communications & Student Services System Upgrades

Long Term Capital Projects (10+ years):

Various Chiller Replacement Projects

INTRODUCTION



Utility Corridor - Zones of stacked, underground utility distributionsystems

INTRODUCTION

OVERVIEW

The Utilities Master Plan is intended as a guide for future capital utility projects that will be required to best serve the University of Tennessee- Knoxville (UTK) and the University of Tennessee Institute of Agriculture (UTIA) over the next 25 years. Though two separate campuses, UTK and UTIA form one region that's dedicated to higher education at the University of Tennessee. The Cherokee Campus is not included in this document. This document is will serve as a counterpart to the 2011 Long Range Campus Master Plan as it is outlines the necessary utility improvements required to fulfill the University of Tennessee's goal to become a top 25 Public Research University.

The goals of this master plan are:

- Discuss the purpose and function of each utility system serving campus, including the importance of these utilities and building services relative to campus improvements
- Provide an overall understanding and operation of existing campus utility systems
- Analyze the need for future utility improvements that will support the University's goals
- Discuss funded capital utility projects including purpose, cost and time-line for implementation
- Create a master plan for each utility that includes future capital utility infrastructure upgrades and space requirements
- Outline the short, mid and long term capital projects along with projects required to maintain the service reliability of all utilities
- Provide the fore-casted utility operations, shop operating budgets and maintenance costs for each discipline on an annual basis
- Discuss the implementation of new energy conservation measures on new and existing utility systems

The purpose of this document is to provide a long range and clear vision of the utility systems at the University of Tennessee. The complexities of the all technical disciplines, which include HVAC, electrical, plumbing, steam and air distribution, will each have efficient amounts of information provided. The campus master plan has foreseen many new buildings to be constructed in the near and distant future. Addressing these possible building utilities could play a huge role in how efficient future developments are implemented.

PROPOSAL OF FUTURE UTILITIES

With the goals of the University of Tennessee to become a top 25 public research institution, a key requirement will be creating and maintaining a reliable atmosphere fitting for first rate academic research and services. The proposal of future capital utility infrastructure improvements addressed in this document will serve as the foundation for the campus towards expansion and efficient operation of new and existing facilities.

This Utility Master Plan will identify capital utility infrastructure upgrades with in the following four areas:

- Current Projects
- Short Term
- Mid Term
- Long Term

Current projects will include all active capital utility infrastructure projects that are occurring on both campuses. These projects may vary in stages of completeness, ranging from planning and design through construction.

Short Term projects will include capital infrastructure projects that are of the most importance and are awaiting approval through the Board of Trustees. These projects address current utility needs and should be implemented in the next two to five years.

The future projects in the mid term and long term categories are at schematic and conceptual phases. These projects correspond with the future growth of campus and necessary upgrades to keep existing infrastructure reliable.

REFERENCED DOCUMENTS

- 2011 Long Range Master Plan - The 2011 Campus Master Plan recommends constructing new buildings and renovating existing facilities in the short, mid and long term visions. This information is essential in creating a utility master plan that will identify future utility needs for these long term visions. This document is available for download at http://masterplan.utk.edu/downloads/

- Campus Landscape Vision & Site Standards - This document outlines key standards regarding how to screen utilities and maintain accessibility to landscape features for future maintenance. This document is available to download at the same website as the 2011 Long Range Master Plan.

- Campus Survey - The University of Tennessee has worked with a local surveyor to create base mapping that provides the locations of chilled water, compressed air, gas, sanitary water, steam, stormwater, telephone communications, underground power, and water utilities on both campuses. Due to the sensitive nature of this mapping, these surveys are not available to the public.

FUTURE DESIGN CONSIDERATIONS

The University of Tennessee is restructuring the steps taken towards the utility design process on campus for new buildings. Aside from designing new buildings that blend with the Collegiate Gothic architectural style, the importance of utility placement and distribution is being integrated into the schematic design phases to allow the proposed utilities to be integrated properly and efficiently into the existing utility system. This restructuring is a key element in creating a project that has reliable and maintainable utility service that is available when the building is ready to be utilized. The following steps are being taken during the project design phase to ensure that proposed buildings on campus will have efficient and reliable utility service:

- Specific building electrical and mechanical systems must be considered during the site development phase
- Campus utility services personnel should be included in every meeting through all aspects of design from conceptual phases to completion
- Designers need to be aware of existing utilities' locations, conditions and capacities(both public and private), in the areas being developed
- Utilities infrastructure modifications or additions required by the project are to be incorporated into the budget for the project
- Campus owned utilities, where available, should be utilized to maintain efficiency of the building
- Continuity of service for every utility, whether public or private, during the construction phase should be a design consideration

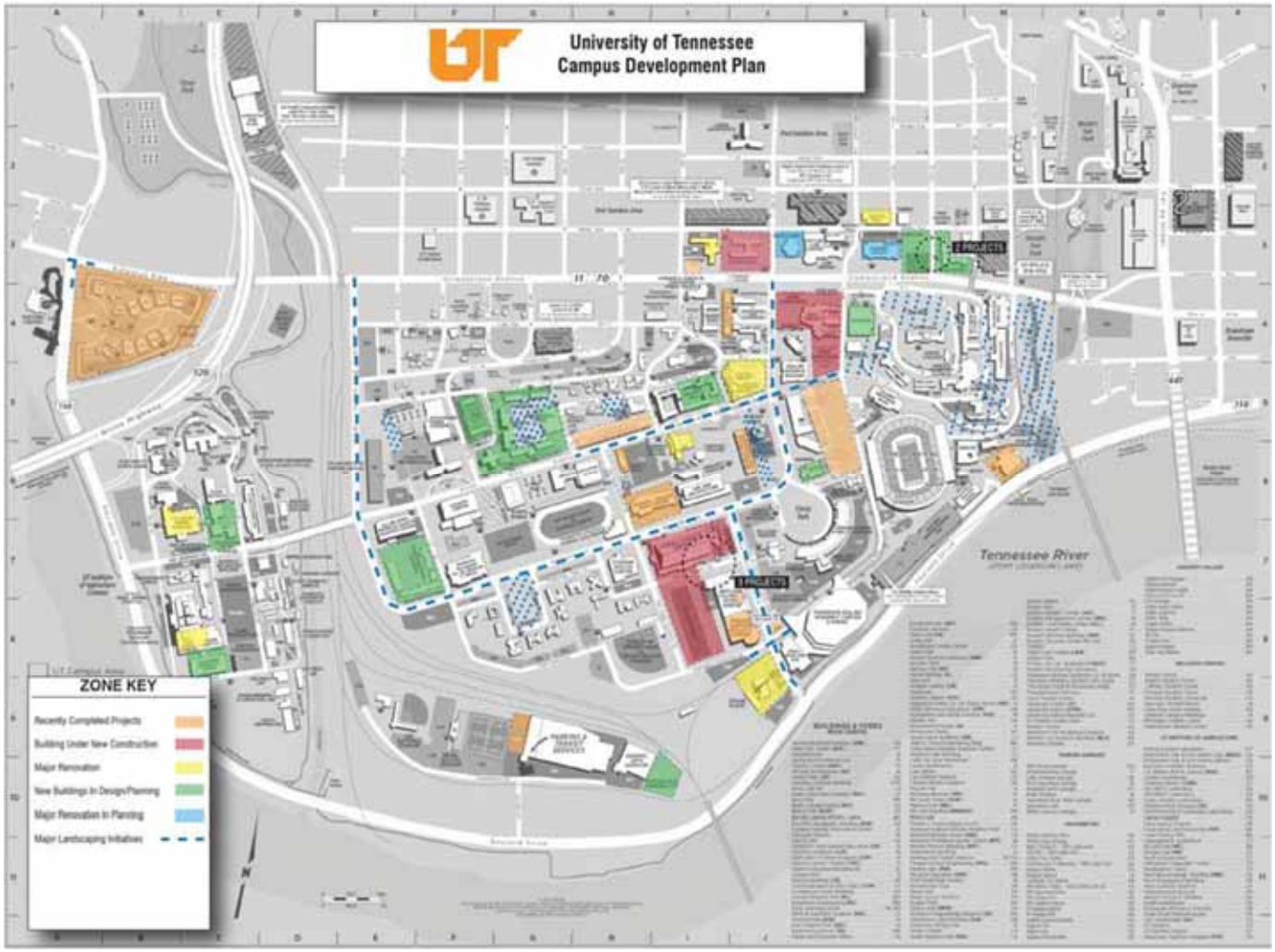
The following page includes a list of current development projects on campus where the design considerations listed above are being implemented.

CURRENT DEVELOPMENT PROJECTS

The UT Campus Development Plan displays all the completed, current and approved projects on the University of Tennessee's campus. The completed projects include Sorority Village, the Temple Hall addition, Humanities and Social Sciences building renovations, the Anderson Training Center, Natalie Haslam Music Center, the John D. Tickle Engineering Building, the Pat Summitt Plaza, the Staff 9 parking Lot, the Cumberland Ave Volshop, the Hand Digital Studio, the Fred D. Brown Jr. Residence Hall and the Joan Cronan Volleyball Center.

Projects underway include the construction of the new Gibbs Hall and parking garage, the extension of Blueberry Falls, completing phase one of the New Student Union, and several smaller renovation projects.

For the ongoing projects on campus see here:
http://conezone.utk.edu/projects/



Current Building Projects

Overview & Utility Needs

The University of Tennessee's journey to become a top 25 public research institution has brought with it a host of facilities improvements across campus. New and renovated academic buildings, student life facilities, and labs and research space, coupled with a renewed focus on landscaping and beautification projects are changing the face of campus for the better. We must balance our growth with our strategic plan and the associated price tags for meeting our goals.

We are focused on accountability and staying affordable and accessible to all qualified students who want to be Volunteers. And once they are here, we commit resources to help our students success and graduate in four years without the burden of debt. This overview of future buildings are expected to all be completed within the next 10 years.

13th and Cumberland

Anticipation Open Date: 2018

13th and Cumberland is a proposed 7-story lab research building located on the corner of Cumberland Ave and 13th Street (approximately X gross square feet). This building is currently under design but does have capital construction funding identified at this time. The following are the anticipated infrastructure upgrades:

Electrical: Upgrade to Laurel Substation
Natural Gas: Existing utility taps
Steam: Existing tap
Water: New 10" main on 13th st
Sewer: Existing tap

Current Building Projects

Ellington Plant Sciences

Anticipated Open Date: TBD

Ellington Plant Sciences is a classroom building proposed on the UTIA campus (approximately X gross square feet). Design and construction have not begun on this project as funding has yet to be identified. Based on the building program, the following infrastructure upgrades are anticipated:

Electrical: New high voltage distribution
Natural Gas: Existing tap
Steam: Existing tap
Water: Main needs replacing
Sewer: Existing tap

Engineering Service Building

Anticipated Open Date: 2018

The Engineering Services Building will be the home of Nuclear Engineering and the Freshman Engineering Engage program (approximately 220,000 square feet). Based on the building program, the following infrastructure upgrades are anticipated:

Electrical: New service connection
Natural Gas: Upgrade service
Steam: Existing tap
Water: Complete loop on lower drive

Current Building Projects

New Residence Hall and New Parking Garage

Anticipated Open Date: 2016

The New Residence Hall and Parking Garage, located on the old Stokely and Gibbs site, will house approximately X beds and X vehicular parking spaces. The design is completed and construction will be completed Jan 2016. The following infrastructure upgrades are required:

Electrical: New heat voltage infrastructure switch
Natural Gas: New meter
Steam: Service tap
Water: New loop
Sewer: New lines

Current Building Projects

Melrose Hall

Anticipated Open Date: TBD

Melrose Hall is a classroom building proposed on the UTIA campus (approximately X gross square feet). Design and construction have not begun on this project as funding has yet to be identified. Based on the building program, the following infrastructure upgrades are anticipated:

Electrical: N/A
Natural Gas: N/A
Steam: Existing tap
Water: Up-size existing lines
Sewer: Existing tap

Panhellenic Building

Anticipated Open Date: TBD

The Panhellenic Building will be replaced due to the growing needs of campus. This building is yet to be programmed, but is anticipated to be research labs with classrooms on lower levels. Based on limited information, the following infrastructure upgrades are anticipated:

Electrical: N/A
Natural Gas: N/A
Steam: N/A
Water: N/A
Sewer: N/A

Current Building Projects

Strong Hall

Anticipated Open Date: 2016

The Panhellenic Building will be replaced due to the growing needs of campus. This building is yet to be programmed, but is anticipated to be research labs with classrooms on lower levels. Based on limited information, the following infrastructure upgrades are required:

Electrical: Already upgraded
Natural Gas: New line
Steam: New line
Water: Upgraded by KUB
Sewer: New tap

Walters Life Sciences

Anticipated Open Date: 2025

The Walters Life Sciences Building will be replaced due to the growing needs of campus. This building is yet to be programmed, but is anticipated to be research labs with classrooms on lower levels. Based on the limited information, the following infrastructure upgrades are anticipated:

Electrical: New taps
Natural Gas: New meter
Steam: New taps
Water: New taps
Sewer: New taps

Current Building Projects

West Campus development

Anticipated Open Date: 2016-19

Melrose Hall is a classroom building proposed on the UTIA campus, approximately XX gross square feet. Design and construction have not begun on this project as funding has yet to be identified.

Based on the building program, the following infrastructure upgrades are required:

Electrical: New distribution
Natural Gas: New distribution
Steam: N/A
Water: New taps and laterals
Sewer: New taps

Electrical Distribution

Overview

The University of Tennessee Knoxville owns and maintains the electrical distribution system that provides electricity to both the UTK and UTIA campuses. This system includes all components of the electrical distribution system, including protective equipment, underground conductors, transformers, and switchgear. The University purchases power directly from the Knoxville Utilities Board (KUB) at 13,200-volts and distributes it within this system. Facilities Services performs maintenance on this system, including repair and replacement of overhead and underground distribution lines, repair and replacement of transformers and switchgear, rerouting power as necessary during emergencies, repair of a building electrical system, and repair and replacement of outdoor lighting systems. It is critical that the electrical system is designed, constructed and maintained to provide the reliability required for a major research institution.

Existing System

UTK Campus Overview

The UTK campus distributes most of the power purchased from KUB (13,200-volts) to both campuses from two substations: Central substation and Laurel substation. A small portion of University properties such as houses and outlying buildings are directly served by KUB. The Central substation utilizes ten nominal 400-amp, 13,200-volt circuits and the new Laurel substation provides four more nominal 400-amp, 13,200-volt circuits. Most of the electrical distribution on the UTK Campus is underground with the goal to have all distribution underground no later than 2018. This allows for a reliable utility environment for a top tier research and academic institution.

The Central substation is an open substation, located on Chamique Holdsclaw Drive, and uses vacuum circuit re-closers with power being provided from an immediately adjacent KUB substation. This substation was built in 1965 and has been upgraded over time. There is a proposal to replace this existing substation due to age, reliability and safety concerns with new technology. The new technology proposed will virtually eliminate substation outages due to vegetation and animal intervention.

Due to continued campus growth, the central substation reached its maximum practical limits. A new substation, the Laurel substation, located at the corner of Sixteenth Street and Laurel Avenue, was constructed and went live in the fall of 2012. This substation was designed to blend in with the surrounding community and is securely housed within a structure constructed using brick and cladding materials. The substation building structure and duct line system were designed to allow substation capacity to double, with ultimate capacity of eight underground circuits. There are currently 4 circuits extending onto main campus.

The four existing circuits serve the following locations:

ELECTRICAL DISTRIBUTION

Min H. Kao Engineering Building
Remaining Buildings on The Hill
Heart of the campus at Middle Drive and Phil Fulmer Way, extending onto the main campus
North side of Cumberland Avenue and extending to a central point on campus, along Andy Holt Drive.

UTIA Campus Overview

Most of the electrical distribution on the UTIA Campus is underground with the exception of a portion of the main feeders leaving the Central Substation and a minor amount of overhead lines serving some of the older greenhouses. The electrical power distribution on this campus is connected to the 13,200-volt system located on the UTK Campus and therefore do not require additional substations at this time. There are two electrical circuits providing power to this campus which originate from sectionalized switchgear located on the Main Campus adjacent to the Allan Jones Intercollegiate Aquatic Center. Portions of the electrical infrastructure serving the UTIA campus are under review and will be replaced or upgraded in the near future.

Transformers

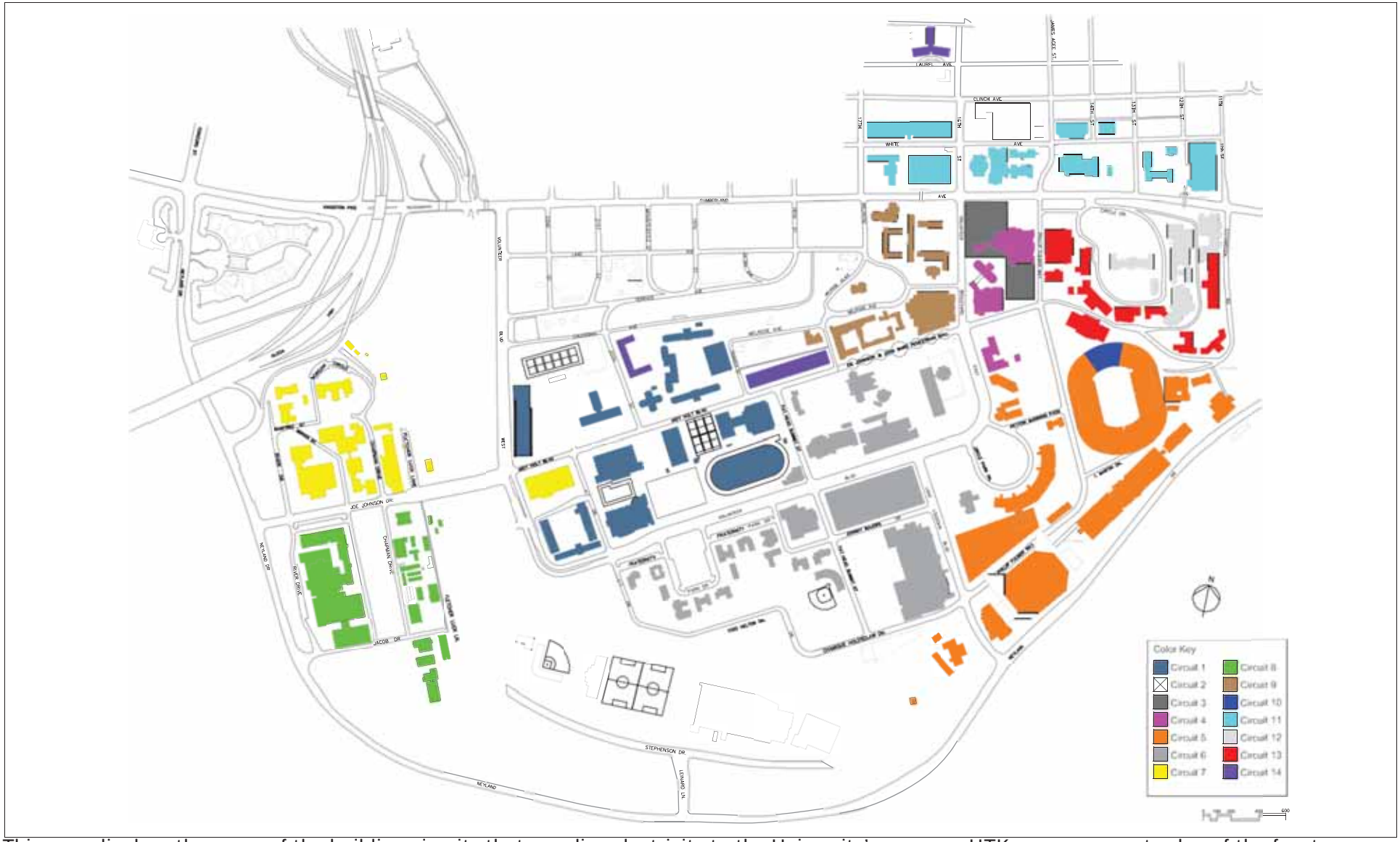
For the servicing of electrical distribution, The University of Tennessee uses Pad Mounted Transformers throughout the campus that come in a variety of designs and configurations. Liquid -filled, three-phase, commercial pad-mounted distribution transformers are designed for servicing underground distribution loads of the size and magnitude of UTK.

Switchgear

The UTK campus uses several different types of primary distribution switchgear: S&C Vista Switchgear and S&C PMH padmount switchgear for distribution and Iso-Phase, Gas Insulated Switchgear for substations. Vista Switchgear and PMH switchgear serve underground distribution. Vista Switchgear is enclosed in a submersible, SF-6 insulated, welded steel tank; providing the ultimate reliability while minimizing real estate restrictions. The University of Tennessee has several vistas located on campus to help with the power distribution. PMH switchgear is air insulated and are mostly used for building switches. UTK uses Iso-Phase, Gas Insulated Switchgear (GIS) in the Laurel Substation and the proposed new Central Substation. The advantages of GIS equipment is its' safety and reliability. This type of switchgear does not require arc flash equipment while servicing and does not expose operators to high and dangerous voltages. It is housed inside a building, immune to animals and weather conditions. The switchgear is virtually maintenance free. The footprint is much smaller versus the old substation and its modular design makes it easier to install. It is also resistant to earthquake and other natural phenomenon such as wind and lightning which can have great effect on lesser designs.

Electrical Distribution

Existing Electrical Circuit Map



This map displays the areas of the building circuits that supplies electricity to the University's campus. UTK campus uses twelve of the fourteen circuits and UTIA uses two circuits. Circuit 2 is the campus standby.

Electrical Distribution

A map is available that displays the locations for the building circuits that supply electricity to the University's campus. As previously stated, the Central Substation controls ten nominal 400 amp circuits while the Laurel Substation controls four nominal 400 amp circuits and has room for future expansion. On the map, the building zones are color coded and each circuit supplies a zone of buildings on campus. UTK campus uses twelve of the fourteen circuits and UTIA uses the remaining two circuits. Refer to appendix A for a table indicating which circuits.

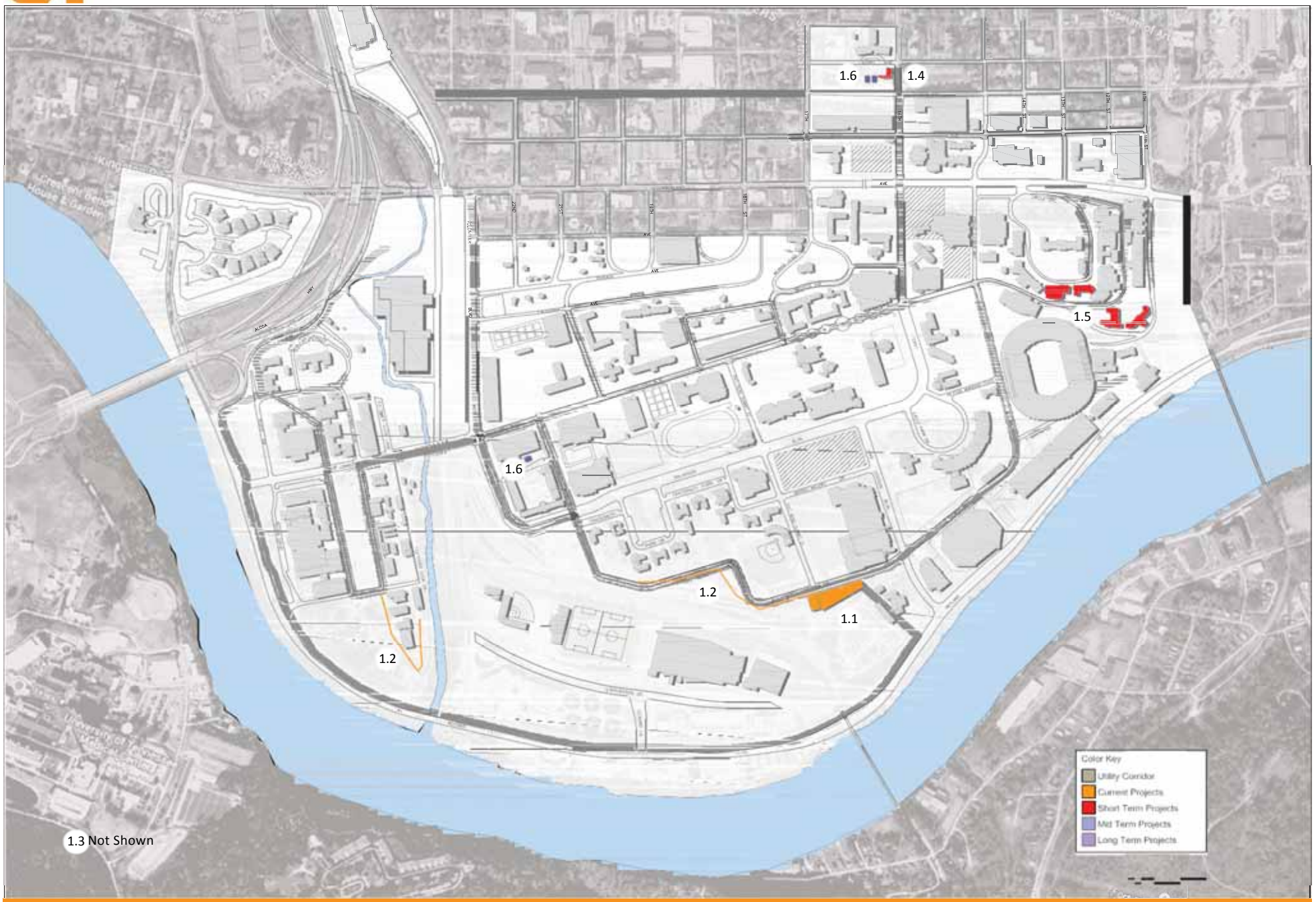
Analysis of Need

Maintenance, replacement and performance upgrades are required to maintain and keep current the existing electrical system that is critical to providing service to the UTK and UTIA campuses. In addition, additional capacity will be necessary to serve future expansions.

Upon review of the existing system the following needs became apparent:

- Older lines insulated with cross-linked polyethylene are beyond their useful lives and require replacement.
- Additional sectionalized switchgear is needed throughout campus to enhance reliability of the system, minimize duration of power outages and to allow for rerouting of electrical feeds to provide redundancy in the system.
- Replacement of older inefficient distribution transformers with new modern transformers with higher efficiencies, resulting in lower operating costs.
- Replacement of the existing Central Substation with a new more reliable substation that will provide additional circuits and service to future campus buildings and expansions.
- Replacement of cross-linked polyethylene insulated power conductors which have reached their useful life expectancy with EPR insulated conductors throughout campus.
- Bury existing above ground power distribution lines in underground duct banks feeding the UTIA campus.

Electrical Distribution



ELECTRICAL DISTRIBUTION

CAPITAL PROJECT LIST

No.	Capital Project	Status of Project
1.1	Main Substation Replacement	Current (2014/15)
1.2	Circuit 7 and 8 Replacement of Overhead Sections	Current (2014/15)
1.3	Campus Metering and Monitoring (Not Shown on Master Plan)	Current (2014/15)
1.4	Laurel Substation Improvements	Short Term (2015/16)
1.5	Fire Safety Improvements	Short Term (2015/16)
1.6	Regional Generator Emergency Backup Supply	Mid Term

Electrical Distribution

Current Projects

Main Substation Replacement

Project Budget: $4,000,000

Fiscal Year: 2014/15

The University's main substation is located along Chamique Holdsclaw Drive. This central substation, which holds ten of the 14 nominal 400 amp, 13,200-volt circuits that supply electricity to the campus, is open to air and utilizes circuit re-closers. The project to replace the existing overhead conditions is funded and underway. The idea is to convert the circuits into 10 new GIS (Gas Insulated Switchgear) circuit breakers. This will address the issue of beautification on this site as well as minimizing the amount of maintenance since the switchgear will be housed inside.

E- Houses (Electrical Houses) are fully functional solutions with electrical switchgear complete with protection and control for interconnection to any utility distribution. They also cost considerably less to engineer, integrate, and construct than structures built on-site. It completes the task with limited resources while simultaneously maintaining existing processes and operations. While not in the current budget, the E-house installed can eventually have brick veneer applied to capture the look of UT buildings. The renovation is set to be complete December 2015.

View of the overhead circuit breakers

Example of E-House at KUB Station

Electrical Distribution

Circuit 7 and 8 Replacement of Overhead Sections

Project Budget: $3,000,000

Fiscal Year 2014/15

Circuit 7 and 8 are overhead distribution lines located on the UTIA campus. These distribution lines will be installed in underground duct banks. The remaining overhead lines on UTK campus behind Fraternity Park will also be installed underground.

Overhead lines by CRC/Mast Lab

Campus Metering and Monitoring Project

Project Budget: $2,000,000

Fiscal Year: 2014/15

A SCADA (Supervisory Control and Data Acquisition) is currently being installed and expansion planned to improve distribution system management, monitoring and control. The first step in expanding and implementing this technology is the installation of radio communication systems and new metering for both electricity and water which is currently underway. The ultimate goal of this system is to improve the acquisition of data for energy management and to greatly reduce or eliminate the possibility of unscheduled outages due to better monitoring and system redundancy.

No Image Available

IDENTIFICATION OF FUTURE PROJECTS

SHORT TERM

LAUREL SUBSTATION IMPROVEMENTS **PROJECT BUDGET: $5,000,000**
FISCAL YEAR: 2015/16

This project will further rehabilitate the Laurel Substation by adding GIS switchgear, resulting in two additional high voltage circuits. This additional capacity is required to accommodate the future demand associated with the construction of Strong Hall and 13th and Cumberland science buildings. This addition will allow for more redundancy of the electricity distribution system, increase the overall reliability, and reduce the possibility of unscheduled outages for all campus properties.

FIRE SAFETY IMPROVEMENTS **PROJECT BUDGET: $15,000,000**
FISCAL YEAR: 2015/16

This project will provide firesafety enhancements to multiple buildings including Ferris Hall, Perkins Hall, Nielsen Physics, and Earth and Planetary Sciences.

REGIONAL GENERATOR EMERGENCY POWER SUPPLY **PROJECT BUDGET: $11,495,000**
FISCAL YEAR: TBD

The electrical system serving UTK campus provides power necessary for academic instruction, critical research facilities, student housing, food service facilities, health care facilities, Police Department, Veterinary Teaching Hospital and administration. A sustained power outage would create very high losses, both monetary and time, including the loss of valuable research. To prevent this loss, three regionally located, four megawatt, diesel generators will be installed to provide power in the event of major emergencies. This installation would allow the University to function as a micro-grid during periods of power curtailment or during extended power outages due to natural disaster or other interruptions to the TVA or KUB systems. For reasons of design and connection to the university system these generators are proposed to be located at the Laurel Avenue Substation (two generators) and the Allen Jones Swim Facility. An additional 4.5 megawatt, Multi-Fuel, gas or fuel oil powered generator is proposed at the Steam Plant.

Electrical Distribution

Operation and Maintenance

The anticipated cost to operate and maintain the electrical distribution system on the UTK and UTIA campuses is approximately **$X*** annually. This cost is exclusive of the direct utility consumption costs paid to KUB and any expenses associated with capital projects included elsewhere in this document.

Additional Resources: UT Facilities Services

- For more information on Standards, Policies, and Specification visit http://facserv.utk.tennessee.edu/policies/default.htm
- For an overview of UT Electrical Services visit http://facserv.utk.tennessee.edu/divisions/Utilities/Electric/default.htm
- For Lighting Standards visit the Landscape Standards document at http://masterplan.utk.edu/files/2013/uploads/landscape-site-standards.pdf

Steam Plant

Overview

The University of Tennessee Steam Plant is responsible for the maintenance and operation of the central steam plant which serves both the Main and Agricultural campuses. 153 buildings, containing over 7,000,000 square feet of space, are served by the Steam Plant. Steam is used for heating and domestic hot water in these facilities, as well as to operate sterilizers, autoclaves, and the like. Eleven miles of underground steam pipe and return lines crisscross the Main and Agricultural campuses. The steam is distributed from the campus Steam Plant year-round via an underground piping system including condensate return piping, steam vaults and steam tunnels. These systems extend approximately 10 miles around campus.

The campus' steam system is utilized for the following campus operations:

1. Steam heat to all campus buildings
2. Hot water for hand washing/ bathing
3. Showers for athletics and dormitories
4. Food Service: cooking and dish washing
5. Sterilization of laboratory devices
6. Sterilization of cages for animal facilities
7. Steam reheat for climate control in buildings
8. Humidification/ dehumidification
9. Heat tracing for piping to prevent freezing
10. Generate electricity through production of steam

Underground Steam Lines

Athletics Whirlpools

Cooking Kettles in the UC

Existing System

The Steam Plant's primary means of energy production is natural gas but also currently utilizes coal as a fuel source. The steam plant has a total of 5 boilers fueled by coal, natural gas, or oil and 1 turbine generator fueled by natural gas.

The overall steam production equipment consists of the following:

- 2 boilers capable of only burning coal
- 1 boiler capable of burning coal, natural gas, or fuel oil
- 1 boiler capable of burning natural gas and/or operating off of waste heat from the gas turbine
- 1 boiler capable of burning natural gas or fuel oil

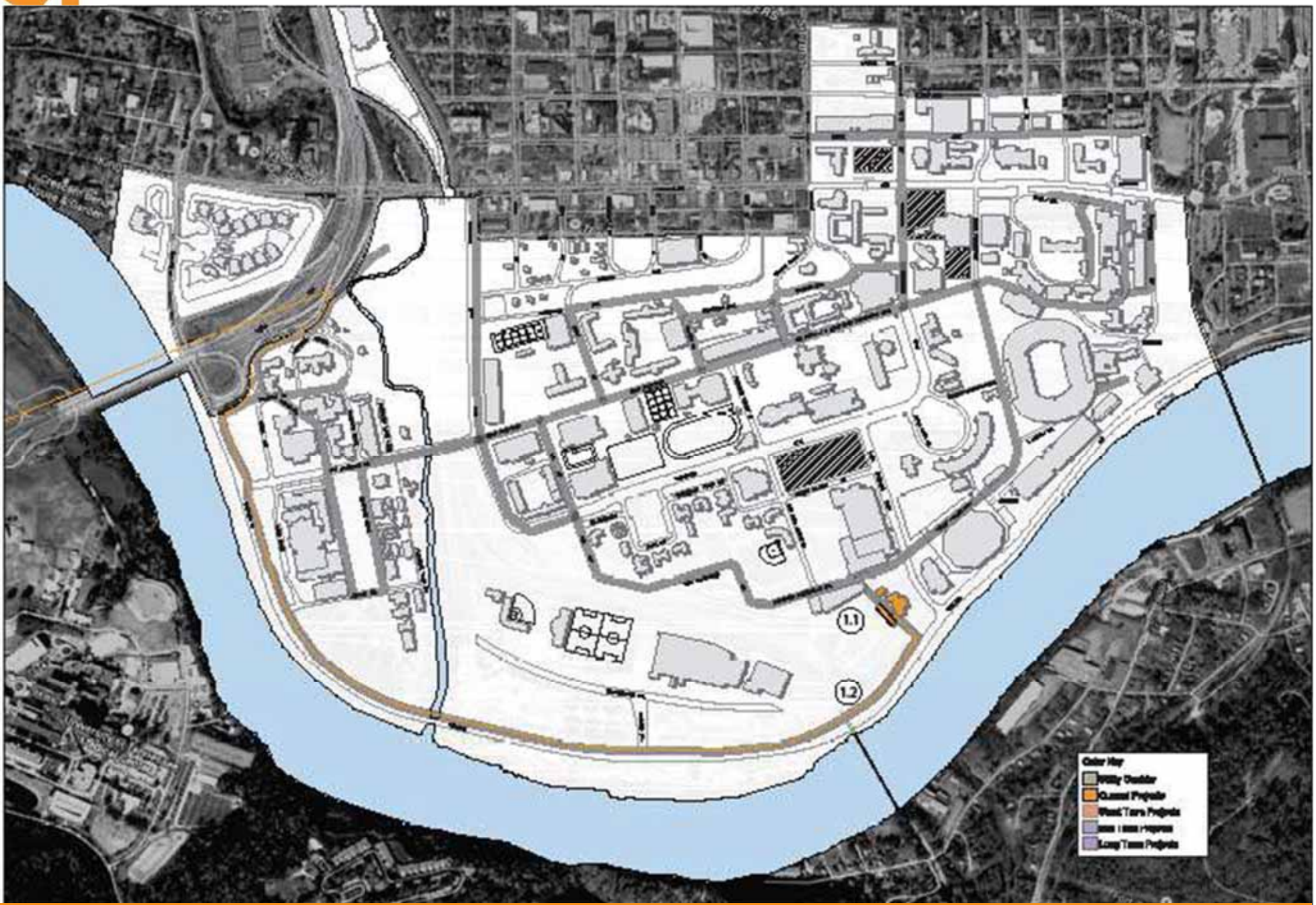
STEAM PLANT

In addition to the steam producing boilers and generators, there are other major components required for operation of the steam plant including:

- Two natural gas compressors that boost fuel pressure to the turbine to 200 psig.
- One roller type coal crusher. This crusher makes it possible to purchase nut and slag coal for the Steam Plant. The crusher is used to convert nut and slag (0 to 3 inches in diameter) into stoker coal (1/4 to 1 1/4 inches in diameter) when necessary.
- One coal conveyor and storage bin system. Coal comes out of the crusher onto a conveyor and elevator system which loads the coal into 200 ton capacity bunkers located above the boilers.
- One 3-cell electrostatic precipitator. This precipitator traps the approximately one ton of flyash generated each day, and brings particulate matter emissions well within the EPA standards. The flyash is conveyed to a closed container for transport.
- Truck scales. The University receives its coal by truck. The scales, certified by the State of Tennessee, are used to weigh each truck delivering coal. The ticket generated by the scales serves as the basis for payment for the coal. Coal delivered is randomly tested to ensure that it meets the conditions specified in the contract.
- Water treatment and testing equipment. Water must be treated before being introduced into the boilers to prevent the build-up of scale and corrosion. Water is tested and treated continuously, and the process also allows for the identification of problems with the steam distribution system.
- Emergency generator. The Steam Plant has a 2 Megawatt, 900 horsepower emergency generator which can power the plant during an electrical outage. The generator is powered by fuel oil. The 6,000 gallon tank ensures that the plant could operate for several days in the event of a severe electrical emergency.

The underground steam distribution network, consisting of piping, vaults, tunnels and reducing stations are including in the underground piping chapter (chapter 4).

STEAM PLANT



Steam Plant

Current Projects

Steam Plant Conversion Project

Project Budget: $25,000,000

Fiscal Year 2015/16

The University of Tennessee's Steam Plant is undergoing a $25 Million conversion from coal to natural gas as its primary fuel source. The conversion to natural gas was due to the Environmental Protection Agency's (EPA) new regulations on reducing emissions from power plants. These regulations required the University of Tennessee to either upgrade their existing boilers to meet these emissions regulations or switch to natural gas. Due to the age and condition of the coal boilers, the University opted to replace all coal burning boilers with natural gas burning boilers to meet this mandate.

View of the Steam Plant

The new EPA rule, known as the Boiler MACT, regulates metals and requires tighter controls on particulates. Mercury is the pollutant that would require the UTK Steam Plant to add emission controls. In order to meet this requirement, two options were analyzed: add emission controls to the existing infrastructure or replace the coal boilers with natural gas boilers. It was decided that UTK would spend r The University of Tennessee's Steam Plant is undergoing a $25 Million conversion from coal to natural gas as its primary fuel source. The conversion to natural gas was due to the Environmental Protection Agency's (EPA) new regulations on reducing emissions from power plants. These regulations required the University of Tennessee to either upgrade their existing boilers to meet these emissions regulations or switch to natural gas. Due to the age and condition of the coal boilers, the University opted to replace all coal burning boilers with natural gas burning boilers to meet this mandate.

Removal of Boiler #1

The new EPA rule, known as the Boiler MACT, regulates metals and requires tighter controls on particulates. Mercury is the pollutant that would require the UTK Steam Plant to add emission controls. In order to meet this requirement, two options were analyzed: add emission controls to the existing infrastructure or replace the coal boilers with natural gas boilers. It was decided that UTK would spend roughly the same amount to add emissions controls as the cost to convert to natural gas. The age and condition of the existing coal boilers was also considered.

STEAM PLANT

It was decided that UTK would convert from coal as a primary fuel source to natural gas, requiring new boilers. The conversation from coal to natural gas would reduce the mercury emissions total by about ten pounds per year and provide emissions that eliminate the need to install emissions control for coal. The rule, finalized in December 2012, must be complied with in 3 years. For more information see http://www.epa.gov/boilercompliance/

The UT Steam Plant Conversion Project began in January 2014, consists of three different phases and is estimated to be completed in mid-2016. The first coal boiler has been removed and the plant is currently awaiting the new natural gas replacement boiler for installation. It should be noted that the both new natural gas boilers will be installed and operational by November 1,2015, allowing us to meet the demands of the 2015/2016 heating system. The UT Steam Plant Conversion Project will consist of:

- Replace boilers 2 and 3 with natural gas, fuel oil boilers (1 is already a natural gas boiler)
- Upgrade the natural gas service from KUB, from Topside Road. The current KUB distribution system is not capable of providing sufficient gas for the UT peak winter load. UT is contributing >$9M to the construction costs of this line. The line must be completed no later than November 1st, 2015.
- Replace and relocate the existing water treatment system. The current system is in two separate locations within plant, and very cramped. These improvements will eliminate the need for some treatment chemicals.
- Replace and relocate the air compressors which are currently in multiple locations.
- Provide additional fuel oil storage. We will increase storage capacity from 40K gallons to 240K gallons, allowing for 3 weeks of backup fuel.
- Add new electrical switchgear to allow generators to be started without KUB electrical service. We are currently unable to restart electrical generation without KUB electrical service and unable to run both generators at the same time. This is a major consideration for disaster recovery if KUB electrical service was lost for an extended period of time.
- Improve the exterior of plant by removing the smoke stack, coal handling and storage, and electrostatic precipitator. The windows in the building will also be replaced along with the building exterior being cleaned.

These three phases of construction are as follows:

- **PHASE 1**: Phase 1 consists of the removal of coal boiler #3 and replacement with a new natural gas boiler #3. Included in addition to replacing boiler #3, critical electrical equipment within the plant (including the motor control centers which provide power to all plant equipment), were also upgraded. This new equipment is arc flash resistant; greatly enhancing the operational integrity and

safety of that system. This work will be continuous through November 2015.

- **PHASE 2**: Phase 2 consists of the decommissioning and removal of coal boiler #2 and replacement with a new natural gas boiler #2. This work will begin in March 2015, and must be completed no later than November 1, 2015. This phase will also include the addition of a second high voltage feed to the plant providing increased electrical redundancy. This redundancy will allow the steam plant to keep operating in the event of a campus electrical outage.

- **PHASE 3**: Phase 3 consists of the demolition and removal of the 300' smoke stack, electrostatic precipitator, remaining coal handling equipment and the replacement of windows within the plant itself. The expected completion for this phase is mid-2016.

At the conclusion of the Steam Plant Conversion Project, the Steam Plant will contain the following infrastructure and achieve the following goals:

- Generate steam utilizing 5 high efficiency natural gas and fuel oil burners and 2 generators: boilers capable of burning natural gas and fuel oil
    - 1 boiler capable of burning natural gas and/or operate off of waste heat from turbine
    - 1 nominal 5 megawatt natural gas fired turbine generator
    - 1 nominal 2 megawatt diesel fueled generator
- Reduce emissions to be compliant with EPA regulations
- Improve aesthetics
- Provide disaster response to loss of KUB electrical power for an extended period of time
    - UTK will be able to disconnect from KUB and operate selected buildings
    - Generation is between 10% of load (summer) and 25% of load (winter)

KUB Natural Gas Main Project

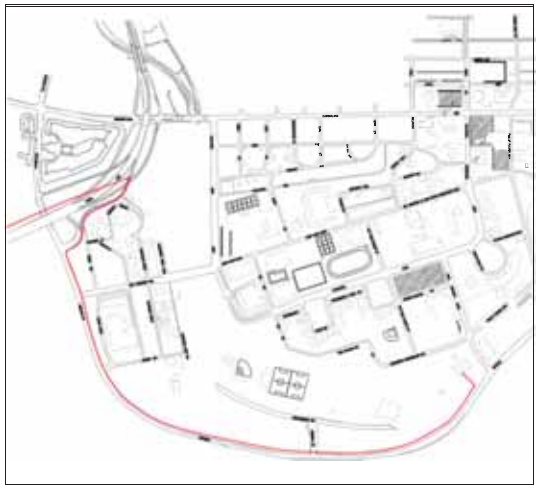
Fiscal Year: 2014/15

Project Budget: $9,000,000

In order to convert the steam plant's fuel source from coal to natural gas, KUB will have to provide a larger natural gas supply to the plant. As such, a new 16inch, 450 psi, high pressure natural gas main is being installed from Topside Road to the University of Tennessee Campus. The 16" gas main will terminate at Tyson Park. From there an 8" high pressure gas main will be extended to the steam plant.

The addition of this line will insure a reliable supply and quantity of gas for the boiler and will allow the operation of the existing 4.5 megawatt gas turbine generator without running the 300 horsepower electrically powered gas compressors. These compressors are needed for operation with lower gas pressures. This will increase the reliability and efficiency of operation for these units. This project is currently under construction by KUB and must be complete no later than November 1st, 2015.

The design, permitting and construction of this gas main is running concurrently with Phase 1 and Phase 2 of the Steam Plant Conversion Project. This alignment for the gas main extends from Topside road, down Alcoa Highway, under the Tennessee River and to the Fulton Bottoms Rugby Field area. From there it is proposed to extend around the UTIA campus and down Neyland Drive to the steam plant. As previously stated, UTK contributed $9M aid in lieu of construction to design, permit and construct this high pressure natural gas main to serve the steam plant.



Map of the Gas Main route

View of the Gas main Installation

OPERATION AND MAINTENANCE

The anticipated cost to operate and maintain the Steam Plant is approximately **$X*** annually. This cost is exclusive of the direct utility consumption costs paid to KUB and any expenses associated with the Steam Plant Conversion Project.

ADDITIONAL RESOURCES: UT FACILITIES SERVICES

For more information on Standards, Policies, and Specification visit
http://facserv.utk.tennessee.edu/policies/default.htm

For an overview of the Steam Plant visit
http://facserv.utk.tennessee.edu/divisions/Utilities/Steam/default.htm

PIPED SYSTEMS

OVERVIEW

The University of Tennessee owns, installs and maintains an underground system of piped utilities that provide necessary services to facilities on the UTK and UTIA campuses. This underground pipe system consists of domestic water, sanitary sewer, steam, natural gas, storm water, chilled water piping and chemical waste disposal. With regards to public utilities (water, sanitary sewer, natural gas and storm water), UTK works in conjunction with KUB and the City of Knoxville to provide these services to both campuses. UTK owns a portion of the infrastructure required to serve campus with KUB and City of Knoxville owning the remainder.

To achieve the University of Tennessee's vision of becoming a Top 25 university, a stable and reliable underground utility environment for conducting valuable research and teaching students is a stringent requirement. As such, the ongoing maintenance and replacement of the underground utility pipe system that provides necessary services to these facilitiesis imperative.

EXISTING SYSTEM

The underground utility pipe systems on the UTK and UTIA campuses consists of seven different utility systems described below:

CHILLED WATER PIPING

UTK distributes chilled water to various buildings throughout campus via an underground pipe network. Chilled water is used for the air conditioning of buildings.

CHEMICAL WASTE PIPING

Chemical waste piping transports waste from laboratories on campus to chemical waste tanks for treatment. Once it is treated, this waste is routed into the sanitary sewer system. UTK owns and maintains the piping along with the chemical waste tanks.

DOMESTIC WATER

Domestic water for both campuses is obtained from the Knoxville Utility Board (KUB). Both KUB and UTK provide domestic water distribution to campus. Connections to the KUB water distribution system are primarily located at Cumberland Avenue and Neyland Drive. UTK owns and maintains water distribution piping consisting of pipes ranging in size from 4 inches to 12inches. The main UTK owned water mains are primarily located on the Hill and adjacent to the east side of Neyland Stadium.

PIPED SYSTEMS

EXISTING SYSTEM

Where UTK owns the domestic water main, UTK owns, installs and maintains the water pipes beginning at valve connections to the KUB water main, up to, and throughout the building. Where KUB owns the domestic water main, UTK begins ownership at the domestic water meter located adjacent to the building. UTK's plumbing shop will maintain the UTK owned water mains and domestic water piping and services within the building, including faucets, safety showers, bathrooms, etc.

SANITARY SEWER

Sanitary sewer service is provided to both UTK and UTIA campuses by KUB. KUB owns and maintains the sanitary sewer mains that serve campus. UTK owns and maintains the sanitary sewer laterals that service all buildings on campus.

NATURAL GAS

Natural gas service is provided to both UTK and UTIA campuses by KUB. KUB owns and maintains the majority of natural gas distribution lines. UTK does own and maintain natural gas distribution system that serves buildings on the Hill, Estabrook and Berry Hall, terminating at the emergency generator at Neyland Stadium. UTK owns and maintains all the natural gas services to all buildings.

STORM WATER

UTK owns and maintains all storm water mains that are located in streets owned and maintained by UTK, in addition to all storm water management structures and piping serving buildings on campus. The City of Knoxville is currently transferring ownership of select streets within the campus to UTK ownership. This will increase the amount of storm water mains and associated infrastructure owned and maintained by UTK.

STEAM DISTRIBUTION

The UTK steam plan provides a reliable heat source to both campuses. This steam is distributed via an underground network of steam vaults, tunnels and piping. This system is owned and maintained exclusively by UTK.

- Vaults and Tunnels: The steam vaults and tunnels provide access to the underground piping at locations where branch lines come off for steam supply to campus buildings. There are three steam tunnels and approximately two hundred steam vaults. Steam vaults are constructed with two openings for egress, component removal /installation and ventilation of the vault. Steam vaults are approximately 10ft X 10ft X 8ft high internally with twelve inch thick walls. Steam tunnels have a minimum of

EXISTING SYSTEM

eight feet of head clearance and three feet of clear aisle space for walking and carrying materials. They are to be cast in place and have egress openings approximately three hundred feet in any direction. The steam tunnels have natural ventilation with thermostat controlled fans to assist where needed.

- Condensate Piping: Condensate piping is utilized to return the condensed steam in the form of water back to the steam plant for reuse in the closed loop system. UTK uses grade B carbon steel seamless pipes for the steam and condensate systems. The piping can be either externally insulated of can be Class A pipe which does not require external insulation. Steam and condensate piping must be engineering and designed to control expansion/contraction, anchoring, etc.

- Steam Distribution Piping: Steam distribution piping is utilized to transport high and low pressure steam up to and throughout campus and within buildings. The pipe construction is the same of the condensate return.

- Steam Pressure Reducing Stations: Steam stations are located at or near the entry point of the high pressure steam coming into the buildings. At the steam stations, steam pressure is reduced through a pressure reducing valve (PRV). Reduced pressure is needed to accommodate the design needs of the building. The steam station consists of a high side pressure isolation valve, a pressure reducing valve (PRV) and a low side pressure isolation valve. In addition, the station has additional valves, gauges, and condensate drip legs and steam traps. Condensate is returned to the Main Steam Plant via underground piping. Many of the steam stations in service are old and in need of repair work and/or replacement. The condition of steam stations is evaluated during normal repair work on the stations such as repair of leaks and replacement of components, when needed. Steam pressure reducing stations are located in all campus buildings that use steam.

EXISTING SYSTEMS UTILITY MAPS

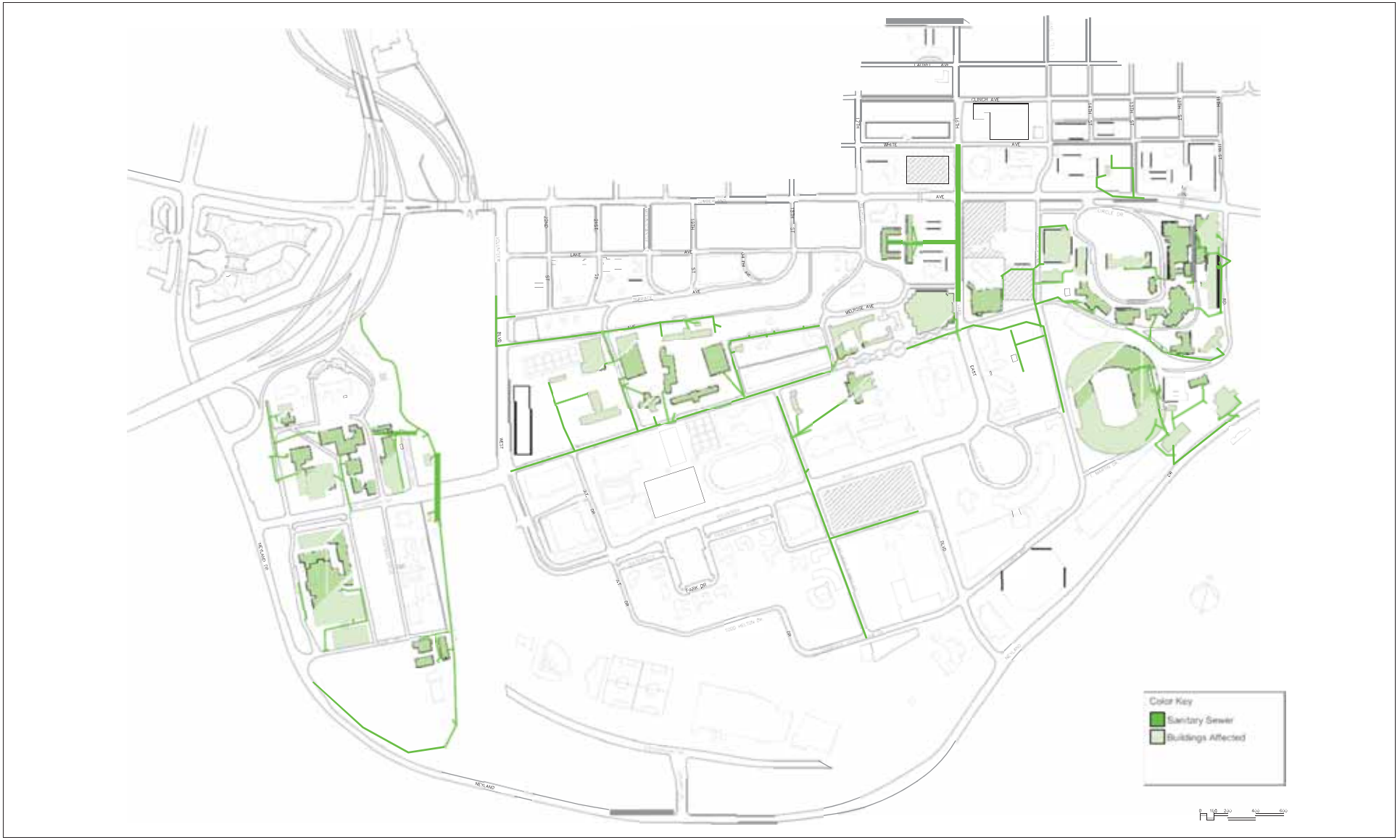
The following utility maps show the location of the existing piped systems mentioned above on campus.

PIPED SYSTEMS

CHILLED WATER SYSTEM

PIPED SYSTEMS

SANITARY SEWER SYSTEM

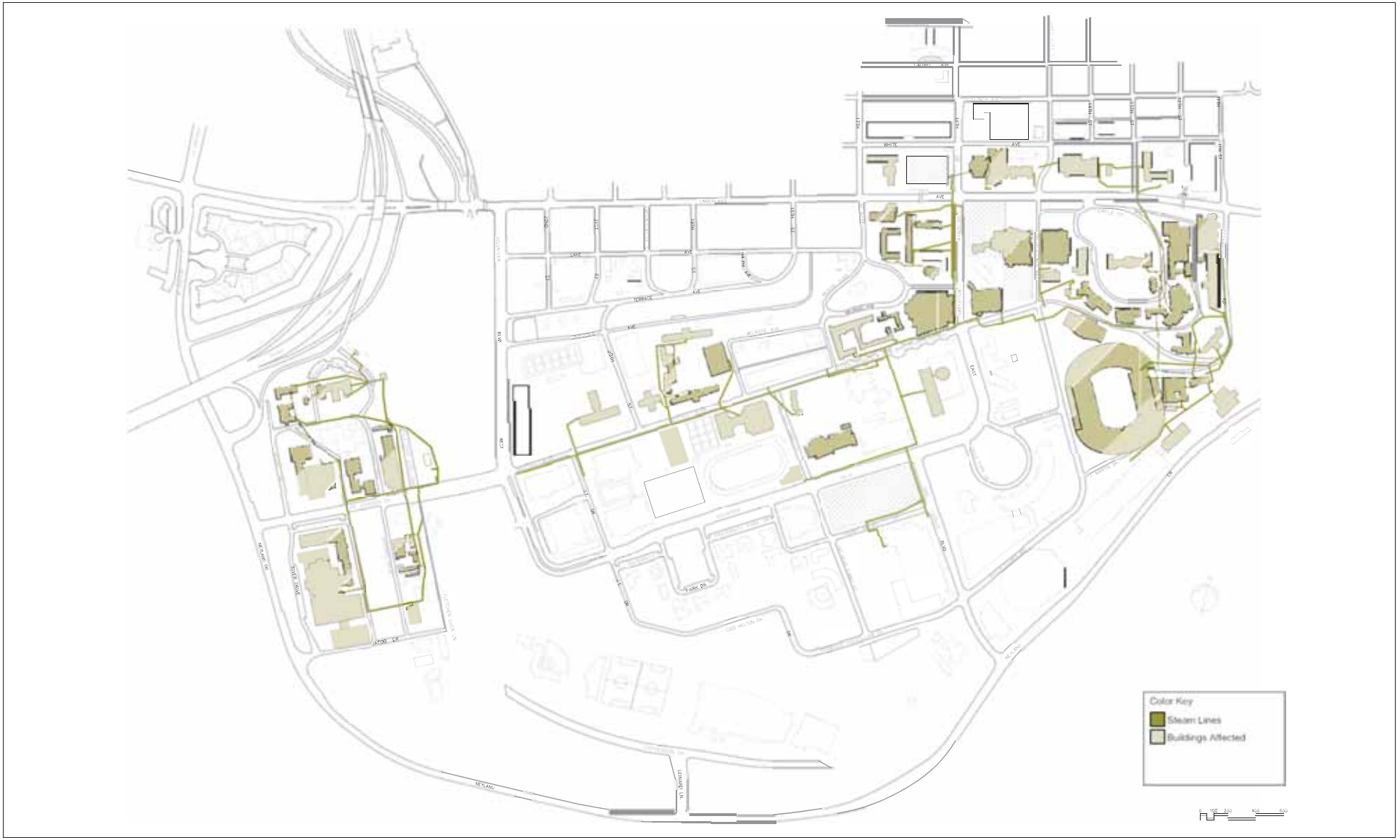


PIPED SYSTEMS

NATURAL GAS SYSTEM

Piped Systems

Steam Distribution System

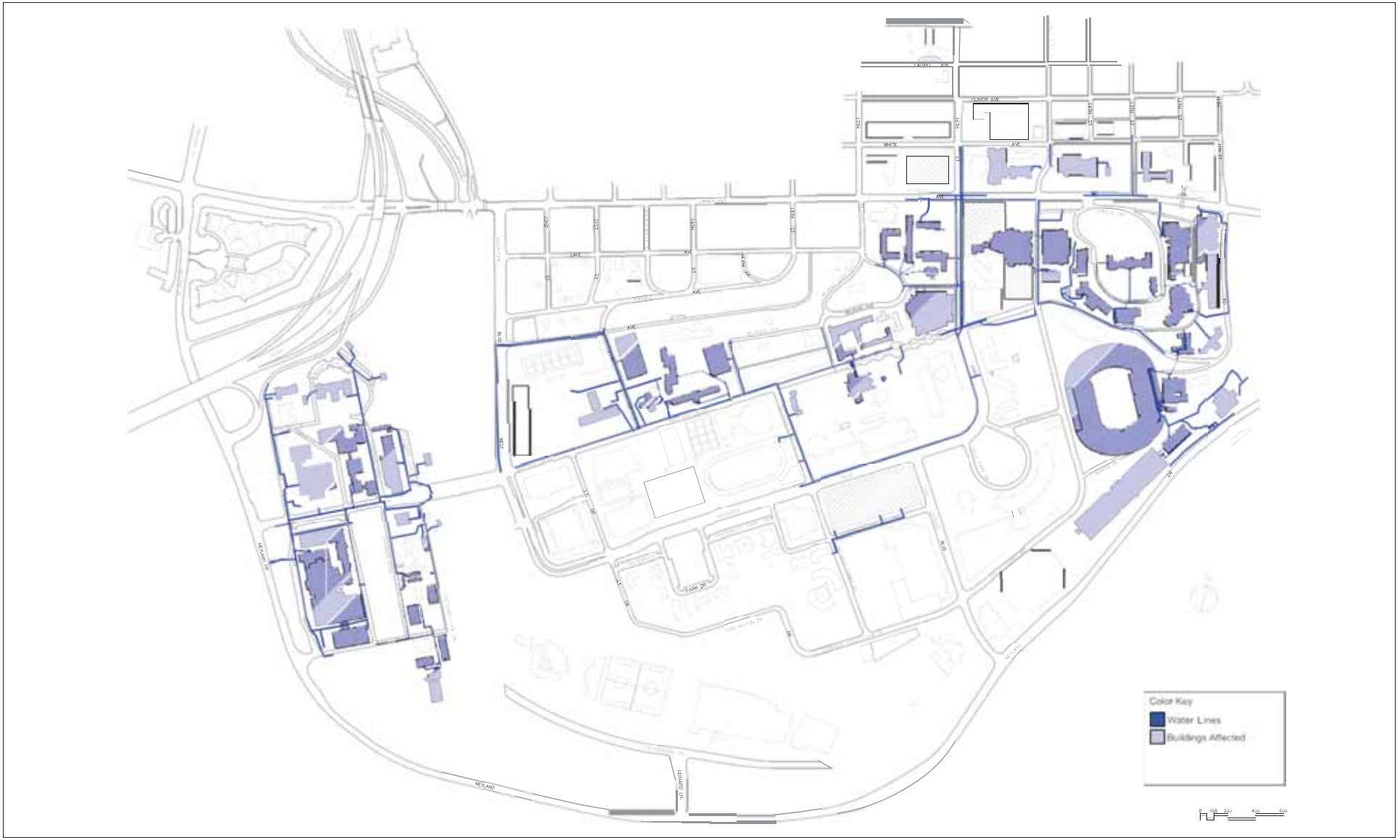


PIPED SYSTEMS

STORM WATER SYSTEM

PIPED SYSTEMS

WATER DISTRIBUTION SYSTEM



PIPED SYSTEMS

ANALYSIS OF NEED

The UTK plumbing shop is constantly evaluating the condition and capacity of existing underground piped infrastructure on campus. As with any utility, these underground pipe networks require periodic maintenance and replacement to ensure safe and reliable service. For example, the steam piping, tunnels and vaults were constructed in the 1960's and are being evaluated and replaced as needed.

The existing underground pipe network is also being evaluated to ensure Campus has adequate underground utility infrastructure to serve campus growth and expansion as identified in the Campus Master Plan. This particularly impacts the steam pipe network which provides a critical service that cannot be provided by KUB.

UTK will be assuming ownership of streets previously owned and maintained by the City of Knoxville. As such, UTK will own and maintain the storm water system along these streets. As this ownership transition occurs, Campus will evaluate and determine a capital maintenance plan for these storm water systems.

STORMWATER (PLACEHOLDER)

STORMWATER (PLACEHOLDER)

Piped Systems

Current Projects

Cumberland Avenue Steam Line Rehabilitation **Project Budget: $1,200,000**

Fiscal Year: 2014/15

This project will rehabilitate the underground steam distribution that cross Cumberland Avenue at 13th Street and the main entrance to the Ayres Hill. This also includes replacement of steam vaults and upgrading the service to Jesse Harris.

Steam Distribution System Improvements **Project Budget: $6,000,000**

Fiscal Year: 2015/16

This project will rehabilitate underground steam distribution between the intersection of Andy Holt Avenue and Volunteer Boulevard East to Cumberland Avenue, connect the loop along Phillip Fulmer from G10 Parking Garage to the intersection of Phillip Fulmer and Middle Drive, and to the intersection of Margaret Alley and Peyton Manning Pass.

Identification of Future Projects

MID TERM

Steam Distribution Maintenance **Project Budget: TBD**

This project will rehabilitate select portions of the existing steam distribution network to ensure reliability. Portions of the underground network are over seventy years old and warrant replacement.

Improvements to Water Distribution System **Project Budget: $10,000,000**

This project will rehabilitate domestic water distribution systems in the Ayres Hill, Neyland Stadium and Agricultural Campus areas. These rehabilitations will consist of water main replacement, new water lines, upgrading pressure reducing stations and backflow stations. Additional fire hydrants will be added to maintain required hose distances for fire suppression.

Sanitary Sewer and Storm Water Improvements **Project Budget: $10,000,000**

This project will rehabilitate the sanitary sewer and storm water collection systems in the Ayres Hill, Neyland Stadium and Agricultural Campus areas. This project will also upgrade the natural gas distribution in the Ayres Hill area.

OPERATION AND MAINTENANCE

The anticipated cost to operate and maintain the underground pipe systems on the UTK and UTIA campuses is approximately **$X*** annually. This cost is exclusive of the direct utility consumption costs paid to KUB and any expenses associated with capital projects included elsewhere in this document.

ADDITIONAL RESOURCES: UT FACILITIES SERVICES

- For more information on Standards, Policies, and Specification visit http://facserv.utk.tennessee.edu/policies/default.htm

- For an overview of UT Plumbing and Heating Services visit http://facserv.utk.tennessee.edu/divisions/Utilities/Plumbing/default.htm

MECHANICAL SYSTEMS

OVERVIEW

The University of Tennessee owns, installs and maintains reliable environmental systems on both the UTK and UTIA campuses. These mechanical systems include all infrastructure to provide temperature and humidity controls in general buildings, laboratory research support (such as vacuum systems, compressed air, exhaust systems and other services), refrigeration for food service facilities and IT support. For the purpose of this utilities master plan, mechanical systems are generally the infrastructure required

To achieve the University of Tennessee's vision of becoming a Top 20 university, a stable and reliable environment for conducting valuable research and teaching students is a stringent requirement. As such, the ongoing maintenance and replacement of the mechanical systems that control these environments is imperative.

EXISTING SYSTEMS

The mechanical systems serving the UTK and UTIA campus can be grouped into three categories: Research Support, General Environment Controls and Auxiliary Services Support.

- RESEARCH SUPPORT

Research Support includes all systems required for conducting research in general labs and specific research labs. The following mechanical systems generally fall under this category:

- Laboratory Compressed Air
- Laboratory Refrigeration
  - Environmental Growth Chambers
  - Freezers
  - Cold Boxes
  - Walk-in Coolers and Freezers
- Laboratory Exhaust
- Fume Hoods
- Heat Recovery Units
- Vacuum Systems

MECHANICAL SYSTEMS

EXISTING SYSTEMS

- GENERAL ENVIRONMENT CONTROLS:

General Environment includes all systems required for controlling the environment in classrooms, offices, student housing, administrative support and other non-specific areas that require general heating and cooling. The following mechanical systems generally fall under this category:

- Chillers and Cooling Towers
- Building piping for chilled water and heating water
- Building Air Pressure (negative and positive)
- Building Duct Work
- Air Compressors
- Air Conditioning Controls
- Heating Systems
- Building Ventilation Systems

- AUXILIARY SERVICE SUPPORT:

Auxiliary Service Support includes the mechanical systems that provide refrigeration for food service on campus and temperature control for IT facilitates.

Mechanical Systems

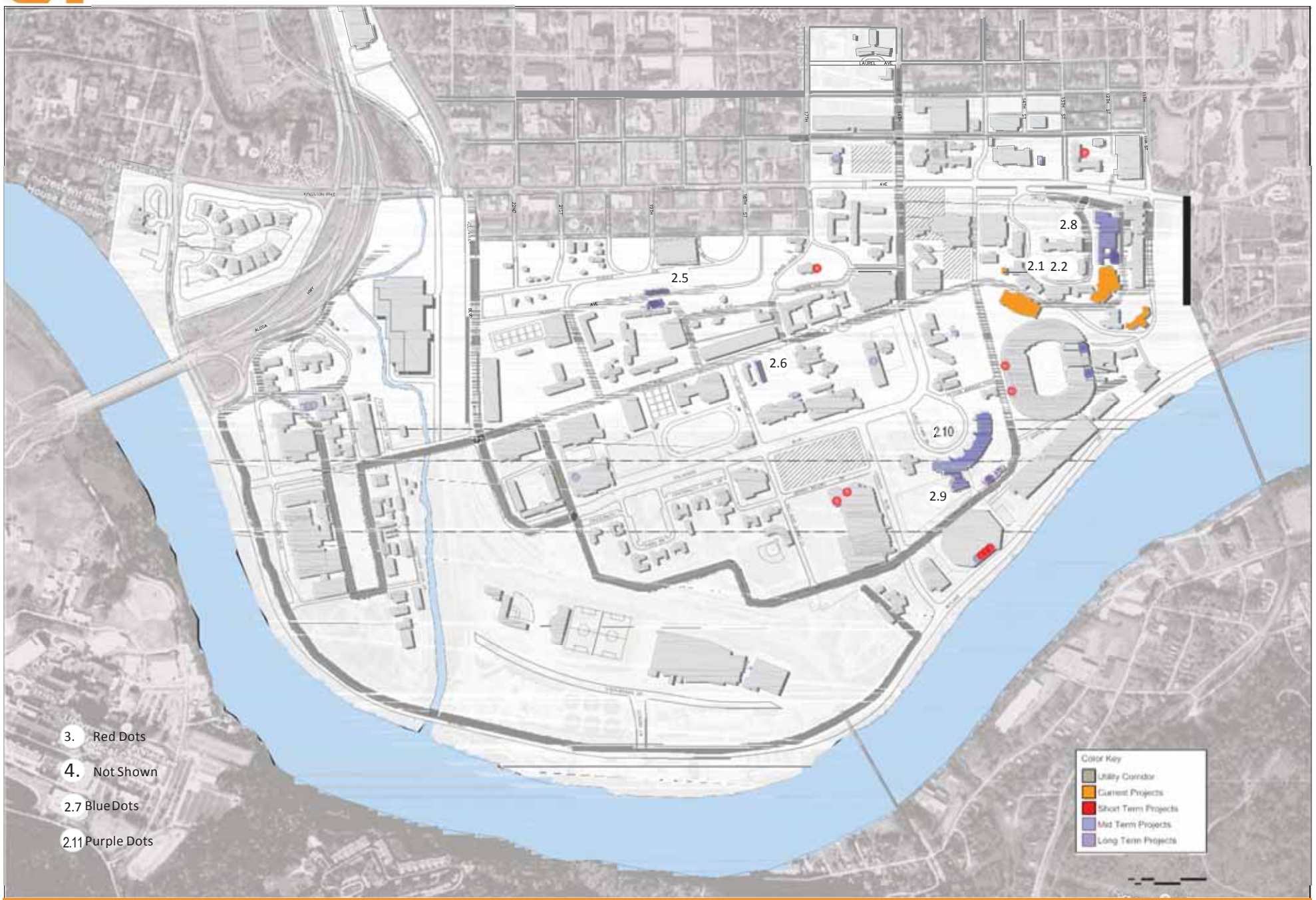
Existing Mechanical Systems Map

MECHANICAL SYSTEMS

ANALYSIS OF NEED

The continual and reliable operation of the mechanical systems listed above is critical to the daily operations on both campuses. With the growth of campus, each existing system needs to be evaluated for capacity and condition. Portions of our existing mechanical infrastructure are reaching the end of their design lives and the replacement of that equipment needs to be addressed in a proactive fashion, before failure disrupts campus operations or research. Another growing concern is the need for redundancy of mechanical systems on campus, specifically those that support the critical research facilities on campus. As it stands, numerous research support systems exist without any back-up in case of equipment failure.

MECHANICAL SYSTEMS



MECHANICAL SYSTEMS

CAPITAL PROJECT LIST

No.	Capital Project	Status of Project
2.1	Chiller System Replacement: The Hill	Current (2015/16)
2.2	Science Engineering System Improvements - Phase 1	Current (2015/16)
2.3	Various Chiller Replacement Projects	Short Term
2.4	HVAC Controls Systems Consolidation and Upgrades (Not Shown on Master Plan)	Short Term
2.5	West Campus Mechanical Building - Caledonia Avenue	Mid Term
2.6	Multi Purpose Mechanical Building - Temple Hall	Mid Term
2.7	Various Chiller Replacement Projects	Mid Term
2.8	Dabney/ Buehler Systems Maintenance Phase 1	Mid Term
2.9	Andy Holt Tower Systems Maintenance/ Controls and Equipment	Mid Term
2.10	Communications and Student Services Systems Upgrades	Mid Term
2.11	Various Chiller Replacement Projects	Long Term

Mechanical Systems

Current Projects

Chiller System Replacements: The Hill

Project Budget: $5,000,000

Fiscal Year: 2015/16

This capital maintenance project will determine the feasibility of replacing chillers in the Alumni Memorial Building versus tying to the Hesler Chilled Water Plant, replacing two older chillers at the Science Engineering Chilled Water Plant, and connecting Ferris Hall to the Science Engineering Chilled Water Plant.

The Hill at the University

Science Engineering System Improvements - Phase 1

Project Budget: $9,000,000

Fiscal Year: 2015/16

This capital maintenance project will repair collapsed exhaust ductwork, replace HRU fans with strobic fans, remove the tall exhaust stacks on the roof, change HRU filtration to bag in/bag out, restore process chiller water loop to lower pressure and more energy efficient system, correct corridor air pressurization problems that cause corridor and exterior doors to be held open by airflow, add chilled water piping to reduce pressure loss as the SERF loop feeds to the west end of the building and on to Nielsen Physics, other capacity upgrades for air systems as funds allow.

The Hill at the University

IDENTIFICATION OF FUTURE PROJECTS

SHORT TERM

VARIOUS CHILLER REPLACEMENT PROJECTS **PROJECT BUDGET: $3,000,000**
FISCAL YEAR: TBD

Due to the condition and age of the following chillers, they are recommended to be replaced (Including associated handlers, pumps and piping) with in the short term: International House, Jessie Harris, Neyland West Skybox 1,Neyland West Skybox 2, Neyland Thompson Sports, and Thompson Boiling Chillers 2, 3 and 4.

HVAC CONTROLS SYSTEMS CONSOLIDATION & UPGRADES **PROJECT BUDGET: $9,000,000**
FISCAL YEAR: TBD

This project will improve the HVAC control systems in buildings on UTK campus. This phase will provide a front end system for the three controls systems on the campus and upgrade controls in the following buildings: Buehler Hall, Hodges Library, Bailey Education, Art and Architecture, South College and Nielsen Physics.

MID TERM

MULTI-PURPOSE MECHANICAL SYSTEMS BUILDING **PROJECT BUDGET: $TBD**
FISCAL YEAR: TBD

A known component of the Mechanical Systems Master Plan is the proposed Multi-Purpose Mechanical Building. Two schematic options are being considered for this building: two story tall building with cooling towers above the chillers and a one story option with cooling towers beside the chillers. A two story building would be beneficial on small areas, where its considerable height would be either necessary or advantageous. The one story option would allow for a less imposing building on level sites where additional real estate is available (as it has a larger footprint than the two story building). Both are being considered in bay modules to allow the client to adjust, in a simple fashion, the number of chillers/cooling towers. Both have overhead doors to the chiller rooms, and louvered vents on the cooling towers' screen walls. The exterior cladding is brick, with stone trim at the masonry openings and copings. The styling is a subdued Collegiate Gothic.

Mechanical Systems

West Campus Mechanical Building - Caledonia Avenue **Project Budget: $TBD**
Fiscal Year: TBD

The mechanical building proposed along Caledonia Avenue is planned to support the West Campus Housing Development. By centrally locating mechanical systems (cooling towers and cooling water pumps) in one building, it is estimated the development would save construction time, construction cost and energy consumption. It would also benefit future maintenance operations. This proposed mechanical building and mechanical systems can be designed to be expanded to supply future buildings consistent with the 2011 Campus Master Plan.

Multi-Purpose Mechanical Building - Temple Hall **Project Budget: $TBD**
Fiscal Year: TBD

This mechanical building is proposed to be located between Temple Hall and the Clarence Brown Theatre. It is anticipated to house new chillers and other mechanical and electrical equipment to replace the existing Music chiller building. It will provide increased reliability, energy efficiency and additional capacity for future growth in this area.

Various Chiller Replacement Projects **Project Budget: $TBD**
Fiscal Year: TBD

Due to the condition and age of the following chillers, they are recommended to be replaced (including associated handlers, pumps and piping) with in the mid term: Neyland East Skybox chillers 1 and 2, Philander Claxton chiller 1, Reese Hall chiller 3 A/B, and SERF chillers 1, 2 and 4.

Dabney / Buehler Systems Maintenance Phase 1 **Project Budget: $9,000,000**

Andy Holt Tower Systems Maintenance / Controls & Equipment **Project Budget: $6,000,000**

Communications & Student Services Systems Upgrades **Project Budget: $6,000,000**

LONG TERM

VARIOUS CHILLER REPLACEMENT PROJECTS

PROJECT BUDGET: $TBD

Due to the condition and age of the following chillers, they are recommended to be replaced (including associated handlers, pumps and piping) with in the long term: Auxiliary Services, Ferris Hall, Stokely Management chiller 3, Andy Holt Tower, Clement Hall, Communications, Conference Center chillers 1 and 2, Humanities chillers 1 and 2, Joe Johnson chillers 1 and 2, Music Building, Philander Claxton chiller 2, Plant Biotech chillers 1, 2, and 3, Reese Hall chillers 1 and 2, SERF chiller 3, Stokely Management chillers 1 and 2, Student Recreation chillers 1 and 2, Taylor Law chillers 2 and 3, and Thompson Boiling chiller 1.

OPERATIONS AND MAINTENANCE

The anticipated cost to operate and maintain the mechanical systems on the UTK and UTIA campuses is approximately **$X*** annually. This cost is exclusive of the direct utility consumption costs paid to KUB and any expenses associated with capital projects included elsewhere in this document.

ADDITIONAL RESOURCES: UT FACILITIES SERVICES

For more information on Standards, Policies, and Specification visit
http://facserv.utk.tennessee.edu/policies/default.htm

- For an overview of UT Air Conditioning Services visit
http://facserv.utk.tennessee.edu/divisions/Utilities/AC/default.htm

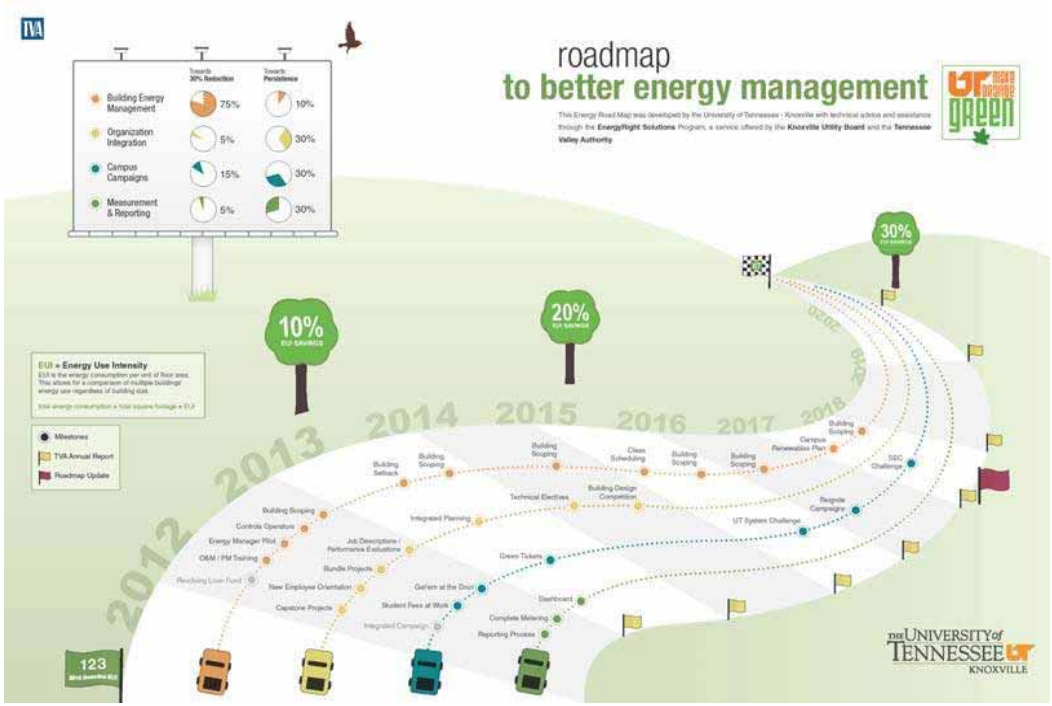
Energy Conservation

Overview

Energy Road Map Program

The University of Tennessee, in partnership with The Tennessee Valley Authority (TVA) and Knoxville Utilities Board (KUB), is working to enhance energy efficiency on the Knoxville campus. UTK has committed to reducing its energy usage by 10% in 2013, 20% by 2016 and 30% by 2020. This will be achieved utilizing a 10–year strategic energy road-map that sets targets for electricity's demand reduction and annual energy savings. This plan could become a blue print for energy management programs at other colleges and universities.

UT Knoxville is one of the largest green power purchasers in the Southeast and is often recognized for its student-led environmental initiatives. In 2005, students approved a special fee to fund green energy purchases and other sustainable initiatives. Since 2008, faculty, staff and students have worked to reduce overall energy consumption, saving more than $1 million.



Energy Conservation

Current Projects

The following are several ways that UTK is working towards conserving energy on campus:

Revolving Fund

A loan fund to finance energy conservation and deferred maintenance projects was established. This fund began with a $50,000 investment. The cost savings incurred by the University for implementing energy saving projects will be returned to the fund for investment in additional energy savings projects.

Energy Task Force

An Energy Task Force was created within Facility Services to discuss ways to conserve energy on the UTK Campus. Zone Maintenance, Utilities, Design, Construction and Sustainability staff are present. These meetings occur bi-weekly and generate a list of projects to be considered.

Building Scoping

Existing buildings on campus are being assessed for opportunities to improve energy performance. This process is underway and energy saving projects have been successfully implemented.

Recognition Program

A program is being developed to recognize Facilities' Services employees, campus staff, faculty, and students for identifying and/or implementing energy success stories.

Energy Manager Pilot

UTK is dedicating resources to focus on campus energy performance and energy saving opportunities. Building baselines are being developed to track money saved by energy conservation efforts. The STAR team is working on implementing this pilot.

Performance Evaluations

It is envisioned that energy conservation will be built into future performance evaluations.

Green Fees at Work

The student paid green fee will increase the ability to fund and implement energy conservation projects on campus. The Student

Energy Conservation

Environmental Initiatives Committee meets and approves projects to be implemented with Green Fee money.

New Employee Orientation

One of the goals is to integrate campus sustainability and energy programs into new employee orientation. All new UT employees would receive handout on energy conservation. There would be a created energy conversation and road-map presentation for all new Facilities Services employees.

Metering

UTK is in the process of installing metering devices on buildings. This will allow for the control of mechanical systems to regulate energy usage during peak and off peak periods.

Identification of Future Projects

Project Name	Est. Cost ($)	Est. Savings ($/yr)	Est. Savings (kWh/yr)	Est. Incentive ($)	Est. Payback (yrs)	5 Year Savings ($)	Old # of Fixtures	Old Wattage (W)	New # of Fixtures	New Wattage (W)	Hours of Operation (Hrs/Day)
11th Street Garage	$150,000	$73,633	1,058,321	$28,053	1.7	$396,218	316	215	316	60	24
Aquatic Center	$41,000	$33,361	488,338	$25,889	0.5	$192,694	101	1080	81	400	8
Art and Architecture	$30,000	$5,227	63,756	$4,056	5.0	$30,191	100	215	100	75	12
Law Library	$22,000	$7,309	89,159	$5,672	2.2	$42,217	300	115	300	59	24
McClung Garage	$55,000	$20,103	289,608	$7,677	2.4	$108,192	200	125	200	40	24
McClung Tower T8	$40,000	$13,472	165,719	$11,021	2.2	$78,381	1250	72	1250	49	10
Min Kao Liebert Controls	$5,000	$25,177	393,699	$0	0.2	$125,885	7 units				
Plant Biotech	$11,000	$1,777	29,614	$1,570	5.3	$10,455	30	215	30	75	12
SERF Lobby	$8,000	$15,644	226,057	$0	0.5	$78,220	153	128	153	12	24
SERF T8 Lights	$3,000	$1,793	29,851	$791	1.2	$9,756	108	62	108	62	24
South College	$12,000	$6,413	92,213	$2,549	1.5	$34,614	50	205	50	15	15
South College T8	$9,000	$2,206	33,252	$2,757	2.8	$13,787	121	144	121	90	14
White Avenue Garage	$75,000	$24,690	417,367	$11,063	2.6	$134,513	256	215	256	75	24
Totals	**$466,000**	**$254,496**	**3,850,772**	**$104,598**	**1.4**	**$1,377,078**	**2985**	**2791**	**2965**	**1012**	**215**

APPENDIX

OVERVIEW

The appendix will be used as a guide for background and detailed information that correlates with the Utilities Master Plan. This includes tables, procedures, and infrastructure maps. The four sections include:

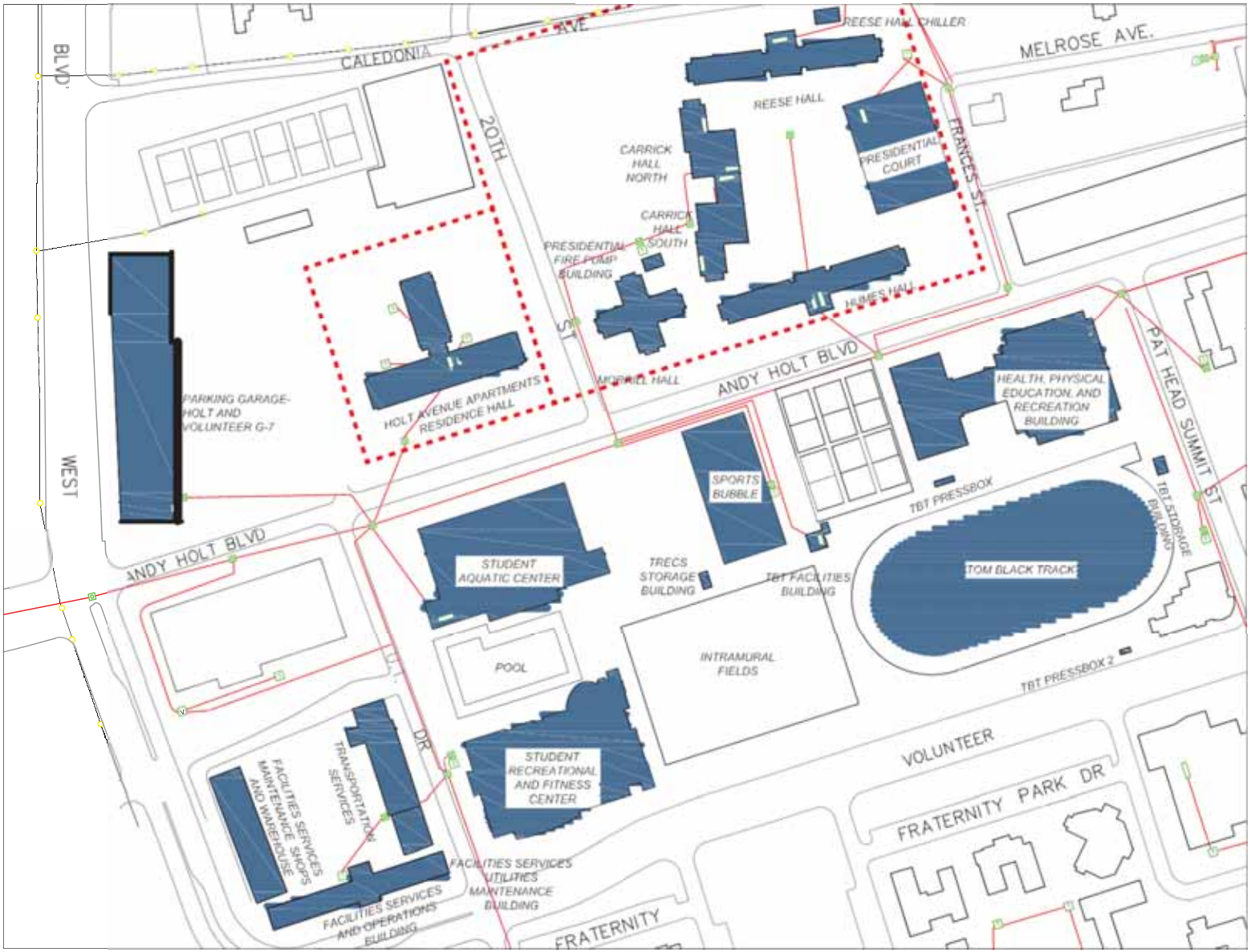
Appendix A: Electrical Distribution

Appendix B: Steam Plant Data

Appendix C: Utility Survey

Appendix D: Chiller Condition Reports

APPENDIX A



Circuit 1Distribution 1"= 300'

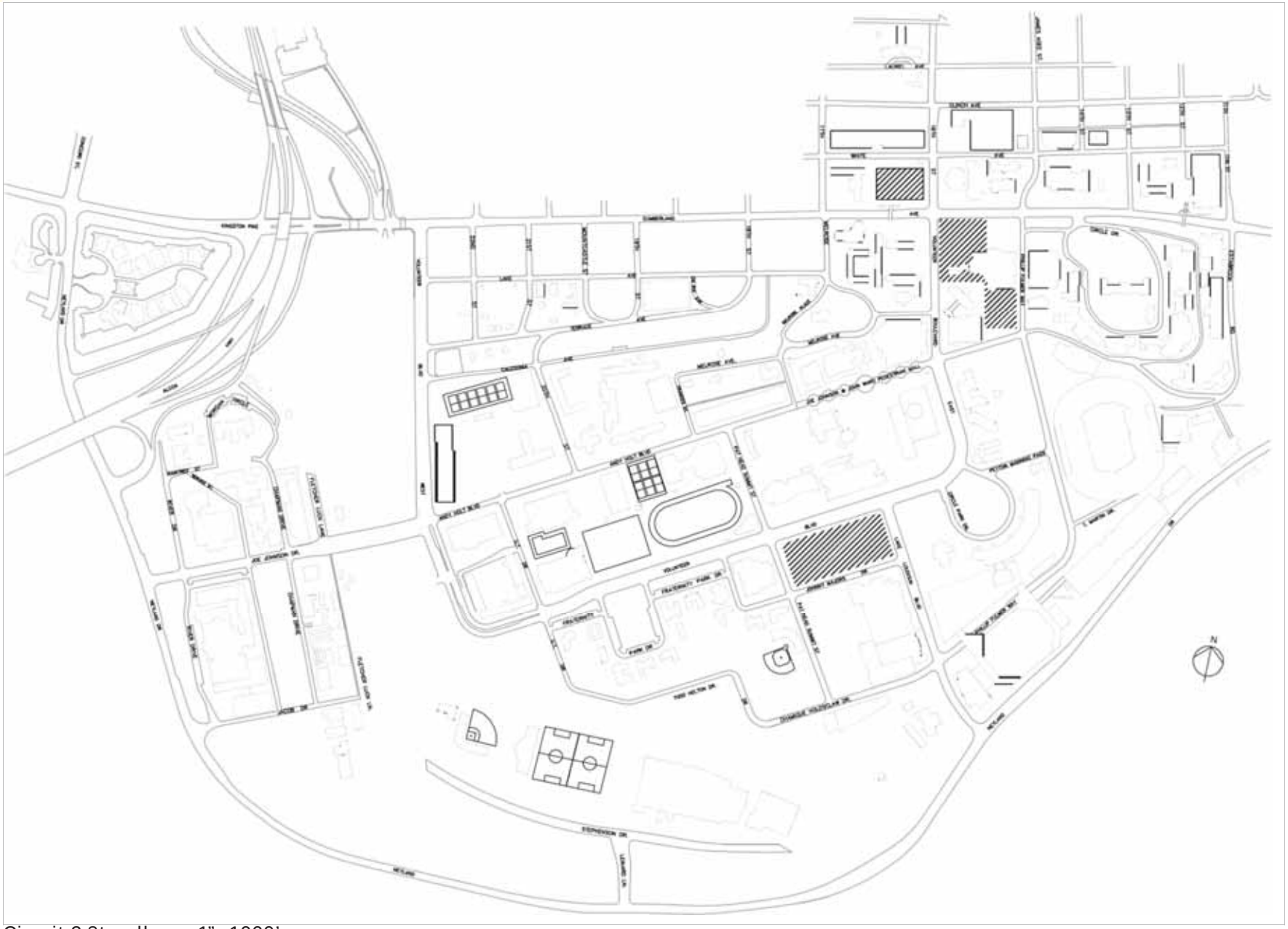
*Conceptual designs for West Development Plan (Presidential Court) underway.

APPENDIX A

MAIN STATION CIRCUIT 1

No.	Building Name	Building No.	Usage	Street No.	Street Name	Gross Sq. Ft.
1.	Carrick Hall North	50122800	Aux	1021	Frances Street	111,472
2.	Carrick Hall South	50123100	Aux	1023	Frances Street	119,950
3.	Facilities Services and Operations Building	50119300	Sup	2233	Volunteer Boulevard	22,378
4.	Facilities Services Maintenance Shops and Warehouse	50119600	Sup	2233	Volunteer Boulevard	28,950
5.	Facilities Services Utilities Maintenance Building	50119800	Sup	2233	Volunteer Boulevard	3,785
6.	Health, Physical Education, and Recreation Building	50121600	Ac	1914	Andy Holt Avenue	175,230
7.	Holt Avenue Apartments Residence Hall	50122500	Aux	2117	Andy Holt Ave	336,488
8.	Humes Hall	50123000	Aux	1911	Andy Holt Avenue	114,748
9.	Morrill Hall	50120000	Aux	1038	20th Street	169,036
10.	Presidential Court	50122900	Aux	1017	Frances Street	77,018
11.	Reese Hall	50122700	Aux	1910	Caledonia Avenue	110,532
12.	Reese Hall Chiller	50122710	Sup	1910	Caledonia Avenue	2,773
13.	Sports Bubble	50120800	Aux	1920	Andy Holt Avenue	28,099
14.	Student Aquatic Center	50120500	Sup	2106	Andy Holt Avenue	71,677
15.	Student Recreational and Fitness Center	50124800	Aux	2111	Volunteer Boulevard	169,288
16.	Tom Black Track Facilities Building	50123810	Aux	1809	Volunteer Blvd	1,100
17.	Tom Black Track Pressbox	50123800	Aux	1809	Volunteer Blvd	372
18.	Tom Black Track Pressbox 2	50123820	Aux	1809	Volunteer Blvd	513
19.	Tom Black Track Storage Building	50123700	Aux	1809	Volunteer Blvd	614
20.	Transportation Services	50120200	Sup	1201	UT Drive	15,052
21.	TRECS Storage Building	50124600	Sup	0	Holt Blvd	479
22.	Volunteer Boulevard G7 Garage	50121200	Aux	2401	Volunteer Boulevard	265,435
23.					Sum	1,824,989

APPENDIX A



Circuit 2 Standby 1"= 1000'

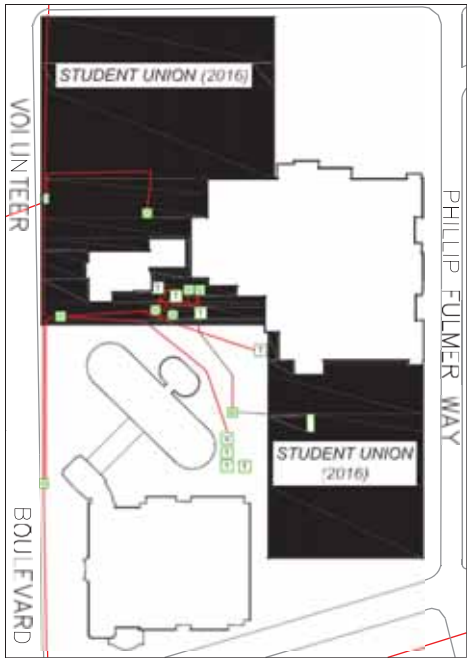
APPENDIX A

MAIN STATION CIRCUIT 2

Main Station Circuit 2 is known as the Campus Standby. Circuit 2 cables are distributed to each area of campus and are dedicated as a standby circuit for the entire 13.2 volt distribution system.

It is used to maintain electrical service during times of maintenance or repair to the system such as when the assigned primary circuit fails or needs to be temporarily removed from service. In other words, it is the backup supply for electrical distribution.

APPENDIX A



Circuit 3 Distribution 1"= 250'

Phase One of the New Student Union expected to be complete in 2015. http://conezone.utk.edu/projects/student-union/

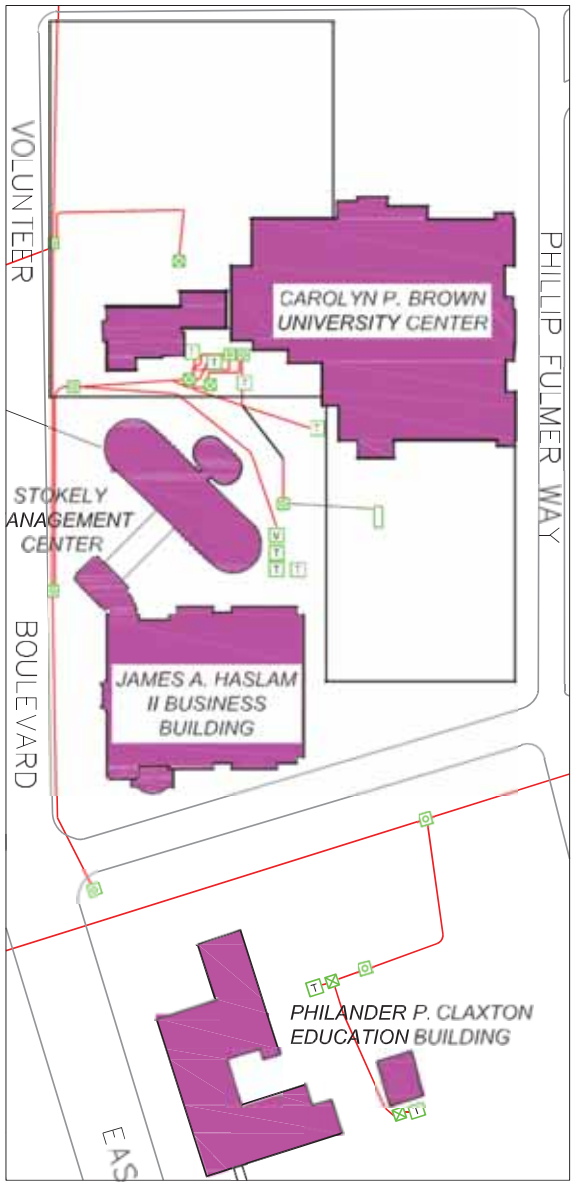
APPENDIX A

MAIN STATION CIRCUIT 3

No.	Building Name	Building No.	Usage	Street No.	Street Name	Gross Sq. Ft.
1	Student Union*	50900600				
2.						

*Circuit 3 is temporarily unloaded and will feed into the Student Union.

APPENDIX A



Circuit 4 Distribution 1"= 250'

APPENDIX A

MAIN STATION CIRCUIT 4

No.	Building Name	Building No.	Usage	Street No.	Street Name	Gross Sq. Ft.
1.	Carolyn P Brown University Center	50112900	Sup	1502	West Cumberland Avenue	212,185
2.	James A. Haslam II Business Building	50112300	Ac	1000	Volunteer Boulevard	184,668
3.	Philander P. Claxton Education Building	50113700	Ac	1122	Volunteer Boulevard	94,498
4.	Stokely Management Center	50112400	Ac	916	Volunteer Boulevard	117,264
5.	Student Counseling Services	50124300	Sup	900	Volunteer Boulevard	16,681
6.	Student Union*	50900600				
7.					Sum	625,296

*Circuit 4 will also feed into the Student Union due to the heavy load of power it will use.

APPENDIX A

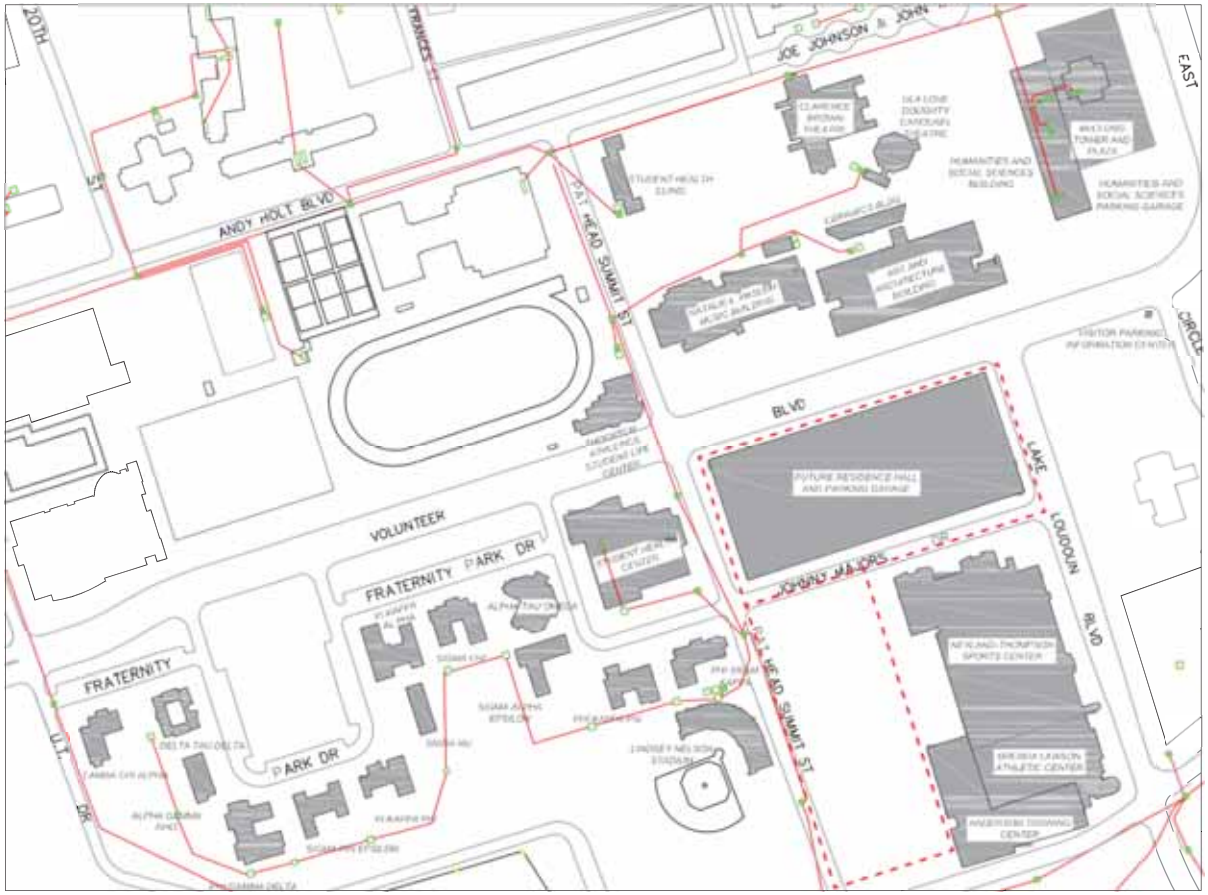
Circuit 5 Distribution 1"= 400'

APPENDIX A

MAIN STATION CIRCUIT 5

No.	Building Name	Building No.	Usage	Street No.	Street Name	Gross Sq. Ft.
1.	Administration Parking Garage	50121400	Aux	1530	Lake Loudoun Blvd	416,762
2.	Andy Holt Tower	50110220	Sup	1331	Circle Park	104,095
3.	Berry Hall	50111500	Ac	1410	Tee Martin Drive	7,128
4.	College of Nursing	50121800	Ac	1200	Volunteer Boulevard	41,807
5.	Communications and University Extension Building	50113300	Ac	1345	Circle Park	110,000
6.	East Skybox & Pressbox	50123610	Aux	1425	South Stadium Drive	65,523
7.	Estabrook Hall	50114100	Ac	1012	Estabrook Road	57,455
8.	Hearing and Speech Center	50140300	Sup	1600	Peyton Manning Pass	12,471
9.	Jane and David Bailey Education Complex	50113800	Ac	1122	Volunteer Boulevard	62,129
10.	John D. Tickle Engineering Building	50112200	Ac	851	Neyland Drive	85,000
11.	Neyland Drive Biology Annex	50111200	Ac	901	Neyland Drive	17,356
12.	Neyland G10 Parking Garage	50137500	Aux	1500	Philip Fulmer Way	629,250
13.	Pasqua Nuclear Engineering Building	50121900	Ac	1004	Estabrook Road	28,338
14.	Pratt Pavilion	50122000	Aux	1610	Lake Loudoun Boulevard	75,793
15.	South & East Stadium	50123500	Aux	1425	South Stadium Drive	259,262
16.	Stadium Drive Parking Garage-G10	50137500	Aux	1500	Phillip Fulmer Way	43,570
17.	Steam Plant	50123900	Sup	1617	Lake Loudoun Boulevard	100
18.	Steam Plant Coal Conveyor Shed	50123200	Sup	1617	Lake Loudoun Boulevard	1,848
19.	Steam Plant Gear Switching/Turbine Building	50123910	Sup	1617	Lake Loudoun Boulevard	88,498
20.	Student Services Building	50110210	Sup	1331	Circle Park	88,498
21.	Thompson-Boling Assembly Center and Arena	50139400	Aux	1600	Phillip Fulmer Way	450,953
22.	West Skybox Addition	50123600	Aux	1425	South Stadium Drive	133,671
23.	FUTURE ENGINEERING BUILDINGS					
24.					Sum	2,691,009

APPENDIX A



Circuit 6 Distribution 1"= 400'

APPENDIX A

MAIN STATION CIRCUIT 6

No.	Building Name	Building No.	Usage	Street No.	Street Name	Gross Sq. Ft.
1.	Alpha Gamma Rho Fraternity	50115200	Aux	1840	Fraternity Park Drive	10,300
2.	Alpha Tau Omega Fraternity House	50115300	Aux	1812	Fraternity Park Drive	15,927
3.	Art and Architecture Building	50110600	Ac	1715	Volunteer Boulevard	183,305
4.	Brenda Lawson Athletic Center	50136910	Aux	1551	Lake Loudoun Boulevard	45,648
5.	Ceramics Building	50113000	Ac	1719	Volunteer Boulevard	5,591
6.	Clarence Brown Theatre	50122400	Ac	1714	Andy Holt Avenue	55,711
7.	Clock Tower	50110400	Sup		Andy Holt Avenue	N/A
8.	Delta Tau Delta Fraternity House	50115400	Aux	1844	Fraternity Park Drive	12,440
9.	Frank H. McClung Museum of Natural History and Culture	50119500	Aux	1327	Circle Park	38,574
10.	Humanities and Social Sciences Building	50118710	Ac	1115	Volunteer Boulevard	102,849
11.	Humanities and Social Sciences Parking Garage	50118730	Aux	1115	Volunteer Boulevard	93,580
12.	Lambda Chi Alpha Fraternity House	50115600	Aux	1848	Fraternity Park Drive	16,297
13.	Lindsey Nelson Stadium	50111400	Aux	1511	Pat Head Summitt St	43,770
14.	McClung Tower and Plaza	50118720	Ac	1115	Volunteer Boulevard	95,949
15.	Natalie L. Haslam Music Center	50144500	Ac	1741	Volunteer Boulevard	135,134
16.	Neyland-Thompson Sports Center	50136900	Aux	1704	Johnny Majors Drive	176,194
17.	Phi Gamma Delta Fraternity House	50115700	Aux	1836	Fraternity Park Drive	14,906
18.	Phi Kappa Psi Fraternity House	50115500	Aux	1804	Fraternity Park Drive	10,387
19.	Phi Sigma Kappa Fraternity House	50115800	Aux	1800	Fraternity Park Drive	13,773
20.	Pi Kappa Alpha Fraternity House	50115900	Aux	1820	Fraternity Park Drive	14,519
21.	Pi Kappa Phi Fraternity House	50116400	Aux	1828	Fraternity Park Drive	10,021
22.	Sigma Alpha Epsilon Fraternity House	50116000	Aux	1808	Fraternity Park Drive	14,180
23.	Sigma Chi Fraternity House	50116100	Aux	1816	Fraternity Park Drive	15,030
24.	Sigma Nu Fraternity House	50116200	Aux	1824	Fraternity Park Drive	9,560

APPENDIX A

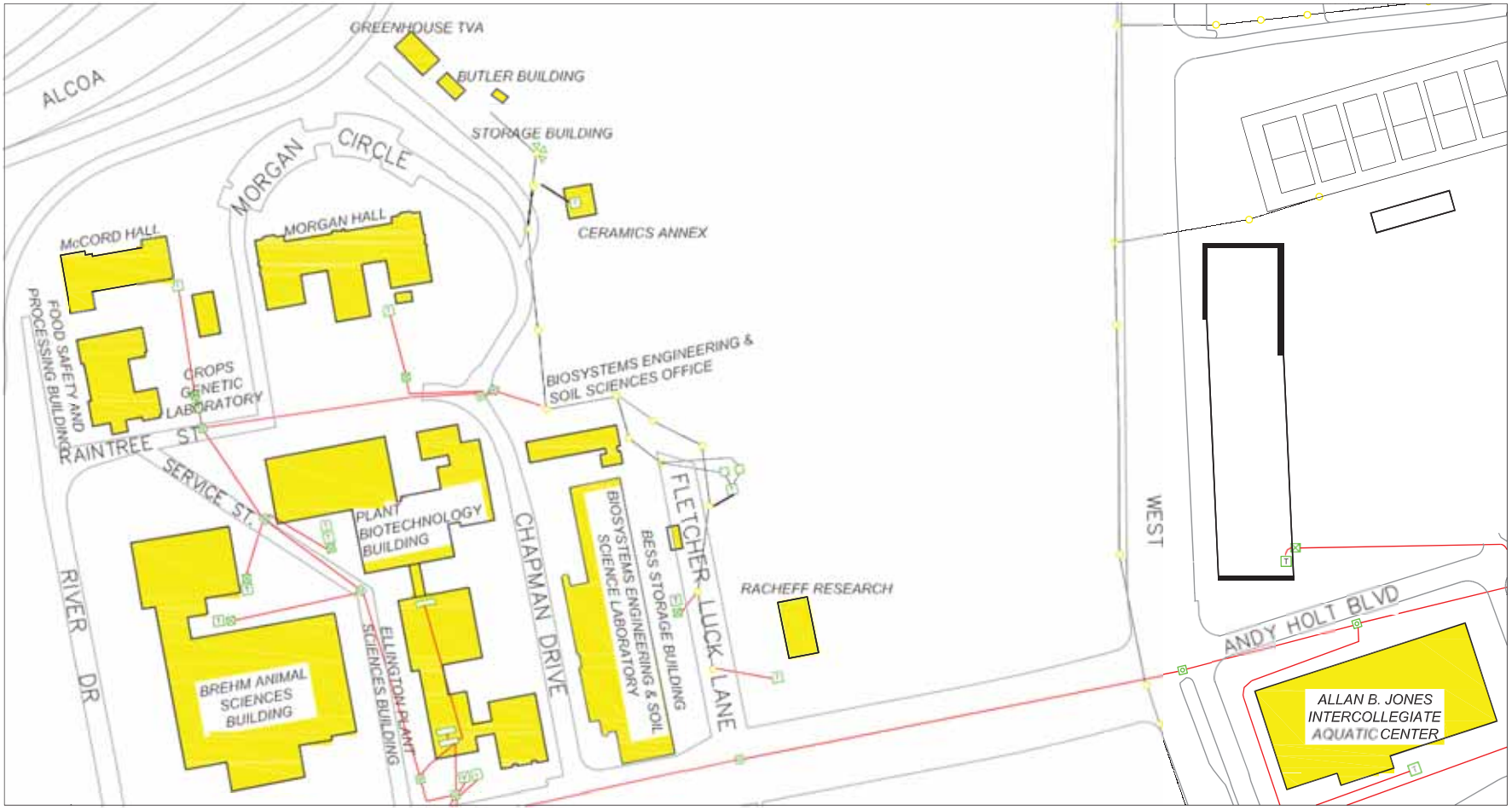
This New Residence Hall and Parking Garage are set to be complete by school years Summer 15' and Fall 17'
http://facserv.utk.tennessee.edu/divisions/Construction/newresidencehall.html

APPENDIX A

MAIN STATION CIRCUIT 6 (CONT'D)

25.	Sigma Phi Epsilon Fraternity House	50116300	Aux	1832	Fraternity Park Drive	15,339
26.	Student Health Clinic	50126600	Sup	1800	Volunteer Blvd	111,497
27.	Temple Hall	50124400	Sup	1818	Andy Holt Avenue	15,295
28.	Thornton Athletics Student Life Center	50111600	Aux	1801	Volunteer Drive	25,571
29.	Ula Love Doughty Carousel Theatre	50112500	Ac	1710	Andy Holt Avenue	7,522
30.	Visitor Parking Information Center	50113200	Aux	1600	Volunteer Boulevard	109
31.	FUTURE MULTIPURPOSE MECHANICAL BUILDING			1800	Andy Holt Avenue	12,000- 15,000
32.	FUTURE PARKING GARAGE			1700	Lake Loudoun Boulevard	
33.	FUTURE RESIDENCE HALL (NEW GIBBS HALL)			1300	Lake Loudoun Boulevard	
					Sum	1,547,105

APPENDIX A



Circuit 7 Distribution (Ag Campus) 1"= 250'

APPENDIX A

MAIN STATION CIRCUIT 7

No.	Building Name	Building No.	Usage	Street No.	Street Name	Gross Sq. Ft.
1.	Allan Jones Intercollegiate Aquatic Center	50120400	Aux	2200	Andy Holt Avenue	83,545
2.	BESS Storage Building	50160800	Sup	2506	E J Chapman Drive	819
3.	Biosystems Engineering and Soil Science Labs Building	50160600	Ac	2500	E J Chapman Drive	49,974
4.	Biosystems Engineering and Soil Sciences Office Building	50160700	Ac	2506	E J Chapman Drive	17,106
5.	Brehm Animal Science Building	50161200	Ac	2506	River Dr	N/A
6.	Butler Building	50164900	Ac	2618	Morgan Circle Drive	740
7.	Ceramics Annex	50168100	Ac	2610	Morgan Circle	2,799
8.	Ellington Plant Sciences Building	50162300	Ac	2431	Joe Johnson Drive	81,082
9.	Food Safety and Processing Building	50161300	Ac	2600	River Dr.	22,791
10.	Food Science and Technology Building	50161400	Ac	2510	River Dr.	N/A
11.	Greenhouse TVA	50162500	Ac	2620	Morgan Circle Drive	3,607
12.	McCord Hall	50160100	Ac	2640	Morgan Circle Drive	43,395
13.	Morgan Hall	50160300	Ac	2621	Morgan Circle Drive	89,836
14.	Plant Biotechnology Building	50162400	Ac	2505	E J Chapman Drive	147,435
15.	Racheff Research Building	50160200	Ac	2519	Fletcher Luck Lane	6,100
16.	Storage Building	50165500	Sup	2616	Morgan Circle Drive	240
17.	FUTURE PARKING GARAGE					
18.					Sum	549,471

APPENDIX A

Circuit 8 Distribution (Ag Campus) 1"= 250'

APPENDIX A

MAIN STATION CIRCUIT 8

No.	Building Name	Building No.	Usage	Street No.	Street Name	Gross Sq. Ft.
1.	Animal Science Laboratory	50161900	Ac	2429	Fletcher Luck Lane	1,479
2.	Bealle Rose Garden Gazebo	50166300	Aux	----		346
3.	Business Incubator	50126300	Sup	2450	E J Chapman Drive	16,200
4.	Central Greenhouse	50169600	Ac	2402	E J Chapman Drive	9,994
5.	CRC - Bioenergy Science and Technology Unit	50166100	Ac	2500	Jacob Drive	11,230
6.	CRC - Material Science and Technology Unit	50166000	Ac	2506	Jacob Drive	15,528
7.	Crops Genetic Laboratory	50168500	Ac	2644	Morgan Circle Drive	5,728
8.	Environment & Landscape Laboratory	50166200	Ac	2512	Jacob Drive	7,621
9.	Forest Genetics Greenhouse (17)	50169400	Ac	2408	E J Chapman Drive	2,359
10.	Greenhouse #10	50163800	Ac	2426	E J Chapman Drive	1,970
11.	Greenhouse #13	50163500	Ac	2426	E J Chapman Drive	2,890
12.	Greenhouse #14 (Plastic)	50165800	Ac	2414	E J Chapman Drive	3,501
13.	Greenhouse #15 (Hydroponic)	50165600	Ac	2412	E J Chapman Drive	145
14.	Greenhouse #16 (Plastic)	50169200	Ac	2410	E J Chapman Drive	2,183
15.	Greenhouse Quonset (Plastic)	50165700	Ac	----	Fletcher Luck Lane	2,400
16.	North Greenhouse	50163900	Ac	2428	E J Chapman Drive	11,474
17.	Plant Propagation Building	50169500	Ac	2405	Fletcher Luck Lane	3,634
18.	Plant Sciences Annex B	50161700	Ac	2420	Fletcher Luck Lane	3,357
19.	Publications and Services Building	50169100	Sup	2412	Fletcher Luck Lane	10,021
20.	Shade House (25X64)	50169300	Ac	2416	E J Chapman Drive	1,600
21.	South Greenhouse	50165900	Sup	2514	Jacob Drive	17,514
22.	UT Gardens Support	50164200	Ac	2427	Fletcher Luck Lane	1,221
23.	Veterinary Teaching Hospital	50169000	Ac	2407	River Drive	274,596
24.	FUTURE GARDENS SUPPORT BUILDING					
25.					Sum	406,991

APPENDIX A

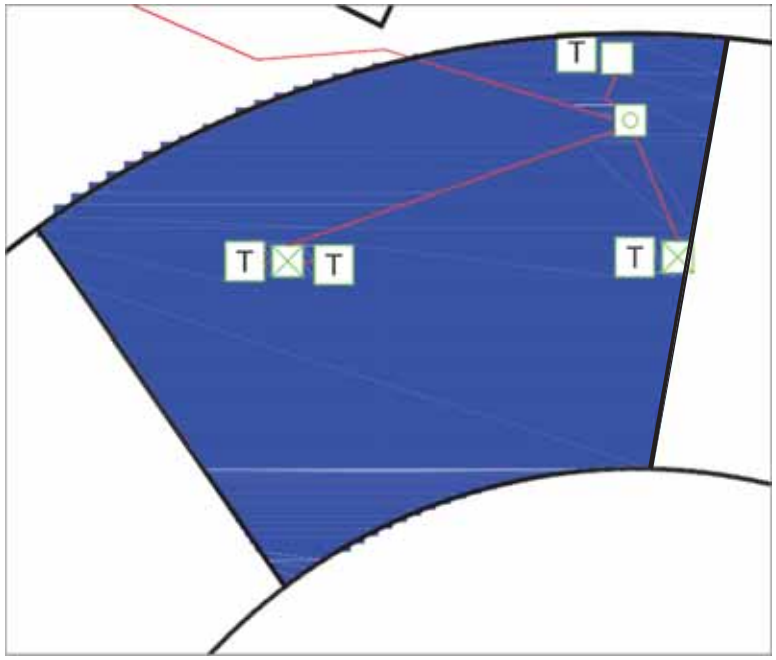
Circuit 9 Distribution 1"= 250'

APPENDIX A

MAIN STATION CIRCUIT 9

No.	Building Name	Building No.	Usage	Street No.	Street Name	Gross Sq. Ft.
1.	Black Cultural Center	50111100	Sup	1800	Melrose Avenue	14,713
2.	Dunford Hall	50117500	Sup	915	Volunteer Boulevard	84,456
3.	Greve Hall	50117100	Sup	821	Volunteer Boulevard	100,138
4.	Henson Hall	50117700	Sup	1618	West Cumberland Avenue	30,488
5.	Hess Hall	50119900	Aux	1720	Melrose Place	221,732
6.	Howard H. Baker Jr. Center for Public Policy	50125100	Sup	1640	Cumberland Ave.	50,497
7.	International House	50120600	Sup	1623	Melrose Place	10,662
8.	John C Hodges Library	50119200	Sup	1015	Volunteer Boulevard	395,956
9.	Massey Hall	50117300	Aux	825	Volunteer Boulevard	135,121
10.	Melrose Hall	50119700	Sup	1616	Melrose Avenue	98,111
11.	Tyson Alumni Center	50114300	Sup	1609	Melrose Avenue	16,338
12.					Sum	1,158,212

APPENDIX A



Circuit 10 Distribution 1"= 50'

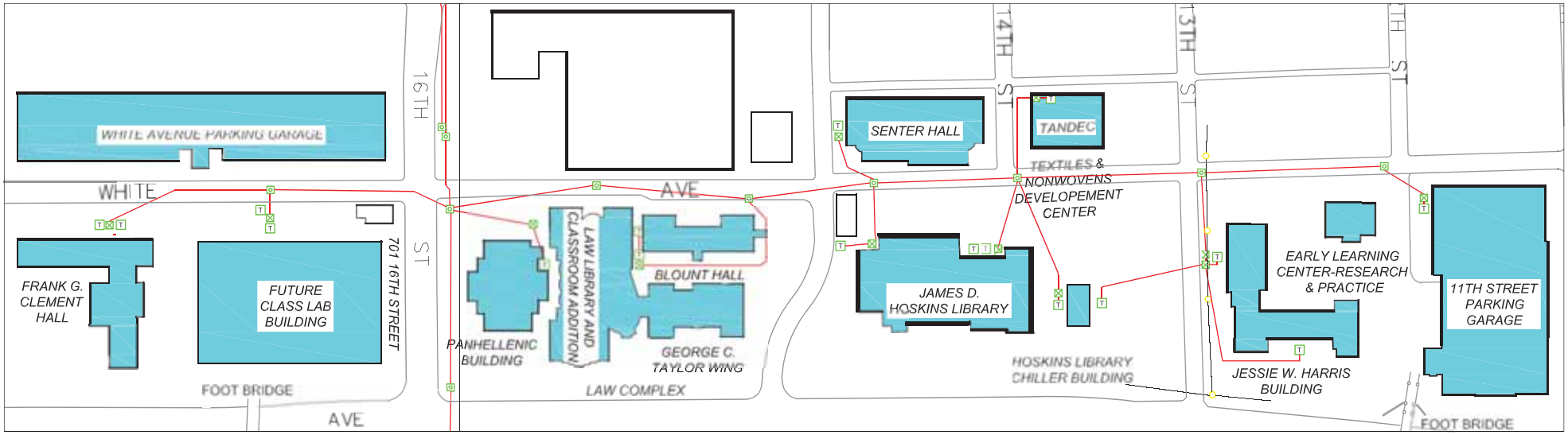
APPENDIX A

MAIN STATION CIRCUIT 10

No.	Building Name	Building No.	Usage	Street No.	Street Name	Gross Sq. Ft.
1.	North Stadium*	50123510		0	Philip Fulmer Way	0
2.	FUTURE ENGINEERING BUILDING					
3.					Sum	0

*The #10 Circuit is temporarily unloaded but feeds into North Stadium.

APPENDIX A



Laurel Circuit 1Distribution 1"= 250'

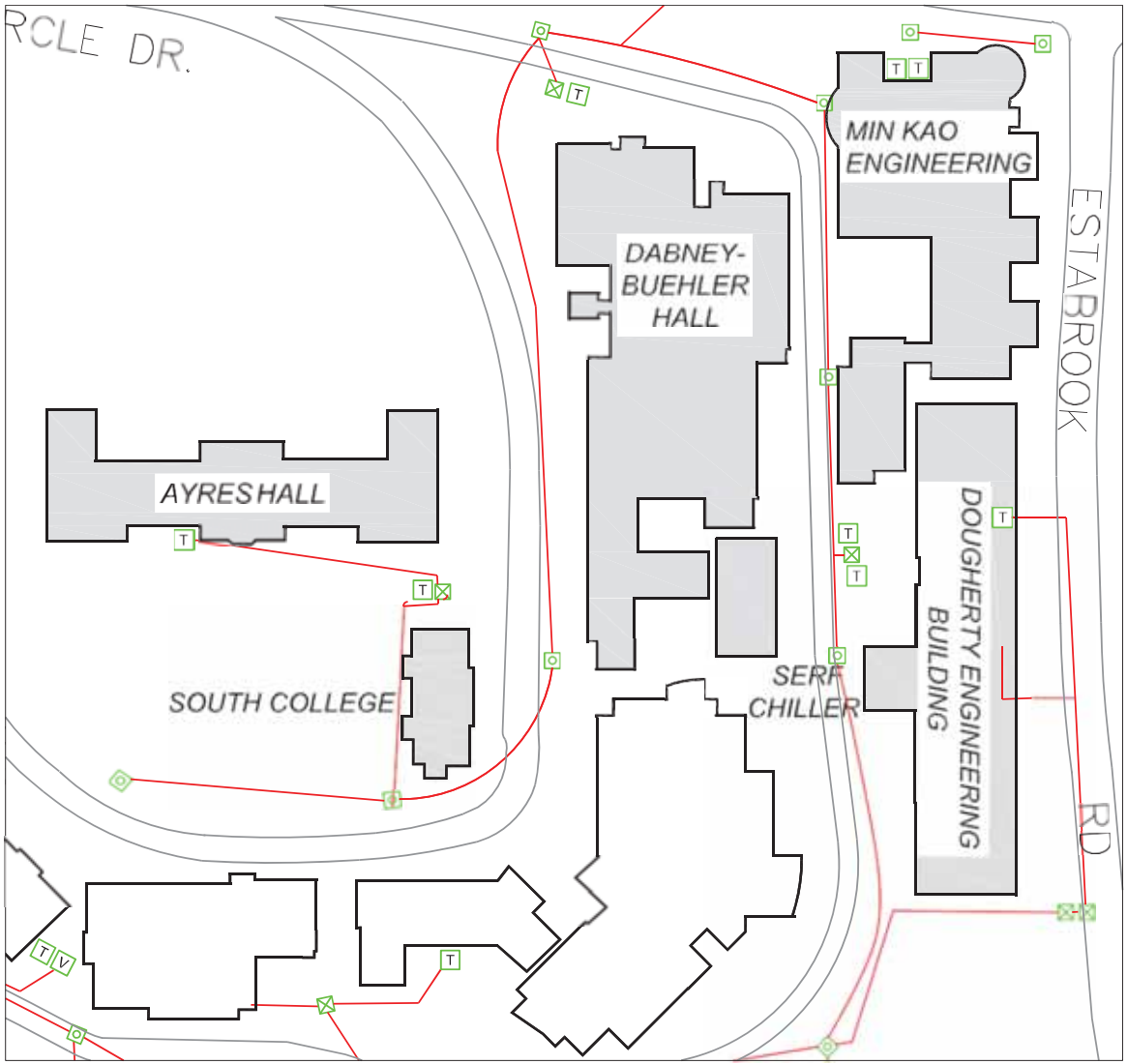
Strong Hall information at http://fs.utk.edu/divisions/Construction/stronghall.html

APPENDIX A

LAUREL STATION CIRCUIT 1

No.	Building Name	Building No.	Usage	Street No.	Street Name	Gross Sq. Ft.
1.	11th Street Parking Garage	50131900	Aux	1101	Cumberland Avenue	466,241
2.	Blount Hall	50110700	Ac	1534	White Avenue	40,604
3.	Carriage House	50118300	Sup	1410	White Avenue	3,423
4.	Early Learning Center - Research & Practice	50118100	Ac	1206	White Avenue	7,810
5.	Frank G. Clement Hall	50113500	Aux	1629	West Cumberland Avenue	162,637
6.	Hoskins Library Chiller Building	50119110	Sup	1400	West Cumberland Avenue	2,106
7.	James D Hoskins Library	50119100	Sup	1400	West Cumberland Avenue	130,282
8.	Jessie W. Harris Building	50117900	Ac	1215	Cumberland Avenue	85,360
9.	Law Complex: George C Taylor Wing	50118910	Ac	1505	Cumberland Avenue	52,176
10.	Law Complex: Law Library and Classroom Addition	50118930	Ac	1505	Cumberland Avenue	126,845
11.	Panhellenic Building	50121300	Aux	1531	Cumberland Avenue	54,384
12.	Senter Hall	50111800	Ac	1401	White Avenue	21,326
13.	TANDEC--Textiles and Nonwovens Development Center	50139700	Sup	1321	White Avenue	16,056
14.	White Avenue Parking Garage	50137700	Aux	1720	White Ave	278,432
15.	FUTURE CLASS LAB BUILDING (STRONG HALL)			1621	Cumberland Avenue	
16.	FUTURE CLASS LAB BUILDING			1300	Cumberland Avenue	
17.					Sum	1,546,277

APPENDIX A



Laurel Circuit 2 Distribution 1"= 200'

APPENDIX A

LAUREL STATION CIRCUIT 2

No.	Building Name	Building No.	Usage	Street No.	Street Name	
1.	Ayres Hall	50111300	Ac	1403	Circle Drive	116,555
2.	Dabney-Buehler Hall	50113100	Ac	1416	Circle Drive	247,049
3.	Min H. Kao Electrical Engineering & Computer Science	50118200	Ac	1520	Middle Dr	188,614
4.	Science and Engineering Building	50118000	Ac	1414	Circle Drive	249,323
5.	SERF/Dabney/Buehler Chilled Water Plant	50118020	Sup	----	Middle Drive	N/A
6.	South College	50123300	Ac	1413	Circle Drive	15,220
7.					Sum	816,761

APPENDIX A

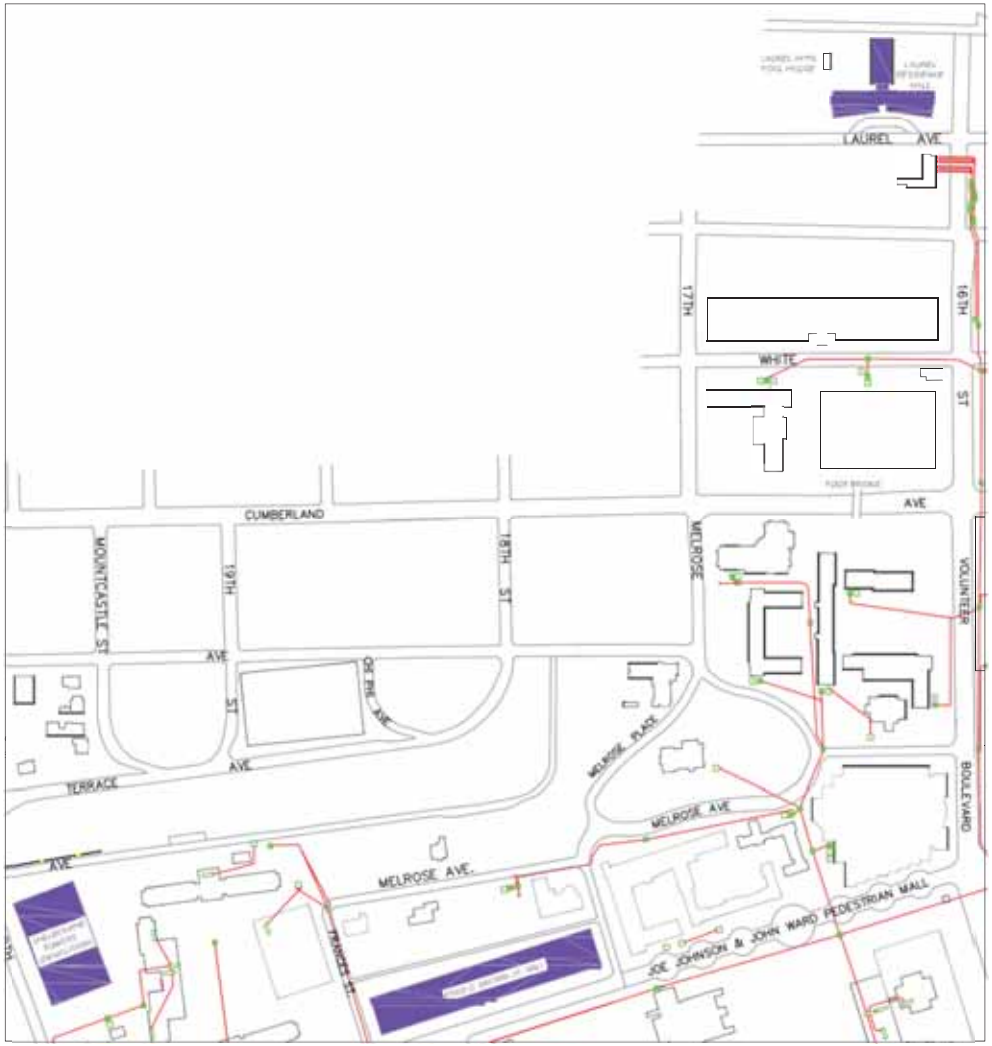
Laurel Circuit 3 Distribution 1"= 200'

APPENDIX A

LAUREL STATION CIRCUIT 3

No.	Building Name	Building No.	Usage	Street No.	Street Name	Gross Sq. Ft.
1.	Alumni Memorial Building	50110500	Ac	1408	Middle Drive	102,893
2.	Austin Peay Building	50110100	Ac	1404	Circle Drive	62,884
3.	Burchfiel Geography Building	50117000	Ac	1000	Phillip Fulmer Way	34,189
4.	Dougherty Engineering Building	50113900	Ac	1512	Middle Drive	129,134
5.	Earth and Planetary Sciences Building	50116900	Ac	1412	Circle Drive	44,677
6.	Ferris Hall	50114900	Ac	1508	Middle Drive	43,387
7.	Hesler Biology Building and Greenhouse	50111700	Ac	1406	Circle Drive	125,098
8.	Nielsen Physics Building	50121700	Ac	1408	Circle Drive	64,357
9.	Perkins Hall	50121500	Ac	1506	Middle Drive	80,805
10.	Walters Life Sciences Building	50119400	Ac	1414	West Cumberland Avenue	153,334
11.					Sum	845,758

APPENDIX A



Laurel Circuit 4 Distribution 1"= 500'

APPENDIX A

LAUREL STATION CIRCUIT 4

No.	Building Name	Building No.	Usage	Street No.	Street Name	Gross Sq. Ft.
1.	Fred D. Brown Residence Hall	50112100	Ac	1817	Andy Holt Avenue	240,000
2.	Laurel Residence Hall	50118810	Ac	1615	Laurel Avenue	293,620
3.	Shelbourne Towers*	50126800	Ac	806	20th Street	167,872
4.	FUTURE WEST CAMPUS DEVELOPMENT					
5.					Sum	701,492
					Grand Total	12,713,361

*Shelbourne Towers demolition complete as Fall 2014. UT bought the apartments from the Grace Development of Nashville.

APPENDIX A

LAUREL SUBSTATION

The Laurel Substation, located on the corner of 16th Street and Laurel Avenue, was made to accommodate the growing size of The University of Tennessee- Knoxville as it pushes to become a top 25 public institution. It houses the four new additional nominal 400-amp, 13,200-volt circuits. There is room to install four more circuits for the future expansions of UT. The design was inspired to blend in with the Fort Sanders neighborhood as it looks like a home to live in. The red brick and gable roofing is consistent with the surrounding buildings and churches.

The circuits of the substation are powered by gas insulated switchgear (GIS). The advantages of GIS equipment is that it does not require arc flashing equipment, it doesn't expose operators to high and dangerous voltages, it's enclosed and housed inside the building from animals and weather conditions, and it very reliable as an energy source. The switchgear is virtually maintenance free, though the gas meters have to periodically checked. The footprint is much smaller versus the old substation and its modular design makes it easier to install.

Front of the Laurel Substation

The switchgear inside the station.

Garage Doors on the east facade

APPENDIX A

TRANSFORMERS

For the servicing of electrical distribution, The University of Tennessee uses Cooper Pad Mounted Transformers throughout the campus that come in a variety of designs and configurations. Liquid -filled, three-phase, commercial pad-mounted distribution transformers are designed for servicing
such underground distribution loads as shopping centers, schools, institutions and industrial plants. They are available in both live-front and dead-front construction, for radial or loop-feed applications, with or without taps.

Typical Pad Mounted Transformer

Some special designs and options may require additional engineering, factory coordination, unusual application requirements or special manufacturing needs. The transformers described herein are designed for the application conditions normally encountered on electric power distribution systems. As such, they are suitable for use under the “usual service conditions” described in IEEE Standard C57.12.00 general requirements for liquid-immersed distribution, power and regulating transformers.

Pad-mounted transformers meet the following industry standards:
IEEE, C57.12.00, IEEE C57.12.34, IEEE C57.12.28, IEEE C57.12.29, IEEE C57.12.70, IEEE C57.12.80, IEEE C57.12.90, IEEE C57.91and NEMA. (IEEE is the Institute of Electrical and Electronic Engineers, NEMA is the National Electrical Manufacturers Association).

For more information, visit www.eaton.com/consultants

Compartmental Features

APPENDIX A

DUCT BANKS AND CONDUITS

Duct banks are groups of conduits designed to protect and consolidate cabling to and from buildings. They are beneficial and built in different configurations that accommodate conduits of varying sizes. They are installed for large buildings that require a substantial amount of wiring. The construction method is designed to protect the cabling outside of the building and consolidate it in one area. Within duct banks the electrical cables are encased by conduits. Each conduit consists of a polyvinyl chloride (PVC) pipe that contains the insulated wiring of the building. These conduits are bundled together and surrounded with a protective covering, which is designed to prevent water damage or physical stress. Where the wiring of the duct bank meets its building, a specialized manhole is required to prevent water from entering the building while allowing the conduit to expand and contract without damaging the duct bank.

The trenches and tunnels used to install underground duct banks require special preparation to provide proper support. Duct banks with concrete casings need a trench prepared with materials capable of supporting the weight of the duct bank while providing adequate drainage. Cabling for ducts buried under existing construction are installed after the duct bank is inserted in the ground. Wiring is drawn through the conduits of the duct bank using guide wires inside the bank; this technique also allows upgrades and repairs on wiring in existing duct banks with minimal digging. The University of Tennessee uses duct banks to encase the electrical cables that distribute power across campus. They are composed of concrete.

PVC Electrical Conduits

Concrete Encased duct bank

APPENDIX A

VISTAS SWITCHGEAR

S&C's Vista Underground Distribution Switchgear is the answer to these and many other underground distribution system problems. S&C worked closely with electric utilities and power users to identify and satisfy needs that were not being met by conventional underground distribution equipment. Vista UDS is an exceptional product that meets all of these needs. Vista Underground Distribution Switchgear is available in manual, remote supervisory, and source-transfer models. All models feature load interrupter switches and resettable, vacuum fault interrupters or arc spinners in series with disconnect switches, elbow-connected and enclosed in a submersible, SF6-insulated, welded steel tank.

Vista UDS's most innovative installation offering is the Undercover style. The Undercover style is ideal for areas with stringent real-estate restrictions or where aesthetics are highly important. The UDS gear is installed underground, but all operations are easily performed by one operator above ground Undercover style installations can also save money by reducing costs associated with trenching and long cable runs. The University of Tennessee has only a handful of vistas located on campus, with most of them being in the Neyland Stadium area to help with the power distribution. The university uses the Pad Mounted style.

For more information on operation and maintenance, visit http://sandc.com/

Pad Mounted Style Vista UDS

Vista at Thompson-Boling Arena

APPENDIX B

MAIN CAMPUS STEAM LOAD

No.	Building Name	Building Number	Steam Demand Lb/ Hr.
1.	11th Street Parking Garage	50131900	NONE
2.	Administration Parking Garage	50121400	NONE
3.	Alpha Chi Omega Sorority	50144800	NONE
4.	Alpha Delta Pi Sorority	50145200	NONE
5.	Alpha Gamma Rho Fraternity	50115200	NONE
6.	Alpha Kappa Alpha Sorority	50145100	NONE
7.	Alpha Omicron Pi Sorority	50145000	NONE
8.	Alpha Tau Omega Fraternity	50115300	NONE
9.	Alumni Memorial Building	50110500	3,250
10.	Anderson Training Center	50137100	N/A
11.	Andy Holt Tower	50110220	4,000
12.	Apartments Residence Hall	50122500	N/A
13.	Architecture Research Annex	50127600	NONE
14.	Art and Architecture Building	50110600	6,000
15.	Austin Peay Building	50110100	1,680
16.	Auxiliary Services Building	50136500	NONE
17.	Ayres Hall	50111300	1,920
18.	Bailey Education Complex	50113800	3,000
19.	Berry Hall	50111500	170
20.	Black Cultural Center	50111100	1,000
21.	Blount Hall	50110700	2,000
22.	Brenda Lawson Athletic Center	50136910	5,000
23.	Burchfiel Geography Building	50117000	2,000
24.	Campus Parking and Information	50113200	NONE
25.	Carolyn P Brown University Center	50112900	8,070

APPENDIX B

No.	Building Name	Building Number	Steam Demand Lb/ Hr
26.	Carriage House	50118300	500
27.	Carrick Hall North	50122800	5,460
28.	Carrick Hall South	50123100	5,460
29.	Ceramics Building	50113000	200
30.	Chi Omega Sorority	50144900	NONE
31.	Clarence Brown Theatre	50122400	2,800
32.	Clock Tower	50110400	NONE
33.	College of Nursing	50121800	1,270
34.	Communications and University Extension Building	50113300	5,680
35.	Dabney-Buehler Hall	50113100	15,000
36.	Delta Delta Delta Sorority	50145800	NONE
37.	Delta Gamma Sorority	50146000	NONE
38.	Delta Tau Delta Fraternity	50115400	NONE
39.	Delta Zeta Sorority	50145700	NONE
40.	Dougherty Engineering Building	50113900	3,300
41.	Dunford Hall	50117500	3,520
42.	Early Learning Center - Research & Practice	50118100	200
43.	Earth and Planetary Sciences Building	50116900	960
44.	East Skybox & Pressbox	50123610	5,000
45.	Estabrook Hall	50114100	1,480
46.	Facilities Services and Operations Building	50119300	600
47.	Facilities Services Maintenance Shops and Warehouse	50119600	600
48.	Facilities Services Utilities Maintenance Building	50119800	600
49.	Ferris Hall	50114900	1,330
50.	Frank G. Clement Hall	50113500	7,230

APPENDIX B

No.	Building Name	Building Number	Steam Demand Lb/ Hr
51.	Frank H. McClung Museum	50119500	830
52.	Fred D. Brown Jr. Residence Hall	50112100	N/A
53.	Goodfriend Tennis Center	50124000	NONE
54.	Greve Hall	50117100	4,070
55.	Health, Physical Education, and Recreation Building	50121600	N/A
56.	Heavy Equipment Shop @ Steam Plant	50127100	NONE
57.	Henson Hall	50117700	1,460
58.	Hesler Biology Building and Greenhouse	50111700	2,950
59.	Hess Hall	50119900	8,300
60.	Hopecote	50131700	NONE
61.	Hoskins Library Chiller Building	50119110	N/A
62.	Howard H. Baker Jr. Center for Public Policy	50125100	5,000
63.	Humanities and Social Sciences Building	50118710	2,400
64.	Humanities and Social Sciences Parking Garage	50118730	NONE
65.	Humes Hall	50123000	5,230
66.	International House	50120600	N/A
67.	James A. Haslam II Business Building	50112300	5,210
68.	James D. Hoskins Library	50119100	5,190
69.	Jessie W. Harris Building	50117900	3,300
70.	Joan Cronan Volleyball Facility	5090500	N/A
71.	John C. Hodges Library	50119200	6,000
72.	John D. Tickle Engineering Building	50112200	N/A
73.	Kappa Alpha Fraternity	50116600	NONE
74.	Kappa Delta Sorority	50145600	NONE
75.	Kappa Kappa Gamma Sorority	50145500	NONE

APPENDIX B

No.	Building Name	Building Number	Steam Demand Lb/ Hr
76.	Kappa Sigma Fraternity	50116500	NONE
77.	Lake Avenue Early Learning Center	50123400	N/A
78.	Lake Ave Early Learning Center (2nd bldg)	50117400	N/A
79.	Lake Avenue Parking Garage	50130500	NONE
80.	Lambda Chi Alpha Fraternity	50115600	NONE
81.	Lady Vols Crew Boathouse	50143900	N/A
82.	Laurel Pool House	50118830	N/A
83.	Laurel Residence Hall	50118810	NONE
84.	Law Complex: George C. Taylor Wing	50118910	2,000
85.	Law Complex: Law Library and Classroom Addition	50118930	2,000
86.	Lindsey Nelson Stadium	50111400	N/A
87.	Massey Hall	50117300	6,000
88.	McClung Tower and Plaza	50118720	2,400
89.	Melrose Hall	50119700	4,000
90.	Min H. Kao Engineering Building	50118200	N/A
91.	Morrill Hall	50120000	7,570
92.	Natalie L. Haslam Music Center	50144500	N/A
93.	Neyland Parking Garage	50137500	NONE
94.	Neyland-Thompson Sports Center	50136900	N/A
95.	Neyland Drive Biology Annex	50111200	NONE
96,	Nielsen Physics Building	50121700	N/A
97.	North Stadium	50123510	N/A
98.	Office of Equity and Diversity	50129200	N/A
99.	Panhellenic Building	50121300	2,500
100.	Pasqua Nuclear Engineering Building	50121900	500

APPENDIX B

No.	Building Name	Building Number	Steam Demand Lb/ Hr
101.	Perkins Hall	50121500	2,200
102.	Phi Gamma Delta Fraternity	50115700	NONE
103.	Phi Kappa Psi Fraternity	50115500	NONE
104.	Phi Mu Sorority	50145400	NONE
105.	Phi Sigma Kappa Fraternity	50115800	NONE
106.	Philander P. Claxton Education Building	50113700	1,610
107.	Pi Beta Phi Sorority	50145900	NONE
108.	Pi Kappa Alpha Fraternity	50115900	NONE
109.	Pi Kappa Phi Fraternity	50116400	NONE
110.	Plant Biotechnology Building	50162400	N/A
111.	Plant Propagation Building	50169500	N/A
112.	Plant Sciences Annex B	50161700	N/A
113.	Pratt Pavilion	50122000	5,000
114.	Presidential Court	50122900	2,950
115.	Presidential Fire Pump Building	50120100	N/A
116.	Publications and Services Building	50169100	N/A
117.	Racheff Research	50160200	N/A
118.	Reese Hall	50122700	5,250
119.	Reese Hall Chiller	50122710	N/A
120.	Regal Soccer Stadium	50126200	NONE
121.	Science and Engineering Research Facility	50118000	20,000
122.	SERF/Dabney/Buehler Chiller	50118020	N/A
123.	Senter Hall	50111800	NONE
124.	Sherri Parker Lee Stadium	50120900	NONE
125.	Sherri Parker Lee Stadium-Team Facility	50120910	NONE

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No.	Building Name	Building Number	Steam Demand Lb/ Hr
126.	Sigma Alpha Epsilon Fraternity	50116000	NONE
127.	Sigma Chi Fraternity	50116100	NONE
128.	Sigma Kappa Sorority	50145300	NONE
129.	Sigma Nu Fraternity	50116200	NONE
130.	Sigma Phi Epsilon Fraternity	50116300	NONE
131.	Silverstein-Luper Building	50140300	N/A
132.	Sophronia Strong Hall	50124100	3,710
133.	South & East Stadium	50123500	6,320
134.	South College	50123300	1,126
135.	South Greenhouse	50165900	N/A
136.	Sports Bubble	50120800	N/A
137.	Steam Plant	50123900	10,000
138.	Steam Plant Coal Conveyor Shed	50123200	N/A
139.	Steam Plant Gear Switching/Turbine Building	50123910	NONE
140.	Stokely Management Center	50112400	2,310
141.	Student Aquatic Center	50120500	2,510
142.	Student Counseling Services	50124300	410
143.	Student Health Clinic	50126600	N/A
144.	Student Services Building	50110210	N/A
145.	TANDEC -Textiles and Nonwovens Development Center	50139700	N/A
146.	Temple Hall	50124400	640
147.	Tennessee Recreation Center For Students (T-RECS)	50124800	10,000
148.	Thompson-Boling Assembly Center and Arena	50139400	20,000
149.	Thornton Athletics Student Life Center	50111600	1,000
150.	Tom Black Track Facilities Building	50123810	NONE

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No.	Building Name	Building Number	Steam Demand Lb/Hr
151.	Tom Black Track Pressbox	50123800	NONE
152.	Tom Black Track Pressbox 2	50123820	NONE
153.	Tom Black Track Storage Building	50123700	NONE
154.	Transportation Services	50120200	220
155.	T-RECS Storage Building	50978700	NONE
156.	Tyson Alumni Center	50114300	700
157.	Ula Love Doughty Carousel Theatre	50112500	N/A
158.	UT Visitors Center	50134400	N/A
159.	Volunteer Blvd. West Parking Garage	50121200	N/A
160.	Volunteer Hall	50126500	N/A
161.	Volshop on Cumberland Avenue	50130700	N/A
162.	W. Allan Jones Intercollegiate Aquatic Center	50120400	10,000
163.	Walters Life Sciences Building	50119400	13,640
164.	West Skybox Addition	50123600	6,940
165.	White Avenue Parking Garage	50137700	NONE
166.	Zeta Tau Alpha Sorority	50144700	NONE

If the Steam Demand is listed as N/A, it has steam but the number hasn't been specified. If it has NONE, the steam is either supplied by another customer or doesn't use steam at all.

APPENDIX B

AG CAMPUS STEAM LOAD

No.	Building Name	Building Number	Steam Demand Lb/ Hr
165.	Animal Science Laboratory	50161900	100
166.	BESS Storage Building	50160800	NONE
167.	BESS Tank & Equipment Storage	50160900	N/A
168.	Biosystems Engineering and Soil Science Labs Building	50160600	3,500
169.	Biosystems Engineering and Soil Sciences Office Building	50160700	410
170.	Business Incubator	50126300	N/A
171.	Brehm Animal Science Building	50161200	2,700
172.	Central Greenhouse	50169600	300
173.	Ceramics Annex	50168100	1,000
174.	CRC - Bioenergy Science and Technology Unit	50166100	500
175.	CRC - Material Science and Technology Unit	50166000	N/A
176.	Crops Genetic Laboratory	50168500	100
177.	Ellington Plant Sciences Building	50162300	3,100
178.	Environment & Landscape Laboratory	50166200	NONE
179.	Equine Hospital*	N/A	N/A
180.	Farm Animal Hospital *	N/A	N/A
181.	Food Safety and Processing Building	50161300	790
182.	Food Science and Technology Building	50161400	N/A
183.	Forest Genetics Greenhouse (#17)	50169400	100
184.	Greenhouse #10	50163800	100
185.	Greenhouse #13	50163500	100
186.	Greenhouse #14 (Plastic)	50165800	100
187.	Greenhouse #15 (Hydroponic)	50165600	100
188.	Greenhouse #16 (Plastic)	50169200	100
189.	Greenhouse Quonset (Plastic)	50165700	NONE

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No.	Building Name	Building Number	Steam Demand Lb/ Hr
190.	Greenhouse TVA	50162500	N/A
191.	Hollingsworth Auditorium	50162300	N/A
192.	McCord Hall	50160100	910
193.	Morgan Hall	50160300	1,760
194.	North Greenhouse	50163900	N/A
195.	Orthopedic Diagnostic Center*	N/A	N/A
196.	Pendergrass Library*	N/A	N/A
197.	Plant Biotechnology Building	50162400	15,000
198.	Plant Propogation Building	50169500	NONE
199.	Plant Sciences Annex B	50161700	N/A
200.	Publications and Services	50169100	N/A
201.	Racheff Research Building	50160200	2,500
202.	Shade House (25X64)	50169300	100
203.	South Greenhouse	50165900	N/A
204.	Storage Building	50165500	NONE
205.	Tennessee Division of Forestry**	N/A	N/A
206.	Tickle Small Animal Hospital*	N/A	N/A
207.	UT Gardens Support	50164200	100
208.	Veterinary Teaching Hospital	50169000	N/A

*These buildings are within the Veterinary Teaching Hospital and don't have separate building numbers.

**The Tennessee Division of Forestry is not a University owned business but resides on the Ag Campus.

APPENDIX B

CONDENSATE SYSTEMS

Our University uses grade B carbon steel seamless pipes for the steam and condensate systems. Directly buried steam and condensate piping that must be designed to control expansion/ contraction, anchoring, etc. They can beeither of the following listed below.

Carbon Steel seamless pipe.

Prefabricated and pre-insulated with a steam service pipe, insulation, an air gap, and a jacket pipe which permits venting and draining of air gap area. This design also to include a temperature sensing line which can identify possible steam leaks in the system and their approximate location. Temperature readings can be monitored in a nearby building. Manufacturing instructions and procedures must be followed when installing this type of system design.

The piping is insulated to keep the piping water tight. With this design, the steam and condensate piping shall be enclosed in a continuous concrete conduit system between steam vaults. The conduit system consist of a pre-cast concrete covers over a foundation slab. The conduit shall be designed to withstand highway loads at 2 feet cover and provide for piping expansion/contraction. A typical design consists of a pipe support cast in place in the foundation slab, roller assemblies and a roller plate welded to each pipe at the point it contacts the rollers. A waterproofing sealant, suitable for this application, shall be used at all joints between foundation slab and pre-cast covers.

APPENDIX B

STEAM VAULTS AND TUNNELS

Steam vaults are approximately 10ft X 10ft X 8ft high internally with 12inch thick walls. Steam vaults may be larger than this to provide adequate and safe movement within the finished vault. Steam vaults are constructed with two openings for egress, component removal /installation and ventilation of the vault. Openings are sized to suit the removal/installation of components and are normally located diagonally. Provisions shall be made to permit access through the top of the vault for valve operation where needed. Access openings like this are to have a water seal in place, when not in use, to keep rain water out. Covers for the vault openings to be lightweight, lockable and be able to withstand vehicle loads. The manhole covers to have stainless steel tags that bear the identification number of the manhole. Access openings to have galvanized steel ladders up to 6" below cover in lieu of "cast-in-place" steps. The steam vaults are to be waterproofed by applying a sprayed on or rolled on membrane to provide overall water proofing. Piping penetrations in the steam vaults shall use an approved "link seal" product to provide a water tight seal.

Tunnels to have a minimum of 8 feet of head clearance, and 3 feet of clear aisle space for walking and carrying materials. They are to be cast in place and have egress openings approximately 300 feet in any direction. The walk-through tunnels shall have natural ventilation with thermostat controlled fans to assist where needed. Fans to also be provided with a hand/off/auto switch. Water proofing of the walk through tunnels to be similar to that used for water proofing of the steam vaults.

View of walk-through Steam Tunnels

Under Volunteer Boulevard

APPENDIX C

UTILITY SURVEYS

The Utility Surveys hold sensitive information that can be accessed by approved personnel.

The Survey Drawings are available as follows:

Chilled Water:

Compressed Air:
Gas:
Sanitary Water:
Steam:
Storm:
Telephone Communications:
Underground Power:
Water:

Links to be provided at another time DemetriusSmith

APPENDIX D

AIR COOLED CHILLER CONDITIONS

No.	Chiller Name and Location	Chiller Condition	Year of Installment
1.	Allen Jones Aquatic Center 1	Good	2006
2.	Anderson Training Center 1	Excellent	2013
3.	Anderson Training Center 2	Excellent	2013
4.	Auxillary Services	Average	1997
5.	Brenda- Lawson Athletic Center	Average	2003
6.	Business Incubator	Good	2007
7.	Ferris Hall	Average	2000
8.	Hess Hall	Good	2007
9.	Howard Baker Center for Public Policy	Good	2008
10.	International House	Replacement	1995
11.	Jesse Harris	Replacement	1994
12.	John D. Tickle Engineering 1	Excellent	2013
13.	John D. Tickle Engineering 2	Excellent	2013
14.	McClung Museum	Good	2010
15.	Neyland Dr. Biology Annex	Excellent	2011
16.	Neyland Stadium East Skybox 1	Poor	2001
17.	Neyland Stadium East Skybox 2	Poor	2001
18.	Neyland Stadium North Endzone	Good	2012
19.	Neyland Stadium West Skybox 1	Replacement	2001
20.	Neyland Stadium West Skybox 2	Replacement	2001
21.	Pratt Pavilion	Good	2007
22.	Stokely Management Center 3	Average	2001
23.	Student Aquatic Center 1	Good	2005
24.	Student Health Clinic 1	Excellent	2012
25.	Student Health Clinic 2	Excellent	2012

26.	Tyson Alumni House	Excellent	2010
27.	Volcard Office	Excellent	2010

CENTRIFUGAL CHILLER CONDITIONS

No.	Chiller Name and Location	Chiller Condition	Year of Installment
1.	Alumni Memorial Building	Average	2003
2.	Andy Holt Tower	Average	1999
3.	Clement Hall	Average	1991
4.	Communications and University Extension	Average	1999
5.	Hesler Biology Building 1	Good	1995
6.	Hesler Biology Building 2	Good	2010
7.	Hoskins Library	Average	1996
8.	Humanities and Social Sciences 1	Average	1995
9.	Humanities and Social Sciences 2	Average	1995
10.	James Haslam Business Building 1	Good	2007
11.	James Haslam Business Building 2	Good	2007
12.	John C. Hodges Library 1	Good	2003
13.	Natalie Haslam Music Center 1	Average	1995
14.	Natalie Haslam Music Center 2	Good	2006
15.	Neyland Thompson Sports	Replacement	1989
16.	Philander Claxton Building 1	Poor	2000
17.	Philander Claxton Building 2	Average	2000
18.	Plant Biotech Building 1	Average	2002
19.	Plant Biotech Building 2	Average	2007

APPENDIX D

20.	Plant Biotech Building 3	Average	2007
21.	Reese Hall 1	Average	1997
22.	Reese Hall 2	Average	1997
23.	Reese Hall 3-A/B	Poor	2000
34.	SERF Chiller 1	Poor	1992
35.	SERF Chiller 2	Poor	1992
26.	SERF Chiller 3	Average	2009
27.	SERF Chiller 4	Poor	1995
28.	Stokely Management 1	Average	1999
29.	Stokely Management 2	Average	1999
30.	Student Center 1	Good	2010
31.	Taylor Law Complex 1	Average	1995
32.	Taylor Law Complex 2	Average	1995
34.	Tennessee Recreation for Students 1	Average	2002
35.	Tennessee Recreation for Students 2	Average	2002
36.	Thompson Boling Arena 1	Average	2005
37.	Thompson Boling Arena 2	Replacement	1987
38.	Thompson Boling Arena 3	Replacement	1987
39.	Thompson Boling Arena 4	Replacement	1987
40.	Walter Life Sciences Building 1	Average	2000
41.	Walter Life Sciences Building 2	Average	2000