NEW MEXICO STATE UNIVERSITY TECHNOLOGY INFRASTRUCTURE

Assessment & Master Plan Report

September, 2022

Prepared by

BRIDGERS & PAXTON

B&P Project No. 8510

INNOVATIVE DEPENDABLE SOLUTIONS

ACKNOWLEDGMENTS

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OVERVIEW

The scope for the NMSU Technology Infrastructure Assessment and Master Plan is to assess the current technology infrastructure, to include:

Purpose

Assess the condition of the NMSU network and related technology infrastructure. Develop a plan to strengthen the connectivity and reliability provided to the full complement of NMSU locations to serve university and system needs for the next decade. The work will identify options for secondary data center sites and include detailed plans for implementation of a selected option.

Main Observation Points

- Wi-Fi Density
- Fiber optic system and extent
- Data Center
- Security and safety – including fire suppression systems
- Power and network path redundancy
- Building, entry & Fire alarm paths
- Security cameras (Placement? Availability? Pathing?)

Collaboration with the Central IT Department (ICT)

Identify and assess needs of the university, including those related to co-location requirements and alternative data center locations.

Pinpoint Necessities of NMSU Technology

Implement a phased plan for IT network infrastructure development over the NMSU main campus and system locations throughout the state of New Mexico.

Refine Infrastructure Plan

Refine infrastructure plan with user groups to finalize NMSUs priorities to accurately reflect the university's technology goals.

Development of a Five-Year NMSU IT Facilities Plan to Define Project Scope

- 2023-2024 (Severance Tax Bond Year)
- 2024-2025 (2024 GO Bond Year)
- Larger phased projects to meet instructional classroom needs, anticipated enrollment, housing, and auxiliary services requirements.

Graphical Representations for a Physical Master Plan

For adoption as an appendix in the Campus Master Plan 2017-2027.
- Master plan diagram for "Telecommunication and Internet" section.
- Development of phased projects for future BRR and Capital Projects to run co-dependently with utility section upgrades, tunnel system upgrades, and roadway replacement projects.

EXISTING CONDITIONS

Milton Hall

Milton Hall, built in 1947 and was at the center of campus at that time. Milton Hall was a Student Union building that incorporated a bowling alley. The bowling alley is currently the secondary data center and more importantly the distribution center for most of the campus fiber and copper backbone cabling. Milton Hall also, is the MPOP for AT&T, Conterra, Verizon, T-Mobile and Century Link (Lumen) service providers. This master plan looks at the conceivability of relocating the secondary data center and cabling distribution center to a new location.

Milton Hall Infrastructure (Cabling) Distribution; the cabling infrastructure that resides in Milton Hall is comprised of 12,000 pairs of copper distribution, which includes 9,000 pair copper distribution from Century Link and 3 (three) racks of optical fiber distribution for the campus.
Of the 12000 pairs of terminated copper in the IT space, the NMSU IT team believes that approximately 3000 pairs are actually in use currently.

As previously mentioned, Milton Hall, is the MPOP for AT&T, Conterra, Verizon, T-Mobile and Century Link (Lumen) service providers. The rack mounted fire alarm system, head-end is located in Milton Hall as well.

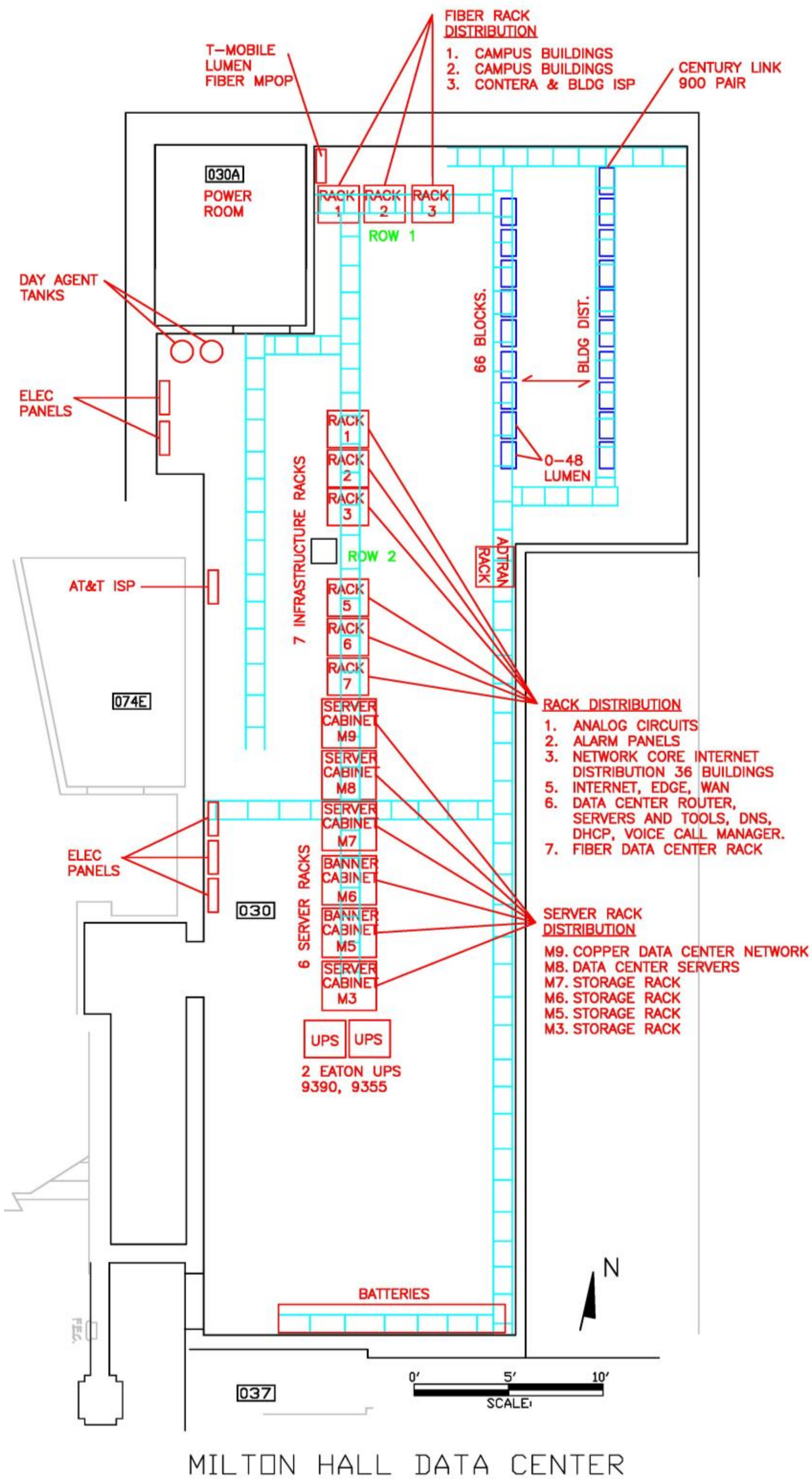


Figure 1 - Current layout of Milton Hall Data Center/Infrastructure Distribution Center

The buildings that receive IT services (internet) directly from Milton Hall, via the optical fiber cable plant are:

Zuhl Library	Astronomy	Corbett Center Student Union
Health and Social Science	KRWG	Chamisa Phase 1
Foster	Native American Cultural Center	Chamisa Phase 2
Branson Library	Campus Bookstore	Rhodes Garriet Hammel
Pan American Center	Biology Annex	Garcia Annex
Business Complex	Student Health Center	Frenger
Guthrie	English	Esports (CCSU)
Educational Services	Speech	Garcia Hall
Satellite Chiller Plant	Milton Hall	English
Breland	Young	Speech
Spiritual Center	Juniper	Milton Hall
	Pinon	

Figure 2 - Milton Hall Infrastructure racks – distributing 12,000 pairs of copper throughout the campus

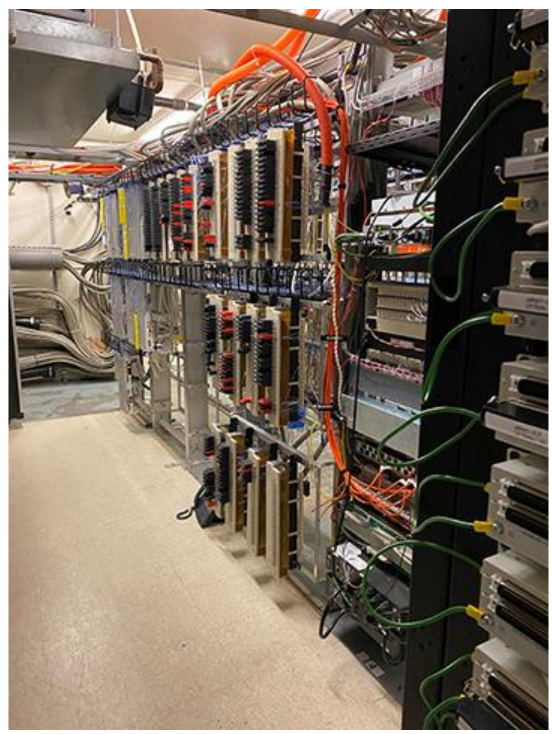


Figure 3 - Copper cabling; infrastructure distribution fused protectors /active Century Link (lumen) rack

Figure 2 - Transitioned cabling from OSP to indoor riser cable, terminated on Homoco distribution frames (racks

Figure 5 - 710 splicing of copper infrastructure distribution splicing

Figure 6 & 7 - Waste plumbing, from the floor above, runs through the ceiling of the Milton Hall Distribution/Data Center and terminates (with a clean-out) in front of the active Lumen rack. Also, pictured above are ceiling drains that are installed above all of the active gear.

Figure 8 - Optical fiber campus distribution racks with roof drains installed directly above the racks.

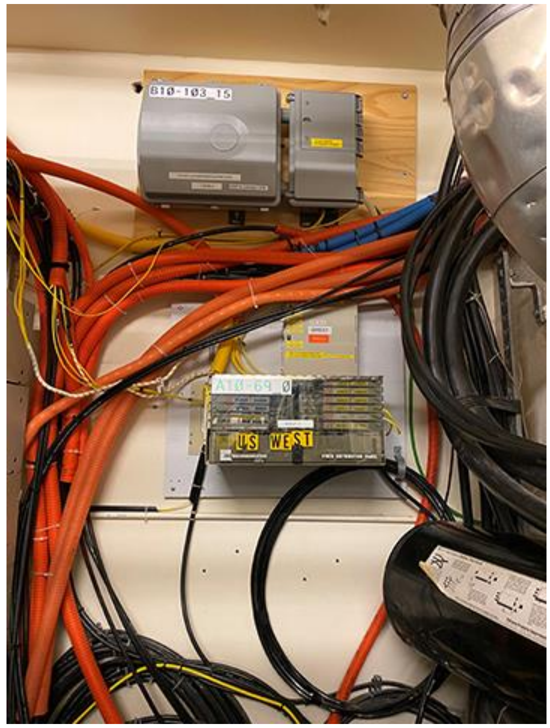


Figure 9 - Service provider MPOP (T-Mobile and Lumen)

Computer Center

The Computer Center building (CC) built in 1970, is the home of the campus's main data center. Most of the area has a raised floor and chilled air is distributed through the floor system. The return air is ducted in the ceiling back to the chilled water HVAC units. Each "specialty" space has its own air handler, the main data center space, the equipment staging room, the network operations room and the shared access room. There are redundant "DX" cooling units on the roof, however these are not operational. Chilled water lines run below the raised floor, as well as direct buried chilled water lines that originate from the science building. There are also hydronic heating water lines under the raised floor that have a history of leaking. When these lines leak, the water is shut off in the data center and the Computer Center building has no heating water supply. Along with the water under the data center floor, power is distributed under the floor as well. With the combination of water and power under the floor, a strategically placed water leak can bring down the whole data center, thereby creating an unforeseen catastrophe. In its current configuration, the data center is not efficient in power or cooling and under the right circumstances will experience significant down time.

Bullet point issues of the existing data center:

- No permanent back-up generator.
- Water and power reside under the floor and in a few instances, flex conduit that provides power, actually "lay" directly on top of the water pipes under the floor.
- Current HVAC air handlers are antiquated and appear to be original to the building.
- Current HVAC is chilled water with DX back up on the roof. DX units are not functional and when the campus losses power the chilled water plant goes down, resulting in a data center that will overheat.
- Current layout of data cabinets/isles and UPS do not meet current code requirements for a data center.

Figure 10 - Main Data Center Space

Figure 11 - Network Operations room.

Figure 12 - Back-up DX units on the roof of the Computer Center building.

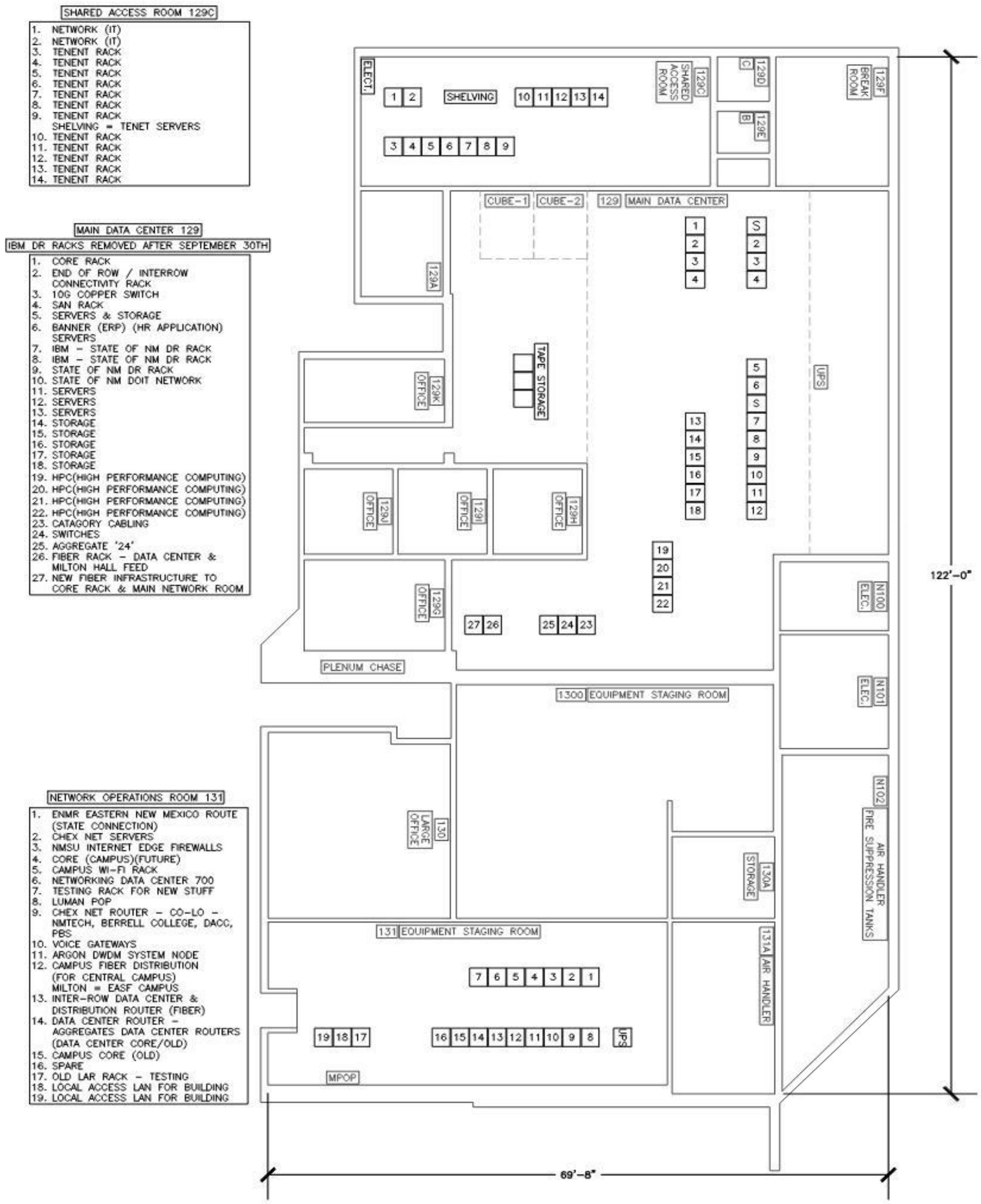


Figure 13 - "Current Data Center Layout in the Computer Center Building"

Tunnels

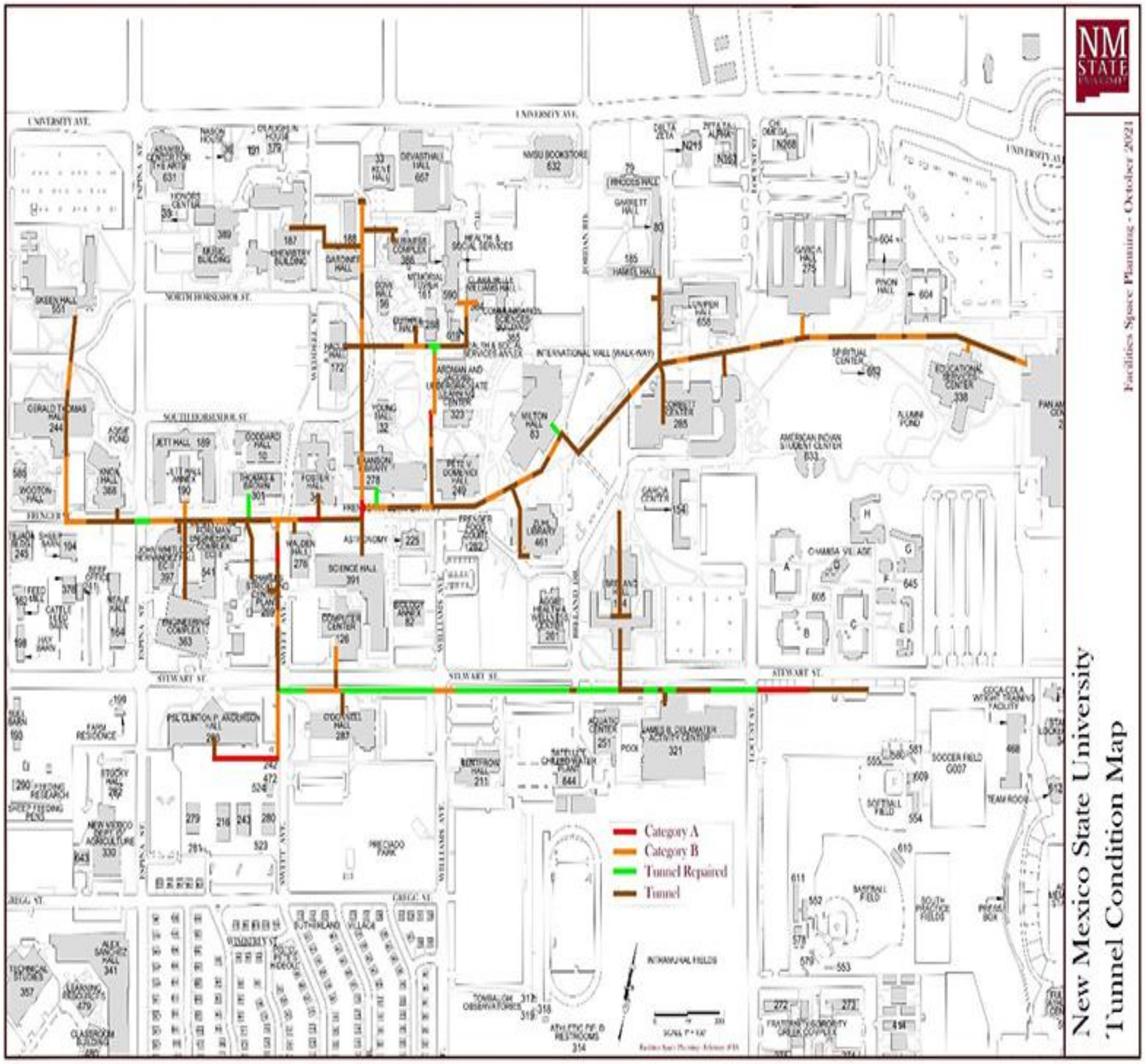


Figure 14 - "Underground Tunnel System"

The main NMSU campus in Las Cruces has an extensive underground tunnel system which serves over half of the campus. The tunnels serve the campus as pathways and feed the campus with chilled water, steam, electricity and communications infrastructure backbone cabling. Currently the tunnels and are going through renovations, with sections being rebuilt and/or in repair. The campus invests $1 million dollars a year in tunnel restoration. Pictured above is a sketch of the NMSU tunnel system, which depicts existing, new and repaired sections of the tunnel system.

Figure 15 - Zuhl Library Tunnel; Building 461

Figure 16 - Science Hall Tunnel; Building #391 – This picture represents new innerduct pathways

Figure 17 - Tunnel to Building 126 – This picture represents existing and newly installed innerduct pathways for optical fiber cable.

Figure 18 - Branson Library Open Tunnel; under repair

Pathways

Communications Pathways

Often overlooked, telecommunications pathways are critical to the success and longevity of the telecommunications/IT infrastructure. It should be scalable and have redundancy incorporated into the design. The existing communications pathways are comprised of the tunnel system, various locations that have 4" conduit duct banks, innerduct only and direct burial. The existing pathways that exit the tunnel system and enter each building, are observed to be mostly steel flex conduit and/or cored holes through the concrete, utilizing exposed innerduct. Utilizing "exposed" innerduct, installed without conduit protection is not a common or suggested solution as plastic innerduct will not detour vandalism or, after time, protect the optical fiber within the innerduct from the elements. As new backbone cables are being installed, through the tunnel system, contractors have been instructed and have been utilizing innerduct, within a minimum of 1-4" conduit for the pathway from the tunnel system into each building.

Figure 19 - Existing Optical Fiber pathway to tunnel system from Computer Center

Figure 20 – Exposed innerduct pathway

Electrical Pathways

Electrical pull-boxes and equipment were found at several instances in the Tunnel. NMSU preference is to keep only the electrical feeders in the tunnel and keep all pull boxes and pad mount switches above-grade for easy access.

Site

Although the campus was established and has been added on to since 1947, the campus itself is planned very well. The south end of the campus is the high point (elevation wise), with the low point being the north end of the campus.

Located on campus are multiple power sources; 4.3 MW Turbine, 4.3 MW solar array, a 4.3 MW battery storage farm and El Paso Electric services.

Located on the campus is a chiller plant that distributes chilled water throughout most of the campus. Chilled water is distributed throughout the campus via 12" water lines either in the tunnels or direct buried and has a 2000 ton capacity. Distributed water temperature varies between 40-48 degrees F. The chiller plant systems are monitored 24/7 via the web based application "Niagara 3". Part of this system includes an ice storage farm. The ice storage farm enables the chiller plant to not operate the chillers and rely on ice storage during the summer months.

Figure 21 - Solar array farm located on the south west corner of the campus.

The multiple power sources, the chilled water distribution system and the tunnel system all lend themselves to an exceptional, efficient, fully redundant data center design.

Figure 22 - Pictured; inside the chilled water plant

Figure 23 - Communications of the solar farm are being handled via microwave.

Figure 24 - Ice storage farm located outside of the chiller plant.

Optical Fiber Distribution

Optical fiber distribution is extensive throughout the campus and is comprised of mostly single mode for campus distribution. The practice of keeping proper cable records has been observed and site feed cable identification for any given building can be found relatively easy. Optical Fiber nodes are present and located in the Computer Center, Milton Hall, Skeen Hall and Tortugas Sub Station.

Copper nodes exist in Milton Hall, Gerald Thomas Hall, Branson Library, Computer Center, Academic Research Center.

Most of the installed optical fiber is underground with a few locations being areal.

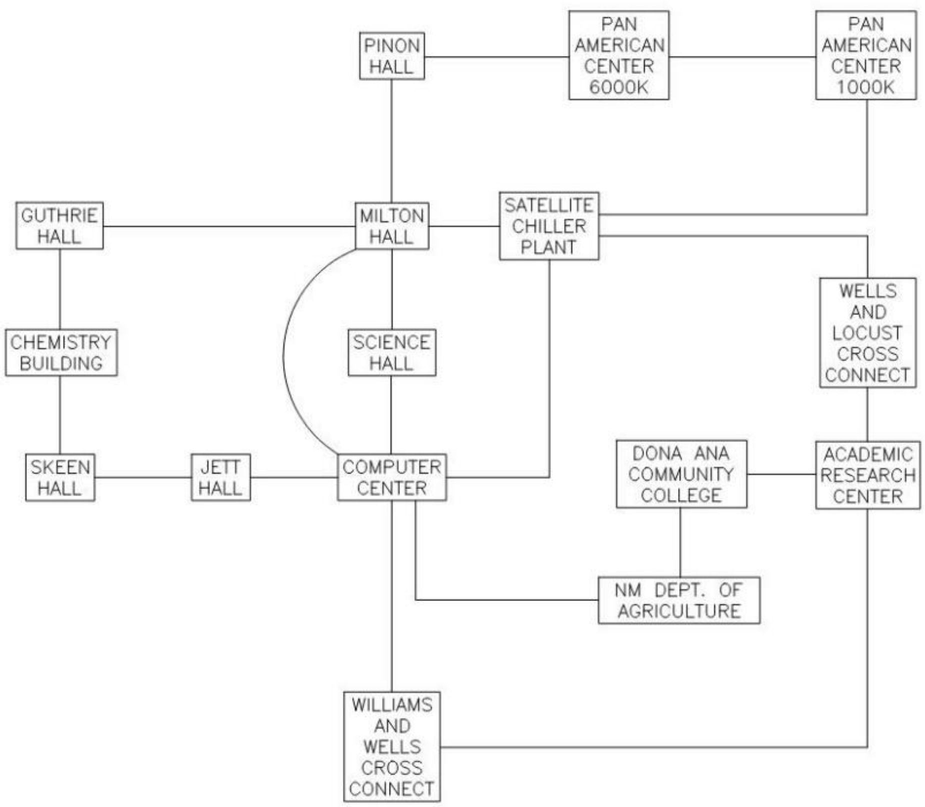


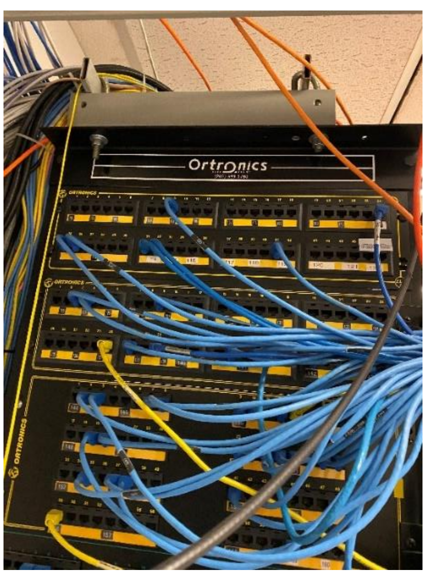
Figure 25 - NMSU Logical Fiber Map

IT (IDF/MDF) Spaces

Existing IDF's are in various states of condition. Most IDF's observed need upgrading. Horizontal and vertical wire management panels do not exist in most cases, or are passed their fill capacity. That goes for the cable trays/Ladder racks within the IT spaces as well. Overfill of cable trays and ladder racks leads to cables being unsupported as in Figure 26 below. Figure 27 depicts a properly laid out MPOP wall field in the basement of the computer Center building. Figures 28 and 29 depict the IDF in Branson Hall. This is an example of category 5 cable (not manufactured anymore) still in use. The pictures also depict the absence of proper horizontal and vertical wire management panels.

Figure 26 - Skeen Building #551 IDF

Figure 27 - Building #126 (Computer Center) entranced facility cross-connect field in basement



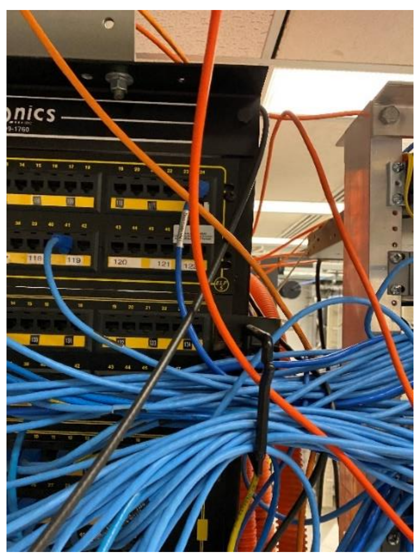


Figure 28 & 29 – Branson Hall IDF

Security

Unfortunately, as with most college campuses, crime does find its way on to the campus. Robberies, are more prevalent towards University Boulevard and Solano Drive. Property crimes; larceny, bicycle theft, auto burglaries and building theft appear to be largely “opportunity” crimes and the campus staff is taking a proactive approach to assist in the mitigation of such behavior.

Surveillance

Currently, approximately 400 security cameras, access control, including duress/lockdown buttons are deployed on the campus. The majority of cameras on the campus are “Axis” branded cameras. The current Video management software is “Video Insight”.
The IT department is currently migrating from the video insight Video management Software to the “Axis Camera Station” software. Included in this upgrade will be the addition of approximately 60-100 additional surveillance cameras throughout the campus.

Access Control

The access control system deployed, approximately 10 years ago, on the campus is the “Blackboard/Transact” system. The system utilizes an AP that students and faculty can access from their personal cell phone. The Transact portion of the system enables campus integrated payments, campus ID’s and campus commerce. The use of proximity readers, cards and personal cell phones with the downloaded AP are the norm for building entry, or the old fashioned lock and key. Access cards are made by the ID department and double as a student ID. The access control system has headend equipment located in every building that currently requires access control. The access control system incorporates 160 duress buttons and when depressed, the campus police dispatch is notified. Duress buttons are typically located in the Garcia Center, locations where money transactions take place and at Educational Services. Currently there is not VMS (video management software) integration with the access control system.

Campus Police Building

The campus police building houses the on-site campus police officers and the dispatch team that utilize multiple screens to view the security camera data.
Communications between officers are handled via two way radios supplied by NM DoIT.
The campus police building is backed up with a generator.

Wi-Fi Access and Capacity

The primary network room for the campus is the NOC which houses the wireless headend equipment for the entire campus. Also, approximately 50% of the wireless routers reside in Milton Hall.

Exterior WAP's are Cisco and Central Wi-Fi is Cisco. Interior WAP's are Cisco #9120 AX. There are approximately 36 AP's on campus with plans in place to add up to 50 more throughout the campus.

The south campus housing is being served by Ubiquity Backhaul. Every dorm room on campus has a Cisco hospitality AP (access point) and a Cisco micro switch. Dorm room walls and offices are lined with a type of foil and/or built with Wi-Fi blocking material to assist with the mitigation of signal propagation.

Figure 30 – Outdoor Wi-Fi

Electrical

Distribution System Overview

El Paso Electric Company (EPE) serves NMSU campus at 13,800/23,900 volts (25 kV) at two locations:

- The Tortugas Substation. Located on Locust Street North of Interstate 10.
- Geothermal Substation. Located on Geothermal Drive East of Interstate 25.

The Tortugas Substation distributes power to NMSU main campus (circuits #1-6) and the Geothermal Substation powers the Aggie Memorial Stadium area (circuit #7). EPE supplies approximately 60 percent of NMSU Las Cruces Campus electricity via the Tortugas and Geothermal Substations, at 23,900 volts. The Tortugas Substation can supply approximately 19 megawatts and the Geothermal Substation can supply approximately 2 megawatts.

NMSU also owns and operates a cogeneration plant (Central Plant) capable of providing 4.5 megawatts of power to the core campus at 4,160 volts. NMSU owns a 500-kilowatt backup generator turbine system (located in the Central Plant) which is used for emergency lighting circuits and miscellaneous power for essential buildings.

NMSU operates 225 kW of photovoltaic generation at four different sites: 180 kW at the Satellite Plant, 50 kW at SWTDI, 15 kW at Campus Health and Counseling, and 10 kW at the ASNMSU Center for the arts.

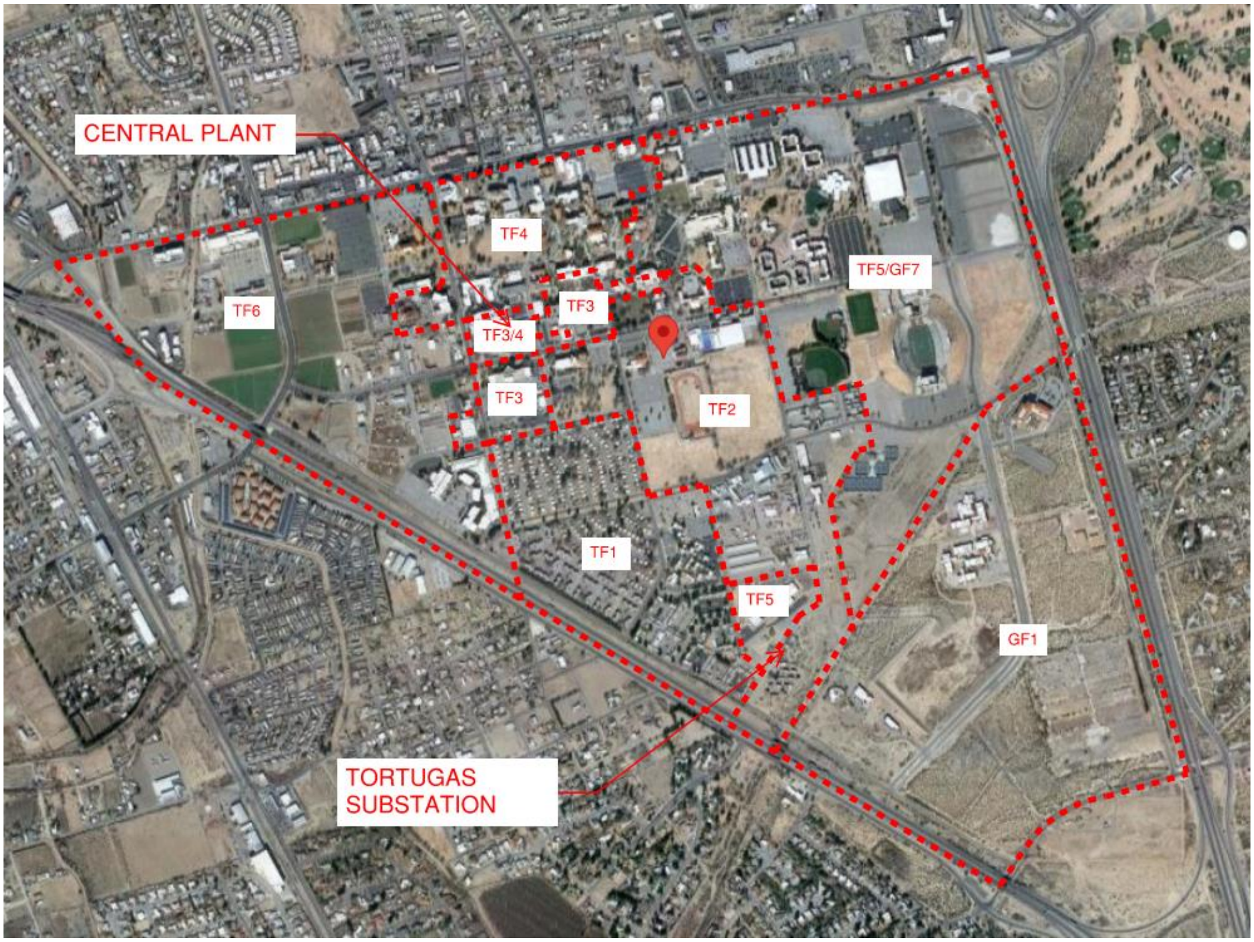


Figure 31 - NMSU Distribution System Zone

The existing medium voltage distribution on campus consists of a combination of 5kV and 25kV transformers and feeders interconnected in a loop-configuration for greater resilience. The original 5 kV still serves a number of buildings via oil switches and pole-type transformers. These systems are at the end of their life expectancy and NMSU has been upgrading over time to the 25 kV system. Most of the existing 5kV cable consists of 500 kcmil copper with smaller cable size for branches. All of the 25 kV cable is #4/0 aluminum with 1/3 concentric neutrals.

Central Plant

The original 5kV electrical service was located at the Central Plant. Installation of the 25 kV circuits started in the 1980s. The Central Plant is located in the intersection of Stewart St and Sweet Ave.

NMSU natural gas fired Turbine is located at the Central Plant. NMSU Turbine (5-kV) is backup by El Paso Electric (EPE) thru the Tortugas Substation (25-kV). Three weekends a year, Friday afternoon thru Saturday afternoon, the Turbine is shut down for maintenance. When this happens all NMSU circuits are being supplied by El Paso Electric only.

The Central Plant contains two 5kV distribution sections. One of the sections is the designated essential distribution board connected via a tie-breaker EBT to El Paso Electric. The EPE backup for NMSU Turbine is circuit #4 at the Tortugas Substation. Circuit #4 serves 23.9kV to 2.4kV transformer(s) T25-385 and T25-390 via pad-mount switch S25-120 located at the Central Plant.

Under normal operation, the turbine serves the Central Plant loads, a few classroom and administration buildings, and Computer Center loads. Excess Turbine power flows through the Turbine Tie Breaker EBT and back to Tortugas Substation. NMSU replaced the turbine 3 years ago, is in good conditions, and still has around 15 years of functional use. Three weekends a year, the Turbine is shut down for maintenance. When this happens, there is no backup powers source and building on-campus rely on back-up power generators on individual buildings.

Feeders EFM, EFW, EFCP, & EFCC are the designated essential circuit loads. If the Tortugas Substation detects an El Paso Electric outage, the Central Plant Distribution Board tie-breaker EBT is opened so that only the essential loads are connected to the turbine. Should the Turbine turn off-line, EPE immediately back feeds the Turbine circuits thru EBT.

Figure 31 & 32 - NMSU Turbine and Essential Distribution Board

Tortuga Substation

El Paso electric serves Tortuga substation (13.8kV/23.9kV) via overhead 25 kV feeder – meter #2179-6095. Tortugas Substation serves NMSU main campus with 6-feeders (TF1 – TF6). The NMSU 25-kV and 5-kV systems are maintained by the NMSU F&S Engineering and Electric Shops.

Power outages in NMSU main campus (Account #8172000000) over the last year were provided by El Paso Electric:

- 06/24/2020 at 19:02: Outage due to lightning storm.

We have no data to indicate that the electrical system will be any more or less reliable than it has been in the last year. Based on the outage information provided, the past utility system performance does not constitute "low reliability" or create "hardship" on the electrical service performance.

Generators

The total number of generators on campus is approximately 17. Buildings on campus with back-up power generators include USDA, Police, Foster, Biology Annex, Pan-Am Center, Chemistry building, among others as shown in the table below.

Maintenance and testing is critical to the continued reliability of emergency generators and must be performed in accordance with manufacturer's recommendations, instruction manuals, and the minimum requirements of NFPA 110 and the authority having jurisdiction. In general, diesel generator sets are required to be exercised at least once monthly, for a minimum 30 minutes.

NMSU maintains two EPA/NMED Air Quality Permits; a Title V Air Permit and New Source Review (NSR) Air Permit. These air permits ensure NMSU is monitoring campus emissions with the goal being to keep them as low as possible. The main pieces of equipment on campus that generate emissions are NMSU's three boilers and one turbine at the Central Utility Plant. It is recommended that the total campus emission be verified before adding more generators on campus. Ambient air quality has a significant effect on human health.

Regulated sources include:

- Cogen Turbines for Electricity and Steam Generation
- Steam Boilers
- Emergency Generators
- Chemical Emissions from Research

The pollutants monitored and regulated by the EPA include:

- Carbon Monoxide
- Lead
- Nitrogen Dioxide
- Ozone
- Particle Pollution
- Sulfur Dioxide

Location		MFG	Model #	KVA	KW	Fuel
Aggie Stadium	Inside West Concourse	Onan	80DGDA	100	80	Diesel
Biology Annex	Roof/Western Rm. 104	Generac	2728210100	25	20	Natural Gas
Center for the Arts	West Side	Cummins	DQHAB-10259827	375	300	Diesel

Central Plant	Inside North	Allis Chalmers	4445931	250	200	Diesel
Central Plant # 1	Outside Southwest	Caterpiller	3406	375	300	Diesel
Central Plant # 2	Outside NorthWest	Caterpillar	3406	375	300	Diesel
Chemistry 95	Outside West	Cummins	GGFD-5713023	43.7	35	Natural Gas
EH&S	EMF Building Northwest	Caterpillar	D80-6	100	80	Diesel
Fire Department	South Lot	Cummins	DSGAC-1402617	188	150	Diesel
Foster Hall	Outside East	Caterpillar	3306	312	250	Diesel
Pan American Center	Outside Southwest	Cummins	DFHA-5747403	876** 1059**	701	Diesel
Police Department	Outside West	Olympian	G20F3	25	20	Natural Gas
Skeen Hall	West Parking Lot	Generac	99A01533-S	312.5	250	Diesel
Supp. Utility Plant	South in Back Lot	Caterpillar	C9 DITA	375	358	Diesel
Wooton Hall	North Parking Lot	Olympian	D150P1	187.5	150	Diesel
A - Mountain Top	KRWG Facility	Caterpillar	LC5	375	300	Diesel
Physical Science Lab	South Lot	Cummins	DSGAB-1201044	156.2	125	Diesel
			Total	4,550.9		

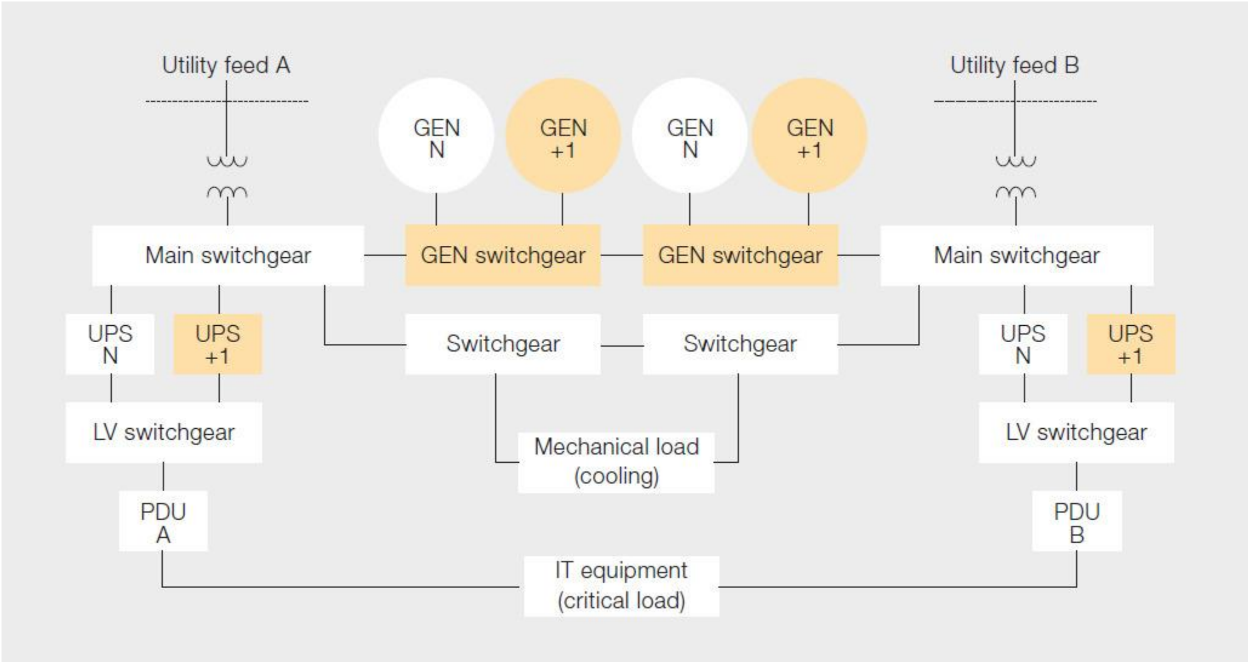


Figure 33 Typical Data Center Tier Level 3, N+1 Distribution System

Energy Management

Utility metering is provided by NMSU's Utilities Department, with some Internet-connected meters that interface with NMSU Niagara Automated System. Campus individual meters are monitored electronically or read manually to monitor power consumption. NMSU Facilities and Services utilizes a Web-based central energy management system to monitor and interact with all campus meters. The Tridium Niagara application provide real-time information on electricity and natural gas to NMSU, which allow development of utility dashboards to track and trend campus energy consumption.

Fire Alarm System

Each building has its own fire alarm system that reports back to a central monitoring dispatch service to report trouble and alarm conditions. These systems are of varying types (addressable vs zone based); varying ages and varying condition. Fire alarm from most building in main campus go back to Milton Hall (primary receiver) or Branson Library (secondary receiver). Some of the copper lines are over 50 years old. It is recommended that new copper lines be extended or new fiber with individual fiber-to-copper switches at each building in accordance with a Phase Plan to avoid interruption of service. NMSU fire alarm standard consists of an addressable type Firelite Alarms by Honeywell.

Buildings with copper feeds originating in Milton CO are as follows:
A Mountain, Activity Center, Aggie Memorial Stadium, Astronomy Building, Barnes & Noble, Biology Annex, Breland Hall, Central Utility Plant, Chamisa, Chamisa II, Chi Omega Sorority, Coca-Cola Weight Room, Communication Sciences, Computer Center, Corbett Center Student Union, Delta Zeta Sorority, Domenici, Dona Ana Branch, Educational Services Center, Engineering Complex II, English Building, Food Court, Football Coaches Bldg, Foster Hall, Fulton Center, Garcia Annex Center, Garcia Hall Residence Center, Golf Course Club House,

Golf Course Maintenance Shop, Guthrie Hall, Hadley Hall, Hardman And Jacobs (ULC), HSS Building, Jacobs Hall, Juniper Hall, Milton Hall, Natatorium, Native American Cultural Center, Node 2,3,6, Pan American Arena, Passive Solar, Pinon Hall, President's Residence, Rentfrow Gym, Rhodes-Garret Residence Hall, Satellite Chiller Plant, Science Hall, Spiritual Center, Student Health Center, Sutherland Village, Tom Fort, Walden Hall, Weight Room, Williams Hall, Young Hall, Zeta Tau Alpha Sorority, and Zuhl Library.

PREVIOUS STUDIES

2017-2027 NMSU Facilities Master Plan:

Master Plan | University Architect | New Mexico State University (nmsu.edu)

RECOMMENDATIONS

The Process – Secondary (DR) Data Center location

One of the main objectives of this study/assessment was to select a site for NMSU's secondary (Disaster Recovery) data center.

With the chilled water plant and 4 types of power sources on the campus, we first looked at a possible site on campus or near the campus. We looked at the opportunity of utilizing the tunnel system for redundant pathways for all systems, communications, fire, chilled water for cooling and power. Being able to utilize all of these resources would allow for a fully resilient data center design.

We looked at remote areas near the campus. The golf course across the highway, the open space areas on the south side of campus (Arrowhead Development Properties), as well as areas within the campus proper. However, with our investigations came the discovery of the current main data center conditions. Our recommendation is to address the main data center first.

Figure 34 – Possible site for new Data Center/Infrastructure Distribution Building

Milton Hall

Milton Hall is currently the secondary data center and more importantly the distribution center for most of the campus fiber and copper backbone cabling. Milton Hall also, is the MPOP for AT&T, Conterra, Verizon, T-Mobile and Century Link (Lumen) service providers. If Milton Hall is to receive a total renovation and repurposed, then there must be a location chosen to duplicate these services elsewhere. Our recommendation is to move the campus cabling infrastructure services to a new data center building. In doing so, eliminate the legacy copper plant and feed the existing campus copper nodes with new SM Optical Fiber.

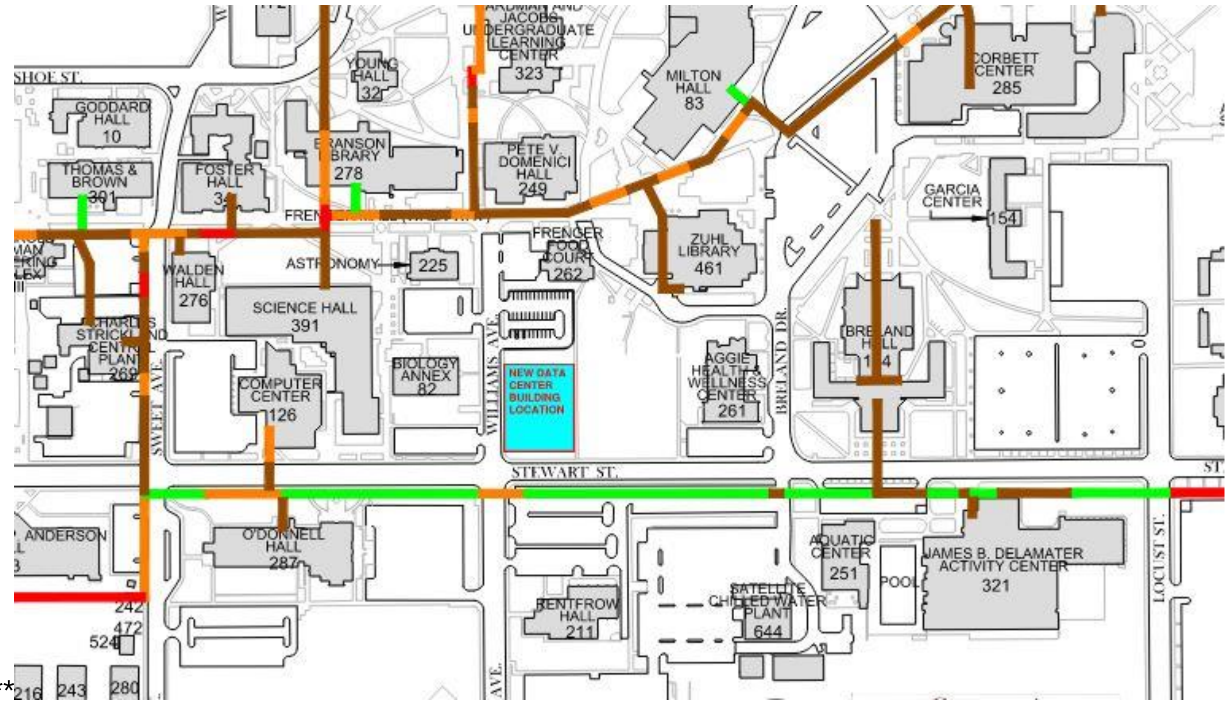


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Figure 35: Proposed New Data Center Building Location

Computer Center

As outlined earlier in this report, the computer center building (main data center) has significant issues. The number one priority should be to build a new modern data center building, that is cooling and power efficient, sustainable and scalable.

Data Center down time facts from a recent study found:

- 93% of enterprises that suffered from a data center down time for more than 10 days, filed for bankruptcy within a year of the outage.
- A recent study initiated by Ponemon Institute indicated that on an average, downtime can cost up to $5,600 per minute or $336,000 per hour.
- The study also indicated the following root causes for an unplanned data center outage along with the percentage of occurrence:
  1. UPS System Failure (29%)
  2. Accidental/ Human Error (24%)
  3. Water/ Heat or Computer Room Air Conditioner Failure (15%)

Data center downtime is a serious risk to any organization's productivity and profitability. The risk needs to be mitigated by following best practices in data center design and also performing regular maintenance and testing activities.

It is our finding that this building should be replaced with a modern, efficient, scalable Data Center Building. The new data center building will take the place of Milton Hall and all of the infrastructure distribution aspects of the building and remove the data center element from the Computer Center building. A new cabling distribution/Infrastructure space will reside in the new data center building. The new building should be rated a tier 4 (Tier 3 at minimum) data center space.

Tunnels

The tunnel systems are managed very well and serve as pathways for utility distribution. They receive approximately $1 million dollars in upgrades every year. Low voltage integrators, when installing new services to buildings are being instructed to install new innerduct, supported per code and out of the way (not to impede access) of other utilities, within the tunnels. This practice should continue. Also, when exiting the tunnels and extending new optical fiber to a building, 2-4" conduits should be installed.

Pathways

Often overlooked are the installed (existing) cable trays within a building. Either cable trays within the IT space (ER, TR, EF), or "basket" trays installed in corridors, are often overfilled due to new cabling being installed "on-top" of existing legacy cabling. Before adding new cabling to an existing pathway, our recommendation is to first identify what existing cable isn't needed anymore and remove it prior to adding additional cable to any existing cable tray system. Workstation pathways for new buildings should, at minimum, be 1" conduit.

As mentioned in the "Tunnels" paragraph, Low voltage integrators, when installing new services to buildings are being instructed to install new innerduct, supported per code and out of the way (not to impede access) of other utilities, within the tunnels. This practice should continue. Also, when exiting the tunnels and extending new optical fiber to a building, 2-4" conduits should be installed.

SECURITY

Surveillance

The IT department is currently migrating from the video insight Video management Software to the "Axis Camera Station" software and updating their Surveillance standards. Included in this upgrade will be the addition of approximately 60-100 additional surveillance cameras throughout the campus. All new buildings and renovated buildings, will have surveillance cameras.
Campus exits and entrances are recommended to receive LPR (License plate reader) surveillance cameras.
More surveillance camera coverage is recommended at; student housing, intersections and at Commercial Buildings.
Full integration of the access control system and the surveillance system is recommended.

Access Control

A new standard that the campus is initiating; all new and renovated buildings will, at minimum, be designed with pathways for access controlled doors. It is desired by the campus police to have the access control system on the emergency lighting circuit, which will enable the access control system(s) to never go “down”. In its current configuration the duress buttons, when depressed, send a notification to the campus police dispatch. There aren’t any “follow me” sensors deployed. The system does provide for individual door or campus wide “Lock-Down in case of an emergency. Access to the web page(s) should be given to the campus police for access. Currently the campus does not utilize VMS (video management software) integration with the access control system. Our recommendations for the access control system is to move forward with the new standard mentioned above, provide the campus police with the necessary tools to access the lock-down functionality of the access control system and integrate the access control system with the Video Management System.

Campus Police Building

The campus police building houses the on-site campus police officers and the dispatch team that utilize multiple screens to view the security camera data.
The Campus police must have access to the lockdown capabilities of the installed access control system. The campus police must have access to the new VMS system/access control system and all components. Training of new systems and defining security procedures/protocol, once the new system(s) functionality has been realized. Intrusion detection, access control and security cameras should all be integrated to help simplify campus security.

ELECTRICAL

New Work

New Data Center located between Williams Ave. and Stewart St.

NMSU electrical masterplan includes adding a new 25 kV feeder for the new Engineering Building that will tie-in to the designated essential/emergency circuit “EFW”. This project includes intercepting the existing 5-kV feeder with a 3-way junction at the South Vault, and installing new pad 350A pad mount switch. A new 2500 kVA, 23.9-kV Wye/4.16-kV Wye will be provided and connected to a new 25-kV pad mount switch at the North Vault in the Central Plant. There is an existing 6” spare conduit from the Central Plant to the tunnel near Thomas & Brown that can be used to serve the new Engineering Building, the new Data Center, and other future buildings.

From the tunnel, 25-kV feeders in 4” conduits can be extended to new 4-way pad mount switch(es) in 8ftx8ft vaults to continue NMSU distribution system. Once the stub-out infrastructure from the Central Plant to Thomas & Brown are in place, new pad mount switch(s) and feeders can be extended to the designated Data Center location.

Medium voltage switches will be solid dielectric switchgear such as G&W or ElastiMold. In general, all medium voltage apparatus will sit on a concrete vault with “A” type anchors embedded in the concrete lid. Minimum size of vault is 8ftx8ftx42”. LECO precast vaults are pre-approved by NMSU. A copper clad ground rod will be installed in one corner of the vault/pullbox.

Duct banks will utilize a minimum of (2)4” schedule 40 PVC conduits and will be covered with 3000-PSI dyed red concrete. A 4/0 bare copper ground wire will reside in the concrete ductbank. For 5kV and 25kV installations the cable will be Okonite URO-J with 1/3 concentric copper neutral per NMSU standards.

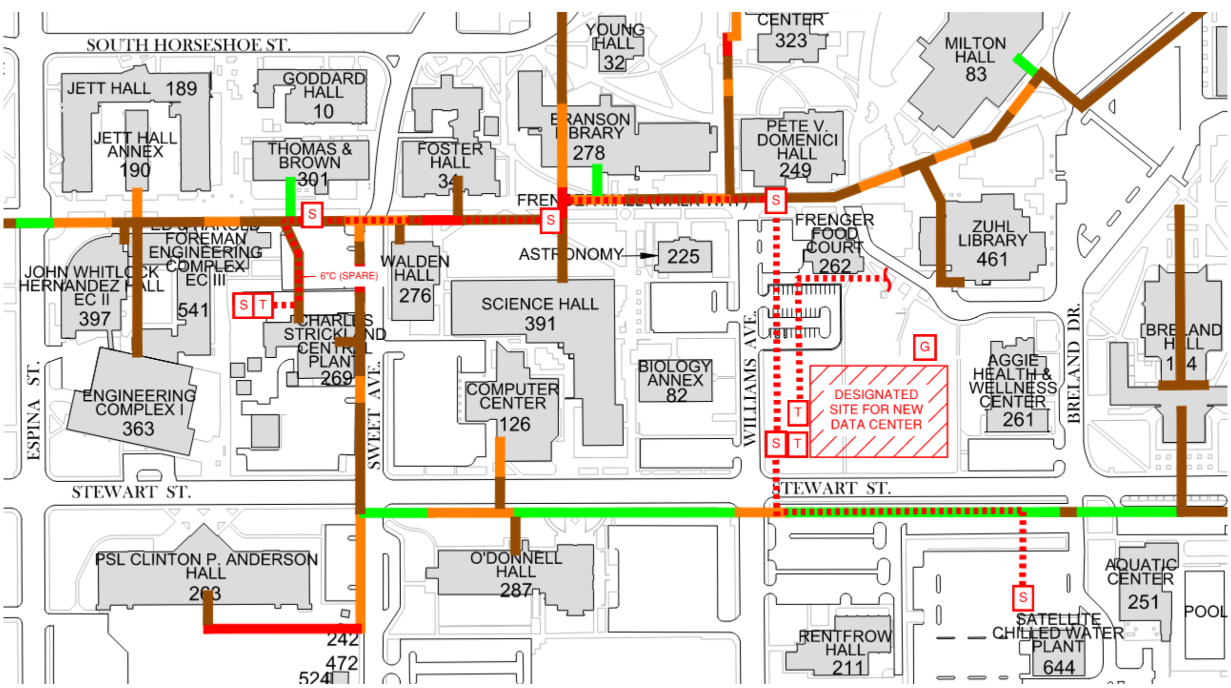

Figure 36 Proposed New Data Center Location Electrical Service

Proposed Distribution System Configuration:

Loop Primary System

The “EFW” circuit / system will consist of one primary loop with transformers connected on the loop. This system is most effective when two services are available from the utility. Each loop is operated such that one of the loop sectionalizing switches is kept open to prevent parallel operation of the sources. By operating the appropriate sectionalizing switches it is possible to disconnect any section of the loop conductors from the rest of the system without affecting the remaining building loads in the loop.

Reliable utilities are a necessity to support Information and Technology Centers on Campus. As mentioned above, it is recommended that a secondary source of power be provided for the Data Center. We understand there is a plan to extend another EPE service from across one of the parking lots North-East of Breland Dr in the future. This new service can be used as the secondary source of power. As an alternative, a separate loop can be extended from the South Tunnel running parallel to Stewart St. These tunnels currently house some of the old 5-kV “SMC” circuits and are anticipated to be replaced in the future.

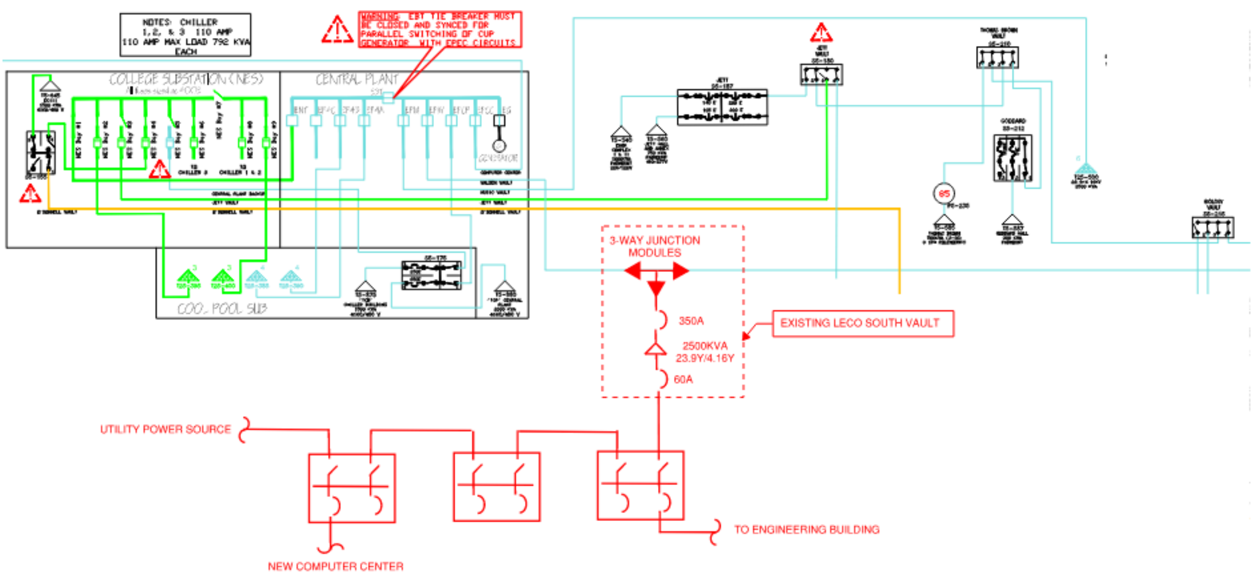

Figure 37 Proposed New Data Center Location One Line Diagram

Secondary Selective System

At the 600V level, each transformer secondary is arranged in a typical double-ended arrangement to meet the Tier Level. The two secondary main breaker and secondary tie breaker are mechanically or electrically interlocked to prevent parallel operation. Upon loss of secondary source voltage on one side, manual or automatic transfer may be used to transfer the loads to the other side, thus restoring power to all secondary loads. This arrangement permits quick restoration of service to all loads when a primary feeder or transformer fault occurs by opening the associated secondary main and closing the secondary tie breaker. Each primary feeder conductor must be sized to carry the load on both sides of all the secondary buses it is serving under secondary emergency transfer.

The anticipated new Data Center demand load is anticipated to be 300 kVA approximately. The telecommunication equipment load is calculated at approximately 12VA/Sq.Ft which equals 120 kVA. The remaining building load is composed of lighting, HVAC, and miscellaneous loads. As a reference, the maximum electrical demand for the Computer Center is 282.2kW (on January 25, 2012). It is important to note that the existing meter communication system for EFW feeder is off-line and metered data was not available. We suggest historical metered data be obtained for feeder EFW to verify circuit capacity is available.

Generator (N+1) System

The new Data Center will include a new generator(s) to back-up loads serving telecommunication equipment. See Figure 33 for a typical N+1 electrical distribution. Two independent sources of electrical power will be provided –a normal source that generally supplies the entire facility and one or more alternate sources that supply power when the normal source is interrupted. The alternate source(s) will be an on-site diesel generator driven by a prime mover. Paralleling generator are being considered to allow for greater redundancy and flexibility.

Chiller Plant

B&P was notified that a number of Chiller were directly powered by El Paso Electric and no back-up systems in place. In other words, during a campus wide power outage, the chiller plant goes down and cooling is not available at critical buildings connected to the Chiller Plant.

It is recommended to connect the Chiller Plant to the emergency Turbine System to allow for a level of redundancy to assure chiller plant loads are operational in case of a power outage. Circuit EFW can be extended to connect the Chiller Plant to the Emergency Turbine generator.

The following chiller electrical metered information was provided:

	Peak Demand (kW)	Date
Chiller8	55	31-Jul-19
CUP Cooling Tower 1	54	22-Jul-22
CUP Cooling Tower 2	48	6-Aug-19
CUP Cooling Tower 3	46	23-Jul-19
CUP Chiller1	648	28-Jun-22
CUP Chiller2	759	27-Aug-21
CUP Chiller 3	130	23-Nov-19
CUP CHWP1	75	26-Jan-20
CUP CHWP2	79	27-Jan-21
CUP CHWP3	79	6-May-19
Total	1973	

The estimated peak demand values are shown below. These are for reference only and should be verified with actual demand load data. Additional loads not accounted here may be present.

SERVICE PROVIDERS

As previously mentioned, the service providers that have a presence in Milton Hall are; Century Link, AT&T, Verizon, T-Mobile and Conterra. Prior to the Milton Hall renovation and during the early stages of the new data center building design, all service providers will need to be contacted to relocate their respective services. Provisions should be made to provide the necessary optical fiber backbone cabling for each provider, from their respective node(s) to the new data center building. This will assist with minimizing the relocation fees from the service providers. This exercise should take place during the installation of the optical fiber feeds to each copper node, during the new data center building build out.

SOLUTION OPC'S

New Data Center Building

- Assuming 10,000sqft building (5000sqft compute space)
- 4 Chilled water Crac units
- 2 fully redundant UPS's
- 80 data cabinets (VED)
- Mechanical and Electrical support spaces
- Staff support spaces
- 2 bathrooms
- Lobby
- Centralized compute space in center of building

Building – $6.5 mil. (650sqft) (Includes Mechanical site)
Site Electrical – $954,975 (includes redundant feeds)
Site Fiber – $1.1 million (replaces all of the copper cable in Milton Hall with Optical Fiber and utilizing fiber to copper switches at the copper nodes on campus)
Design costs – $670,000 (Architect, Electrical, Mechanical, IT, Structural)

Total OPC - $9,224,975

Milton Hall Infrastructure Distribution Replacement Center

If a new data center building is not constructed on Campus, then the DR (disaster recovery) solution located in Milton Hall and all of the infrastructure distribution services, data racks, cabling and service provider MPOP's (main point of presence), will need to be relocated to a new location. This could be a "stand alone" building or an addition to a new/existing building.

- Assuming 2,000sqft building
- 2 Chilled water Crac units
- 2 fully redundant UPS's
- 18 data cabinets (VED)
- Mechanical and Electrical support spaces
- Staff support spaces
- 2 bathrooms

Building – $1.3 million (650sqft)

Site Electrical – $760,000
Site Fiber – $1.1 million
Design costs – $234,156 (Architect, Electrical, Mechanical, IT, Structural)

Total OPC - $3,394,156

Data Center Disaster Recovery Site (CNM)

As the requirement for a DR site to be located at least 60 miles from the main data center, a DR location in a co-location data center that is rated a Tier 3 data center could be very cost effective. CNM has offered DR data center space to NMSU at their main campus data center, at a much discounted rate. Also included in CNM's costing proposal is a 100 MB internet connection. It is our recommendation that if the new data center building is built then the DR site at CNM would be applicable. The CNM proposal is an attachment to this report for confidentiality.

Data Center Disaster Recovery Site (Arrowhead Center)

The Arrowhead Co-Location Data Center is in the conceptual stage as of this writing. We have met with the development team for Arrowhead Center and although the sites being discussed (SE area of the campus) aren't greater than the 60 mile DR requirement this may be a cost effective option. One advantage being on the NMSU fiber network, thereby eliminating service provider costs entirely. The development team has stated that would meet the rates being offered by CNM.

Data Center Disaster Recovery Site (Alamogordo Campus)

This option lends itself to building a new data center building at the Alamogordo Campus and utilizing some of the compute space, within the new building to accommodate the Las Cruces DR Site requirement.

- Assuming 6,000sqft building (3000sqft compute space)
- 3 Chilled water Crac units
- 2 fully redundant UPS's
- Up to 40 data cabinets (VED)
- Mechanical and Electrical support spaces
- Staff support spaces
- 2 bathrooms

Building – $6.5 million. (650sqft)
Site Electrical – $760,000**
Site Fiber – $1.1 million**
Design costs – $426,816 (Architect, Electrical, Mechanical, IT, Structural)

Total OPC - $6,186,816

** Our time at the Alamogordo Campus was short and the estimates listed are in line with the NMSU campus in Las Cruses **

Chiller Plant Back-up Power

This option includes cost allowances to provide back-up power from NMSU 5-kV Turbine System to the Chiller Plant. This will provide a level of redundancy at the chiller plant to make sure chill water is available for cooling in case of a power outage. The suggested solution is to bring power from circuit “EFW” in a loop feed configuration. Connection point will be at the nearest 4-way pad mount switch

Site Electrical – $550,000
In-Building Systems – $400,000

- It includes step-down transformers, new switchboard to tie-in existing systems and secondary feeder distribution.

Design costs – $66,500 (Electrical)

Total OPC - $1,016,500

Access Control on Emergency Lighting Circuit

At NMSU request, we include this estimate to provide back-up to each building on site for access controls. It includes extending circuits from the 5-kV turbine system to 5-kV – 240/120V transformer near each building. The old emergency circuits for continuous lighting may be re-used for this purpose. The estimate assumes there are no circuits available to re-use. Approximate building counts used for estimate are shown below:

- Total number of buildings in Las Cruces campus: 246 (approx.)
- Total number of buildings with Generators: 17 (approx.)
- Total number of buildings connected to the 5-kV turbine: 32 (approx.)

Per Building Allowance - $40,376
Total on Campus (Las Cruces) allowance - $7,954,072

PLANNING AND FUNDING

The solution for Milton Hall must be in place for the year 2025. With some funding in place now, the project can move forward once the direction has been selected.

- 2023-2024 (Severance Tax Bond Year) - Move forward with design and site work for the desired solution
- 2024-2025 (2024 GO Bond Year) – With additional funding in place, complete the new building/addition.
- 2025-2026 Renovate Milton Hall and the old Computer Center Building

The sample project schedule above coincides with the active tunnel project and additional projects being started and completed over the next three years. Removing the data center element from the Computer Center building will allow for the CSB (Computer Center Building) to be fully renovated and used for academic and or office spaces. Removing the Data Center and cabling infrastructure distribution element from Milton Hall will also will allow for Milton Hall to be fully renovated and used for academic and or office spaces.

PHASING

It will be imperative to the successful migration from Milton Hall and the Computer Center building to the new Data Center Building to complete the new Data Center building prior to the renovations of Milton Hall and the Computer Center building. With the completion of the new Data Center building, testing of the optical fiber feeds to the copper nodes, testing of critical data center components, electrical and mechanical testing, back-up generator testing, DCIM testing and service provider testing should all be completed with favorable results prior to cutting over to the new data center and decommissioning of the old data center.
Prior to the exercise above, a DR site agreement should be made, outfitted and tested. This DR solution can be temporary until the decision of building a DR site at the Alamogordo Campus or leasing DR space at Arrowhead Center once that is built, is made.

END OF REPORT