chapter 7
infrastructure and utilities
It is incumbent upon all of us to build communities with the educational opportunities and support systems in place to help our youth become successful adults.

RUBEN HINOJOSA
The LRDP is the University’s first long range planning effort to address the campus-wide system of infrastructure and utilities. Although the majority of the system is underground and hidden from view, campus infrastructure and utilities—like the street network—is connected to a larger, city-wide system and must be adequate to serve new growth. While some services such as gas and electricity must be conveyed from off-campus sources, the University supplies other services such as building heating and cooling, and irrigation. This chapter provides a review of the campus’ existing infrastructure and utility system, and identifies recommended improvements to distribute infrastructure and utilities to new development areas. The chapter includes a series of comprehensive infrastructure and utility maps for planning and designing new campus uses and facilities.
A study of the existing utility infrastructure was performed with an emphasis on identifying the utility needs related to possible growth and changing priorities as part of the Long Range Development Plan (LRDP). A study (referenced here as the Utility Master Plan) simultaneously performed by Affiliated Engineers, Inc. (AEI) examined the existing utilities in much greater detail, with an emphasis on mapping the utility usage and transmission and identifying existing deficiencies and short term needs in the utility infrastructure.

**Background**

The University of Wyoming has a basic utility infrastructure which combines several providers:

**The University Physical Plant provides:**
- Steam (for heat)
- Chilled water (for cooling)
- Compressed air
- Electricity distribution for the core campus
- Most areas of landscape irrigation

**The Division of Information Technology provides:**
- Campus telecommunication services and infrastructure maintenance

**The City of Laramie provides:**
- Potable water, including fire protection
- Sanitary sewerage
- Storm sewer service
Private or third party utility companies provide:

- Natural gas (Source Gas)
- Cable Television (Bresnan Cable)
- Electricity (Rocky Mountain Power)

To assess Infrastructure and Utilities at the University of Wyoming, the existing conditions were determined in the following categories, with an emphasis on identifying constraints and limitations that would affect the ability to develop the University in accordance with the LRDP:

**Energy Use (Central Energy Plant)**
- Steam
- Chilled Water
- Compressed Air

**Electricity**

**Water**
- Potable Water
- Raw Water (Irrigation)
- Storm Water

**Sanitary Sewer System**

**Gas System**

**Telecommunication Systems**
- Telecommunication
- Cable Television

The following sections summarize the findings in each category including existing and potential capacities.
Design Goals
The emphasis of the utility study within the LRDP is to accommodate the required supporting utility infrastructure within the existing physical and potential development districts. Deficiencies within the existing infrastructure should be identified during each new planning stage and the necessary steps to address the identified deficiencies can be built into the budgets and timelines necessary to carry out the growth plans.

Facilitation of Growth
After identifying target growth areas and types, utility distribution corridors were identified to meet the demands of the projected growth.

The implications for the projected growth are discussed in each utility grouping with attached maps of logical routing and beneficial looping for the relevant distribution systems. The mapping shows the suggested layout; however, the plans can be flexible within reasonable limits. For example, if it becomes necessary to block a proposed corridor in one area, the corridor may be re-routed, as long as the full distribution can still be achieved.
Energy Distribution
(Central Energy Plant)

The Central Energy Plant (CEP), brought online in 1983, is located just west of 19th Street and south of Harney Street toward the north edge of the main campus. The primary function of the plant is to generate steam (presently from coal) which is then distributed via piping to the connected campus buildings for heat. For year round campus cooling needs, the plant generates chilled water for cooling key buildings using electric-driven centrifugal chillers and a free cooling flat plate heat exchanger system. A more complete and detailed analysis of the Central Energy Plant appears in the Sustainability section of this LRDP Volume.

STEAM

Steam is generated at the University’s Central Energy Plant for building environmental heating and domestic hot water production needs throughout the campus core. The steam and condensate return lines are generally distributed through a system of tunnels, with a few direct-bury lines at selected locations.

Essentially there is no steam or condensate metering for this system other than at the CEP. Usage is estimated based on the type, age and size of building. The University is in the process of metering steam, chilled water and electricity at each connected facility.

For new buildings, especially on East Campus, the cost of extending the tunnels and piping systems will need to be analyzed against the possible savings in heating costs and maintenance of using these systems. To add significantly to the distribution coverage of the steam system, additional boiler capacity may have to be added, should alternative energy sources prove not to be economical. The Utility Master Plan (AEI, 2009) includes estimated current loadings and the build-out loadings for the steam system based upon full demand being provided by the CEP, and notes certain areas which require improvements to continue the present level of service for this system when future development occurs.

Future Conditions

Steam, either in a utility tunnel or in conduit, would be provided to the key growth areas by extending the service from the existing service areas as shown on the planning map. The newest areas would benefit by access to the 125 per square inch distribution which is not currently provided to the far West Campus. A short connection from the Central Energy Plant (CEP) to the new opportunity area A around the north side of the cemetery will be essential and will allow for looping the system through the existing West Campus.
piping. This improvement has been further studied and described in the *Utility Master Plan* (AEI et. al., 2009). The University should obtain a license to place the required utilities in the public right-of-way.

Utilities from the CEP are not currently projected to extend east of 22nd Street, since the cost of the additional extensions may not be justified by the type of development projected to occur there. Current projections are for lower density or joint-private development, perhaps with the exception of some student housing. As mentioned elsewhere, a detailed cost-benefit analysis should be performed as part of the individual planning for any particular project. Since other utilities will likely be extended along Willett Drive to reach development areas south of Willett Drive and east of 22nd Street, the same alignment could be used to extend steam and chilled water if such an extension were warranted.

The *Utility Master Plan* also indicates that the steam generating plant may need to have an added boiler or boilers when the peak demand approaches 150,000 pounds per hour (allowing for reserve capacities). Peak demand is currently at around 115,000 pounds per hour during very cold weather events. Expansion of the energy plant could occur on the existing site, though the area available will depend on how much set-back from the street is required. Areas to the west and south are also available.

A possible incorporation of biomass (targeting the beetle-killed pine material from surrounding national forests) into the fuel stream could require a staging or drying area near the CEP. The proposed area could consist of 3 acres adjacent to the existing facility. The same area has been targeted for a possible future relocation of facility maintenance offices and fleet maintenance facilities.

In their analysis of the utility tunnel system, AEI identified a portion of tunnel within the older academic core area that needs to be replaced. It is recommended that the replacement of this infrastructure be coordinated with any surface improvements, including landscaping and transit improvements. The looping of the system north of the cemetery could help with this replacement. The affected area is north of Prexy’s Pasture.

**CHILLED WATER**

Chilled water is also produced at the CEP (Central Energy Plant), using electrical centrifugal equipment and flat plate heat exchangers. The chilled water is generally distributed using non-insulated direct-bury pipelines, paralleling the steam system.
The main steam and chilled water system provides connections to the historic campus core as well as connections to newer existing facilities such as the Indoor Practice Facility and the Wyoming Technology Business Center (WTBC) building. The system also provides main line connections, primarily within utility tunnels, to areas designated for future development. The chilled water is generally distributed using non-insulated direct-bury pipelines, paralleling the steam system.
Map 7A Proposed Steam and Chilled Water System

Source: University of Wyoming
Twenty-one buildings with steam heat also have at least partial chilled water for cooling. The system is also not generally metered, but this will be addressed with the above mentioned metering project.

**Future Conditions**

The steam and chilled water utilities form the core of new utility corridors extending to the new development areas. Similar to the steam system, extension of the chilled water distribution system to new facilities on East Campus will require a detailed cost-benefit analysis. The projected extension of the system would go east from the Central Energy Plant and loop south through the athletic fields just east of 22nd Street.

The chilled water generating capacity is currently at 2,000 tons. If the demand exceeds 2,000 tons, a new chiller plant might best be installed on West Campus. In order to mitigate a future chilled water plant and system expansion, the University has instructed its design consultants for new construction and renovation projects to design without cooling and, if cooling is needed, then try to use evaporative cooling schemes. It is anticipated most of the chilled water growth will be for existing facilities which have high heat gains and low floor to ceiling heights that negate using the larger ducting required for evaporative cooling.
The AEI utilities report recommends planning for the new chiller plant on the West Campus in order to meet increased demands.

**COMPRESSED AIR**
Compressed air is distributed through the tunnel system. It was primarily installed to assist in operating building temperature control devices (damper and valve motors), thermostats, etc. The compressed air system has compressors and dryers at the CEP and Engineering Building. Some laboratories also use compressed air from the central system.

**Future Conditions**
Compressed air can be generated as needed with local equipment and does not have to be centrally distributed. Expansion of this system is not a major planning factor or constraint, but if the tunnel system is extended, the compressed air distribution system can easily be extended as well. Compressed air could also be distributed in direct-bury piping if it were needed. The main advantage of using centralized compressors is that larger shared compressors are more efficient and easier to maintain than smaller distributed equipment. Newer building temperature controls are direct digital control systems (DDC) and do not depend on the compressed air system. Thus the importance of the compressed air system is declining.
Electrical Distribution System

Grid power for the region comes off the Western Area Power Administration (WAPA) grid. The local provider and maintainer of overhead power lines is Rocky Mountain Power. The core campus is fed from two distribution stations, with the stations and all wiring and distribution equipment downstream owned and maintained by the University. This system is generally underground and all buildings it serves are metered, but usage is not closely recorded or monitored unless it is billed monthly back to the department. All Laramie area off-campus buildings are powered and metered directly from the Rocky Mountain Power distribution system.

A small 35KW photovoltaic facility has been installed to the south of the Indoor Practice facility. This facility is on the building grid and being utilized. There are additional photovoltaic panels on the roof of the Engineering building which were initially experimental but are now on the grid. The Utilities Master Plan (AEI, 2009) examines the electrical demands and infrastructure system and growth needs in more detail.

Future Conditions

If significant development occurs on East Campus, an expansion of the existing substation would be beneficial as the existing stations are reaching capacity. Such a modification could provide power for the proposed new housing areas and related development. An alternative solution for the east housing is to continue the Rocky Mountain Power service which is presently provided in this area. Depending on how development occurs, it may be feasible to add a third campus feed that would take load off the existing substations and provide for further expansion. Other scenarios might entail setting up isolated sections that would allow the facilities in that area to obtain their power from a cogeneration scheme at the CEP.
The mapping for the electrical system shows some areas where it would be beneficial for development and aesthetic reasons to eliminate overhead power lines, especially along Willett Drive and along Lewis Street.

A new electrical main distribution switching station is contemplated near the corner of Lewis and 9th Street to handle the new loads north of Lewis and to replace 40-plus year old equipment that is located in a deep basement and does not have any capability for expansion. A proposed chiller facility could take primary power from this location as well, so combining these installations would be convenient.

Another reason for a possible third substation would be to have power directly from the WAPA distribution center, located north of Reynolds along 30th Street. This would bypass Rocky Mountain Power’s system with the University purchasing the electricity directly from WAPA. The University would also have to own and manage the feed into campus from the North 30th location. The cost savings are dramatic.

All power should be placed underground, both for reasons of aesthetics as well as safety and reliability. The Physical Plant would prefer the standard S&C Electric Company sectionalizing and pad mounted transformer equipment. This may be in conflict with architectural direction.

One additional benefit of expanding the University electrical distribution system is that the University could more directly control the green efforts detailed in the AEI utility report, including schemes such as wind generation or self generation conversion at the central energy plant.

**WATER SYSTEM**

This section examined the following subsystems: potable water, fire protection, storm sewer and runoff control, and irrigation supply. The first four of these utilities is provided to the University distribution systems by the City of Laramie Utilities Department at interface points, while the last is a University system.
The proposed electrical system for the campus is generally in place, with expansions required as campus development extends north of Lewis Street and north of Harney Street. It will also be beneficial for development and aesthetic reasons to eliminate overhead power lines, especially along Willett Drive and Lewis Street. Underground power lines should be incorporated into the redevelopment of the Summit View Apartments site.
Map 7B Proposed Electrical System

Source: University of Wyoming
POTABLE WATER AND FIRE PROTECTION

Potable water is provided by the City of Laramie through the municipal treatment and distribution system. The system connects to the campus at numerous points and is generally metered through main metering at key points rather than at individual buildings. The City of Laramie takes a little less than 50% of its water from the Laramie River near a water treatment plant about 20 miles west of the City. The other primary sources are from wells in the Casper aquifer along the east side of town. In addition to these sources which have protected senior water rights, Laramie also holds the water rights associated with the Monolith Ranch, located southwest of town, which has senior rights to additional Laramie River water and groundwater.

The primary treatment facility west of town was built in 1964 but has had numerous upgrades and modifications. The current City planning study does not note the plant as a significant constraint on quality or quantity of potable water at this time, though the need for replacement and upgrade is contemplated in roughly 10 years.

Water storage facilities located primarily on the east side of town (several are located just off campus to the east) provide the municipal pressures, though there is one storage tank near the airport in West Laramie. The University is located in the Zone 2 area, having pressures between 50 and 65 per square inch. The campus was not identified as a deficient area for fire protection coverage in the Laramie Water Management Level II Study (WWC, August 25, 2006), though individual modeling was not performed for fire flow scenarios within the campus boundaries.

The modeling done by AEI for their utility study has indicated that a series of fire hydrants located along the south central portion of the main campus do not provide necessary commercial fire flows, suggesting that the older 6” and 8” water mains should be upsized to 10” as soon as
practical. This situation is a good example of why longer range planning is beneficial. For the future development contemplated in this plan, mains should be at least 8” diameter and the utility corridors should provide for looping systems which will assure adequate supplies and pressures even during a potential fire flow event.

The residential area to the north of Central Campus is currently in a different pressure zone (City of Laramie Zone B) from the campus (City of Laramie Zone A), but campus development should incorporate the area into the campus system.

The Laramie Comprehensive Plan (Ken-dig Keast Collaborative, June 13, 2007), indicates a water base capacity able to serve roughly twice the current water demand. The City has an on-going issue regarding aging and leaking water mains, especially with older cast iron piping. The current program of water main replacement within the City is falling behind the identified needs within the system boundaries, including on and near campus. This issue can only be identified as an area of opportunity or concern at this stage of planning. Generally, the University owns and maintains water piping from the point of main metering to the end use.

The City does not currently have any reservoir storage capacity, and during low river flows (possible drought conditions), can only increase the pumping from the well fields to meet demands. The City has taken steps to protect the Casper Aquifer from depletion and contamination, and has contingency plans for problems from either the river source or the well fields. These plans and more details on the water supply in Laramie can be found online at http://www.ci.laramie.wy.us.

**Future Conditions**

The City has adequate capability to provide additional water for any of the projected growth scenarios. Currently the City has reserved water rights from the Laramie River which can be tapped with additional treatment facilities should demand on the water system increase beyond the capacity of the current system.

City water mains crossing campus in Lewis/Willett, in 15th and in 22nd streets need to remain. Smaller mains such as those north of Lewis Street could be moved though Bradley Street if needed to form a future utility corridor.

In addition to other considerations, the City of Laramie generally gives input to any construction plans with regard to fire

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The water, irrigation and storm sewer systems on the UW campus include campus and City utility lines, detention ponds, campus open spaces and storm water buffers. The campus will further manage water consumption and demands of the storm sewer system through catchment systems and green street design.
Map 7C Proposed Water, Irrigation and Storm Sewer Systems

- Existing Water
- Proposed Water
- Discontinued Water
- Existing Storm Water
- Proposed Storm Water
- Proposed Irrigation
- Detention Pond
- Proposed Storm Water Buffer
- Existing/Planned Campus Building
- Potential Campus Building
- Campus Open Space
- Campus Boundary

Source: University of Wyoming
protection, including meter spacing and access for fire equipment. Requirements for water mains include provisions for looping, depth below freezing (generally given as 6 feet for Laramie) and separation from sanitary and storm sewer systems or other potential sources of cross contamination. In the proposed utility corridors, the potable water mains should generally be at least 10 feet from the sanitary sewer systems except where they cross. Water demand can be further controlled or reduced if measures are taken to install low water use fixtures and equipment in existing facilities. All new facilities will provide this equipment.

RAW WATER (IRRIGATION)
The University has two main wells that provide irrigation water to most of the green areas of the campus with the exception of the athletic recreation fields north of Willett drive and east of the tennis courts and the golf course. No metering is installed for these well systems except at the well heads. For mapping, the general areas of irrigation are shown along with the water source. A few athletic fields are watered through an agreement with the City, and are thus irrigated with potable water since the City does not distribute untreated water. Several studies addressing the possible distribution of raw water (Laramie River source) for irrigation have been performed, but no action has been taken by the City to date.

Based on the Consumptive Use & Consumptive Irrigation Requirements in Wyoming (Pochop, Teegarden, Kerr, Delaney and Hasfurther, Wyoming Water Resources Center (WWRC) Publication #92-06), the irrigation season for the City of Laramie runs from late April to early October. Recommended application is approximately 17 to 20 inches of irrigation (2 gallons per minute per acre) during the season, with peak demand during June, July and August. Actual irrigation application rates are typically much higher, but more intermittent. The City of Laramie has a restriction program to reduce irrigation use during times of drought, but it does not apply to University well-produced water.

Future Conditions
The University groundwater production generally has capacity to cover the irrigation needs of the present irrigated areas. New green areas within East Campus study area may require additional wells or other sources be developed. The raw
water produced by these wells has a slightly elevated salt or hardness quality which requires that excess water above the crop minimums be delivered to avoid buildup of salts in the ground.

Further extension of the irrigation system to serve the planned landscaped or irrigated areas in the new opportunity areas is logical and easily accomplished except perhaps for the areas north of Lewis Street and south of Ivinson Street on West Campus. The University could consider using foundation drain collection to partially serve these areas. Since the water from the irrigation wells and shallow collection systems has an elevated salt content, these sources generally require “over-irrigation” to keep the salts flushed from the soil, thus complicating attempts to conserve this water.

**STORM WATER SYSTEM**

Storm water on the campus is collected and discharged through the municipal storm sewer system. The storm system for campus is generally a grid which discharges toward the south and into collector mains that discharge into the Spring Creek drainage way. Spring Creek then discharges to the Laramie River.

**Previous Studies and Status Quo**

*The East Campus Drainage Study* (Banner, 1983) and some more recent plan amendments have identified recommended improvements and upgrades for the study area. Among the other recommendations, the original study assumed that storm water collectors and detention facilities would be improved along 15th Street, Grand Avenue, 22nd Street and 30th Street, as the existing infrastructure at that time was inadequate. The drainage study made certain assumptions about building and parking densities, buildout, green spaces and runoff that will need to be revisited as the planning for East Campus area progresses. The University has continued to review each improvement on the East Campus with the basic assumptions of the study and have found in many cases the original recommendations for pond sizing have been more than adequate. Generally the City of Laramie requires that storm water discharges after any particular development shall not exceed the historic storm water discharges prior to development.

*The West Campus Drainage Study* prepared by Nolte Associates, Inc. was completed in 2009. The study analyzed the condition of storm sewer infrastructures and storm water flows that outfall into a small lake/detention pond in Labonte Park. The area studied is generally located between Grand Avenue to the south and Canby Street to the north, and 12th Street to the east and 5th Street to the west, encompassing portions of West Campus. The study concluded that the current system is undersized to properly convey 2-year storm events. The study also
provides a number of engineering recommendations and alternatives to improve the storm sewer system.

Future Conditions
From a capacity standpoint, the municipal system is at or beyond capacity for the campus and adjoining areas and some minor flooding is periodically observed during severe storm events. The Utility Master Plan prepared by AEI performed some field observations during an extreme rainfall event and identified several improvements which could help with the current system, but essentially recommended further detailed study, particularly for West Campus and 15th Street run-off basins. The AEI study acknowledged that the Ivinson Avenue storm sewer operates at a surcharge during extreme events and does not appear capable of handling the needed flows. The system may have been inadequately designed or else the lines are not adequately maintained, reducing the capacity of the system. One possible improvement to the Ivinson System would be to incorporate the park area (The Green) at 9th Street and Ivinson Avenue as a storm water relief area and allow additional peak flows to back up into The Green.

In general, new development needs to be planned in such a way as to not increase the storm discharges to the existing infrastructure. This will likely require additional detention and storage facilities along with the new development as well as some improvements to conveyance facilities downstream of the development. The Utility Master Plan study recommends further study and design of storm water facilities associated with the stadium parking lot and 22nd Street, and the enlargement of select detention ponds to handle increased flows once Central and East Campus areas are developed further. The City has also acknowledged a need for additional improvements downstream of the campus.
The City storm water system downstream of the University is somewhat stressed. New hardscape areas will tend to increase run-off in general, but can be balanced by designing new landscape areas as storm water buffers or temporary detention as well. This would be a good standard for non-recreational green areas such as the frontages at the University edges. In addition, current storm water detention facilities could potentially be modified to provide some recreational or aesthetic benefits not currently realized by the utilitarian designs of those facilities.

Sanitary Sewer System
Similar to the potable water system, the sanitary sewer collection and treatment is provided by the City of Laramie. The sanitary sewer system is generally a grid system flowing from east to west, which flows to the treatment plant approximately 2.7 miles northwest of campus, just west of the Laramie River.

The municipal sewage treatment plant has a capacity of 6 MGD and was built in 1999. General plant flows are approximately 4.5 MGD, although the need for an additional digester has been identified.

Some areas of sanitary mains have been identified as near capacity, but these handle residential as well as University waste and will generally be upgraded as needed within the City main replacement program. The University provides and maintains the sanitary distribution on all University properties. The University sanitary system connects to the City’s distribution system within the public rights-of-way. The University modeled the sanitary system as part of the Utility Master Plan and found no major deficiencies. There are some areas of concern, but they are localized and will be addressed in the future.

FUTURE SANITARY SEWER SYSTEM
The City Grid sanitary collection system extends through the campus, and can be extended to serve the open properties in the East Campus. For redevelop-
The sanitary sewer collection and treatment on the UW campus is provided by the City of Laramie. The sanitary sewer system is generally a grid system flowing from east to west, which flows to the treatment plant approximately 2.7 miles northwest of campus, just west of the Laramie River. Some areas of sanitary mains have been identified as near capacity, but these handle residential as well as university waste and will generally be upgraded as needed within the City main replacement program. The University provides and maintains the sanitary distribution on all University properties. The University sanitary system connects to the City’s distribution system within the public rights-of-way.
Map 7D Proposed Sanitary Sewer System

- Existing Sanitary Sewer
- Proposed Sanitary Sewer
- Existing/Planned Campus Building
- Potential Campus Building
- Campus Open Space
- Campus Boundary

Source: University of Wyoming
ment of the areas north and south of the West Campus, sewer usage densities may increase as shown by the Utility Master Plan, though sewer capacities should not be exceeded.

Expansion of the University does not create an immediate problem for the treatment plant capacity, but concerns related to laboratory waste streams (specifically toxic or hazardous materials) impact have been raised by City staff. Monitoring stations at key locations may be required in the future. As stated in the water discussion, low-flow plumbing fixtures on future facilities will also reduce the peak demands of the existing sanitary system.

**Gas System**

Natural gas on campus is provided by Source Gas Company. Gas distribution is largely limited to the individual housing areas, cooking purposes, laboratory uses, domestic and heating hot water generation in outlying buildings off the campus and incinerators around campus.

Most of the billing, even for the housing units, is collected and paid by the University.

**Future Conditions**

Development on the East Campus may require consolidation and rerouting of gas mains as the current distribution system was established for a more residential model to reach all the individual buildings. It would be beneficial to reduce the number of individual boilers in any new development scenario as these units are a high maintenance item.

Gas mains can generally be routed in the proposed utility corridors. Many small distribution lines in the residential areas should be removed. A previous study (Pipeline Feasibility Study, Enserco Energy Services, May 4, 1997) recommended that the University pursue a main line gas tap and have a pipeline run to serve the campus and possibly the school district and local hospital.
Gas mains can generally be routed in the proposed utility corridors. The proposed gas system will require retrofitting in several areas of campus with the most notable being the Summit View Apartments site. Many small distribution lines in the residential areas should be removed.
Map 7E Proposed Gas System

- Existing Gas Line
- Proposed Gas Line
- Discontinued Gas Line
- Potential Campus Building
- Campus Open Space
- Campus Boundary
- Existing/Planned Campus Building

Source: University of Wyoming
Telecommunications System

On-campus telecommunications are provided by the Division of Information Technology. Fiber optic connections are available at the I-80 communications corridor to the AT&T, Sprint and MCI cables. These options give the University a strategic location in terms of connectivity, including the possibilities of redundancy if required. Currently the University has a dedicated fiber connection running along highway 287 to Fort Collins, Colorado, where it ties to Denver via the joint Colorado State University connection. Fiber optic lines on campus are run through the utility tunnels and through a system of small conduits as needed to connect all campus nodes.

The current system has a redundant connection, when needed, through the Bresnan cable system which is connected to the Level 3 communications system. In the short term future, this link is planned to connect to the high-speed computing center to be built just west of Cheyenne.

For remote locations such as the off-campus agricultural facilities in West Laramie, the University has installed some dedicated line-of-sight or point-to-point dishes. From key points on campus, including coverage of the older residence areas which do not currently have fiber, there is a system of wireless internet access available.
On-campus telephone service is also provided by the campus Information Technology Department. At this time, the primary service is still using copper wire, although new facilities and renovations are moving to Voice over Internet Protocol (VoIP). The telephone service connects to the Qwest Communications System infrastructure at the main switch building, located south of the Greenhill Cemetery along Willett Drive.

**Cable Television**

Internal (UW) cable television lines are run in conjunction with the telecommunications lines, especially for campus buildings. Dormitories and residence halls also have basic cable television access via an arrangement with the local cable television provider, Bresnan Cable. The residents can then purchase expanded cable television services through a separate contract with Bresnan.

**Future Conditions**

Telecommunications systems can be readily expanded to new facilities as needed, provided the necessary conduits are strategically placed for running fiber optic cables. A new trunk line along Willett would likely be needed for the development of the East Campus, depending on specific needs. Upgrades in speed and capacity are contemplated for key equipment on campus, but these upgrades do not require replacement of the current fiber optic cables now in place. The Division of Information Technology has been proactive in placing the basic infrastructure (conduits) in the ground whenever possible to allow for future needs.
On-campus telecommunications are provided by the Division of Information Technology. The University is in a strategic position in terms of connectivity with possibilities of redundancy if required. Fiber optic lines on campus are run through the utility tunnels and through a system of small conduits as needed to connect all campus nodes. From key points on campus, including coverage of the older residence areas which do not currently have fiber, there is a system of wireless internet access available. Telecommunications systems can be readily expanded to new facilities as needed.
Map 7F **Proposed Telecommunications System**

Source: *University of Wyoming*
Utility Corridors

Where several utilities can be bundled into one area, a corridor is created. Although there are minimum separation requirements for sewers and potable water lines, there are some options for stacking, if needed. Similarly, it is good practice to keep steam and chilled water separated. As buildings are constructed, the planned corridors can be re-routed as required; however, the basic idea of providing designated corridors through which to distribute utilities is important to aid in future development and minimize costs.

Present utility corridors are identified, both for University utilities and for City utilities. Future utility corridors are also identified, and the recommended capacities of the utilities within those corridors should be adjusted to meet the long-term projected needs of the development. It is projected that the capacities for utilities within new corridors could be similar to the capacities in the existing corridors. The projected demands and estimated costs for provision of future utilities are presented in charts within the Utility Master Plan (AEl), and are not reproduced here. The demands are based on the same build out projections provided by the LRDP team.
Conclusion and Utility Action Items

Historically, the University of Wyoming has performed admirably with respect to assuring that utilities are available for the facilities that require them. In general, the direction to proceed is to continue utility development as has been historically done for the campus. However, some of the planning and foresight that are evident in discussions with staff have not been previously documented in the context of a long term development plan and there is a risk of planning loss should individuals with specific historic context (such as presence at meetings and discussions), or with specific vision for future solutions retire or leave the process to others. All the attached planning maps reflect the expertise of the staff and the comments of numerous persons who have reflected on the ramifications of the long term development plan for the University. If development can occur in the locations indicated, the plans provide a roadmap for continued provision of the necessary utility infrastructure for such development. Having such a wide vision will allow for better utility sizing and staging, to make sure that a particular project does not ignore the needs of future development that may occur adjacent or subsequent to its own development.

Some miscellaneous action items which have been suggested during the discussions about the long range plan can be helpful when planning future projects on campus:

- When making repairs and improvements to current infrastructure, such as those recommended in the Utility Master Plan, the improvement should be designed consistent with the LRDP as well. If a specific development must encroach a designated utility corridor, reroute the utility corridor and document how the future downstream development will have access to the required utility.
Utility corridors are created where several utilities can be bundled into one area. While it is good practice to keep some utilities separated, there are strategies to allow most utilities to share single corridors. As buildings are constructed, the planned corridors can be re-routed as required, but the concept of providing designated corridors through which to distribute utilities is important to aid in future development and minimize costs.
Map 7G Utility Corridors

Source: University of Wyoming
• Incorporate the recommendations regarding landscaping that serves to buffer or mitigate storm water runoff into any plans for landscaping improvements when possible.

• When performing the cost-benefit analysis for extending CEP utilities to a new project, consider sharing the cost between multiple users based on the LRDP.

• Work with the City of Laramie to revise the water distribution system and the pressure zone as required for Opportunity Area A, and to obtain an easement to pass CEP utilities within the public right of way (15th Street) to loop and serve the same area.

• Develop and permit the use of foundation drainage discharges for landscape irrigation where feasible.

• Construct power distribution systems underground in all new projects and when replacing legacy systems.

• Attempt to loop water main systems, and where possible, CEP systems, for redundancy and better load balancing.

• Continue discussions and joint efforts with the City to improve storm water drainage systems as projects are developed.