

Utilities



Cornell cannot function without reliable electricity, gas, heat, cooling, water and sewers, and the campus is serviced by incredibly complex networks of utilities. Even as conservation initiatives continue to succeed, demands on the utility systems for capacity and reliability will increase. Ongoing maintenance, upgrading and modifications, and far-sighted planning, will be required to meet these demands and support the university's sustainability goals.

4.38

Secure and maintain a permanent network of utility corridors

The Ithaca Campus is served by an incredibly complex network of utility systems. Overall, these systems are generally in good condition. Some portions of the systems, however, are old and in need of repair, replacement or expansion in the near term. To assure that all needed utility services are provided on a continual basis across the campus, ongoing operations must continue to respond as needed to keep the systems functional and reliable, and efforts to improve system efficiency should continue. Short-term and project-specific utility initiatives should be undertaken in anticipation of the long-term plan for an area. This may result in higher front-end infrastructure costs but will ensure cost-efficiency over the long term.

Maintenance, renewal and expansion of the university's utility systems should respond to the following:

 major campus utility corridor

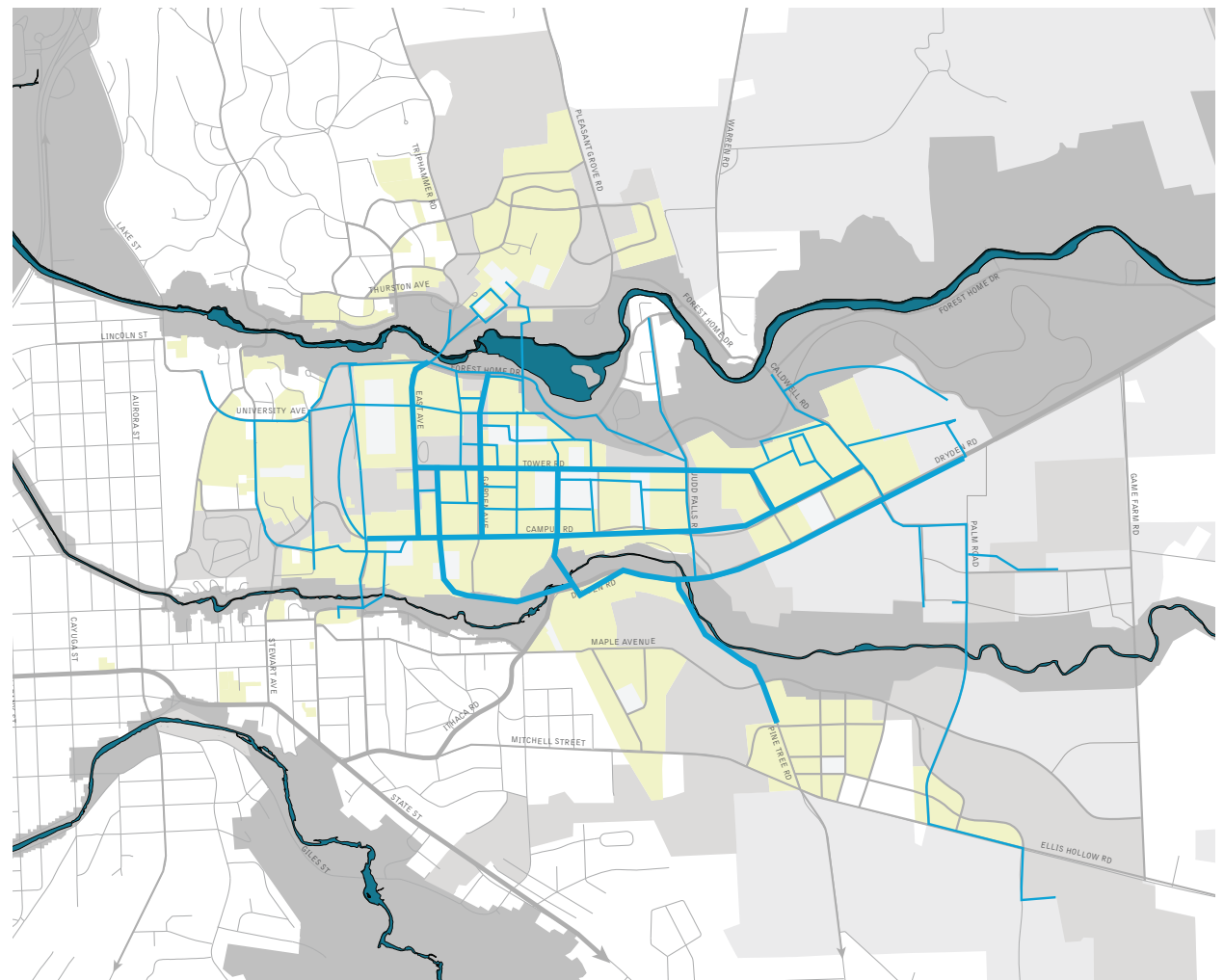


fig 43 – Major campus utility corridors

Anticipated growth

Upgrades to production and delivery capabilities for services must be in place prior to new development. Growth scenarios based on this Plan will require significant upgrades to nearly every service provided by the university as well as expansion into areas minimally served or not served at all. Larger infrastructure systems, such as steam and chilled water lines, must be carefully planned and constructed in advance of growth to facilitate use of shared utility networks.

The need for reliable services

Regardless of the specific utility, classrooms, dormitories and laboratories must function properly, at all times. Utility systems must be able to meet the needs of the campus under high demand periods and unexpected or temporary incidents. Redundant or alternative delivery routes, which do not currently exist in all critical areas of campus, will keep disruption of services to a minimum.

Public health and safety

Careful attention to maintenance of the utility networks is important to overall campus safety. Unplanned failures can be minimized through a proactive approach to routine maintenance. The Cornell Utilities Department must continue its ongoing effort to implement its Capital Improvement schedule.

Sustainability goals

The university is striving to achieve climate neutrality. Green guidelines, similar to Cornell's Green Building Guidelines, should also apply to utility infrastructure, both existing systems to be maintained and upgraded and new systems. By reducing the current consumption of resources by existing facilities, Cornell will have more capacity to meet the future needs of the growing campus.

Economic feasibility

Deferred maintenance ultimately results in a greater need to fund large capital improvement projects. The Cornell Utilities Department's Capital Improvement Plan attempts to provide and operate utility services on a financially stable basis. This 10-year financing plan identifies funding needs for both routine maintenance activities and the anticipated growth of the campus. It allows enough advance notice for action items to be identified and worked into future budgets. By looking at the bigger picture for each utility, the university can make minor adjustments to when items will be funded, with the goal of achieving a stable budget from year-to-year.

4.39

Locate utility corridors under streets and open spaces

To minimize spatial conflicts and costs associated with relocation, upgrading and maintenance, major utility corridors should be located along the protected road right-of-ways and permanent open spaces identified in the Physical Structure Plan (Section 4.10). Many buildings will be serviced directly from this network, but some areas and sites will require the planning and securing of a finer-grain permanent network of utilities that efficiently services individual buildings.

The plan's objective of establishing large, well integrated green spaces such as the proposed Alumni Quad and the Judd Falls Greenway, for example, will almost certainly create opportunities to significantly reconfigure or relocate large segments of distribution systems. That magnitude of change is more likely to bring about basic system design changes aimed at increasing efficiency, redundancy and capacity, reducing line losses, and simplifying long-



term maintenance requirements. The expectation that a significant number of existing buildings will be demolished over a period of years may provide similar opportunities. In some instances, elimination of those buildings will be directly related to the creation of new green spaces. In other instances, existing buildings or facilities will be replaced by modern new buildings that will provide both internal and external opportunities for improving distribution system efficiency. In some instances, planning for new facilities can also be an opportunity to build in additional system redundancy that can improve reliability of those systems and make routine on-going maintenance easier to carry out without negative impact on day-to-day operations within those buildings.

Future development in the East Hill Village area will require substantial new utility infrastructure. Major corridors from the north should be located and designed to have a

minimal impact on the landscape. Distribution systems required within the village to support the administrative, residential and commercial uses proposed should align with the planned grid of local streets and driveways.

Fiber optic cable and other essential information technology (IT) infrastructure are more flexible than other utilities. It is important, however, to coordinate the installation and upgrading of IT lines with other underground services. When other utilities are being relocated or extended, conduit should be included to allow the easy installation of cable.

4.40

Continue to focus on energy conservation

The university has taken some very significant steps to make their systems more energy efficient. The lake source cooling system, for example, has significantly reduced energy consumption for cooling needs and has been widely recognized as a model of efficiency. More broadly, President Skorton set the tone for future thinking and planning for all aspects of campus development, including utility services, by establishing a goal for the campus to become “climate neutral”.

The Department of Utilities and Energy Management must continue to play a lead role in the university’s ongoing energy management program. The program has been instrumental in limiting growth in total delivered energy to a near zero level over more than 15 years. The Energy Conservation Initiative is working to reduce campus use to a level 20% below year-2000 levels and to promote highly efficient new buildings.

4.41

Support long-term utilities planning and life-cycle costing

New distribution lines can be planned and built to take advantage of state-of-the-art technology to prevent line losses and improve efficiency of delivery systems. Better, more modern construction and installation methods can be sought that will reduce the need for future maintenance and repair. Where new lines are needed or existing lines need to be relocated, it may be possible to seek shorter delivery routes that will have beneficial energy saving effects.

As the future unfolds, the campus master plan will guide development in a way that will take maximum advantage of opportunities to reduce energy consumption, improve energy system efficiency, reduce waste, and promote new building designs that will support adaptive reuse over many years as the specific needs of academic and administrative programs change.

As with many other universities, Cornell has, from time to time, experienced periods of budget limitations that have challenged the task of maintaining its extensive and complex utility systems. The Department of Utilities and Energy Management has done an outstanding job of getting optimum results from available funds. Meeting campus master plan objectives while continuing to provide efficient, reliable utility services will require the university to give utility funding a high priority and to budget for utility systems in a manner that allows the Department to look far enough into the future to anticipate the likelihood of major problems before they occur and to deal with them in a time frame that prevents them from becoming critical.

As the budget process adapts to the goals of the campus master plan, so, too, should the process by which projects are estimated adapt. Every project should be looked at from the perspective of life-cycle cost. Life cycle cost

estimates should be multi-dimensional, looking not only at expected direct expenditures for physical building maintenance, but also at indirect costs related to energy consumption and waste disposal over the anticipated life time of the building. There will be times when the university is faced with competing priorities and the practical need to balance sustainability goals with financial realities. Where energy consumption is seen as a key dimension of project life-cycle cost, potential energy savings can weigh heavily in the decision to spend more or less money to optimize sustainability gains.

4.42

Incorporate services into landscape and streetscape design

Utility work must be carried out in a manner compatible with the desire to protect and preserve certain characteristics of the campus landscape, particularly in those areas that are seen as enhancing the experience of being on the campus. For example, utility-related structures required to be above grade should be located in areas that are less visible or, if necessary, such structures should be screened or otherwise supported by landscape changes that make the structure less distracting to the observer. Landscape considerations will be particularly important when planning and designing underground parking below open spaces and stormwater management facilities within open spaces.

Surface elements of stormwater management systems should be designed and located so as to have minimal impact on the perceived quality of spaces. Visible surface drainage should be limited wherever possible to cured

street surface areas and aesthetically pleasing channels. All reasonable efforts should be taken to eliminate or minimize surface erosion from stormwater. Drainage for newly created or rebuilt athletic fields should be designed to prevent surface ponding and promote efficient surface absorption and runoff. In support of the pedestrian-friendly campus, drainage should be designed to keep sidewalks free from standing water and to eliminate ponding on streets, sidewalks and primary pathways.



Examples of stormwater management incorporated into landscape design

Maintain, improve and expand system components

- Steam
- Chilled Water
- Electric
- Potable Water
- Stormwater Management
- Sanitary Sewer
- Natural Gas

Steam

Some segments of the steam distribution system are more than 80 years old. A long-term effort to replace much of the aging system is underway. Nearly 75% of planned replacement on the endowed portion of the campus is complete. With funding commitments more difficult to obtain for needed work on the East Campus, less than 20% of the planned replacements are complete. Obtaining funding to allow timely maintenance on that portion of the system should be a very high priority as long-term development of the East Campus moves ahead.

A new Combined Heat and Power Project, now underway and scheduled to come on line in 2009, will substantially increase Cornell's ability to produce its own energy, further reducing the need for off-campus sources of electrical power. The project will add sufficient electric capacity to accommodate demand from much of the anticipated campus growth for the foreseeable future. A new gas delivery line will connect Cornell with the inter-state pipeline located in the Ellis Hollow area, supporting the Combined Heat and Power Project, increasing energy efficiency and reducing emissions related to campus energy production.

As campus planning begins to respond to the changes proposed by the campus master plan, significant segments of the existing distribution system will be affected. In some areas, existing facilities may need to be removed and

relocated and some distribution patterns may need to be revised as new buildings are constructed to reflect the overall objectives of the plan. Cornell will be faced with a constant need to look at short-term system maintenance, upgrade and replacement efforts in the longer term context of the campus master plan. Although detailed long-term plans for new buildings will come about over a period of many years, areas set out in the campus master plan as the intended space for new structures should be avoided wherever possible when relocating distribution lines. Whenever possible, the renewal of aging portions of the system under future building sites should include relocation.

As plans develop for portions of the campus that will be most significantly affected by the long-term major development objectives of the campus master plan, new steam lines will be needed to serve areas of the campus that are either not served or where service is limited, such as South Campus.

Improving distribution redundancy will continue to be a priority. As new projects are planned, and particularly as plans continue for replacement of existing lines, it will be important to plan for and fund additional built-in redundancy, particularly in those areas that are now deficient in that regard. Buildings and general areas where the nature of research projects require highly reliable sources of energy must be a high priority for assuring both system capacity and redundancy as growth continues.



Combined Central Heating and Power Plant

Chilled Water

Cornell's lake source cooling facility reflects the university's real commitment to responsible environmental stewardship. Providing all but a small portion of the chilled water needed for campus cooling, it is estimated that the system reduced energy consumption for cooling purposes by about 86%.

As successful as the lake source cooling initiative has been, there will always be opportunities for improvements in capacity, efficiency and redundancy. Not all areas of service have sufficient capacity and redundancy, and some facilities in well-served areas have little or no redundancy. In some areas there is no chilled water service at all. Overall, the chilled water system has significant potential for growth as only 50% of existing buildings are cooled. It is believed that the lake source cooling facility offers a longer service life than other alternatives, and has reduced the reliance on refrigerants and pollutants produced in the generation of electricity required.

A detailed 15-year capital plan for funding future system expansion is in place. The Department of Utilities and Energy Management is already moving ahead with plans for replacement of piping on the endowed campus, and studies have been underway to determine specific needs for that portion of the system located within East Campus.

As plans for future development of the campus become clearer, the chilled water circulation systems may need to be relocated in some areas. Capital funding will need to be responsive and timely, particularly as physical expansion into more remote locations such as the proposed East Hill Village and the more intense development areas envisioned for the East Campus reaches a more detailed planning stage.

Electric

The new Combined Heat and Power cogeneration system project will provide Cornell with heating steam capacity for the foreseeable future and significantly increase the overall efficiency of campus heating. It will also increase Cornell's ability to produce its own energy, further reducing, although not replacing, the need for off-campus sources of electrical power. Utilities and Energy Management is currently completing an electrical master plan which will require approximately five new substations on campus. This is part of the program undertaken to maintain the existing electric distribution infrastructure, continue to grow and upgrade the system as needs grow, and the continuance of energy conservation measures to balance the increases in needs with development of additional capacity.

Campus redevelopment and expansion in the years ahead will provide opportunities to seek system distribution modifications in anticipation of the more energy-intensive buildings that are envisioned. Additional substations will be needed to assure efficient and reliable electric service to both existing facilities and new development areas.

To implement the vision for East Hill Village and Cornell Park, Cornell, working with NYSEG, should plan for the 115kv overhead electric lines in South Campus to be relocated underground, ensuring any development or infrastructure built in the area does not preclude the burying of the lines.

Potable Water

The source of the potable water for the university is the Cornell water filtration plant which draws raw water from surface water intakes from the Fall Creek. Additionally the university has interconnections with the Southern Cayuga Municipal Water Authority which serve as redundant source for the university. Both sources are dependant on the Cayuga Lake Watershed as the ultimate source of raw water. This watershed covers 785 square miles of agricultural, residential, industrial and forest land.

The Department of Utilities and Energy Management oversees treatment and distribution of about 1.5 million gallons per day of potable water. Although some water is now purchased from a local municipal provider, on-campus filtration plant and related facilities could be expanded to treat up to 3.6 million gallons per day, more than enough to satisfy campus water consumption during the growth and expansion period projected by the campus master plan. With continuing conservation efforts at both production and consumption ends of the system, Cornell should be able to provide for its own drinking water for the foreseeable future. As it proceeds with capital improvements, the university should consider developing a watershed management plan, which may identify ways to improve water quality and reduce treatment costs. As part of a carefully planned research project, such an initiative may qualify for grant monies.

Stormwater Management

Since stormwater has a direct and significant impact on the environment, Cornell's approach to managing stormwater is initially discussed in Sections 4.3 and 4.4.

A comprehensive approach to stormwater management is needed to comply with federal, state, and local laws, to achieve Cornell's sustainability goals, and to protect Cornell's buildings and infrastructure from flooding. Permanent stormwater practices that reduce the volume, rate, and pollutant load of stormwater runoff are required in addition to traditional storm sewer infrastructure. This enabling approach will require careful planning from a holistic perspective and for individual sites to ensure the overall stormwater management system(s) within each drainage area on campus are effective.

Stormwater management strategies will vary across the campus, depending upon the particular circumstances and challenges in a drainage area. Strategies will include designing stormwater practices based on drainage areas (see sections 4.3 and 4.4), retrofitting existing development with stormwater practices (for example, adding stormwater practices where possible, identifying stormwater outfalls that discharge large volumes of water and building stormwater practices at these locations and reducing flows from upstream), collecting and reusing stormwater for irrigation, and designing project sites to minimize stormwater impacts.

Stormwater practices can be a valuable aesthetic and habitat addition to the landscape in addition to protecting the environment. They should be incorporated into greenways, stream buffers, and landscaped areas. Permeable paving materials, naturalized landscaping, swales, ponds, created wetlands, rooftop retention, green roofs are some of the common techniques to be considered.

Reducing the land area dedicated to parking is an important strategy for decreasing stormwater runoff, although underground parking structures will reduce the volume of soils available to absorb stormwater. Given the likelihood that some future buildings or building complexes in Core Campus will require underground drainage control systems, planning for such systems will need to be coordinated with plans for underground parking. Generally, underground systems should not be located where the campus master plan envisions either a building or underground parking.

As Cornell moves toward more stormwater infiltration through detention ponds, distribution fields, underground detention facilities, and the like, it should analyze effects on the water table across the campus. If the projected increase in the high water table is significant, then potential impacts on existing and new structures below-grade will need to be carefully assessed.

4.44

Develop a utilities strategy for East Hill Village

Providing utility services for East Hill Village will be challenging in many ways. Servicing the existing campus and proposed densified core is fairly straight forward as there already exists a comprehensive network of utility corridors and a capital improvement plan for the next 15 years. That largest challenge for providing services to East Hill Village will be the necessity to secure utility corridors through private or publicly owned properties. Looking at the utilities as a comprehensive system will be important for the development of East Hill Village. Putting aside the need for rights-of-way, the campus master plan has thus far included concepts for stormwater management and potable water, and allows for a natural gas lateral, noting that Cornell would like to limit their own ownership of natural gas transmission lines. At this time chilled water could be expanded into the East Hill Village area and seems to have the most viability from a centralized utility standpoint because of the available capacity, the cost

effectiveness, and the potential for increased sustainability resulting from the increase in centralized infrastructure and reduction in use of electric production required by non centralized chillers.

Electric service to East Hill Village still needs to be explored. There is a project to serve the East Hill Office Building and the largest potential for service directly to Cornell facilities will be to the proposed Computing and Information Science building. Since a greater portion of the East Hill Village area is privately owned or controlled, discussions with NYSEG will be prudent and need to be part of the next steps in defining electric distribution. The next step to be investigated for the East Hill Village area from a utilities perspective would actually come out of the Community Design and Development Strategy proposed in Section 4.18. The expansion of utilities into the East Hill Village area will require a well defined comprehensive development plan to be established first so that all of the potential utility needs can be adequately answered. Given that this would involve expansion of utilities into land not totally under the control of Cornell, the proposed customer base will need to be well defined.

