UMASS LOWELL

Learning with Purpose

UMASS LOWELL

Strategic Development Plan 2016-2021

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[1] https://www.uml.edu/Facilities/Planning/Strategic-Development-Plan-2016-2021.aspx

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EXECUTIVE SUMMARY

Consistent with the Special Review Procedure established between the Secretary of Energy and Environmental Affairs of the Commonwealth and the University of Massachusetts Lowell (UMass Lowell) in 2012, this *2016-2021 Strategic Development Plan Update* documents planned development activities at the University for the period between 2016 and 2021 through providing a comparison of actual conditions in 2016 to projections made in 2012, a schedule of planned projects between 2016 and 2021, estimates of the individual and cumulative environmental effects of those projects, and updated measures to avoid, minimize, and mitigate those effects.

The actual conditions of the University in 2016 are generally consistent with projections modeled in the *2011-2016 Strategic Development Plan*. As anticipated, the University grew its enrollment, faculty size, and research funding significantly during this period. Capital projects were completed as anticipated and their environmental effects were avoided, minimized, and mitigated as planned, including those associated with transportation and greenhouse gas emissions.

Since 2010, UMass Lowell's transformative growth and development have been guided by a multi-year strategic planning process, titled *UMass Lowell 2020, A Strategic Plan for the Next Decade*, which provides a blueprint for how the University will achieve national and international recognition as a world class institute by 2020. In addition to academic and research initiatives, this strategic plan includes specific objectives related to master planning, facilities renewal, and sustainability. The plan is updated regularly with the participation of over 200 campus constituents and progress is reviewed against quantitative benchmarks on an annual basis. Recent updates have included expanded sustainability goals and metrics, as well as a specific committee dedicated to promoting the campus' sustainability initiatives.

Corresponding to *UMass Lowell 2020*, the *UMass Lowell Climate Action Plan* was adopted in 2012 with the goal of achieving carbon neutrality by 2050. Strong commitment and determined effort by the University had resulted in achieving its 2020 emission reduction goals five years ahead of schedule despite significant campus growth.

Looking forward, the University anticipates a series of capital projects focusing on facilities renewal and upgrading, in contrast to the focus of the past five years on new construction projects. Consequently, the resulting environmental effects are expected to be even smaller than in the previous planning period. With effective project planning and management processes in place, together with its track record and commitment in sustainability, UMass Lowell is fully confident in its ability to mitigate new environmental effects and reduce existing ones, while continuing to expand enrollment and research activity.

1. CHAPTER ONE – BACKGROUND

1.1 HISTORY AND CONTEXT

The University of Massachusetts Lowell (UMass Lowell) and its three campuses have evolved as the legacy of the Lowell Normal School (later Lowell State College, now South Campus) and Lowell Textile School (later Lowell Technological Institute, now North Campus). From their founding at the turn of the 20th Century, each of the schools grew and expanded until the two merged in 1975 to become the University of Lowell. The University of Lowell became part of the University of Massachusetts System in 1991.

Both schools experienced a period of rapid expansion between 1950s and 1970s, with substantial real estate acquisition and new building construction. Lowell Tech's expansion into the Northern Canal Urban Renewal District for student housing created the current East Campus. The physical growth of the campus slowed in the 1990s and early 2000s.

Beginning in 2007, UMass Lowell has grown at an unprecedented pace, increasing enrollment by 55% and adding approximately 1,500,000 square feet of campus building space through new construction, real estate acquisition, and renovations.

Today, UMass Lowell offers its nearly 18,000 resident and commuter students over 120 bachelors, masters, and doctoral degrees and professional certificates in the Fine Arts, Humanities, Social Sciences, Sciences, Education, Engineering, Health Sciences, and Business.

The dramatic growth of the campus over the past decade has been guided by a robust planning effort designed to effectively anticipate and manage the University's growth, including the *2011-2016 Strategic Development Plan*, a *Climate Action Plan*, campus sector plans, and transportation planning efforts. Most notably, UMass Lowell developed a strategic plan in 2010, titled *UMass Lowell 2020, A Strategic Plan for the Next Decade*, which articulates its vision for the year 2020, outlines a blueprint for how to achieve it, and establishes a rigorous benchmarking process for documenting and evaluating progress toward the University's strategic goals.

Figure 1. UMass Lowell's Urban Context

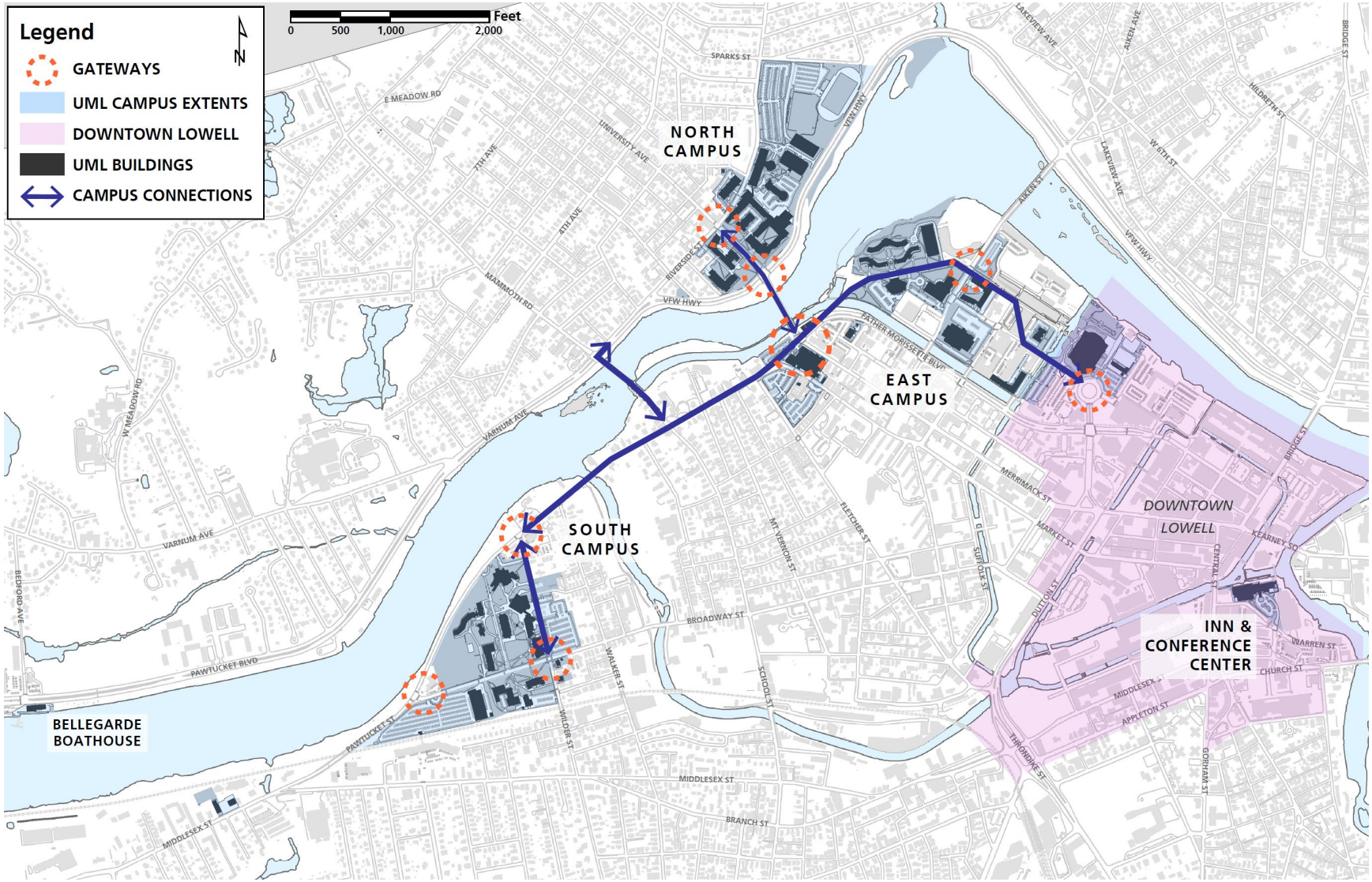
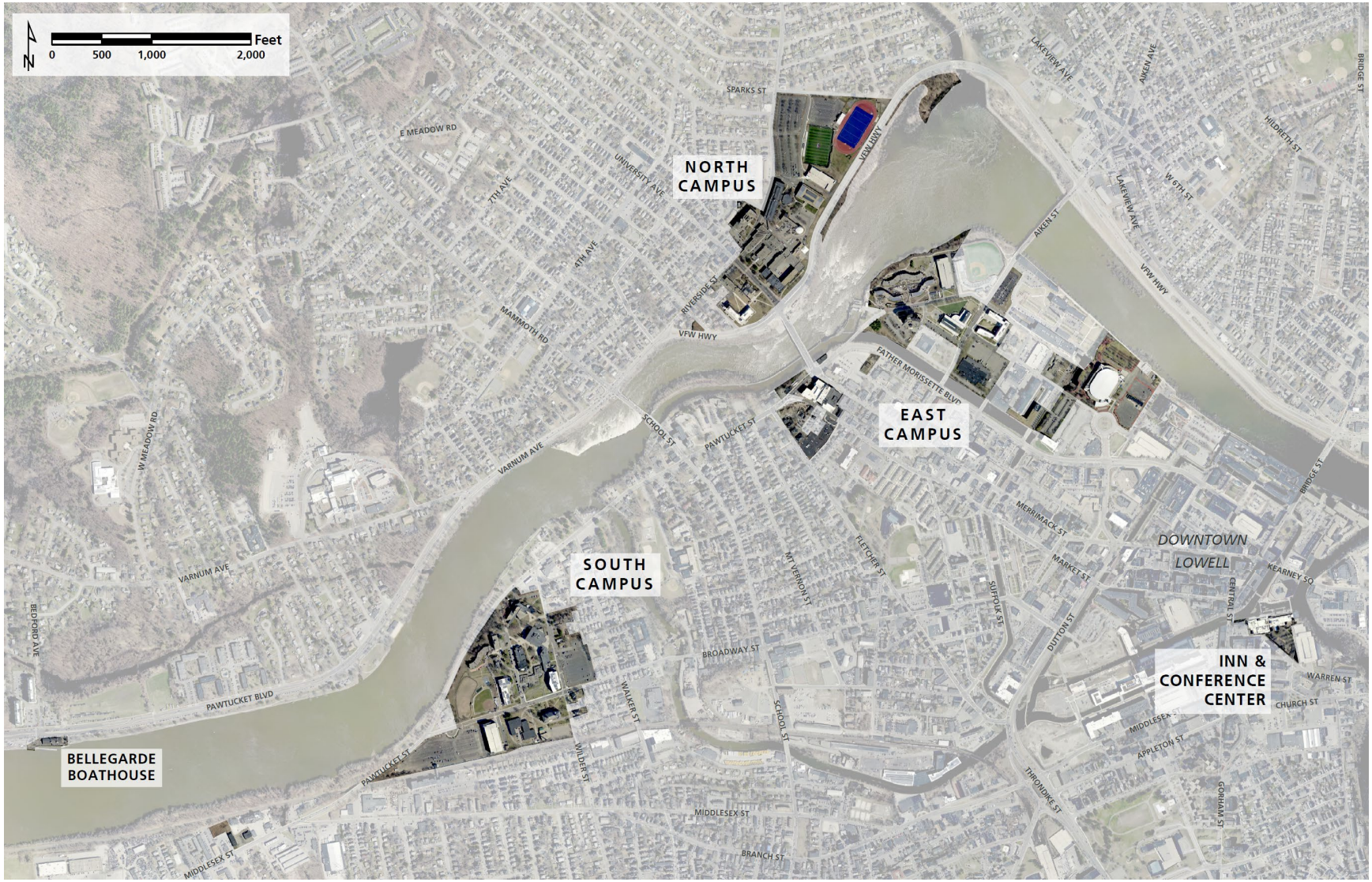


Figure 2. Aerial View of the City of Lowell and UMass Lowell Campuses



1.2 PROJECT REVIEW

The Massachusetts Environmental Policy Act (MEPA) review of capital plan projects at UMass Lowell is governed by a Special Review Procedure that provides for a capital planning update (in the form of a Notice of Project Change) every five years and for the filing of an Environmental Notification Form (ENF) for any individual project that separately meets a MEPA review threshold. The original *2011-2016 Strategic Development Plan* (hereafter as *2011-2016 SDP*) was filed with and reviewed by MEPA in 2012. This *2016-2021 Strategic Development Plan Update* (hereafter as *2016-2021 SDP Update*) is the first required five-year update to the *2011-2016 SDP*. Since 2012, construction has proceeded on a number of projects, none of which individually met MEPA review thresholds. Section 1.3 summarizes the status of the individual projects described in the *2011-2016 SDP*.

1.2.1 Special Review Procedure

In August 2011, UMass Lowell filed an ENF with the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) Massachusetts Environmental Policy Act (MEPA) office for a 650-space parking garage on the University's North Campus. In the Certificate of the Secretary of Energy and Environmental Affairs for the North Campus Parking Garage, an Environmental Impact Report (EIR) was not required but UMass Lowell was required to propose a Special Review Procedure (SRP) covering new projects anticipated in the next five years, prior to the submission of future ENFs. The Special Review Procedure was established by the Secretary of EEA and UMass Lowell in a Certificate dated March 23, 2012, and signed by both parties. Under the SRP, the *2011-2016 SDP* was required. It is attached alongside with the March 23, 2012 Certificate in Appendix B of this *2016-2021 SDP Update*.

1.2.2 *2011-2016 Strategic Development Plan*

The *2011-2016 Strategic Development Plan* was prepared to document the projects proposed at UMass Lowell between 2011 and 2016, to determine the cumulative environmental effects of those projects, and to adopt appropriate measures to avoid, minimize, and mitigate those effects. The *2011-2016 SDP* was filed in August 2012 and noticed in the Environmental Monitor on September 5, 2012. The Secretary issued a Certificate accepting the SDP, requiring no further MEPA review on October 12, 2012. That Certificate and the comments attached to it are found in Appendix A.

This *2016-2021 SDP Update* responds to the requirements of the Certificate and, as directed by the Secretary, provides a full response to the comments (see Chapter 6). In addition, this *2016-2021 SDP Update* provides a comparison of conditions expected in 2016 to actual conditions, a schedule of likely projects between 2016 and 2021, estimates of the individual and cumulative environmental effects of those projects, and updated measures to avoid, minimize, and mitigate those effects.

1.3 PROJECT STATUS

For consistency, the University has designated July 1, 2016 as the milestone date for all "current" data and "existing" conditions described in this document, except where specifically noted otherwise. This date is the start of the University's 2017 fiscal year. Throughout the document

where “FY” or fiscal year is used it refers to the University’s July 1 – June 30 fiscal year. Unless noted as a fiscal year, dates in this document refer to calendar years.

Every capital projects discussed in the *2011-2016 SDP* was completed except the new Manning School of Business building, subsequently named the Pulichino Tong Business Center (or in short form “PTB” for Pulichino Tong Building), which is currently under construction and on schedule to open in spring 2017. The University has successfully addressed the projects’ environmental effects, consistent with the expectations established in the *2011-2016 SDP*.

The University also maintained ongoing communications and collaboration with the local community, city officials and agencies, private landowners and businesses, as well as state and federal governments to improve the traffic circulation, urban environment, and economic condition around UMass Lowell’s campuses.

The University successfully reached its 2020 greenhouse gas emissions targets five years ahead of schedule, achieved LEED certification for four buildings, and dramatically reduced its per capita utility consumption. The University’s transportation demand management strategies reduced trip generation and parking demand for every population on campus from commuter students to faculty and staff.

UMass Lowell expects to continue and build upon these successful trends over the next five years, as it implements the projects discussed in this document. Figure 3 and Figure 4 illustrate the 2016 existing and projected 2021 physical conditions of the University. Chapter 3 addresses the goals, objectives, planning assumptions, planning process, and planning considerations for the next five years. Updates and details of specific current and future capital projects are discussed in Chapter 4.

Figure 3. Existing Conditions of UMass Lowell, 2016

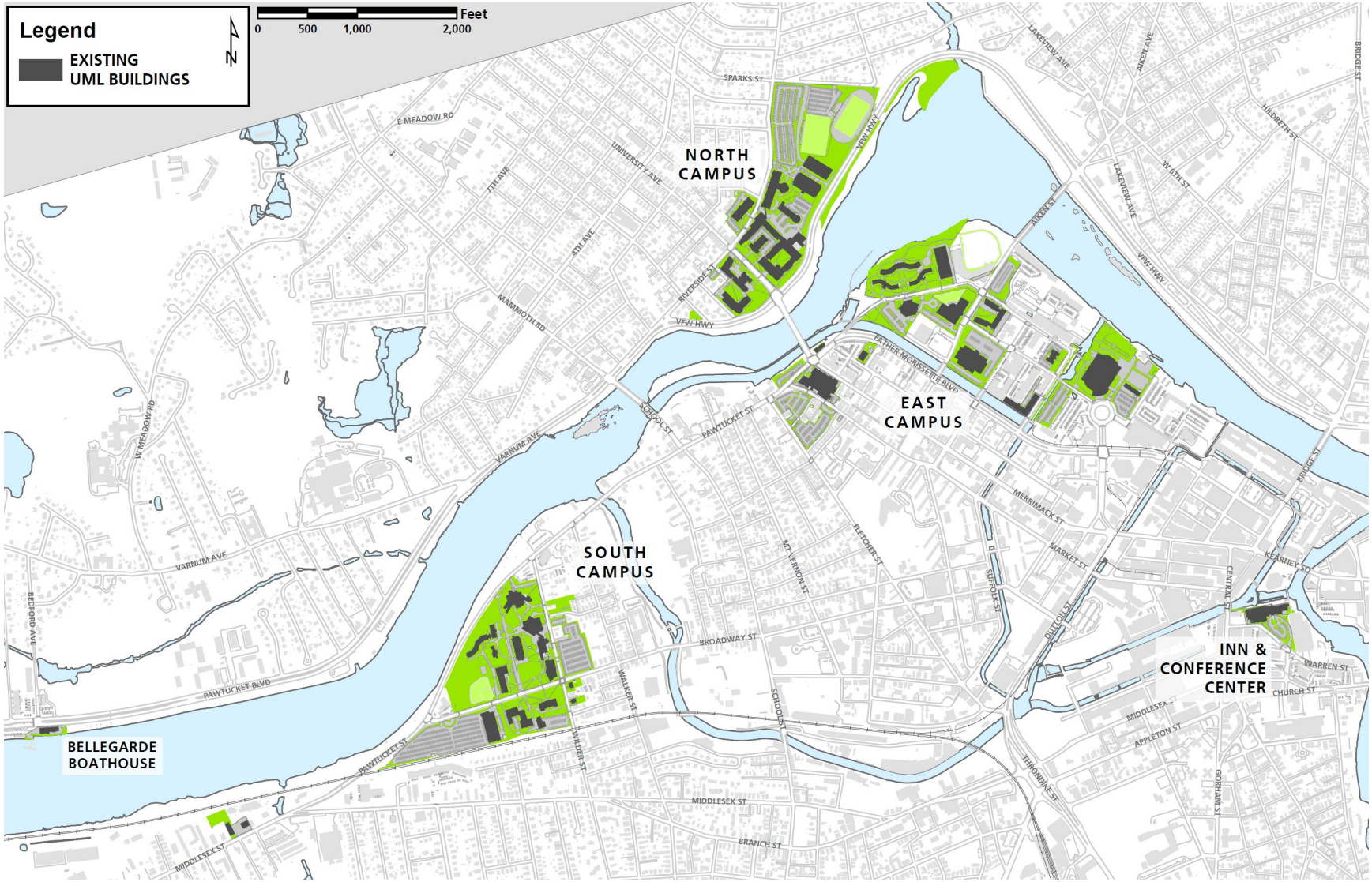
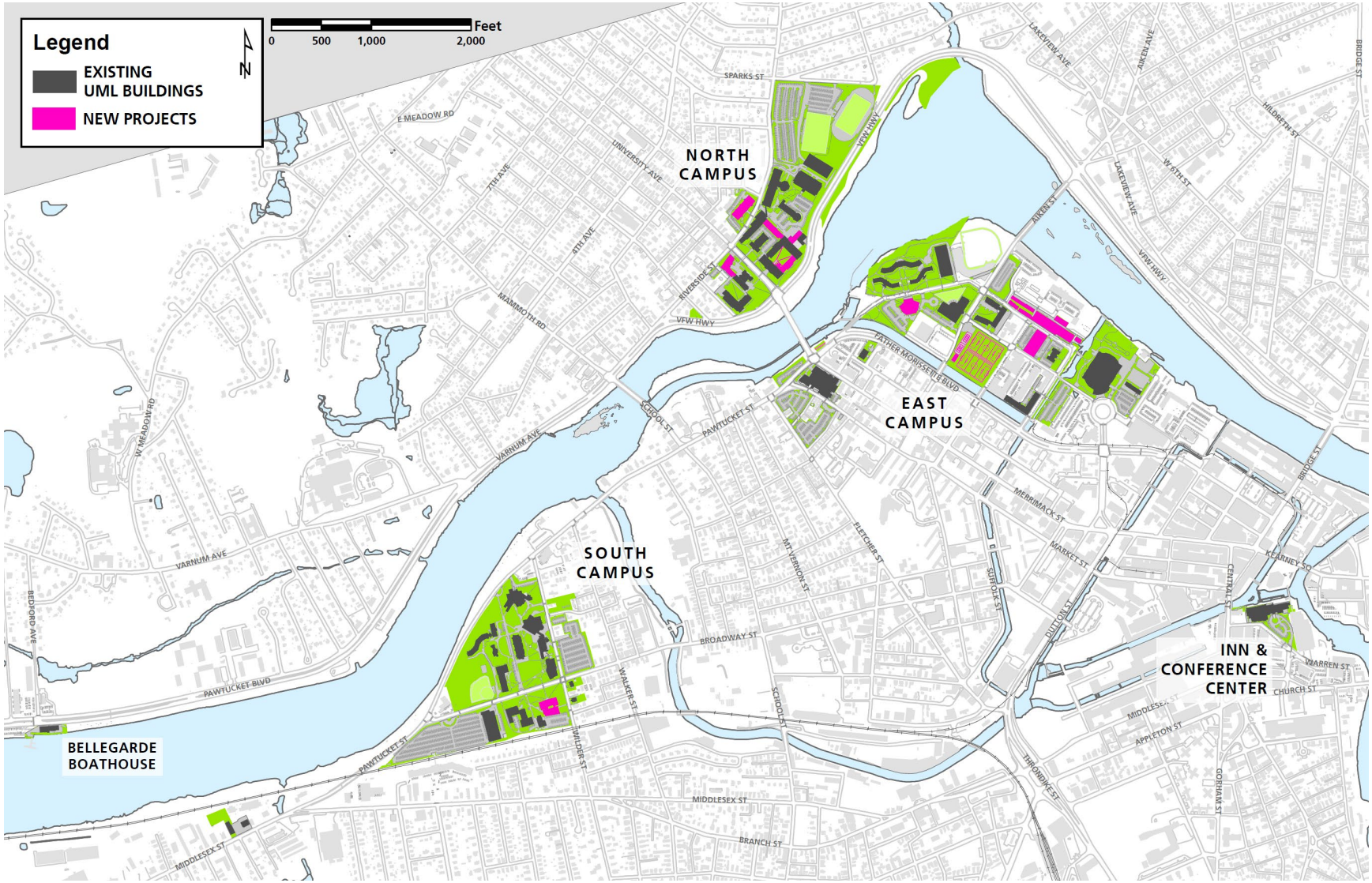


Figure 4. Projected Future Conditions of UMass Lowell, 2021



2. CHAPTER TWO – EXISTING CONDITIONS, 2016

This chapter provides an overview of UMass Lowell's campus in 2016, considering the present size, use, and location of sites and buildings, followed by an overview of the transportation network, utilities, and infrastructure.

UMass Lowell's North, South, and East Campuses occupy almost 135 acres of land, contain fifty-four buildings, and house 3.9 million gross square feet of built space. In addition, The University also leases a number of existing properties across the city to meet space needs, to project the University's presence in the city, to support economic and community development, and to foster strategic collaborations with municipal, corporate, and not-for-profit partners.

2.1 CAMPUS EXTERIOR SPACES

UMass Lowell has made considerable improvements to the campus landscape over the past five years. Most notably, the University demolished the former South Campus Dining Hall to create a green campus mall oriented along the north-south axis from Durgin Hall to Coburn Hall. In addition to dramatically improving the sense of place, wayfinding, views, and landscaping, the South Campus Mall project reduced impervious surface and enhanced handicapped accessibility.

As part of the North Quad Pod Addition project, the Southwick Courtyard is undergoing a similar conversion from surface parking to landscaped open space, enhancing the character of the entire complex, providing outdoor activity space, and reducing impervious surface. Other completed and ongoing capital projects have consistently incorporated sustainable landscaping and minimized paved surfaces in their site design plans.

The University also redeveloped several parking lots, incorporating additional landscaping, on-site stormwater retention, and other best practices to satisfy recently updated City of Lowell stormwater requirements and reduce or eliminate runoff into adjacent drainage or combined sewer systems. Green roofs were incorporated into the design of University Crossing and Saab ETIC, further reducing stormwater runoff.

The University also celebrates its campus tree canopy. UMass Lowell was the first college in New England to be named an official Tree Campus USA, designated by the Nebraska-based Arbor Day Foundation in 2011. The University continues to receive this recognition annually, reflecting its detailed inventory, maintenance, and management of the trees on campus.

Table 1 and Table 2 show the projected and actual proportions of pervious and impervious surfaces on the University campuses in 2016. The deviation between the projected and actual Green Space on North Campus is almost entirely due to a more accurate mapping of the boundaries of an undeveloped riverfront parcel of land on the North Campus and the conveyance of a large portion of this parcel to the Massachusetts Department of Transportation for the realignment of an adjacent roadway and bridge. The increase in impervious area on East Campus is largely due to the acquisition of previously developed and largely impervious properties.

Figure 5 through Figure 8 illustrate the locations and extents of pervious and impervious areas across the three campuses as of 2016.

Table 1. UMass Lowell Pervious and Impervious Surfaces, 2016 as Projected in the *2011-2016 SDP*, in acres

	North Campus[2]	South Campus	East Campus[3]	University Total
Roof Areas	8.71	6.32	10.90	25.93
Other Paved Areas	13.61	15.35	15.28	44.24
Total Impervious	**22.32**	**21.67**	**26.18**	**70.17**
Total Green Space[1]	**30.52**	**17.42**	**16.87**	**64.81**
Total Area	**52.84**	**39.09**	**43.05**	**134.98**
Pervious %	58%	45%	39%	48%

Does not include leased properties and spaces.
(1) Previous Areas was classified as Green Space in the *2011-2016 SDP*.
(2) North Campus includes 11.0 acres of undeveloped Merrimack River frontage.
(3) East Campus includes University Crossing and the Inn & Conference Center.

Table 2. UMass Lowell Pervious and Impervious Surfaces, FY2016 Actual, in acres

	North Campus	South Campus[1]	East Campus[2]	University Total
Roof Areas	8.60	6.48	12.05	27.12
Other Paved Areas	15.38	16.77	19.98	52.13
Total Impervious[3]	**23.98**	**23.24**	**32.03**	**79.26**
Pervious Areas	**18.89**	**19.23**	**17.58**	**55.70**
Total Area	**42.87**	**42.47**	**49.61**	**134.96**
Pervious %	44%	45%	35%	41%

Does not include leased properties and spaces.
(1) South Campus includes the Bellegarde Boathouse.
(2) East Campus includes University Crossing and the Inn & Conference Center.
(3) Sum may not equal to total due to rounding errors.

Figure 5. North Campus Pervious and Impervious Surfaces, 2016

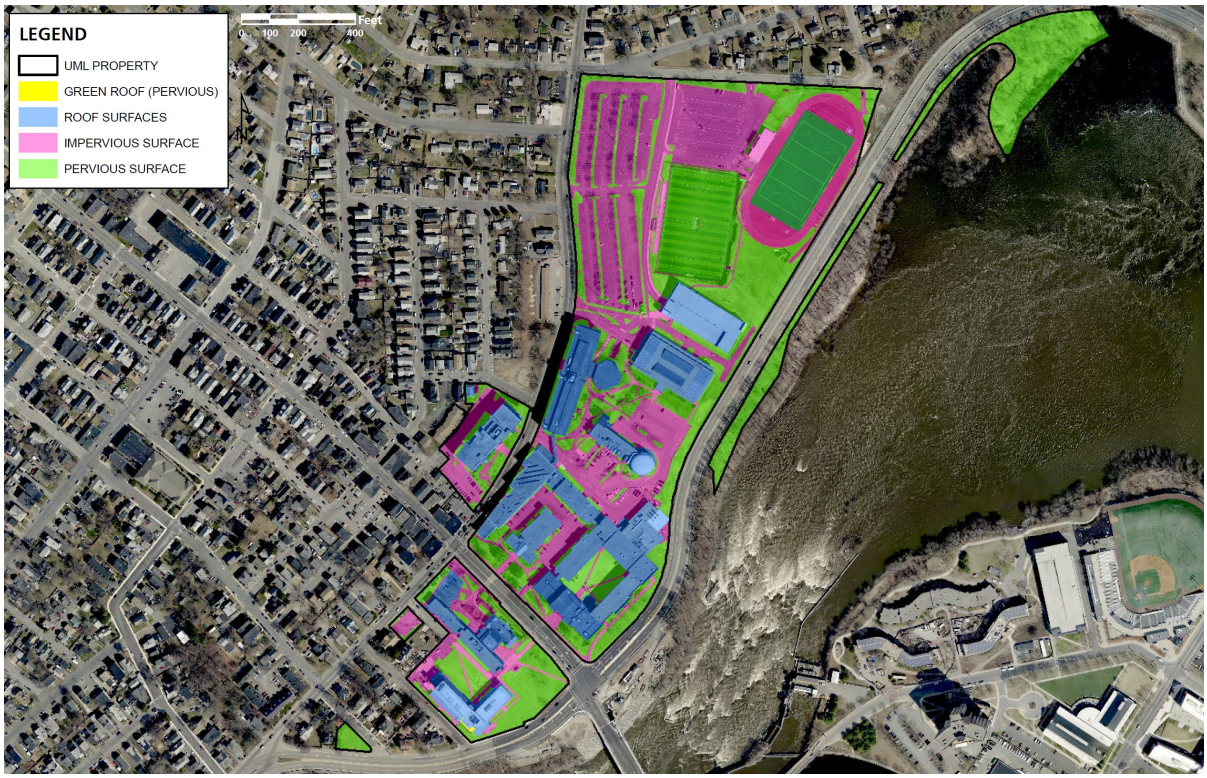


Figure 6. South Campus Pervious and Impervious Surfaces, 2016

Figure 7. East Campus Pervious and Impervious Surfaces, 2016

Figure 8. ICC and Boathouse Pervious and Impervious Surfaces, 2016

2.2 CAMPUS INTERIOR SPACES

UMass Lowell expanded its campus building space by about 513,000 gross square feet over the past five years. Approximately 32% of the campus square footage is devoted to academic and research space. Student support spaces (residential and athletic/recreational), administrative, campus and facilities support, and parking spaces make up the rest.

As part of its space planning effort, the University actively tracks all space usage and demand across the campuses via a Facilities Information System (FIS). The FIS maintains an active inventory of every individual room on campus by a unique space ID, space use, and assignment. This information feeds into the operations and services work order systems to keep track of work items, into the project management database to keep track of ongoing projects, and into the space planning and programming model for space usage analysis and space demand projection.

Table 3 summarizes the existing building use of all spaces across the University, complemented by graphic illustration in Figure 9. Figure 10 through Figure 13 present a more detailed view of each campus of UMass Lowell with the location and primary use of each building and ongoing project.

Table 3. Existing Building Use at UMass Lowell, FY2016

Building Use	North Campus	South Campus[2]	East Campus[3]	UMass Lowell Total
Academic	350,524	242,663	17,724	**637,816**
Research	160,732	5,348	35,420	**175,097**
Residential	0	65,413	373,353	**438,766**
Student Life	38,787	47,366	134,811	**205,821**
Athletic/Recreational	55,718	17,566	113,936	**187,220**
Administrative	58,296	26,787	130,768	**230,492**
Support	29,135	17,558	56,048	**102,741**
Parking	169,818	207,722	183,637	**561,177**
Other[1]	8,053	8,957	8,040	**25,050**
Total Net Assignable Square Feet (NASF)	**871,063**	**639,380**	**1,053,737**	**2,564,180**
Gross Square Feet (GSF)	1,308,439	955,642	1,653,635	**3,917,716**

Does not include the following:
- Leased buildings (345,884 NASF)
- Pulichino Tong Business Center (55,841 GSF under construction)
- Central Services and Facilities Operations Buildings on Middlesex St. (9,424 GSF under renovation)
- 193 Pawtucket St, 199 Pawtucket St., and 225 Aiken St. (73,263 GSF of vacant properties awaiting demolition)

(1) "Other" consists of currently unassigned spaces and assignable spaces under renovation
(2) South Campus includes UMass Lowell Bellegarde Boathouse
(3) East Campus includes University Crossing and the UMass Lowell Inn & Conference Center

Figure 9. Existing Building Use at UMass Lowell, FY2016

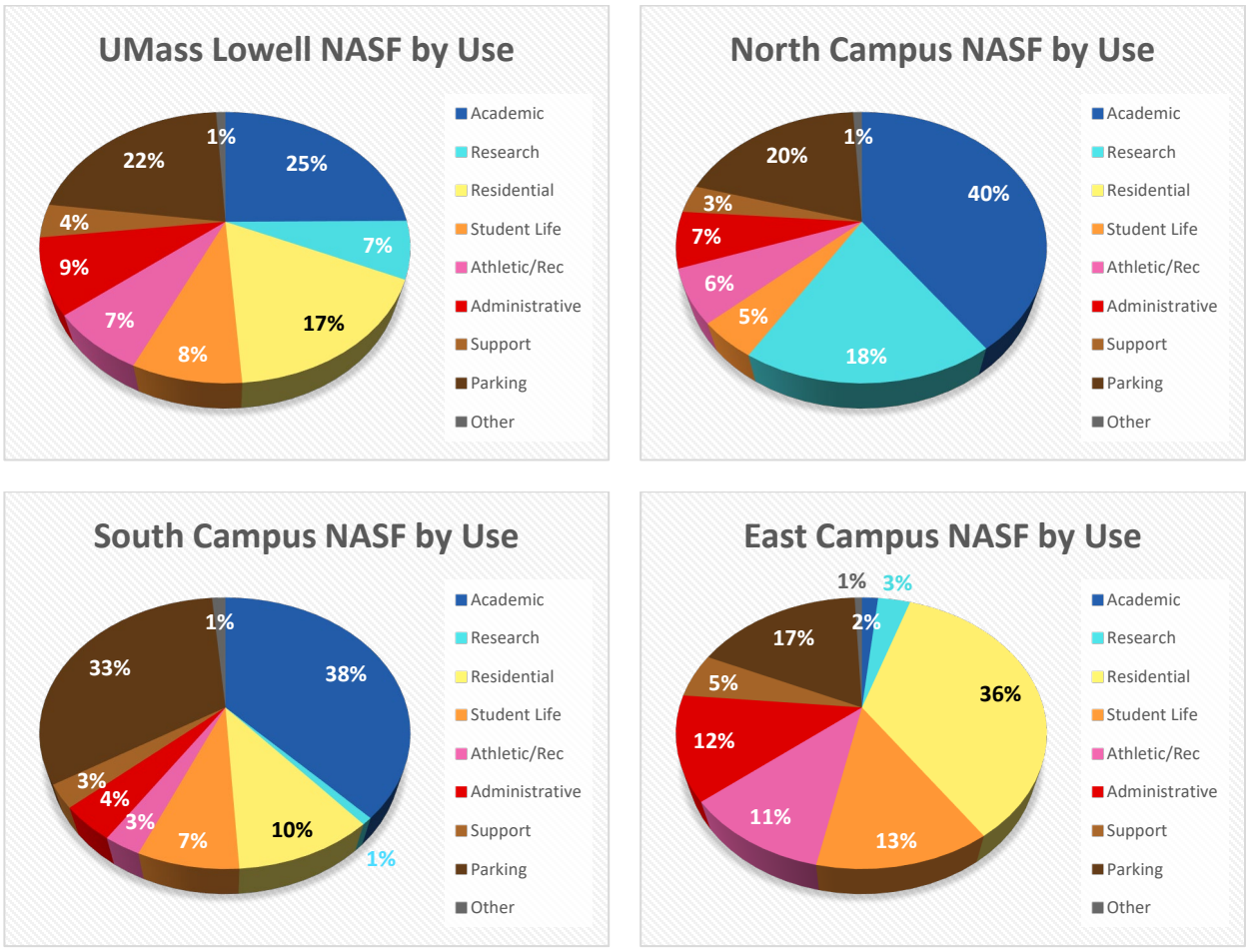


Figure 10. North Campus Building Use, 2016

NORTH CAMPUS *(18 buildings)*

Existing Buildings

#	Building Name	Year Built
1	Alumni Hall	1950
2	Ball Hall	1958
3	Costello Athletic Center	1967
4	Cumnock Hall	1954
5	Falmouth Hall	1907
6	Grounds Maintenance Garage	1966
7	Kitson Hall	1902
8	Lydon Library	1969
9	North Campus Garage	2012
10	North Power Plant	1910
11	Olney Hall	1974
12	Olsen Hall	1974
13	Pasteur Hall	1938
14	Perry Hall	1950
15	Pinanski Center	1968
16	Saab Emerging Technologies & Innovation Center (ETIC)	2012
17	Southwick Hall	1902

Buildings under Construction

#	Building Name	Expected
5a	North Quad Pods Addition – Falmouth Hall	2016
17a	North Quad Pods Addition – Southwick Hall	2016
18	Pulichino Tong Business Center (PTB)	2017

Exterior Spaces

#	Exterior Space Name
A	Cumnock Lawn
B	Cushing Field Complex
C	Pinanski Quad
D	Riverside Parking Lot
E	Saab ETIC Quad
F	Saab ETIC Riverview Terrace

Exterior Spaces under Construction

#	Exterior Space Name
G	North Quad / Southwick Courtyard

Figure 11. South Campus Building Use, 2016

SOUTH CAMPUS *(17 buildings)*

Existing Buildings

#	Building Name	Year Built
1	150 Wilder St.	1905
2	820 Broadway St.	1890
3	Allen House	1854
4	Coburn Hall	1894
5	Concordia Hall	1966
6	Dugan Hall	1962
7	Durgin Hall	1976
8	Health & Social Sciences Building (HSSB)	2013
9	Mahoney Hall	1960
10	McGauvran Student Union	1974
11	O'Leary Library	1974
12	Sheehy Hall	1989
13	South Campus Garage	2013
14	South Power Plant	1966
15	Weed Hall	1972

Newly Acquired and under Renovation

#	Building Name	Year Built
16	1485 Middlesex St.	1969
17	1499 Middlesex St.	1977

Exterior Spaces

#	Exterior Space Name
A	Broadway Riverview Lot
B	Riverview Field
C	South Campus Quad / Mall
D	Wilder Staff Lot

Figure 12. East Campus Building Use, 2016

EAST CAMPUS *(16 buildings)*

Existing Buildings

#	Building Name	Year Built
1	Ames Textile	1968
2	Bourgeois Hall	1967
3	Campus Recreation Center (CRC)	2001
4	Donahue Hall	1989
5	East Campus Garage	2007
6	Fox Hall	1973
7	Leitch Hall	1967
8	Tsongas Center	1997
9	Tsongas Garage	1968
10	University Crossing	1959
11	8 James St. / UC Building 6	c.1985
12	University Suites	2013
13	Wannalancit Mills	1862

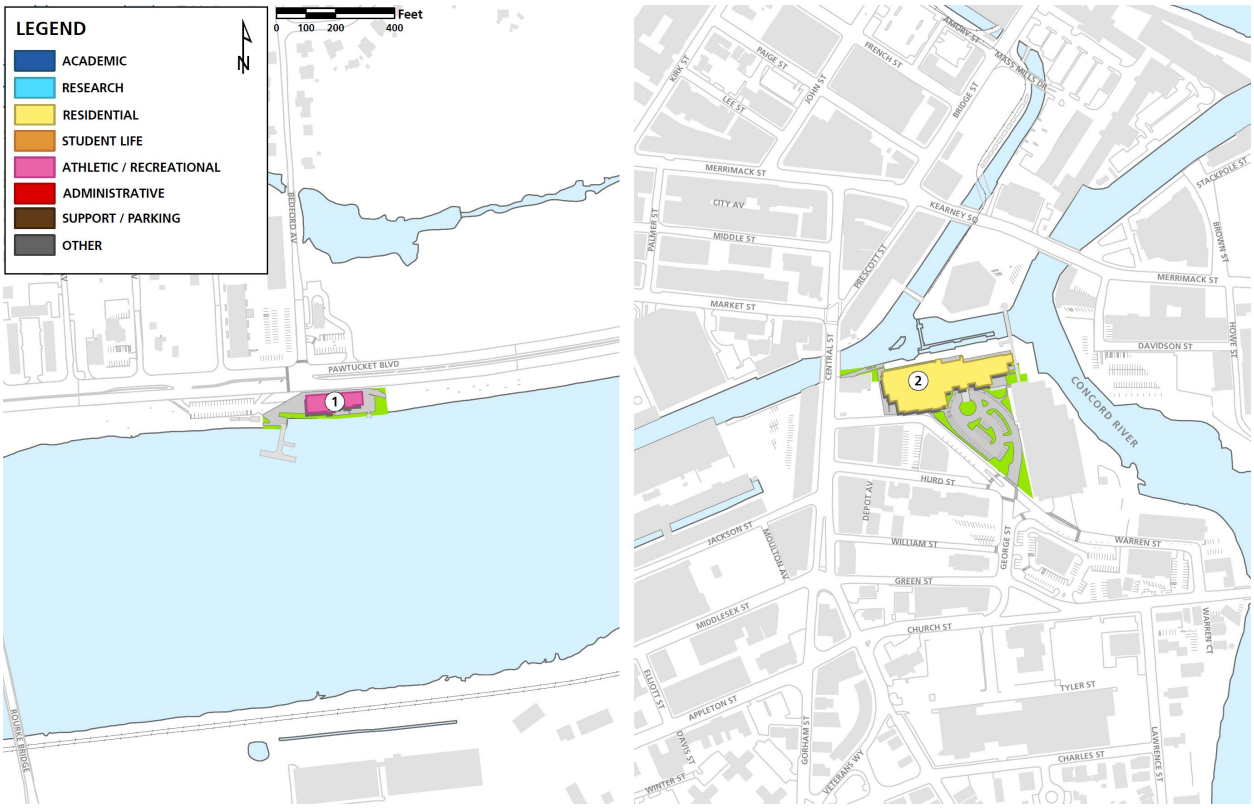
Vacant and to be demolished

#	Building Name	Year Built
14	193 Pawtucket St.	1905
15	199 Pawtucket St.	1890
16	225 Aiken St.	1968

Exterior Spaces

#	Exterior Space Name
A	Fletcher Lot
B	Perkins Street Lot
C	Rec Center Quad
D	Riverwalk (City of Lowell)
E	Salem Lot
F	Tsongas North Lawn
G	Tsongas West Lawn

Figure 13. ICC and Boathouse Building Use, 2016



BELLEGARDE BOATHOUSE & INN AND CONFERENCE CENTER *(2 buildings)*

Existing Buildings

#	Building Name	Year Built
1	UMass Lowell Bellegarde Boathouse	1984
2	UMass Lowell Inn & Conference Center (ICC)	1984

2.3 TRANSPORTATION CONTEXT

The *2011-2016 SDP* emphasized UMass Lowell's goal to create "one campus/one community" and the challenges toward achieving that goal at the outset of the five-year period. Over the past five years, the University significantly improved the connection between the three campuses, addressed student, faculty, and staff transportation needs, and promoted more sustainable modes of transportation. The success of its effort can be documented by increased transit ridership, decreased per capita parking demand, increased usage and expansion of sustainable facilities and car-/bike-sharing programs, and a disproportionately small increase in Average Daily Traffic (ADT) on roadways serving the campus despite significant growth in student enrollment.

2.3.1 Public Transit

UMass Lowell operates its own day, evening, and weekend shuttle system (UMass Lowell Riverhawk Roadster), which services campus and community destinations, and works with the Lowell Regional Transit Authority (LRTA) to extend public transit access to its regional bus service and the MBTA commuter rail network at the Charles A. Gallagher Transit Terminal. The University and the LRTA are actively engaged in ongoing dialogue to enhance and strengthen their opportunities for collaboration.

Ridership for the Roadster had more than doubled since 2011, averaging 7,500 on typical school days and reaching as high as 8,400 on peak class days. The University has also been actively improving the system efficiency, conducting usage tracking and customer surveys, and adjusting bus frequency and routes accordingly. UMass Lowell will continue to monitor ridership over the next five years.

Nevertheless, bus routes in both systems remain limited by weight restrictions on deteriorating canal bridges around Lowell, which forces full-size buses to detour, adding travel time, emissions, and cost. One closed bridge, the Broadway Street Bridge over Pawtucket Canal, is currently being replaced. Transit access will be greatly improved to and from South Campus when the new bridge reopens in 2017. The University and the City of Lowell have partnered to secure a Federal TIGER grant and other funding to repair and replace six additional deteriorating bridges, which will dramatically improve bus transit operations serving the campuses and adjacent neighborhoods. More details can be found in Section 4.4, under Lowell Canal Bridges.

Figure 14 is a route map for LRTA Route # 6, 7, and 9 – routes that service UMass Lowell. Figure 15 shows the 2016-17 Roadster bus routes.

Figure 14. LRTA Bus Routes in the Vicinity of UMass Lowell, 2016

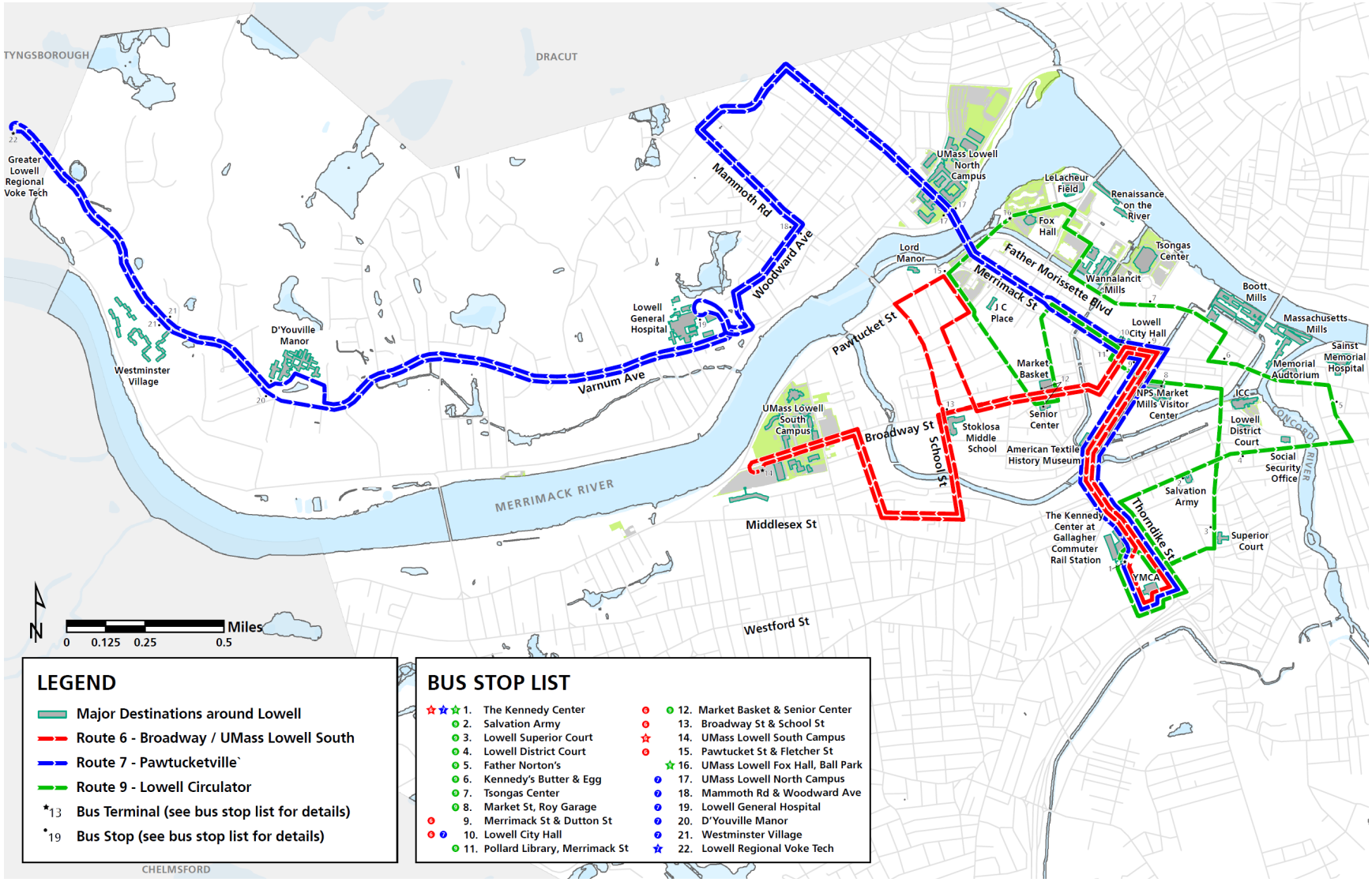
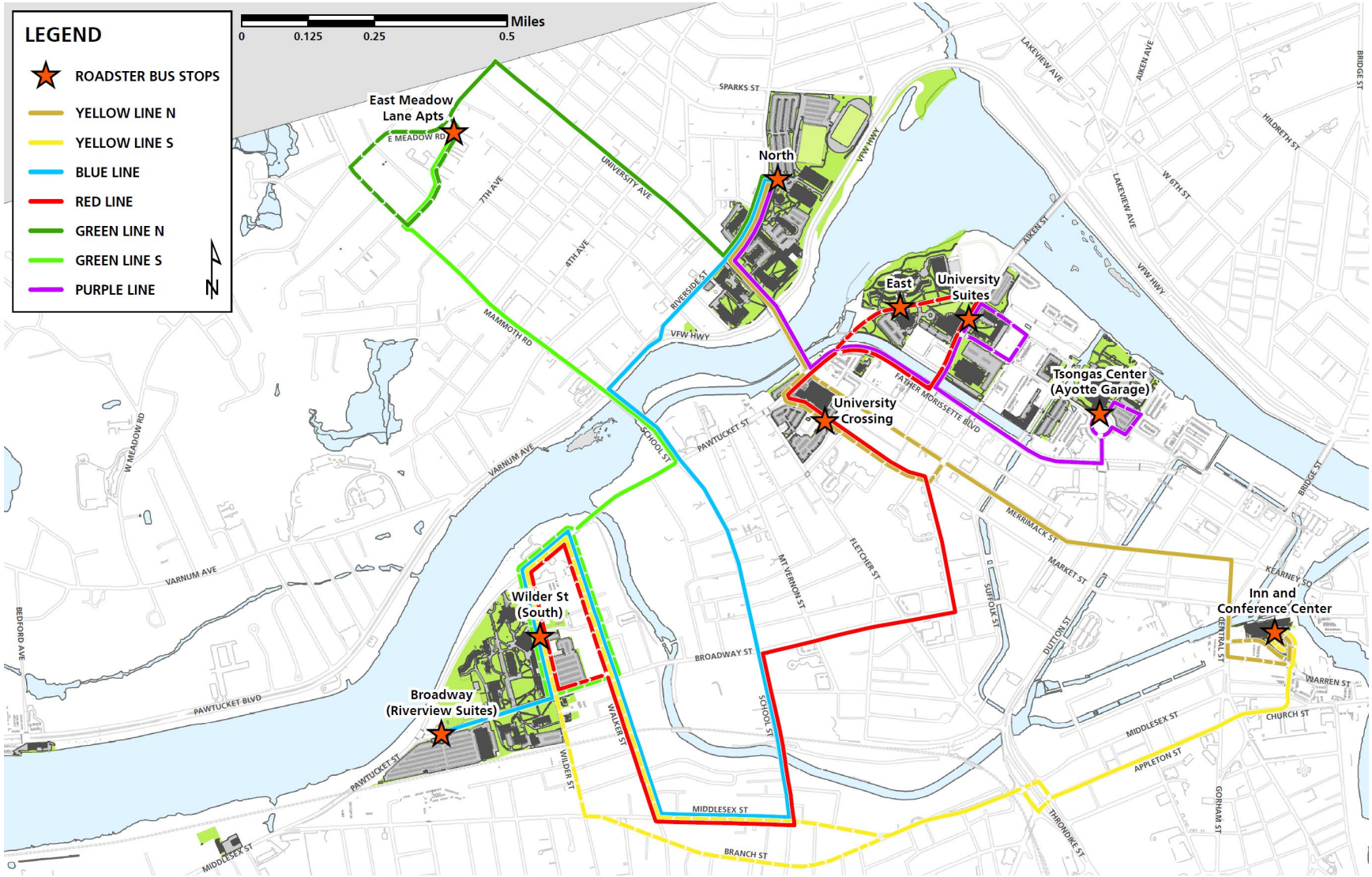


Figure 15. UMass Lowell Roadster Shuttle Routes, 2016



2.3.2 Parking

UMass Lowell's parking pressures have eased considerably since 2011. While growing student enrollment continues to generate parking demand and most parking lots around UMass Lowell remain full during peak periods, the combination of new parking construction, new parking leases, transportation demand management programs, sustainable transportation facilities improvements, and parking decal price increases have served to balance parking supply and demand.

Parking Supply

Over the past five years, the University added two parking garages, expanded two parking lots adjacent to the University Crossing, and expanded another parking lot along Wilder Street on South Campus. These projects greatly increased the University's owned parking supply. As a result, the University ended a major remote parking program (a leased parking lot two miles away from campus with free shuttle service) in 2012 and no longer uses the softball field and lawn area on South Campus as an overflow lot, restoring these areas to their original purposes.

After accounting for parking lot redesign (mainly involving the addition of handicapped spaces to improve accessibility for persons with disabilities) and unanticipated ownership changes in several properties containing parking spaces, UMass Lowell has a total of 6,174 parking spaces as of 2016. In addition, the University also leases 727 parking spaces from private parties and the City of Lowell.

Figure 16 and Table 4 detail the location and number of parking spaces in every University-owned parking lot or garage in FY2016, with comparison to the projection in the *2011-2016 SDP* and the future projection for FY2021.

It is worth noting that 136 then existing parking spaces in Tsongas Lot C and surface parking in front of the UMass Lowell Inn and Conference Center were inadvertently left out in the *2011-2016 SDP*. They are included in the FY2016 Actual and FY2021 Projected parking space counts.

Figure 16. UMass Lowell Parking Lots and Garages, 2016

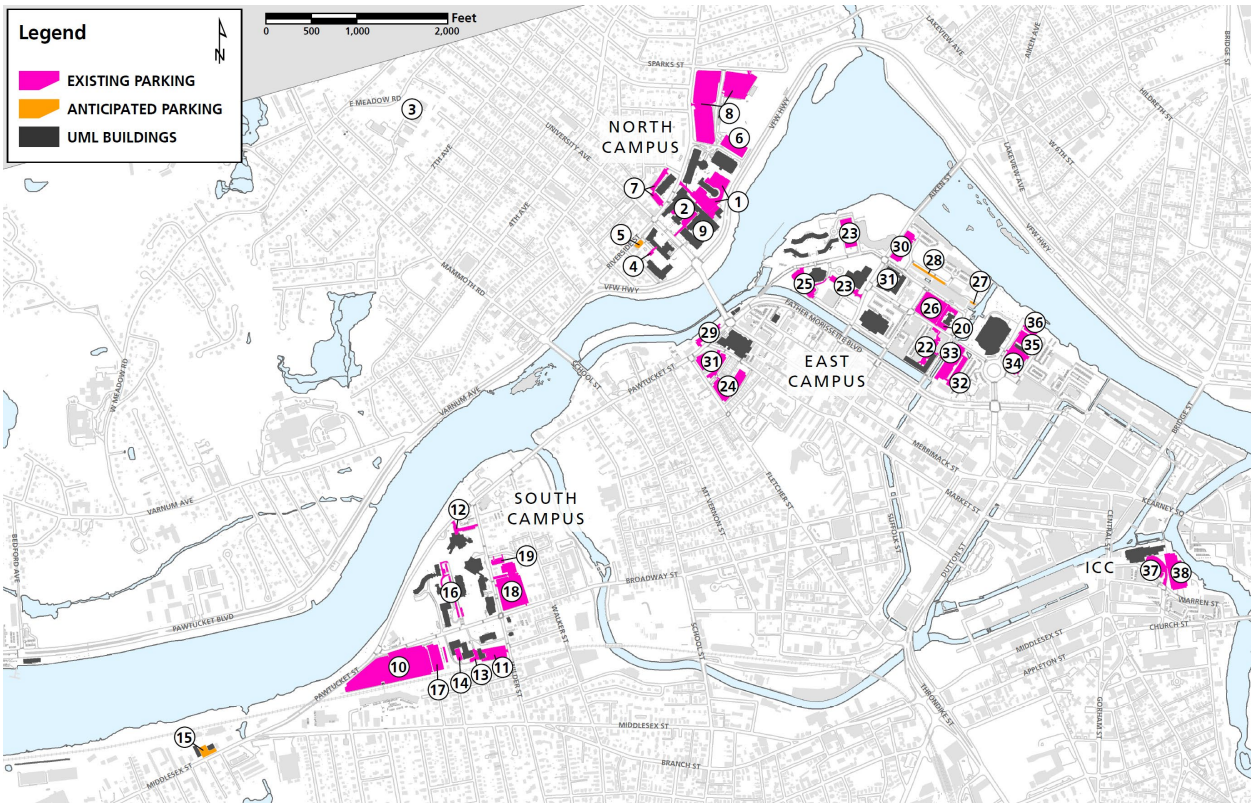


Table 4. UMass Lowell Parking Supply, 2016

#	Lot / Garage Name	FY2016 Projected	FY2016 Actual[1]	FY2021 Projected[1]	Notes
	North Campus	**1,974**	**1,741**	**1,740**	
1	Costello / Pinanski	143	126	157	Redesign planned
2	Cumnock	82	76	12	Partial conversion into courtyard planned
3	East Meadow Lane	55	0	0	Property sold in 2014
4	Saab ETIC	0	4	4	Handicapped spaces
5	Standish Visitor	0	0	20	Converted from undeveloped property
6	North Campus Garage	650	642	642	
7	Olsen	67	67	67	
8	Riverside Lots A & B	907	826	838	Redesign planted
9	Southwick	70	0	0	Being converted into courtyard
	South Campus	**2,299**	**2,328**	**2,385**	
10	Broadway Riverview	952	949	949	Formerly Riverview
11	Coburn	69	69	69	
12	Durgin	25	25	25	
13	Mahoney Lower	39	12	12	Carpool lot

#	Lot / Garage Name	FY2016 Projected	FY2016 Actual(1)	FY2021 Projected(1)	Notes
14	Mahoney Upper	32	32	32	
15	Middlesex – Central Services	0	0	57	
16	Solomont	47	31	31	
17	South Campus Garage	760	765	765	
18	Wilder Faculty/Staff	355	411	411	
19	Wilder Visitor	20	34	34	Formerly Lovejoy
	East Campus	**1,502**	**1,734**	**2,131**	
20	Ames	51	51	51	
21	Campus Recreation	58	58	58	
22	East Courtyard	49	49	49	Formerly Wannalancit: East Lot
23	East Campus Garage	630	630	630	
24	Fletcher Lot	145	184	184	Formerly Salem Lot B
25	Fox	90	90	90	
26	Hall Street Garage	0	20	369	UMass Lowell held easement in FY16; expected to purchase existing parking in FY17
27	Hoff Alumni Center	0	0	6	Expected to purchase existing parking in FY17
28	Lawrence Drive	0	0	42	Expected to purchase existing parking in FY17
29	Pawtucket Visitor	0	52	52	
30	Perkins Street	140	141	141	
31	Salem Lot	67	132	132	Formerly Salem Lot A
32	Tremont Preferred	71	71	71	Formerly Wannalancit: Tremont Lot
33	Tremont Visitor	17	17	17	Formerly Wannalancit: Visitor Lot
34	Tsongas Lot B	133	130	130	
35	Tsongas Lot C	0	85	85	Existing lot inadvertently left out in *2011-2016 SDP*
36	Tsongas Lot D	51	24	24	
	THE ICC	**320**	**371**	**371**	
37	ICC Surface	0	51	51	Existing lot inadvertently left out in *2011-2016 SDP*
38	ICC Garage	320	320	320	
	University Total	**6,095**	**6,174**	**6,627**	

(1) UMass Lowell leased 727 parking spaces in parking lots and garages owned by the city and private parties in FY2016. The University anticipates leasing around 870 parking spaces under similar terms in FY2021.

UMass Lowell is not anticipating major parking garage or parking lot construction in the next five years. The University is expecting to acquire approximately 375 existing parking spaces as part of the Perkins Properties in FY2017. Upon completion of the Pulichino Tong Business Center construction, a portion of the site currently being used for construction staging will be restored to parking as the Standish Visitor Lot. The University also acquired existing paved parking areas

with its purchase of 1485 and 1499 Middlesex Street. These will be added to the campus parking inventory following the renovation of the two buildings for Central Services and Facilities Operations. In conjunction with the comprehensive renovation of Perry Hall, modifications to the Costello / Pinanski Lot and Cumnock Lot will also impact the campus parking inventory. In total, the University projects a net gain of approximately 450 spaces by FY2021, as well as a net gain of about 143 spaces under lease.

Parking Demand

While adding parking, the University has been putting as much effort into reducing parking demand through a combination of transportation demand management (TDM) programs, sustainable transportation facilities improvements, and parking decal price increases. Section 5.6 has more details on the ongoing TDM programs, Section 2.3.3 has more details on sustainable transportation facilities improvements, and the following paragraphs discuss the parking decal price increases and the overall effect of these demand reducing policies and programs.

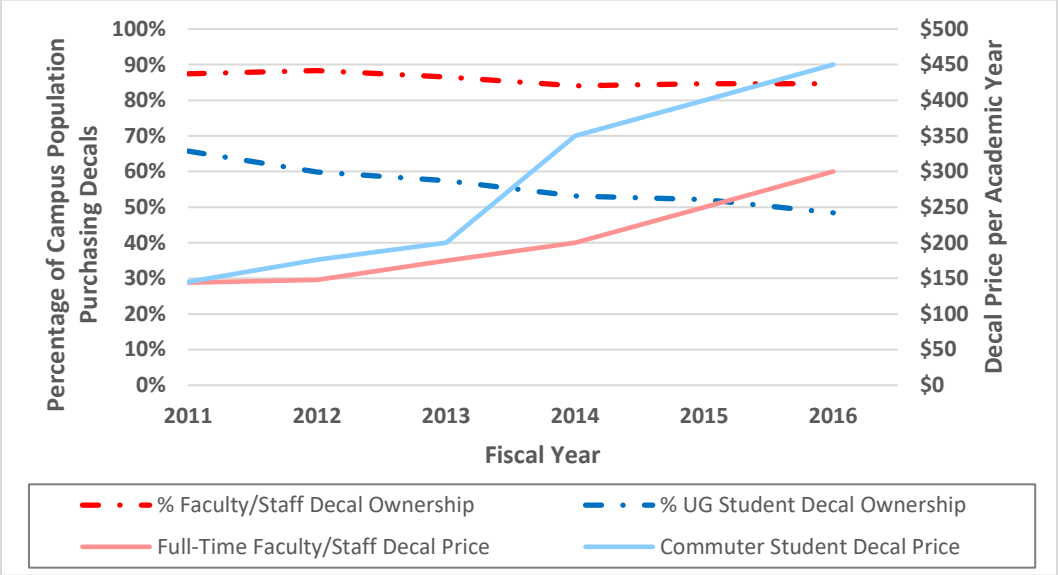
Parking decal ownership decreased between 3% to 19% among faculty, staff, and students between FY2011 and FY2016. Table 5 and Figure 17 illustrate this downward trend.

Table 5. UMass Lowell Parking Decal Ownership and Prices

Decal Type	Decal Owners (FY2011)	% of Pop. (FY2011)	Yearly Decal Pricing (FY2011)	Decal Owners (FY2016)	% of Pop. (FY2016)	Yearly Decal Pricing (FY2016)	Decal Owners (% change)	% of Pop. (% change)	Yearly Decal Pricing (% change)
Full-time Faculty/Staff	1,189	98%	$144	1,564	95%	$300	32%	-3%	108%
Part-time Faculty/Staff	642	72%	$0	578	65%	$80/ 150(3)	-10%	-7%	n/a
Resident Students(1)	1,253	40%	$175	1,262	30%	$450	1%	-10%	157%
Commuting Students(2)	4,448	80%	$145	3,800	61%	$450	-15%	-19%	210%
Vendor/ Visitor	285	-	$144	354	-	$288	24%	-	100%

(1) Resident student population is based on beds available on campus
(2) Commuting student population includes only undergraduate students, as graduate students and continuing education students generally take classes during off-peak times when parking decals are not required. Graduate students with teaching and research assistantships are also eligible to purchase the less expensive staff decals (thus included as part of the faculty/staff decal ownership category)
(3) FY2016 Yearly decal pricing was $80 for adjunct faculty and $150 for part-time staff

Figure 17. UMass Lowell Parking Decal Ownership and Prices, FY2011 – FY2016



The increase in parking decal prices across the board over the past five years offers an explanation for the decline, which is especially evident among the student population. The transportation demand management policies adopted by the University also contributed to the general reduction of parking demand. Improved bicycling and walking conditions, new residential halls and private residential development catered to students close to campus, and University-supported sustainable transportation programs all encouraged students, faculty, and staff to drive less.

The University expects these sustainable transportation policies and programs to remain in place. Section 5.6 discusses them in the context of the next five years.

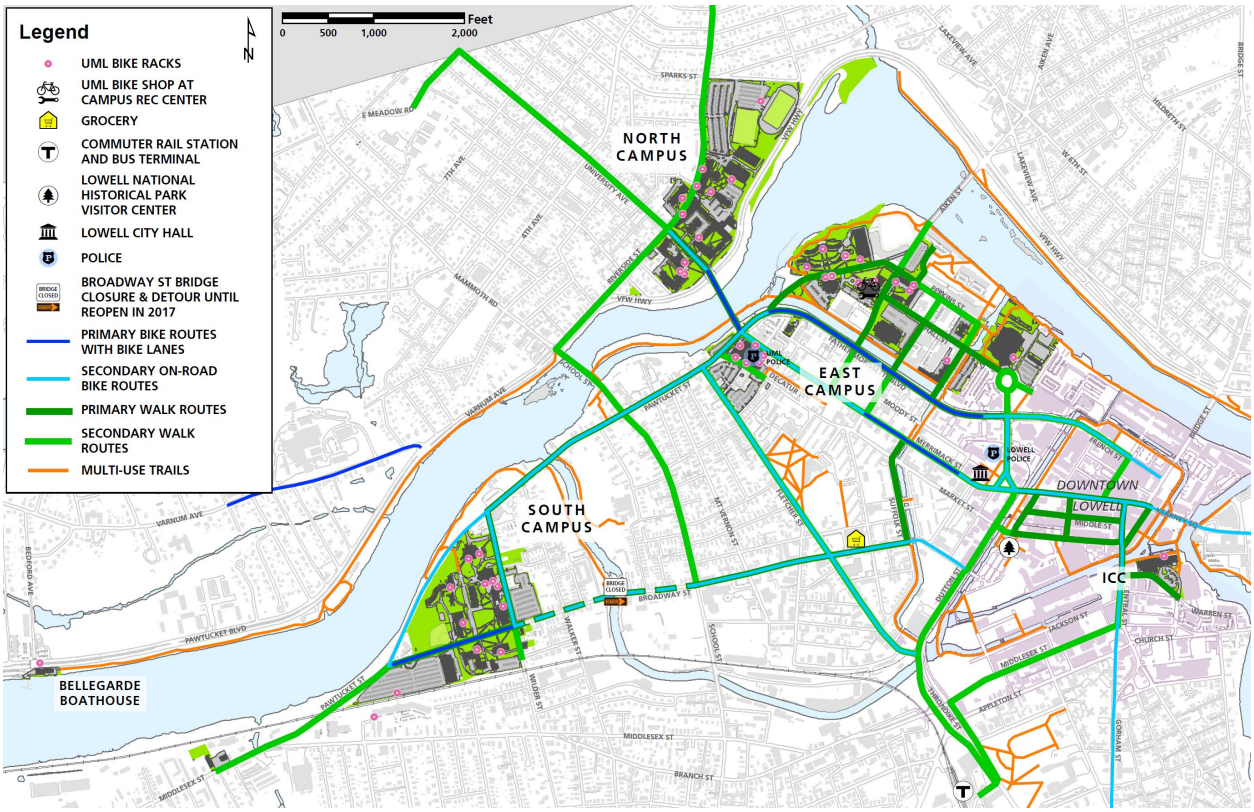
2.3.3 Sustainable Transportation

Lowell, with its industrial heritage, offers very walkable, as well as attractive, streetscapes. Besides improving public transit service and relieving parking condition on campus, the University promotes bicycling and walking as a sustainable and healthy way to travel between the campuses and other local destinations. Working with the City of Lowell and other partners, the University continues to improve the bike and pedestrian access to and among the three campuses. Furthermore, the University offers both bike-share and car-share (via Zipcar) services to students, faculty, and staff to reduce automobile use and parking demand.

Bike and Pedestrian Routes

UMass Lowell continues to work with the City of Lowell to improve bicycling and pedestrian connections between the three campuses to promote sustainable and healthy modes of transportation. Figure 18 shows the current bike and pedestrian routes in the vicinity of the University.

Figure 18. Bike and Pedestrian Routes in the Vicinity of UMass Lowell, 2016



A system of on-street bike lanes, shared bike routes, and off-street multi-use trails link the three campuses, as well as Downtown Lowell, the ICC, and the Kennedy Bus Transfer Center and MBTA Lowell Commuter Rail Station at the Gallagher Transit Terminal. During the past five years, the City of Lowell has improved bicycling facilities, installing new dedicated and shared bike lanes on the streets across the city and around the campuses. For pedestrians, most of the streets in the city are equipped with sidewalks on both sides and intersection traffic controls are continuously improving.

While it is still a work in progress, the bike and pedestrian link from East Campus to Downtown Lowell is well connected and offers multiple routes between destinations. Father Morissette Boulevard and a section of Merrimack Street are equipped with dedicated bike lanes.

On the other hand, the link between South Campus and the other campuses is limited, primarily relying on the Pawtucket Street Corridor. The closure of the Broadway Street Bridge eliminates the only other route across the Pawtucket Canal that offer direct access from the other campuses to South Campus. Fortunately, the bridge closure and detour will end when the replacement of the bridge is completed in 2017.

Since the *2011-2016 SDP*, both vehicular and bike/pedestrian access on the Pawtucket Street Corridor has improved. Most notably, the Massachusetts Department of Transportation (MassDOT) completed the University Avenue Bridge Replacement (Howe Bridge), significantly improving the link across the Merrimack River. Besides the new bridge, the City of Lowell and

MassDOT funded upgrades at multiple intersections on the Corridor to improve safety and traffic flow. The City and the University have also commissioned a bike and pedestrian improvement study for the Corridor.

To the west of the South Campus, the Bellegarde Boathouse is accessible by bicycling and walking via a riverfront multi-use path that begins at the Intersection of Mammoth Road/ School Street and Varnum Avenue/Riverside Street.

Other Sustainable Transportation Facilities and Programs

In addition to working with the City of Lowell and other partners to improve bicycling and walking routes on surrounding City streets, the University also invests in sustainable transportation facilities on the University campus, including a well-distributed system of bike racks, electric vehicle charging stations, and dedicated parking spaces for carpool vehicles.

The University also operates a campus bike share program called FreeWheelers, which is available to all UMass Lowell students, faculty, and staff members, as well as sponsoring Cambridge-based Zipcar to provide discounted car sharing program to University's affiliates. Zipcar locations are available at the parking garages on each campus.

Surveys and statistics collected by the University, FreeWheelers, and Zipcar show that these facilities and programs are well received and used. The University will actively improve and expand these programs as usage rates increase.

Figure 19 through Figure 22 show the locations of these sustainable transportation facilities and programs across UMass Lowell.

Figure 19. North Campus Sustainable Transportation Facilities, 2016

Figure 20. South Campus Sustainable Transportation Facilities, 2016

Figure 21. East Campus Sustainable Transportation Facilities, 2016

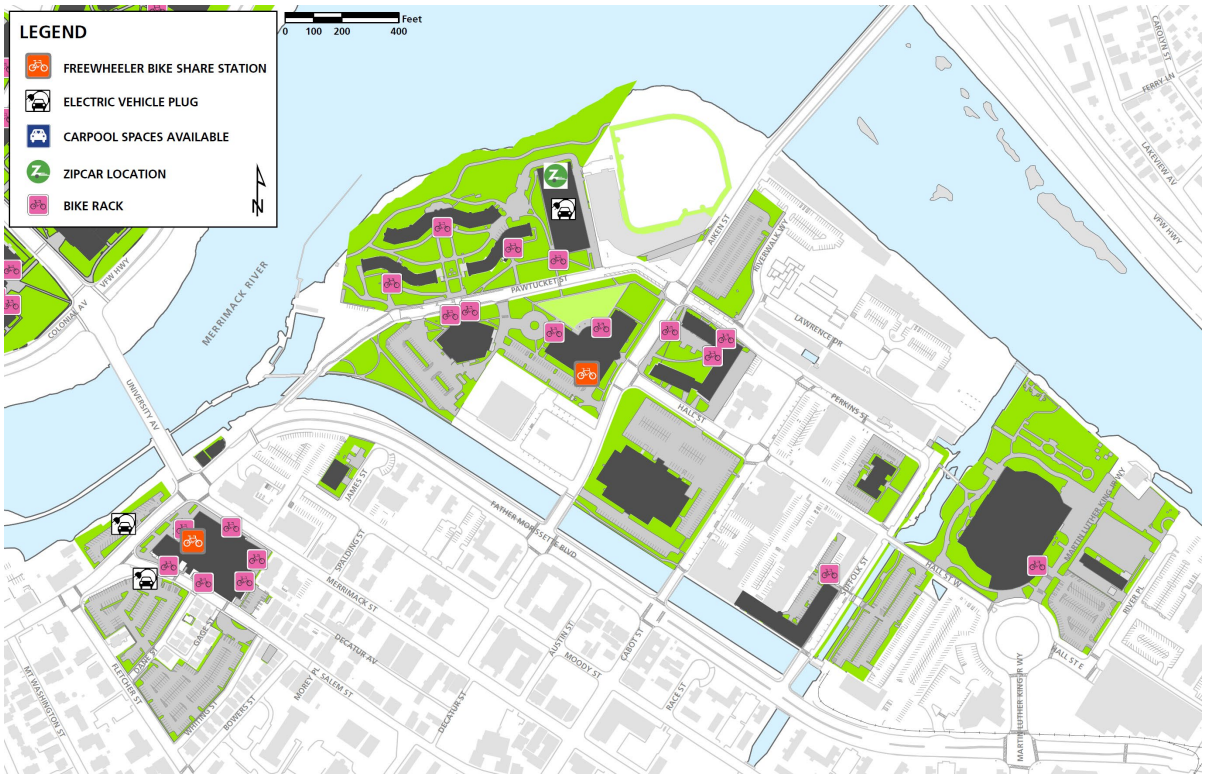
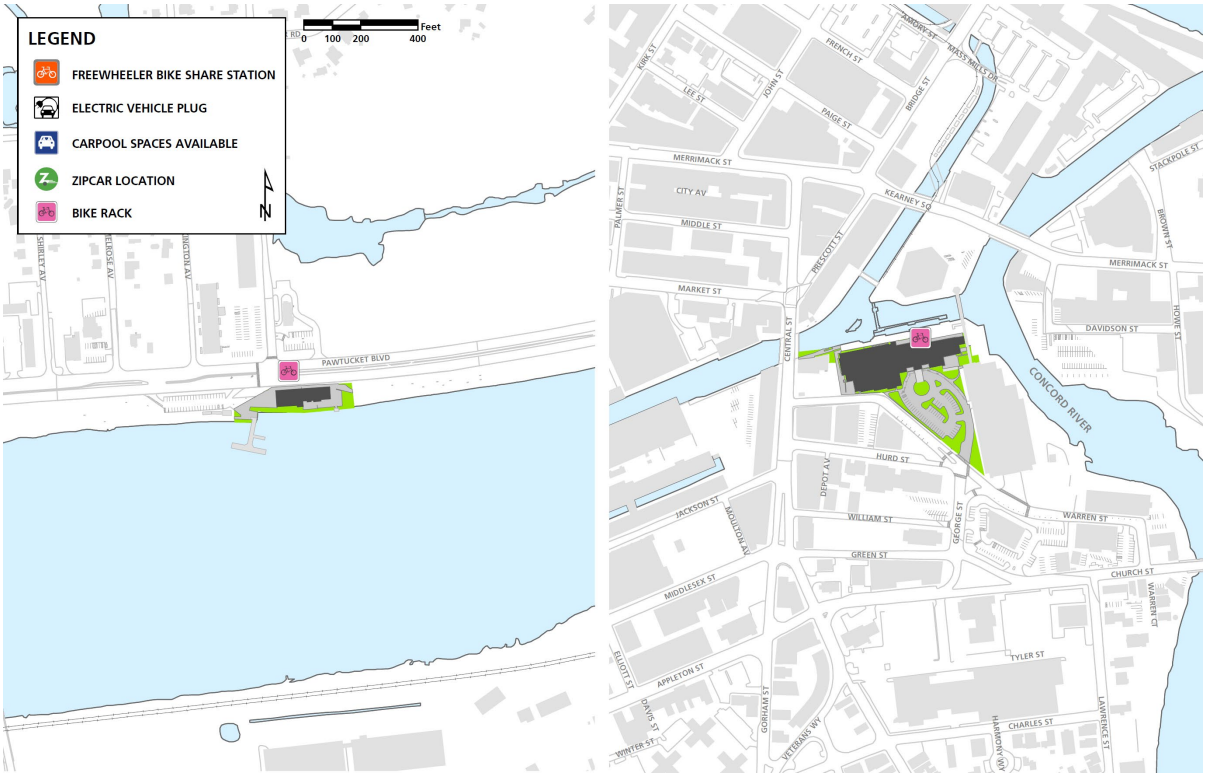


Figure 22. ICC and Boathouse Sustainable Transportation Facilities, 2016



2.3.4 Vehicle Trip Generation

Estimating total average daily vehicle trip generation for UMass Lowell, a complex physical campus with multiple campuses and schedules that vary from day to day, is at best an inexact science. A reasonably conservative approach is to use the same ITE LUC 550 methodology employed in the *2011-2016 SDP* Expanded Notice of Project Change – Supplemental Information submitted on August 31, 2012. Table 6 illustrates the findings of this analysis.

Table 6. ITE LUC 550 ADT Calculation for UMass Lowell, FY2016

	Headcount	Average Daily Traffic(1)
2016 all employees (actual)	2,559	16,765

(1) Equation: e ^ (0.74 * Ln(X) + 3.92) where X = the number of employees

The ADT of 16,765 represents an increase of 2,098 trips since 2011, based solely on the increase in total employment at UMass Lowell during that period. This equates to a 2.8% annual rate of increase, which greatly exceeds actual observed conditions on the roadways surrounding the campuses.

UMass Lowell hired The Engineering Corporation (TEC) as the transportation engineering consultant for the *2016-2021 SDP Update*. Reviewing historical traffic data provided by the Northern Middlesex Council of Governments (NMCOG), the City of Lowell, UMass Lowell, and the Massachusetts Department of Transportation (MassDOT), TEC reported on page 11 of its Campus Transportation Update (see Appendix D) that:

> The [Average Daily Traffic] Data indicates that traffic volumes immediately surrounding the UMass Lowell campuses have increased by approximately 0.5 percent per year since 2010, while the annual growth rate along major arterial corridors throughout the City has grown at *only 0.17 percent per year since 2010*. This marginal level of traffic increase is consistent with other low traffic growth rates within urban environments and demonstrates that UMass Lowell's aggressive growth in student enrollment and new building construction within the past five years has not resulted in a corresponding increase in vehicle traffic.

This finding of only marginal traffic increases likely is a result of the aggressive TDM programs and parking pricing initiatives that discourage single occupancy vehicle trips among all campus populations, as well as broader societal trends toward reduced auto use among Millennials. It is worth noting that even the conservative ITE LUC 550 ADT model confirms that despite UMass Lowell's significant growth, growth in trip generation falls well below the MEPA threshold of 3,000 ADT.

TEC also conducted a trip generation analysis and projection for FY2021 using an updated detailed trip generation analysis model. Section 5.6.3 discusses the model and ADT projection in further detail.

Origins of Vehicle Trips to Campus

Based on geographic data provided to the University when parking decals are purchased, Figure 23 shows that faculty, students, and staff commuted to UMass Lowell from a range of locations in Merrimack Valley, Southern New Hampshire, and beyond. The recent pattern is largely identical to that in 2010, as depicted in the *2011-2016 SDP*. Outside of Lowell, the highest density of commuters came from the nearby towns of Chelmsford, Billerica, Dracut, Methuen, and Nashua NH, as well as a clusters of communities along major highway routes, such as Interstate 495 and U.S. Route 3. Table 7 provides a more precise description of commuter driving distances in FY2016.

Figure 23. Commuter Origins, FY2016

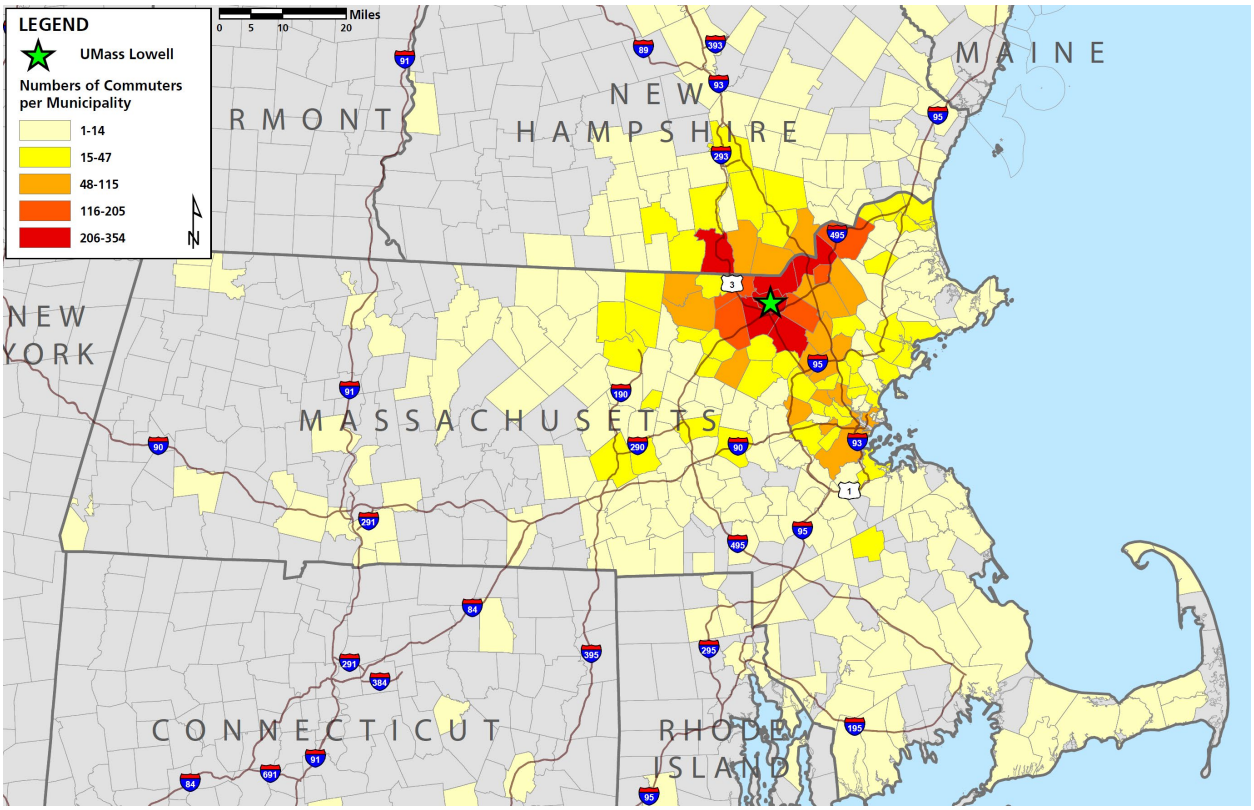


Table 7. Driving Distances for UMass Lowell Parking Decal Owners, FY2016

Distance to Campus (mi)	Student Decal Owners	Faculty/Staff Decal Owners	All Decal Holders
0 to 1	5%	6%	5%
1 to 3	9%	11%	10%
3 to 5	11%	15%	12%
5 to 10	11%	12%	11%
10 to 20	31%	25%	28%
20 to 50	32%	28%	30%
50+	2%	3%	3%
Mean (mi)	**18.9**	**32.3**	**23.6**
Median (mi)	**13.0**	**12.0**	**13.0**

Table 7 shows that while a majority of students, faculty, and staff who purchased a parking decal lived beyond 10 miles from the University, close to a quarter of the decal owners lived within 10 miles of school or work. Consequently, UMass Lowell's transportation demand management strategies will focus on promoting alternative sustainable transportation options for these groups of decal owners. In addition, the University has begun offering a housing subsidy to encourage more faculty and staff to purchase or rent housing within the City of Lowell, increasing the likelihood that they will be able to take advantage of TDM options and further reduce driving trip generation. Section 5.6 presents the details on these policies and strategies.

2.4 UTILITIES AND INFRASTRUCTURE

UMass Lowell relies upon typical urban infrastructure for utility service connections to the campus. The University maintains water, sewer, electric, gas, and steam infrastructure on campus. Regional utilities operated by the City of Lowell provide water and wastewater. National Grid distributes and meters electricity and gas serving campus facilities. New UMass Lowell projects are designed to minimize impacts on these systems. Significant resources have been invested to reduce University's generation of wastewater and consumption of water and fossil fuels.

2.4.1 Water and Wastewater

UMass Lowell relies on the municipal Lowell Regional Water Utility (LRWU) for water supply. Based on LRWU water meter readings, the University used 104,500 CCF (CCF, or Centum Cubic Feet) of water in FY2016, averaging around 214,000 gallons per day. The LRWU sources and treats water from the Merrimack River.

The University's sanitary wastewater flows to Lowell City Wastewater Utility's (LRWWU) Duck Islands Waste Water Treatment Plant downriver from the University. LRWWU does not track the University's wastewater flow but it can be assumed the University's outflow would be its water usage minus irrigation and cooling tower consumption plus any stormwater entering combined sewers after falling on University property. Based on standard wastewater flow assumptions (90% of water use), the University generated 94,155 CCF of sanitary wastewater in FY2016, averaging 193,000 gallons per day.

2.4.2 Stormwater Management

Using the New York State Simple Method with the same set of assumptions as in the *2011-2016 SDP*, it is estimated that UMass Lowell generated 101,515 CCF of stormwater in FY2016.

Since adopting its *2009 Stormwater Management Program* (attached in Appendix C), UMass Lowell has made substantial investments to implement the plan across the three campuses, including stormwater drainage and catch basin upgrades, storm-sewer separation projects, underground tank removals, impervious surface reduction, public awareness and education programs on stormwater runoff and water pollution, and an ongoing outfall screenings and catchment investigations.

Storm Drainage and Retention Basin Upgrades

Separation of combined sanitary and stormwater drainage from Riverside Street took place in 2009. Catch basins behind Perry Hall were redesigned to discharge stormwater to the Merrimack River.

In 2010, The University installed an oil water separator (OWS) at the end of the stormwater line between the North Power Plant (NPP) and Pasteur Hall. The OWS was installed to separate sand, silt, debris, and potential accidental release of oil from bulk oil deliveries at the NPP from the runoff discharging into the Merrimack River.

An OWS was also installed at the Riverside Street Parking lot near the corner of Sparks Street, as well as at the Coburn Parking Lot near the South Power Plant.

In 2012, The University renovated University Crossing and the adjacent parking lot areas. The new parking lots incorporated water retention and infiltration systems that retain all stormwater on site, ultimately recharging the groundwater. The building includes green roofs and on-site stormwater retention and infiltration infrastructure. This project also separated drainage and sanitary piping to the mains in the streets. A program of real estate acquisitions and site redevelopment has reduced the overall net impervious surface area in the vicinity of University Crossing. Through a partnership initiative with the LRWWU, the University also assisted with the separation of stormwater drainage and sanitary sewage infrastructure throughout the surrounding neighborhood.

The comprehensive renovation of Leitch and Bourgeois Halls on East Campus primarily focused on interior renovations but included the installation of two water recharge systems for building and perimeter drainage and separation of combined sanitary sewers and stormwater drainage during the summer of 2013. The same project also generated updated mapping of stormwater drainage to the Merrimack River behind the residence halls.

The University maintains a catch basin stenciling program, manned by University staff and student volunteers, to increase awareness of stormwater pollution and stewardship of the environment, as well as discouraging illegal dumping into the catch basins. Metal medallions have also been affixed to most University-owned catch basins.

Decatur Way Community Project

The improvement of Decatur Way was a prominent component of the University's partnership with the LRWWU. Decatur Way runs from the south side of University Crossing to Decatur Avenue between Salem Street and Merrimack Street. This project transformed an abandoned and unmaintained dead-end alley with a history of illegal dumping and criminal activity into a vibrant community resource.

An initiative led by the neighborhood group Acre Coalition to Improve Our Neighborhood (ACTION), the walkway began its transformation in 2009 and the project gained speed after UMass Lowell opened its University Crossing student center adjacent to the site. The University provided an easement to connect the former dead-end alley to Salem Street and allow the LRWWU to run a new drainage main under the walkway.

The result, named "Decatur Way…Water, Art, and You," is an L-shaped public space, green alley, and outdoor learning gallery nestled between Salem and Merrimack streets that measures 1,200 feet long by 16 feet wide. The area features murals, poetry installations, and other artwork – including drawings in pigment that is only visible when the pavement is wet – and an arbor for climbing vines. Underneath it all is a new stormwater filtration system with porous concrete that absorbs water, allowing it to return to the soil instead of pooling on the pavement where it could accumulate contaminants and harm the environment. The space also hosts various exhibitions on educating the public on topics relating to water and stormwater.

In June 2016, the revamped Decatur Way was unveiled to the public during an event featuring Lowell schoolchildren, artists, neighborhood leaders, and representatives of ACTION, UMass Lowell, City of Lowell, and LRWWU, who helped create the new space.

Underground Tank Removal

The removal of underground fuel storage tanks reduces the risk of contamination of stormwater runoff. In 2012, the University removed two 500-gallon underground storage tanks used for storing fuel oil for emergency generators located at Donahue Hall on East Campus and Sheehy Hall on South Campus. In 2016, the University removed a 6000-gallon underground storage tank formerly used to store gasoline for vehicle fueling from the parking lots adjacent to the Tsongas Center.

Reducing Impervious Surfaces

The University strives to reduce impervious surfaces and incorporate stormwater capturing features in its new construction and renovation projects.

Before and after the demolition of the South Dining building and construction of the South Campus Mall

The University Crossing building completed in 2014 was designed with landscaping features for capturing stormwater and a small green roof located toward Salem Street, in contrast to the densely built and largely impervious St. Joseph's Hospital property it replaced.

In November 2015, the University began developing the *South Campus Landscape Master Plan* to study and enhance open spaces on South Campus, with the goal to meet or exceed the University's sustainability goals through promoting sustainable transportation, accommodating green infrastructure, and achieving maintenance goals for campus open space. This plan is also establishing new standards for sustainable landscape design that will be applied across all campuses.

The demolition of the South Campus Dining building and construction of the South Campus Mall in spring 2016 was the first-phase implementation of the landscape master plan. The mall replaces a building and its surrounding paved areas with a sizable green space.

In conjunction with the ongoing construction of service pod additions to the North Quad, the former Southwick parking lot was replaced with a landscaped open space that includes a sizable portion of pervious surface in 2016.

As noted in Section 2.1 above, the net proportion of impervious campus area actually increased slightly between 2011 and 2016. However, this is almost entirely due to the more precise and accurate mapping of the boundary of a large University-owned parcel directly abutting the Merrimack River, which reduced its measured area considerably without actually changing the amount of pervious land area. The boundary adjustment, combined with the conveyance of a significant portion of this parcel to the Massachusetts Department of Transportation, resulted in a net reduction in pervious surface on campus by 9 acres but did not result in a comparable reduction in actual pervious land.

Before and after the North Quad Pods Addition and the re-landscaping of the Southwick courtyard

Storm Drainage and Outfall Investigation and Map Update

The University has retained AMEC Earth & Environmental, the same engineering consulting firm that developed the *2009 Stormwater Management Program*, to do a series of storm drainage and outfall screenings, catchment investigations, as well as an update on the seven-year-old stormwater drain pipe and outfall maps. The map update covers the findings of the latest investigations, including several previously undocumented storm drain pipes across the campuses.

Figure 24 through Figure 27 show the interim stormwater drain pipe and outfall map for each of the three campuses.

Section 5.2.2 discusses the ongoing and new policies and programs in regards to stormwater management, as well as projected stormwater generation in FY2021.

Figure 24. North Campus Interim Stormwater Drain Pipe and Outfall Map

Figure 25. South Campus Interim Stormwater Drain Pipe and Outfall Map

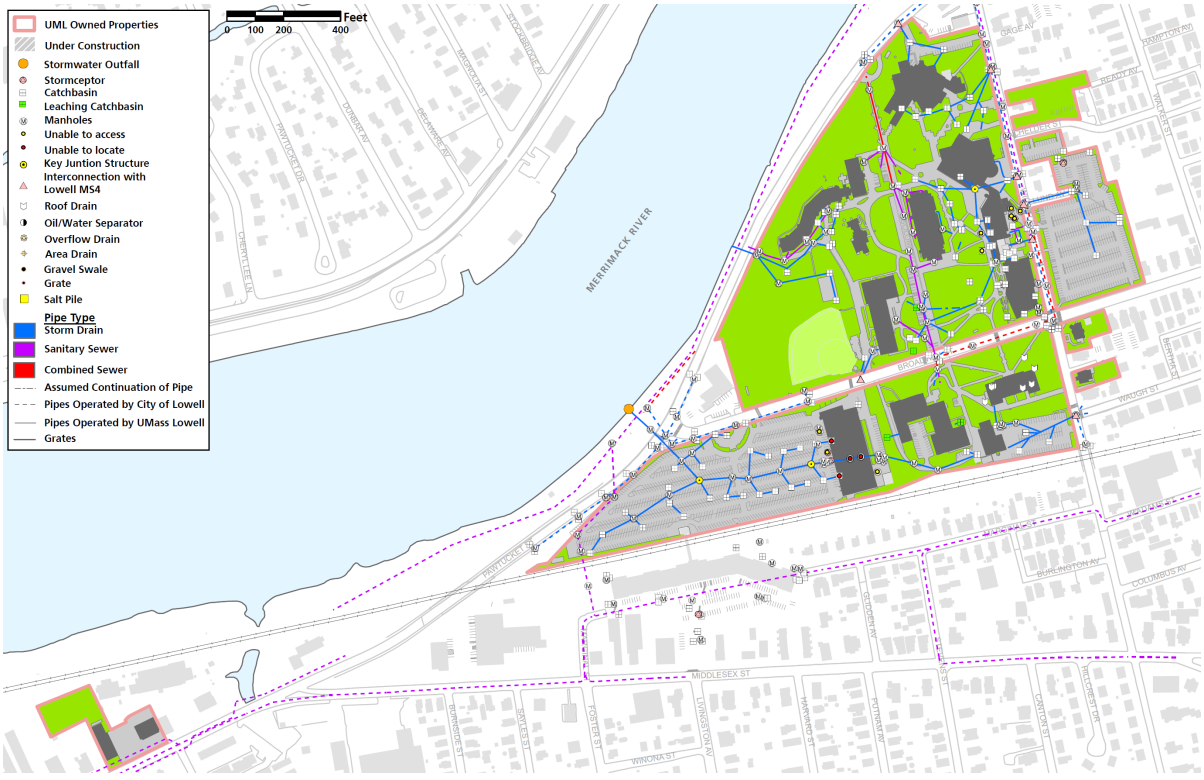


Figure 26. East Campus Interim Stormwater Drain Pipe and Outfall Map

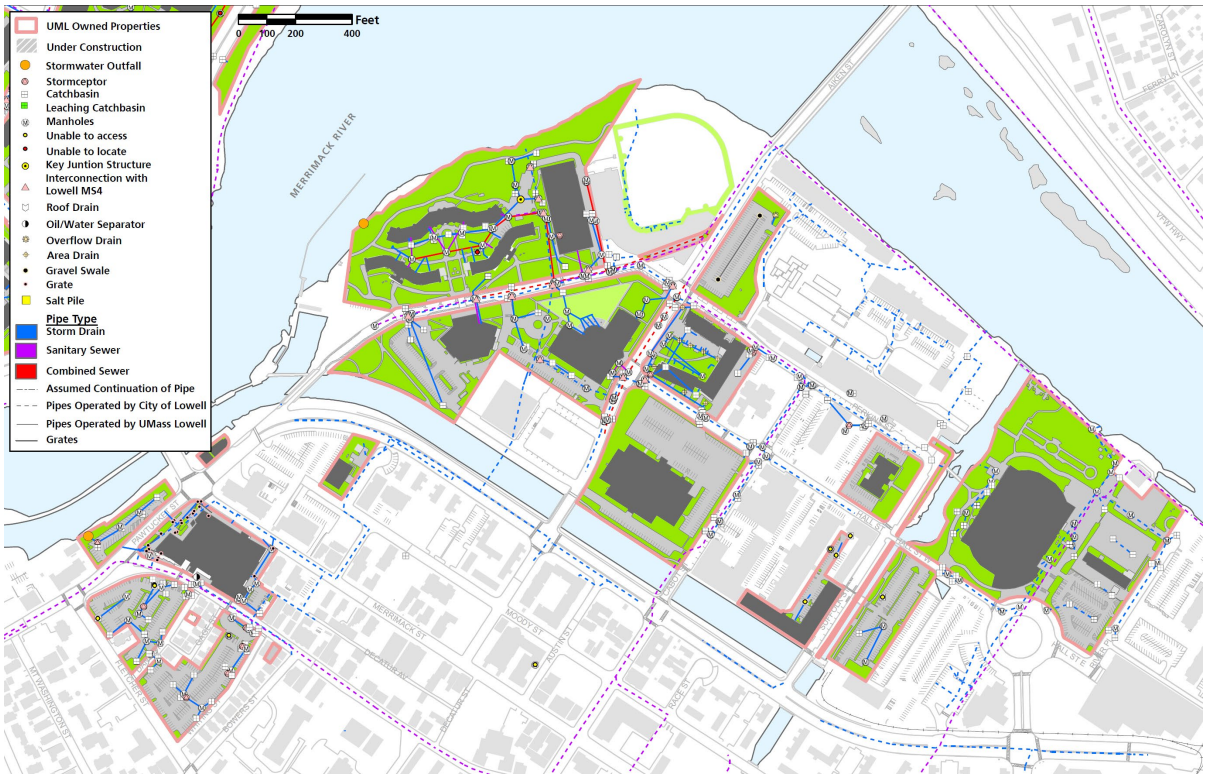
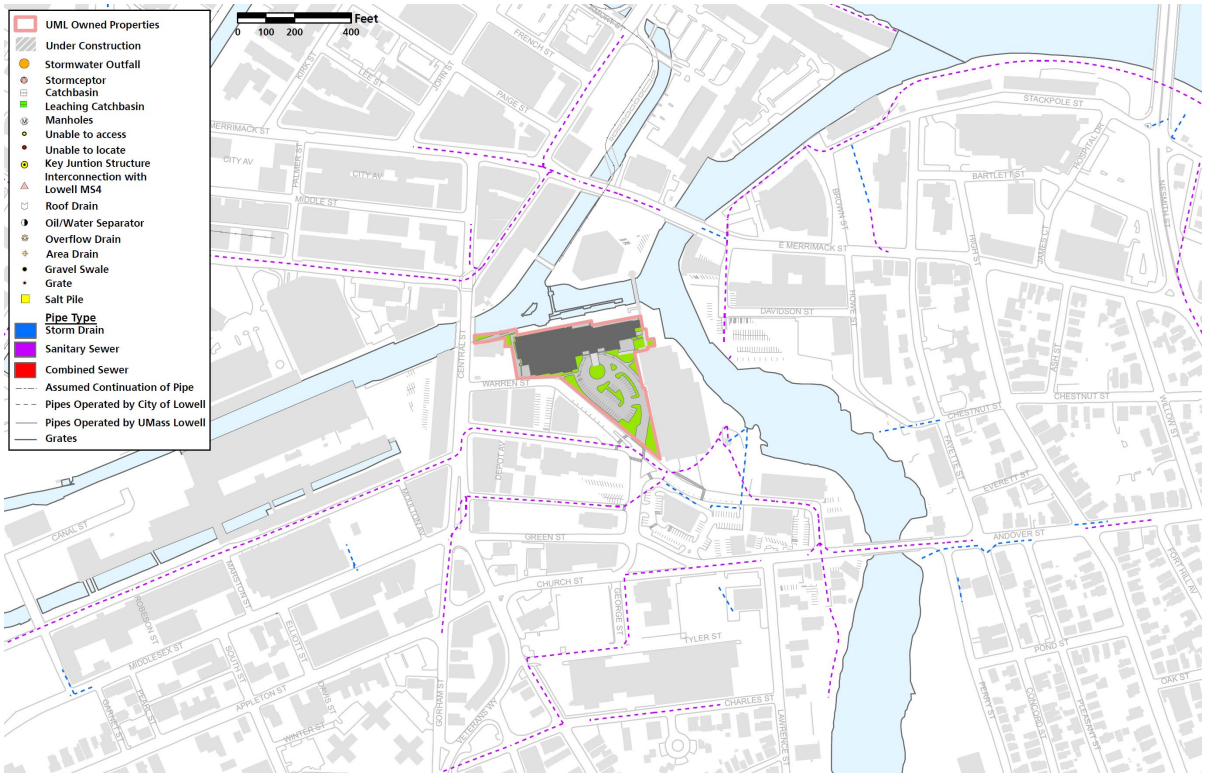


Figure 27. ICC Interim Stormwater Drain Pipe and Outfall Map



2.4.3 Steam and Power

UMass Lowell purchases electricity and gas from National Grid but relies on two heating plants for steam generation and maintains steam lines across the campuses for heating. The North Power Plant (NPP) and South Power Plant (SPP) each has 3 boilers that can burn both natural gas and fuel oil. Since FY2012, the heating plants burn natural gas as primary fuel and burn #2 and #6 oils only as backup fuel. NPP phased out the more polluting #6 oil in favor of #2 oil (equivalent to Ultra-Low-Sulfur Diesel) through its boiler replacement/upgrade in 2012. SPP is undergoing a similar boiler replacement project to increase efficiency of the gas boilers and phase out #6 fuel oil, which is anticipated to be completed by the end of December 2016.

The University used 49.9 million kWh of electricity and 232 Dth (Dekatherm) of natural gas in FY2016.

The University has also installed 4 arrays of photovoltaic solar panels on building rooftops, with a generation capacity of 246 kW:

- Bourgeois Hall – 46 kW
- Costello Athletic Center – 71 kW
- Dugan Hall – 83 kW
- Leitch Hall – 46 kW

Ball Hall also has an array of photovoltaic solar panels (13.1 Kw) and wind turbines (4.7 kW) used for research and academic purposes.

Figure 31 in Section 3.5.2 shows the location of these renewable energy facilities and the University's LEED certified buildings. Additional solar panels are being installed as part of the Accelerated Energy Project (AEP) and other construction projects. The most significant of these will be a 200 kW DC array on the roof of the South Campus Garage.

The boiler replacement projects at the heating plants are further discussed in Section 5.7. Past, current, and projected electricity use and gas use are discussed in Section 5.8. Other energy efficiency projects and the overarching *UMass Lowell Climate Action Plan* are discussed in Section 3.5.

3. CHAPTER THREE – PLANNING FOR THE FUTURE

Previous discussions have highlighted some of the issues surrounding UMass Lowell's physical environment. This chapter talks about the University's approach to address these challenges through a strategic planning process. The following sections identify planning goals, assumptions, and processes. The resulting University development needs are highlighted here as a context for the capital development program.

3.1 GOALS AND OBJECTIVES

In 2010, UMass Lowell embarked on a multi-year strategic planning process, titled *UMass Lowell 2020, A Strategic Plan for the Next Decade*. It provides a blueprint for how UMass Lowell will achieve national and international recognition as a world class institution, among other objectives, by 2020. Every subsequent University planning activity is grounded in implementing the goals and objectives laid out in *UMass Lowell 2020*. *UMass Lowell 2020* has been updated periodically (most recently in March 2016) to adjust for ongoing progress and changing conditions.

Goals related to facilities renewal and master planning falls under Pillar V: Entrepreneurial Stewardship in Higher Education. In addition to the goals set out in the original document, the *UMass Lowell 2020* updates added emphasis on entrepreneurship, accessibility, and compliance with the American with Disabilities Act, student life and services enhancement, and emergency preparedness. Furthermore, sustainability was elevated to a separate strategic priority, with a focus on meeting the University's *Climate Action Plan* milestones. The following strategic goals and priorities most influence campus planning and development activity:

- Building mechanisms and approaches that recognize and support UMass Lowell as a one campus/one academic community, in all its interactions and mix of participants
- Create sound and sustainable rolling master and facilities renewal plans that drive organizational development and activities to foster a single academic community
- Foster ease of movement around campus and within the city. Expand the way-finding system, including signage, technology, and gateways while enhancing campus accessibility and compliance with the spirit of the Americans with Disabilities Act.
- Leverage the attributes of our legacy and place by building on Lowell's collaborative tradition and practice in developing the urban fabric of one campus/one city.
- Strengthen collaboration with city and community planning counterparts to identify mutually beneficial strategies to promote one campus/one city.
- Improve the quality of the campus environment including green spaces, interior and exterior places, and fuller integration of the iconic Merrimack River.
- Incorporate programs of exhibited art and shared archives that complement our legacy in key locations.
- Using entrepreneurial strategies, renew, modernize, and right-size campus facilities while addressing growth.,

- Renew and reconfigure spaces that support academic success and career readiness, student collaboration, entrepreneurship and research, including learning commons and academic conferencing.
- Improve student life for the growing body of residential and commuter students, through enhancements and expansion of auxiliary and student services, in particular, dining, athletic, and recreational resources.
- Progressively reduce the deferred maintenance backlog by broadening investments in preventative and corrective measures while concurrently supporting the development of facilities needed for new programmatic requirements and growth.
- Confirm a sense of safe, modern, and welcoming campus community through enhanced security and technology across the campus.
- Continue to invest in security technologies, including building-access systems and emergency communications systems, and enhance community-based policing.
- Expand collaboration with the Lowell Police Department and other law enforcement agencies.
- Continuously improve the University's business-continuity posture, disaster-recovery capabilities, and emergency preparedness including medical response and training. Seek grant funding where possible.
- Support the full range of campus activities and programs with information technology systems that are current, secure, and have sufficient capacity to meet projected demand.
- Responsibly renew and enhance energy systems and infrastructure for sustainability and cost avoidance and meet the *Climate Action Plan* milestones.
- Modernize existing buildings to improve energy conservation. Strive for LEED certification in new building and renovation projects.
- Implement the University's Accelerated Energy Program (AEP) to provide significant energy efficiency and conservation enhancements.
- Implement sustainable practices, including transportation and landscaping initiatives and water conservation.
- Evaluate and implement renewable energy opportunities.

In addition to the *UMass Lowell 2020* updates, the University transparently monitors its progress by publishing an annual report card of key quantitative measures of various goals and objectives. The latest report card was published along with the *UMass Lowell 2020* Update in March 2016 (attached in Appendix G). The fall 2020 enrollment and faculty/staff targets in the *2016 Report Card* are used as the basis for projections in this SDP Update.

3.2 PLANNING ASSUMPTIONS

Enrollment at UMass Lowell has continued to grow as planned, increasing by 18% in the past five years, resulting in an overall enrollment of 17,450 in fall 2015. This growth has occurred despite overall declines in the college-age population in New England.

Most demographic studies suggest that New England's college age population will continue to decline over the next five years. UMass Lowell anticipates that it will continue to be able to capture an increasing share of this population by providing greater value to students than some of its competitors. Additional enrollment growth is expected to come from continued improvements in retention rates. However, the University does anticipate a slowing of its annual growth rate to an average of 1.7% through 2020, achieving a total enrollment of 20,000 students by the end of the five-year period. As of October 2016, the fall 2016 enrollment is 2.2% higher than the enrollment in fall 2015.

Table 8. UMass Lowell Student Enrollment, Fall 2010 to Fall 2020

Headcount	Fall 2010 Actual[1]	Fall 2015 Projected[2]	Fall 2015 Actual[1]	Fall 2020 Projected[1]
Undergraduate	8,675	10,000	10,457	12,400
Graduate & Non-Degree Day	3,426	5,000	4,184	4,700
Total Day Headcount	**12,101**	**15,000**	**14,641**	**17,100**
Online & Continuing Ed	2,585	3,000	2,809	2,900
Total Headcount	**14,686**	**18,000**	**17,450**	**20,000**

(1) Data from *UMass Lowell 2020: 2016 Report Card*
(2) As projected in *2011-2016 SDP*

The number of faculty (shown in Table 9) also grew since the *2011-2016 SDP*. Full-time faculty members increased from 434 to 565 between fall 2010 and fall 2015. The University anticipates its total faculty (including full-time-equivalent of part-time faculty members) will reach 861 FTEs in the fall of 2020. This faculty growth is designed to maintain the desired faculty/student ratios as student enrollment increases.

Campus staffing is expected to grow only modestly with minimal or no expansion of the non-student facing administrative, research, and support staff. Academic and student services staffing may grow approximately proportionate with the growth in undergraduate enrollment. The total staff growth is projected to be less than 75 FTEs.

The University is committed to a program of renovating and "right-sizing" office space in existing buildings on campus according to established guidelines to absorb the bulk of this growth in existing buildings, limiting the need for new construction.

Table 9. UMass Lowell Faculty Members, Fall 2010 to Fall 2020

Headcount	Fall 2010 Actual[1]	Fall 2015 Actual[1]	Fall 2020 Projected[1]
Full-Time Faculty	434	565	661
Part-Time FTE	190	182	200
Total Faculty FTE	**624**	**747**	**861**
Percent Instruction Capacity by Adjuncts	30%	24%	23%
FTE Student: FTE Faculty Ratio	18:1	17:1	18:1

(1) Data from *UMass Lowell 2020: 2016 Report Card*

3.2.1 Student Residences

Since the *2011-2016 SDP*, UMass Lowell has transformed itself from a commuter-oriented campus to one with a significant student resident population. Between fall 2010 and fall 2015, UMass Lowell increased its campus housing inventory by a net of approximately 1,000 beds through new construction and long term leases with private developers. 41% of the fall 2015 undergraduate population lived in campus housing. The planned projects described in this document will allow the University to continue to house its students on campus at these rates through at least fall 2020.

As on-campus student housing increases, demand for supporting amenities for student life and recreation grows proportionately. The Aiken Street Recreation Fields project is an example of the University addressing such demand. In addition, the University will continue the renewal of older resident halls, upgrading and renovating them where possible, and removing those that are functionally obsolete, have significant deferred maintenance needs, and are exceedingly difficult to bring into compliance with modern building and accessibility codes. The Fox Hall Elevator Addition project is an example of the University's efforts to modernize and address code compliance and functional challenges in existing dormitory buildings.

Significantly, the growth in on-campus housing also reduces the University's impacts on parking and transportation infrastructure both on and off campus. Although both rates are declining, as will be discussed in more detail elsewhere in this report, undergraduate students living in on-campus housing bring vehicles to campus at a rate that is approximately half of the rate for undergraduate commuter students.

3.2.2 Research

Increasing research expenditures, shown in Table 10, signal a continual need for more specialized research space and supporting space for graduate students and research teams. This need is most evident in science and engineering disciplines, but also affects health and environment programs, as well as art and music, to lesser degrees.

While research space demand is unique to each discipline and is difficult to predict, the University actively tracks, models, and projects research space usage and demand on each campus. New buildings dedicated to research, such as the Saab ETIC, provides brand-new research space for cutting-edge research while other new buildings, such as the Pulichino Tong Business Center to which the Manning School of Business will relocate, frees up spaces in older buildings and in turn allows renovation, right-sizing, and, if necessary, conversion into research spaces. While these projects are logistically complex, the University makes use of close-fitting space programming to maximize space efficiency and alleviate the need for new construction. Renovation projects like the Perry Hall renewal will result in high-quality laboratory spaces suitable for contemporary research and increased space efficiency without increasing the campus's overall footprint.

Table 10. UMass Lowell Research Dollar Volume, Fall 2010 to Fall 2020

Expenditures	Fall 2010 Actual[1]	Fall 2015 Actual[1]	Fall 2020 Projected[1]
Total R&D Expenditures (millions)	$59.3	$70.4	$90
Total R&D Expenditures per Tenure Track Faculty Member	$162,145	$166,392	$175,000
Total Externally Funded Research (millions)	$32.7	$40.4	$50

(1) Data from *UMass Lowell 2020: 2016 Report Card*

3.2.3 On-Line Education

On-line education – including both online courses and blended in-class/online courses, has been a significant factor in UMass Lowell's academic growth, and expansion in course offerings are expected to continue, as shown in Table 11. While further expansion of on-line education may defer part of what would otherwise be new space demand on campus associated with growing enrollment, it cannot be assumed to reduce overall space needs. The University has incorporated on-line and continuing education into its model on space usage and demand.

Table 11. UMass Lowell Online Course Registration, Fall 2010 to Fall 2020

Enrollment	Fall 2010 Actual[1]	Fall 2015 Actual[1]	Fall 2020 Projected[1]
Online & Continuing Education Enrollment Headcount	2,585	2,809	2,900
Online Course Enrollments[2]	16,698	25,021	29,500

(1) Data from *UMass Lowell 2020: 2016 Report Card*
(2) The sum of the number of students enrolled in each online course at the given period.

3.3 THE PLANNING PROCESS

In contrast to the fixed master planning approach that many institutions employ, UMass Lowell has embraced a coordinated rolling master planning model. Anchored in the *UMass Lowell 2020* Strategic Plan, which outlines the academic vision for the University, this approach identifies the physical support and infrastructure necessary to achieve the University's strategic goals.

Components of this coordinated planning framework include a series of campus-level rolling master plans, system plans, topical and thematic plans, resource inventory and documentation, and capital financial and project plans. This approach ensures that planning activities and outcomes are responsive to changing conditions and aligned with reasonable time horizons to guide the University in making appropriate strategic investment decisions in furtherance of its core mission and functions. All of these efforts incorporate robust stakeholder engagement efforts, including outreach beyond the campus where actions under consideration may have or be perceived as having impacts on the University's neighbors or the City of Lowell.

The campus-level plans affirm the academic objectives of each of the colleges and derive space, infrastructure, and facilities improvements necessary to accommodate the successful implementation of those objectives. These plans typically employ a five-year and ten-year horizon and the University strives to update them at least every five years to ensure their alignment with evolving circumstances. Since the *2011-2016 SPD* was approved, UMass Lowell has completed

and updated academic campus sector plans for both the North and South Campuses, the findings of which are instrumental in defining the development program described in this SDP Update.

Topical and thematic plans delve more deeply into particular areas necessary to support the continued transformation of the campus. Examples include: definition of the facilities needs of the planned College of Pharmacy; an assessment of the needs of campus recreation programs; a study of improving pedestrian and bicycle accommodations along the Pawtucket Street corridor conducted in partnership with the City of Lowell and other neighborhood stakeholders; a campus-wide accessibility improvements plan; a *South Campus Landscape Master Plan* that incorporates thoughtful consideration of stormwater management; student housing demand modeling; and a study of the evolution of the campus libraries.

Resource inventory and documentation informs all planning work and enables data-driven decision-making. Notable among these exercises are documentation of deferred maintenance needs in all campus buildings, surveys of campus utility infrastructure, transportation and parking surveys, and instructional space utilization studies. These surveying and documentation efforts correspond with the University Facilities Informational System (FIS), as mentioned in Section 2.2.

3.4 NEW SPACE REQUIREMENTS

There is a continued need for growth of instructional and research space campus-wide. The key drivers of this space demand include:

- **Enrollment Growth –** With a growing reputation for high-quality education at an affordable price in contrast to increasingly cost-prohibitive private alternatives, UMass Lowell continues to see annual increases in applicants and has committed to a Strategic Plan to accommodate additional enrollment up to a total of 20,000 students by fall 2020, as detailed in Section 3.2.
- **Research Growth –** This is an essential component of a major university and a primary driver of many of UMass Lowell's sustaining contributions to the economic development of the Merrimack Valley and the Commonwealth. Modern research requires larger and more complex facilities, particularly in the Sciences and Engineering, which must be consistently renewed to support rapid advances in these fields.
- **Residential Campus –** As UMass Lowell has transitioned from a predominantly commuter school to a residential campus in recent years, student success has risen and many of its proportional impacts on traffic and parking demand have declined significantly. However, the University's on-campus space demands related to student housing and student life functions have increased.
- **Right-sizing & Addressing Obsolescence –** As the University strategically modernizes and responds to evolving standards for instructional and research space, many program areas require additional square footage to adequately accommodate new technology and other needs.
- **New Academic Programs –** UMass Lowell's ongoing success and growing reputation, as well as changes in public expectations for higher education, have stimulated demand for new academic programs. While the University strives to integrate these into existing

facilities and interdisciplinary academic communities, invariably new programs place additional pressures on space.

Recognizing the inherent costs and challenges in addressing all of the University's space demands through new construction, UMass Lowell has employed a number of fundamental strategies to minimize the need for new construction and its associated impacts. These include:

- **Centralization of Services –** A lingering legacy of the two separate colleges which merged to form the University was the duplication of functions on two campuses located less than a mile apart. With the Strategic Plan priority focus on forging a "one campus" identity, UMass Lowell has worked to consolidate administrative offices, general education, public safety, central services, student services, food and retail functions, information technology, maintenance and housekeeping, etc. into right-sized space, reducing their overall impact on campus facilities.
- **Relocation of Non-academic Functions** – In order to facilitate instructional and research growth within existing core academic buildings, UMass Lowell is strategically decanting administrative, service, and other non-academic uses to central facilities (if student-facing) and remote facilities (when not student-facing).
- **Repurposing Existing Facilities and Previously Developed Properties** – To minimize the environmental and financial costs associated with new construction, UMass Lowell employs a wide range of approaches to meeting space demands, including acquisition and adaptive reuse of existing buildings, redevelopment of vacated urban sites adjacent to the campus, and leases of private facilities.

3.4.1 North Campus

In 2014 and 2015, Payette helped UMass Lowell and the Commonwealth's Division of Capital Asset Management and Maintenance (DCAMM) to complete a thorough review of the existing and future space needs of the three North Campus colleges (the Kennedy College of Sciences, the Francis College of Engineering, and the Manning School of Business), as well as the services needed to support their visions and requirements for teaching and research activity. This study projected enrollment growth, modeled space programs, assessed the capacity of existing facilities to accommodate them, developed alternative scenarios to address space needs, and recommended solutions to accommodate research facilities, instructional labs and classrooms, faculty offices, and required support spaces.

Notable features of the recommended strategy, which is designed to maximize the utility of existing space and minimize the need for new construction, include:

- **Pulichino Tong Business Center –** Complete construction and relocate the Manning School of Business into the new building, allowing back-fill of offices and classrooms by other academic departments.
- **North Quad Pod Addition –** Complete construction of the infrastructure, accessibility, and code compliance Pods at the North Quad to enable efficient and cost effective renovation and use of the four-building complex.,

- **Perry Hall Renovation –** Comprehensive renovation of the building for interdisciplinary Engineering laboratory uses, including restoration and completion of the fire-damaged fourth floor.
- **Olsen Hall Renovation –** Build infrastructure for new core research facilities and renovate academic space within Olsen Hall, as either a renovation or modest addition, to support Life Sciences.
- **Centralized Services and Operations –** Relocate remaining non-academic functions which do not need to be in close proximity to teaching and research facilities, from the North Campus to the new Central Services and Facilities Operations Buildings on Middlesex Street, allowing academic expansion within existing buildings.
- **Specialized Space –** Strategically align uses with existing buildings' ability to support specific use. Reserve buildings with adequate infrastructure, ceiling heights, structural grid and systems, and or core research facilities for laboratory and other technically intensive uses. Assign office and classroom uses to buildings with less technical capacity.
- **Interdisciplinary Collaboration –** Support interdisciplinary cross-pollenization of ideas through the development of shared research facilities and the adjacent placement of collaborative academic departments.
- **Renovation Project Coordination –** Plan space re-assignments and capital project sequences to maximize opportunities for renovation of existing buildings in phases of at least a full floor at a time to achieve right-sized space allocations and efficient floor plans, while minimizing costs.
- **Enabling Projects –** Capitalize on code enabling projects like the North Quad Pod additions to maximize utility and capacity of existing buildings.
- **Current Trends for Learning Space –** Consistent with trends in higher education planning, incorporate common spaces, informal study areas, academic support, and service functions in renovated interior and exterior landscape spaces as applicable and appropriate.
- **Sustainable Buildings –** Address deferred maintenance and improve energy efficiency across building systems in conjunction with renovation projects to improve the comfort of occupants, reduce life-cycle costs, and enhance environmental sustainability.

3.4.2 South Campus

In 2012, consulting planners and architects from Perkins+Will completed the South Campus Sector Plan on behalf of DCAMM and UMass Lowell. In 2015, Sasaki was engaged to review and update this plan as part of the University's commitment to a rolling master planning process that is highly responsive to the ever-evolving circumstances of a rapidly growing research university. These two plans form the basis for a comprehensive strategy to document the academic visions, evaluate existing conditions, identify facilities needs, and recommend solutions to accommodate the requirements of teaching and research for the College of Health Sciences, College of Fine Arts, Humanities, and Social Sciences, and Graduate School of Education.

Notable features of the recommended strategy, which is similarly focused on maximizing the utility of existing space and minimizing the need for new construction, include:

- **Coburn Hall Renovation and Addition –** Enable significant additional utilization of Coburn Hall and accommodate academic objectives by addressing accessibility and code deficiencies and increasing program space through a renovation and addition project.
- **Health Science Core –** Support the College of Health Sciences' goal to concentrate teaching and research functions on South Campus in support of interdisciplinary work and efficiency of operation.
- **South Campus Mall –** Build on the newly-created South Campus Mall as an anchor for a traditional campus setting to support Humanities and Fine Arts programs, with continued investment in landscape enhancements to improve accessibility, stormwater management, and the overall character of the campus.
- **Education Core –** Provide the necessary facilities to enable the School of Education to restore additional undergraduate programs.
- **Student Life –** Continue to expand the resources available to support a dramatically increased South Campus residential population resulting from the opening of the Riverview Suites dormitory.
- **One Campus / One Community –** Reinforce the "one campus/one academic community" strategic priority by improving the connectivity between South Campus and the other UMass Lowell campuses.
- **Shared Resources –** Encourage the development and use of shared resources such as conference space, study and learning commons, and adjunct offices.
- **Code Compliance –** Resolve code deficiencies where it is appropriate and cost-effective to do so, in order to enable the maximum efficiency of existing buildings.
- **Centralized Services and Operations –** Relocate remaining non-academic functions which do not need to be in close proximity to teaching and research facilities, from the South Campus to the new Central Services and Facilities Operations Buildings on Middlesex Street, allowing academic expansion within existing buildings.
- **New Building Sites–** Reserve sites and plan for potential future addition of new buildings, including one at the intersection of Solomont Way and Broadway Street and another at the corner of Bachelder Street and Wilder Street.
- **Sustainable Buildings –** Address deferred maintenance and improve energy efficiency across building systems in conjunction with renovation projects to improve the comfort of occupants, reduce life-cycle costs, and enhance environmental sustainability.

3.4.3 East Campus

From its inception in the wake of the City of Lowell's urban renewal activities of the 1960s, East Campus has served as a center for student housing and activities. UMass Lowell intends to continue to invest in East Campus as the primary location to support its emergence as a residential university. East Campus also serves as the strongest geographic link between the University and Lowell's Downtown and the conduit for enabling resident students to have a positive impact on the cultural and economic vitality of the city.

Primary strategic priorities for East Campus include:

- **Student Life –** Reinforce the concentration of student housing and student activities so that resources for supporting academic success can be most effectively provided and a robust student life experience can be achieved.
- **Recreation –** Construction of new outdoor recreation resources at the 225 Aiken Street site.
- **Fox Hall Elevator Addition –** Add new elevators to Fox Hall to improve vertical circulation and meet code requirement in an 800-bed high-rise dormitory.
- **Student Housing –** Expand available on-campus student housing with minimal environmental impacts through strategic East Campus real estate acquisition.
- **University Crossing –** Support the growth of University Crossing as a gateway for the entire University and a hub of student life and service functions.
- **Wannalancit Business Center –** Continue to support academic growth on North and South Campuses by decanting non-academic administrative functions to the Wannalancit Business Center.
- **Campus Parking –** Meet and minimize campus parking demands and impacts using property already devoted to parking use through leases and acquisitions, as well as continued increases in the number of available on-campus residence hall beds to avoid construction of significant new parking lots or structures.
- **Sustainable Transportation –** Reduce vehicle trips by investments in improved pedestrian, bicycle, and transit connections between the residential East Campus and the academic campuses.
- **Sustainable Buildings –** Address deferred maintenance and improve energy efficiency across building systems in conjunction with renovation projects to improve the comfort of occupants, reduce life-cycle costs, and enhance environmental sustainability.

3.4.4 Renovated Interior Space

The University's approach to meet its space needs prioritizes renewal and re-use of existing facilities, wherever possible. The vast majority of capital projects anticipated on campus over the next five years involve work on existing buildings. The growth of the University population and the changes in space requirements over the years have meant that it is not possible to meet all space needs within existing structures, and some new construction is necessary. However, that construction, together with better use of existing space, allows re-assignment, renewal, and re-use of existing buildings. Planning is underway for this work, which seeks to address deferred maintenance, consolidation and expansion of departments and programs as needed, and assignment of activities to buildings which have the structure and services to appropriately support those activities.

3.5 CLIMATE ACTION PLAN

UMass Lowell's *2012 Climate Action Plan* (*CAP*) was incorporated into the *2011-2016 SDP*. Since then, the University has been aggressively implementing strategies highlighted in the *CAP* and, in turn, achieved the Phase 1 milestone and emission reduction goals set out in the *CAP* five years ahead of schedule despite continuously expanding both student enrollment and the physical campus. The *CAP* is attached in Appendix E of this SDP Update.

University's actions and activities related to the *CAP* over the past five years include:

- Incorporated the *CAP* into the *UMass Lowell 2020* Strategic Plan and organizing a Climate Action Plan Implementation Subcommittee to identify and execute GHG reduction projects and initiatives;
- Established a robust inventory of the University's GHG emission sources and a standardized accounting and reporting protocol of the GHG emissions;
- Adhered to the University's commitment to achieve at least LEED Silver Certification on all new buildings;
- Reduced approximately 9,550 MTCO2e/yr of GHG emissions through energy efficiency projects developed between FY2011 and FY2015;
- Implemented and expanded transportation demand management strategies and programs to reduce commute trips and driving between the three campuses;
- Deployed UPrint, a green initiative to reduce paper waste by eliminating unwanted and excess printing through a centralized printing software system, which had reduced 40% in printing annually, or 17 million pages per year;
- The University's Department of Facilities Management, Operations and Services worked closely with the University's Sustainability Office in regards to best practices and annual reporting for fertilization application and refrigerant release avoidance;
- Published climate action plan biennial interim reports for FY2013 and FY2015, both of which were submitted to Second Nature, the Boston-based non-profit that oversees the American College & University Presidents Climate Commitment (ACUPCC), of which UMass Lowell is one of its signatories. These reports are publicly accessible online on the Second Nature website[2], and the FY2015 Interim Report is attached in Appendix F of this SDP Update.

3.5.1 Greenhouse Gas Management

UMass Lowell follows the GHG Protocol of the World Business Council for Sustainable Development and the World Resources Institute to calculate GHG emissions and establish its *CAP* milestones and interim goals toward carbon neutrality. The GHG Protocol is the most widely used international GHG emission accounting tool and it provides organizations with a standard methodology to understand, quantify, and manage GHG emissions while facilitating fair

[2] http:/reporting.secondnature.org/search/?institution_name=lowell&commitment_type=%3F%3F&carnegie_class=%3F%3F&state_or_province=%3F%3F

comparisons and preventing double-counting and double-crediting. For accounting and reporting purposes, the GHG Protocol categorizes GHG emissions into three "scopes":

- Scope 1: GHG emissions from sources that are owned or controlled by the organization;
- Scope 2: GHG emissions resulting from the generation of electricity, heat, or steam purchased by the organization; and
- Scope 3: GHG emissions from sources not owned or directly controlled by the organization but related to its activities.

Accordingly, UMass Lowell groups its various sources of GHG emissions under the three scopes with corresponding performance measurement basis, as illustrated in Table 12.

Table 12. Components of GHG Emissions Scope at UMass Lowell

Scope	GHG Emission Source	Scope Performance Measurement Basis
Scope 1	• On-campus Stationary Sources • University Fleet Vehicles • Refrigerant Releases • Fertilizer Application	Gross Floor Area Based (MTCO2e/1000 SF)
Scope 2	• Purchased Electricity	Gross Floor Area Based (MTCO2e/1000 SF)
Scope 3	• Student Commuting • Faculty / Staff Commuting • University Financed (Business) Air Travel • Study Abroad Air Travel • Wastewater Treatment • Paper Purchasing • Electricity Transmission and Distribution	Student Population Based (MTCO2e/FTE Student(1))

(1) Full-Time-Equivalent student enrollment

Since Scope 1 and 2 share the same basis in performance measurement, the two scopes are combined in the University's GHG emissions reports and projections. Such is the case for the *CAP* Mitigation Phases and Milestones, as shown in Table 13.

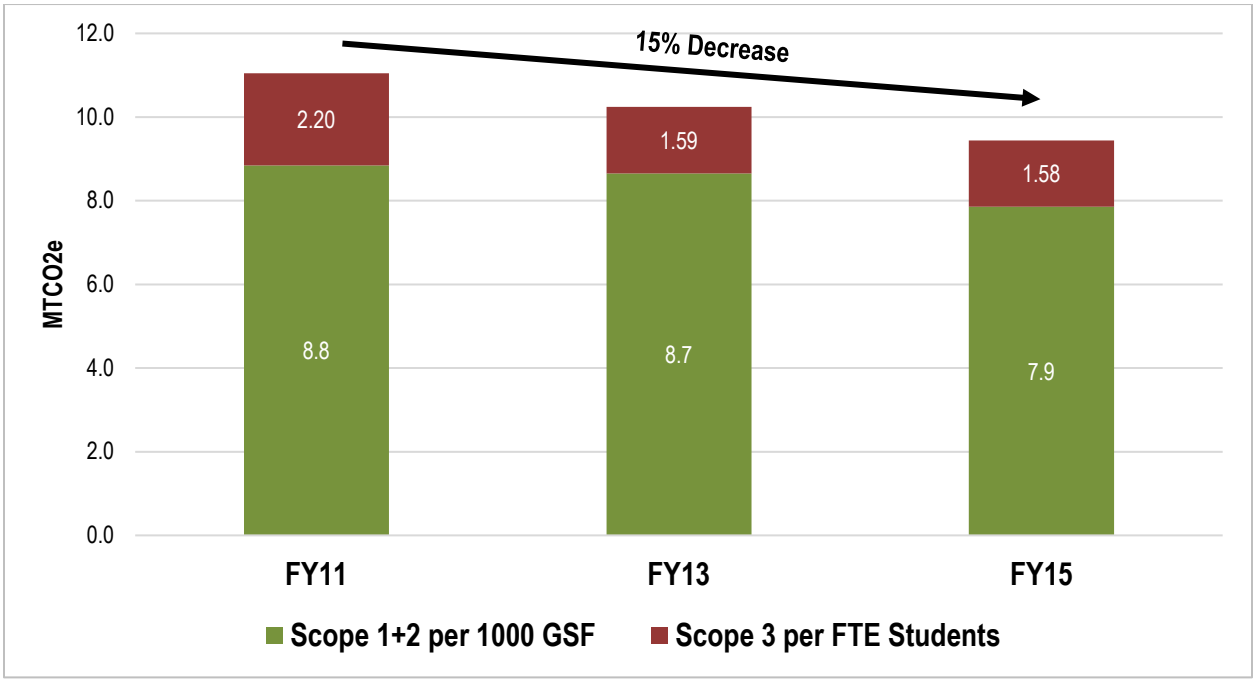
Table 13. FY2015 Emissions vs. Climate Action Plan Mitigation Phases & Milestones

Phase	Time Frame	Scope 1 + 2 Performance Standard (MTCO2e/ 1000SF)	Scope 3 Performance Standard (MTCO2e/ FTE Student)	Goal Net GHG Emissions (MTCO2e)	Milestone Status
FY2015 Emissions		7.85	1.58	54,086	--
Phase 1	**FY2020**	**8.0**	**1.90**	**60,565**	**Achieved**
Phase 2	FY2030	6.0	1.50	47,100	In Progress
Phase 3	2050	0	0.00	0	In Progress

The criteria for achieving each phase milestone, including the Goal Net GHG Emissions, are set out in the *CAP* in 2012, which uses a Business-As-Usual GHG emission projection as the baseline. The GHG emissions as measured under the scope performance measurement basis are known as normalized GHG emissions.

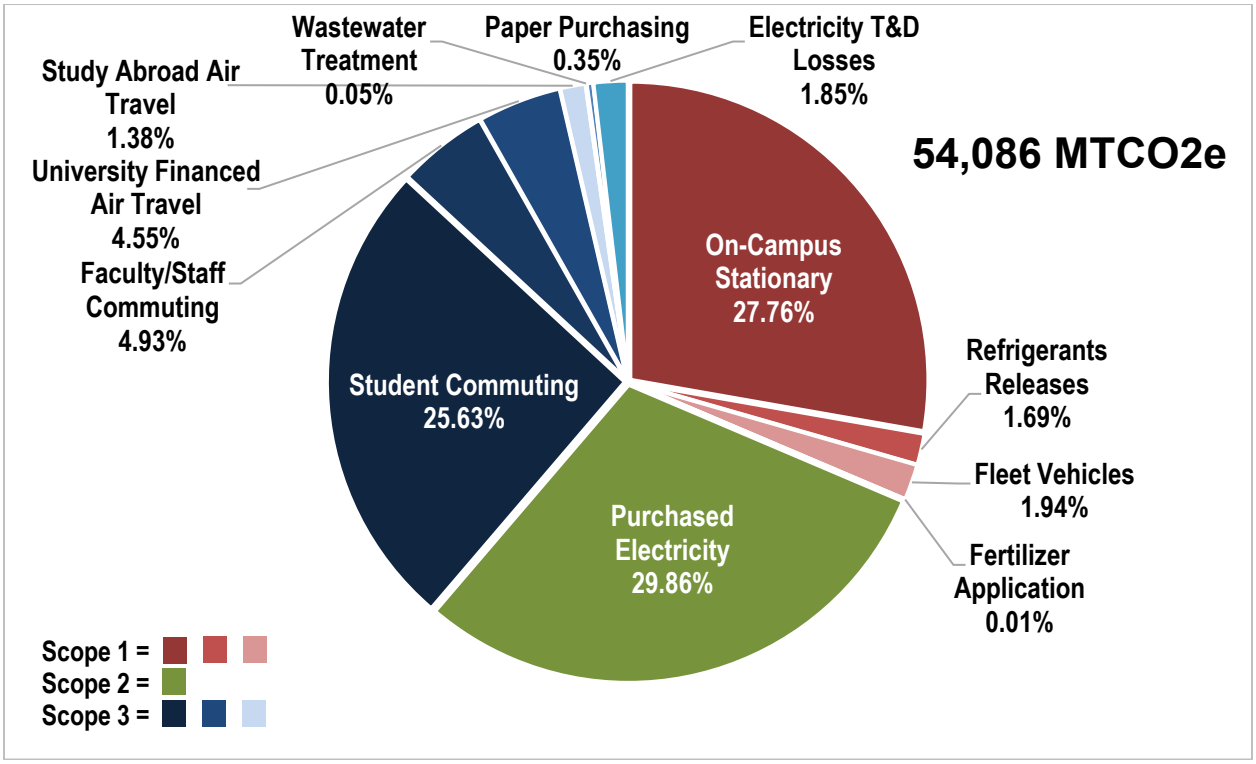
As noted, UMass Lowell achieved the Phase 1 milestone in FY2015, five years ahead of schedule. From FY2011 to FY2015, Scope 1+2 Performance improved from around 8.8 to 7.85 MTCO2e/1000 SF and Scope 3 Performance improved from 2.20 to 1.58 MTCO2e/FTE Student, showing the effects of the University's emission mitigating effort despite a 18% increase in FTE student enrollment and 24% in campus floor area.

Figure 28. UMass Lowell Normalized GHG Emissions, FY2011, FY2013, & FY2015



The downward trend in normalized GHG emissions was primarily driven by boiler conversion to burn natural gas instead of oil, implementation of comprehensive TDM strategy, and energy efficiency upgrades on buildings across the campus. To illustrate this, Figure 29 shows the breakdown of FY2015 GHG Emissions, as reported in the *UMass Lowell 2015 ACUPCC Climate Action Plan Interim Report* (attached in Appendix F).

Figure 29. UMass Lowell GHG Emissions by Emission Source, FY2015



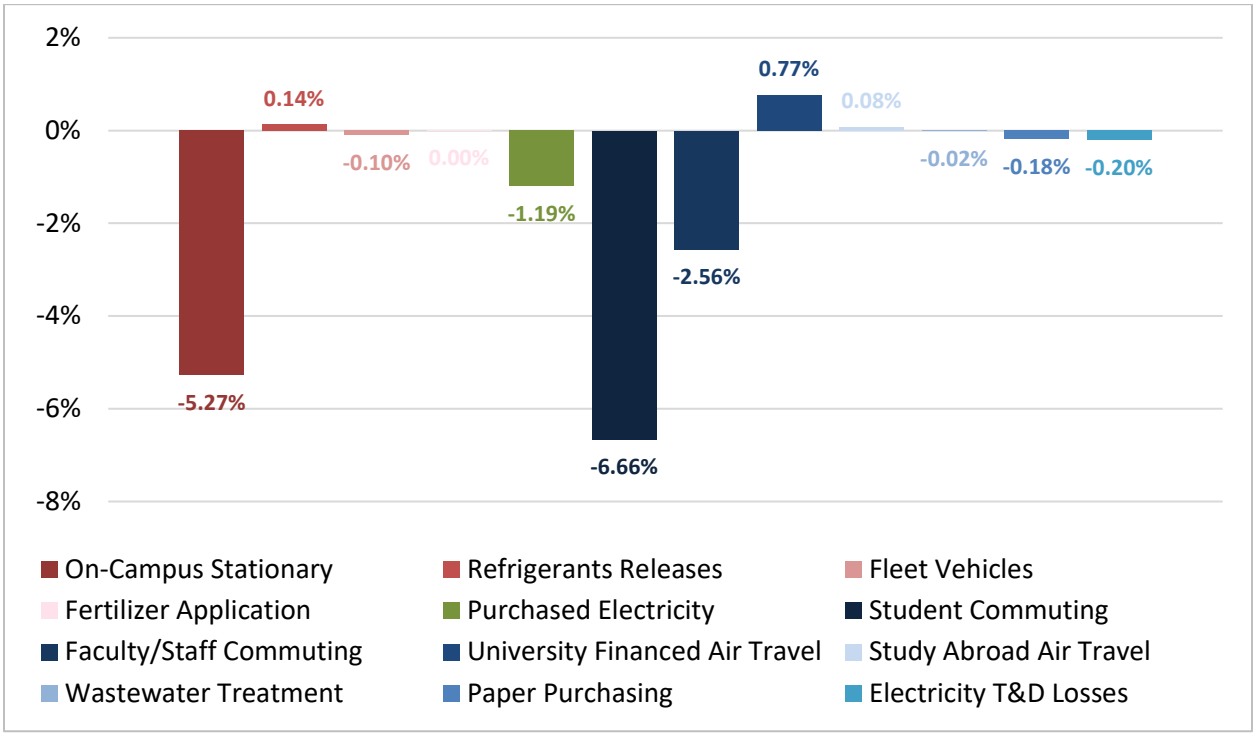
Scope 1: On-campus emissions (fuel for space heat, refrigerant losses, fertilizer application)
Scope 2: Off-campus emissions associated with production of purchased electricity
Scope 3: Off-campus emissions resulting from campus operations (commuting, wastewater treatment, air travel)

On-campus Stationary (mainly the gas- and oil-fired steam heating plants), Purchased Electricity, and Student Commuting made up a majority of the University's overall GHG emissions in FY2015. Ongoing boiler conversion from oil to gas, as discussed in Section 2.4.3, directly addresses the on-campus stationary category. Transportation demand management strategy does the same to both student and faculty commuting.

For Purchased Electricity, although the University has limited control or influence on the mixture of fuels used to generate electricity for the New England Region electrical grid system, the many energy efficiency upgrade projects that the University has undertaken reduce the GHG emissions in this category. Ongoing energy efficiency projects are detailed in Section 4.1.2.

Figure 30 shows the weighted percent change in Normalized GHG Emissions by emission source between FY2011 and FY2015. In other words, this figure breaks down the 15% decrease, by emission source, in normalized GHG emissions from FY2011 to FY2015, as noted in Figure 28.

Figure 30. Weighted Percent Change in Normalized GHG Emissions by Emission Source between FY2011 and FY2015



Each emission source is weighted by its contribution to the overall FY2015 GHG Emissions, as illustrated in Figure 29. Percentages add up to 15.19%.

Figure 30 also shows that the University's effort in mitigating emissions from on-campus stationary sources and student & faculty/staff commuting yields the largest contribution to the overall GHG emissions reduction. However, air travel and refrigerant releases had added GHG emissions. The University has noted these trends and incorporated adjustment in the strategies as it takes on the next phase of the Climate Action Plan. Section 5.9 will cover the University's strategy to limit environmental effects related to GHG Emissions for the next five years.

3.5.2 Green Building Design Standards

UMass Lowell, alongside the University of Massachusetts Building Authority (UMBA) and the Commonwealth's Division of Capital Asset Management and Maintenance (DCAMM) – other Commonwealth agencies that the University often partnered in funding and managing construction projects, are subject to the Governor's Executive Order 484, titled "Leading by Example – Clean Energy and Efficient Buildings."

This executive order requires all Commonwealth agency projects larger than 20,000 square feet to adhere to the "Massachusetts LEED Plus" standard for projects designed for public entity while projects smaller than 20,000 square feet have to at least meet minimum energy performance standards. Both the Massachusetts LEED Plus and minimum energy performance standards were established by the Commonwealth of Massachusetts Sustainable Design Roundtable.

The Massachusetts LEED Plus standard includes:

- Certification by the U.S. Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) program for all new construction and major renovation projects over 20,000 square feet;
- Energy Performance 20% better than the Massachusetts Energy Code;
- Independent 3rd party commissioning;
- Reduction of outdoor water consumption by 50% and indoor water consumption by 20% relative to standard baseline projections; and
- Conformance with at least 1 of 4 identified smart growth criteria:
    - Construct or renovate on a previously developed site, or
    - Construct or renovate on a brownfields site, or
    - Construct or renovate on a site with public transportation (train or bus) within one-half mile, or
    - Maintain 75% of existing building structure and envelope.

Projects smaller than 20,000 square feet shall meet at least one of the following:

- Adhere to the "Massachusetts LEED Plus" standard, or
- Surpass the Massachusetts Energy Code requirements by at least 20%, or
- Follow the prescriptive approach of the New Buildings Institute's Advanced Buildings Benchmark Tool, a flexible system of specific criteria for technologies and practices that provide unique paths to achieving energy-efficient buildings.

The USGBC's LEED program has four level of certification based on a point-based rating system: LEED Certified, LEED Silver, LEED Gold, and LEED Platinum. While the Executive Order does not specify the level of certification required, UMass Lowell has set LEED Silver as the minimum target for all new construction and major renovation projects greater than 20,000 SF. As such, new buildings and renovated spaces are designed to achieve a LEED Silver or higher certification. Projects smaller than 20,000 SF will be designed to at least meet the Massachusetts LEED Plus standard but not undergo the USGBC's LEED certification process.

LEED Building Construction Projects

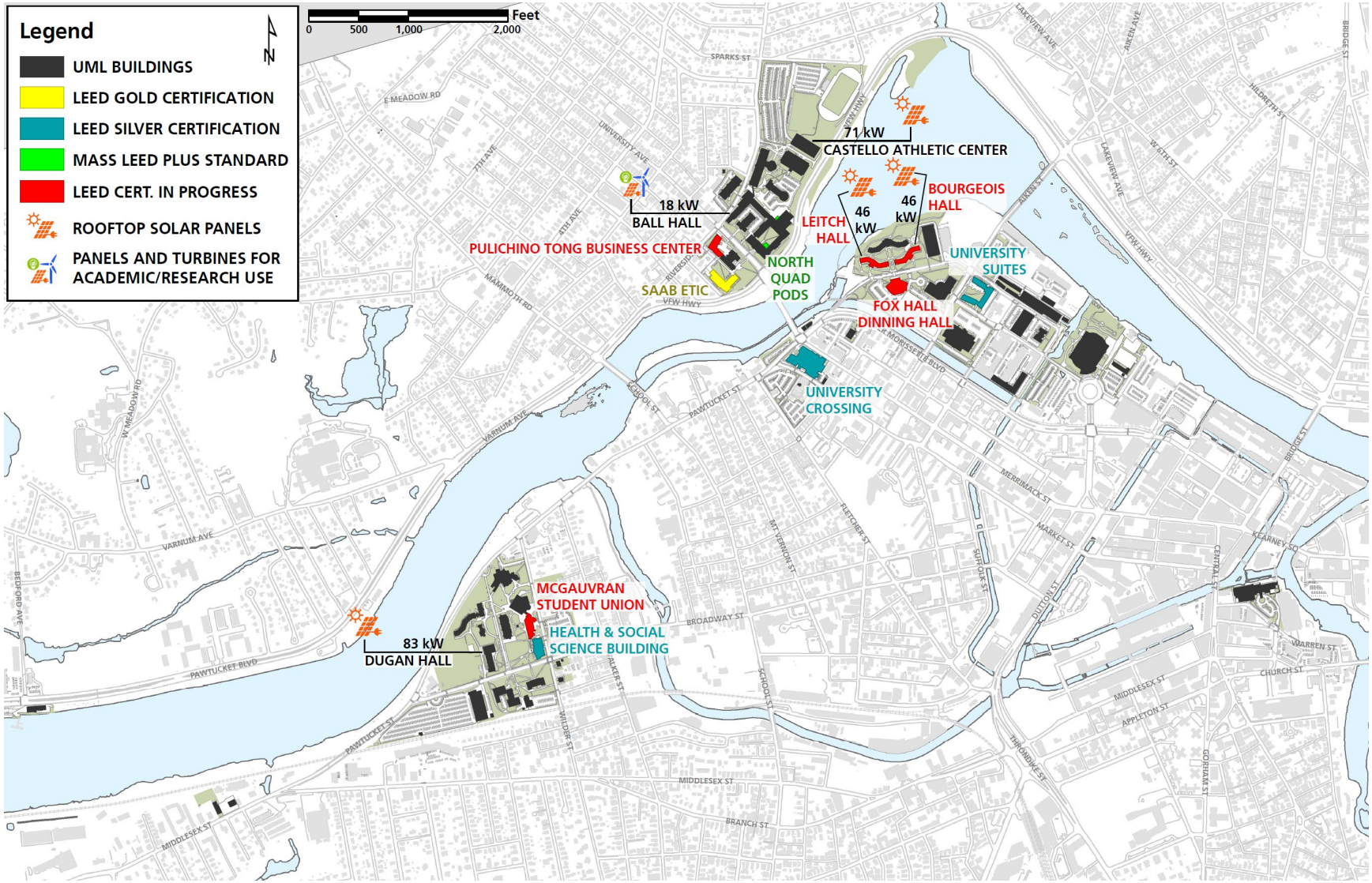
Since the adoption of this minimum building standard, the University has a growing list of LEED certified buildings:

- The **Mark and Elisa Emerging Technologies and Innovations Center (ETIC)** was certified LEED Gold.
- The **Health and Social Sciences Building (HSSB)** was certified LEED Silver.
- The **University Suites** residence hall was certified LEED Silver.,

- The **University Crossing** student center was certified LEED Silver. In addition, the Crossroads Café at University Crossing was recognized as a "3-Star Certified Green Restaurant" by the Green Restaurant Association in November 2016 for the sustainable features of the dining facilities and University Dining's commitment in sustainability.
- The **McGauvran Student Union** Repurposing Renovation (Dining Hall for South Campus) was completed in November 2015 and fully occupied in January 2016. The project includes installation of a natural gas high-efficiency heating and domestic hot water system, which replaced the steam-based heating system powered by the South Power (Steam Heating) Plant. The LEED certification is in progress and a minimum of LEED Silver certification is expected. In addition, the South Campus Dinning Commons at the McGauvran Student Union was also recognized as a "3-Star Certified Green Restaurant" by the Green Restaurant Association in July 2016.
- The **Pulichino Tong Business Center (PTB)** is in construction phase and is due to be occupied in January 2017, featuring high efficiency HVAC and LED lighting systems, a passive solar wall, and other sustainable building features. The building is expected to achieve a minimum of LEED Silver certification.
- The **Pod Addition to Coburn Hall**, an enabling project much like the North Quad Pod Addition Project, will upgrade the building's electrical and heating system, as well as addressing accessibility and code deficiencies. This project is expected to be completed in 2020 and will be designed according to the Massachusetts LEED Plus standard.

Besides these new construction projects, renovations at Bourgeois Hall, Leitch Hall, and Fox Dining Hall were designed to achieve LEED Silver certification and are also undergoing the certification process. Figure 31 shows the location of each LEED certified buildings on campus, along with the location and capacity rating of rooftop solar panels on University buildings.

Figure 31. UMass Lowell LEED Certified Building and Renewable Energy Facilities, 2016 Existing plus Perkins Properties



4. CHAPTER FOUR – CURRENT CAPITAL PROJECTS PLAN

Previous chapters have identified UMass Lowell's framework for physical evolution and responsive planning, as well as the scale of need for additional space. This chapter describes the major capital projects underway or proposed to address identified needs. These projects, together with the optimization of existing facilities, will make significant progress toward meeting the University's academic, research, and student life needs.

4.1 RECENT CAPITAL PROJECTS

4.1.1 2011-2016 UMass Lowell Capital Projects

The *2011-2016 Strategic Development Plan* identified eight major capital projects then anticipated. Since that document was published and approved, the following projects have been successfully completed as proposed:

- The **Mark and Elisa Saab Emerging Technologies and Innovation Center** opened on North Campus in fall 2012.
- The **North Campus Garage** opened in fall 2012.
- The **North Power Plant** was comprehensively updated for code compliance and greater efficiency and operational for the fall 2012 heating season.
- The **University Suites** residence hall opened on East Campus in fall 2013.
- The **Health and Social Sciences Building** opened on South Campus in fall 2013.
- The **South Campus Garage** opened in fall 2013.
- The **University Crossing** student center opened on East Campus in fall 2014.
- The **Pulichino Tong Business Center** is currently under construction and is expected to open in spring 2017 as the new North Campus home to the Manning School of Business.

4.1.2 UMass Lowell Energy Efficiency Projects

Many campus-funded energy efficiency projects have been completed, including:

- **North Power Plant Upgrade –** This project, described in detail in Section 2.4.3, consisted of providing two new dual-fuel highly-combustion-efficient fire-tube boilers, deaerator tank, feed water pumps, exhaust-gas-to-return-water economizers, and plant-wide steam master controls. The existing Boiler No. 3 was upgraded with a new burner front, combustion controls, and forced draft fan to improve efficiency.
- **Leitch and Bourgeois Residence Halls –** By the beginning of the fall of 2014, both residence halls had major renovations to the building automation systems, space heating, outside air ventilation, domestic hot water, and electrical and lighting systems incorporating building and energy code updates.,

- **North Campus Infrastructure Renewal Program –** Scheduled for completion by the end of 2016, this renewal program will add more green space to the campus and update the mechanical systems for several buildings. Renovations and new construction (two building pods adding about 10,000 square feet of additional space) in the North Campus Quad will be designed to the Mass LEED Plus standard.
- **Exterior LED upgrades –** Costello Athletic Center sidewall and overhangs; Tsongas Center grounds; South Campus Garage building roof, wall packs, parking lot, street, and post lights; North Campus Garage wall packs and walkways; and East Campus Garage Parking Area LED retrofit lighting.
- **Interior LED Lighting –** Falmouth Hall; Pasteur Hall; Kitson Hall; Mahoney Hall; Olsen Hall first floor and restrooms; Ball Hall mechanical rooms and Room 210; Cumnock Hall and Olney Hall stairwells and auditoriums; ICC LED lighting; Fox Hall stairwells; Campus Recreation Center weight room; Durgin Hall mechanical room and restrooms on floors 2-4; and O'Leary Library Room 222.
- **Lighting Controls** were added to Tsongas Center, North Campus field lighting, and Southwick Hall occupancy sensors.
- **Steam Piping and Steam Plant projects** include: Steam insulation jackets for North Power Plant; Vault and piping upgrades for both North and South Power Plants; EPA Maximum Available Control Technology permitting; North Power Plant flash tank and piping study and upgrade.
- **Steam Trap Maintenance** – Five Phases of the campus-wide Steam Trap Maintenance program were completed and these projects repaired or replaced all traps on campus. Regular steam trap maintenance is scheduled for the foreseeable future.
- **HVAC Efficiency Retro-commissioning Projects** was completed for Weed Hall; is under design for ETIC laboratory and clean rooms on all floors; and under construction for ICC first and second floor HVAC units.
- **Rink floor surface and refrigeration system at the Tsongas Center** was replaced by a sustainable (zero ODF and GHG factors in the refrigerant) glycol circulation system, consisted of highly efficient chillers, pumps, process logic controls, and cooling tower.
- **Renewable Energy Program** – Four buildings' roofs had new solar photovoltaic arrays installed, with a total generation capacity of 246 kW DC.
- **Virtual Net Metering Contracts** – Besides generating solar energy on-site, UMass Lowell maintains Virtual Net Metering Contracts with owners of independent renewable energy installations to guarantee the University's commitment in the promotion of renewable energy in the Commonwealth. These contracts are essential for the owners to secure financing for the development of their installations. In FY 2016, the University facilitated the development of five off-site solar power installations in the New England region, with a total generation capacity of 15.9 MW.
- **The EnerNOC Computerized Building Energy Intelligence System** was installed to meter thermal and electrical energy for many buildings on campus. This has been used as an aid to determine which buildings are efficient and which are in need of improvement. The system improves metering and verification of energy projects, as well as providing essential information for demand response during peak load hours.,

- **Building Automation System (BAS)** was installed among buildings across the three campuses between 2012 and 2013, which allowed 5-10% reduction in energy consumption. Working alongside the EnerNOC system, BAS also enable centrally-controlled demand response actions during peak load hours.

Recent internal energy projects, alongside the ongoing campus-wide Accelerated Energy Project and other energy efficiency projects, are summarized in Table 14, with their project cost and estimated energy savings.

Table 14. Recent and Ongoing Energy Efficiency Projects at UMass Lowell

Campus	Building	Project Status	Energy Efficiency Project Description	Total Cost of Project	Annual Energy Savings in Electricity (kWh / yr)	Annual Energy Savings in Natural Gas (therms / yr)	Annual Energy Savings in Fuel Oil (gallons / yr)	Total Cost Savings per year
All Campuses	University-wide	Planned	EnerNOC Demand Response Power Metering Splitters	$206,000				$20,000
All Campuses	University-wide	Completed	Cooling tower water metering installation	$61,000				$15,000[1]
All Campuses	University-wide	Completed	Steam trap maintenance phase 4 & 5	$50,000		40,000		$47,000
All Campuses	University-wide	Completed	Piping insulation improvement	$84,000		15,000		$20,000
All Campuses	University-wide	Ongoing	UMass Lowell Accelerated Energy Program (AEP)	$27,000,000	6,000,000	500,000		$1,404,000
East Campus	Bourgeois Hall & Leitch Hall	Completed	LEED building upgrade and certification[2]	n/a	n/a	n/a	n/a	n/a
East Campus	University Suites	Ongoing	Window switch climate control program	$136,000		18,000		$20,000
East Campus	Wannalancit Mills	Completed	Natural gas meter consolidation	$40,000				$12,000
ICC	ICC	Ongoing	Climate controls and HVAC variable air valve improvement for common areas, dining, banquet & conference areas	$379,000	500,000			$70,000
ICC	ICC	Ongoing	Execution of control modification and gas conversion for 5 roof top air handling units	$350,000	365,000			$45,000
ICC	ICC	Completed	Study on control modification and gas conversion for 5 roof top air handling units	$20,000				$0
North Campus	Costello Athletic Center	Completed	LED lighting upgrade in building rear and side	$20,000	10,000			$1,000
North Campus	Cumnock Hall	Completed	LED lighting upgrade	$6,000	16,000			$19,000
North Campus	North Power Plant	Completed	Boiler 1 & 2 EPA Max Available Control Technology (MACT) upgrade and certification	$6,000				$0
North Campus	North Power Plant	Completed	Insulation improvement	$30,000		9,000		$11,000
North Campus	North Campus, Olsen Hall, Pinanski Hall, Perry Hall North Maintenance Garage	Completed	LED lighting conversion for exterior light posts and wall pack	$20,000	20,000[1]			$3,000[1]
North Campus	North Quad Complex	Ongoing	North Quad Pods Addition infrastructure project[2]	$25,000,000	n/a	n/a	n/a	n/a
North Campus	Olney Hall	Completed	Basement SEM water reclamation and chiller efficiency upgrade	$100,000	100,000[1]			$10,000[1]
North Campus	Pulichino Tong Business Building	Ongoing	High efficiency HVAC, LED lighting systems, passive solar wall as part of the building design	$70,000,000	76,000	11,000		$24,000
North Campus	Saab ETIC	Completed	Boiler and HHW control improvement	$82,000		13,000		$15,000
North Campus	Saab ETIC	Completed	Study on efficiency and safety improvement for laboratory HAVC on 1st and 2nd floors	$10,000				$0
North Campus	Saab ETIC	Completed	Study on efficiency and safety improvement for laboratory HVAC on 3rd and 4th floors	$4,000				$0
North Campus	Saab ETIC	Completed	Study on efficiency and safety improvement for clean rooms HVAC through redesign and retro CXG	$10,000				$0
North Campus	Saab ETIC	Completed	Execution of efficiency and safety improvement for laboratory and clean room HVAC from 1st to 4th floors	$300,000	330,000	61,000		$140,000
North Campus	Southwick Hall	Completed	Occupancy sensors improvement	$14,000	16,000			$2,000
North & East Campus	Riverside Parking Lots & Fox Hall Parking Lot	Planned	Execution of replacement of 90-foot light tower with new LED light poles	$250,000				$2,000
North & East Campus	Riverside Parking Lots & Fox Hall Parking Lot	Planned	Study on replacement of 90-foot light tower with new LED light poles	$185,000				$0
North & South Campus	North Power Plant & South Power Plant	Completed	Execution of vault installation and repair - phase 1	$1,500,000				$0
Off Campus	n/a	Completed	Virtual net metering credit projects - 5 totaling 15.9 MW (FY 2015)	$0				$1,231,000
South & East Campus	South Campus, Wannalancit Mills, & Tsongas Center	Completed	LED lighting conversion for exterior light posts and wall pack	$170,000	180,000			$22,000
South Campus	HSSB	Completed	HVAC Monitoring Based Commissioning	$20,000	80,000[1]	10,000[1]		$20,000[1]
South Campus	McGauvran Student Center	Ongoing	LEED building upgrade and certification (showing savings over baseline building)	$34,000,000	143,000	29,000		$53,000
South Campus	Weed Hall	Ongoing	Study on retro commissioning of tab and controls	$40,000				$5,000
South Campus & University Crossing	University Crossing & Riverview Suites	Planned	EnerNOC computerized building energy intelligence system installation	$20,000				$0
University Crossing	University Crossing	Completed	LEED building upgrade and certification (showing savings over baseline building)	$97,000,000	490,000	5,000		$66,000
							AEP Savings (by FY 2017)	**$1,404,000**
							Total Savings from Other Projects in FY 2015:	**$1,873,000**

(1) Preliminary estimates
(2) Project estimates not currently available

4.1.3 2011-2016 Capital Projects by Others

In addition, several projects permitted and completed by others have directly benefited UMass Lowell, including:

- The **Howe Bridge** which carries University Avenue over the Merrimack River opened to traffic in 2013.
- Private developers constructed and master leased the residence hall building now known as **Riverview Suites to UMass Lowell**. The first phase opened in fall 2013 and the second phase opened in fall 2015.
- Private developers completed the renovation of **110 Canal Street** in the Hamilton Canal District and leased two floors to UMass Lowell to house its Innovation Hub, which opened in 2015.

4.2 CURRENT CAPITAL PROJECTS

4.2.1 North Campus

North Quad Pod Addition

Two "pod" additions to the North Quad are expected to open in fall 2016. The Pods will provide toilet rooms, vertical circulation, and utility infrastructure to address long-standing code deficiencies and improve the utility, accessibility, and comfort of the four North Quad buildings for users. The investment in the Pods will enable future renovations of the North Quad buildings – Southwick, Pasteur, Falmouth, and Kitson Halls without burdening smaller projects with major code compliance limitations. These future renovation projects will help the University absorb a significant amount of projected growth in the Science and Engineering Colleges through right-sizing and more efficient and appropriate allocations of office, classroom, and dry lab spaces in these buildings.

Southwick Courtyard

In conjunction with the North Quad Pod Addition project, the former parking lot in the Southwick Courtyard has been closed to traffic and is being used as a construction staging area. Upon completion of the Pods, the courtyard will be converted to a landscaped open space, increasing pervious green space on the North Campus and reducing traffic/pedestrian conflicts while creating an attractive outdoor gathering and study space for

students and faculty. The new courtyard will open during the 2016-17 academic year.

Perry Hall Engineering Building

The 48,000-square-foot facility was built in 1950 as a Paper and Textile Engineering Lab. Patchwork renovations over the years have left Perry Hall inconsistently useful, out of compliance, and unable to support the laboratory and academic needs of the contemporary College. These issues were magnified with a fire that has rendered the fourth floor unusable since May 2012.

This project, developed with DCAMM as part of the University's Science & Engineering Plan in 2010, calls for a LEED-certifiable, comprehensive upgrade to the building, restoration of the fourth floor and additions to complete the fourth floor. Work will increase the net usable square footage by more than 50% to meet the needs of the College, where enrollment has nearly doubled in the past five years to meet market demands. ADA and compliance with contemporary building codes, including providing an elevator for the four-story building, are also a significant part of the project scope and cost.

This building is both a key facility for the Francis College of Engineering, UMass Lowell's signature program, and a vehicle for implementing the Commonwealth's economic development strategy. It will house research and instructional laboratories and associated industry partnership facilities to support interdisciplinary programs in biomedical engineering, clean energy, environmental engineering, and other fields that are driving the innovation economy in Massachusetts.

When it reopens in 2018-19, the renovated Perry Hall will allow UMass Lowell to strengthen its role as a leading supplier of entrepreneurial research and workforce development for the industries where the Commonwealth needs to maintain its competitive advantage.

4.2.2 South Campus

South Campus Mall

As envisioned in the South Campus Sector Plan, the successful repurposing of McGauvran Hall into a new dining and marketplace building for South Campus allowed the former South Dining Building to be demolished in spring 2016. The removal of this inefficient and unattractive building opened a new landscaped quadrangle or mall at the heart of South Campus anchored by the historic Coburn Hall and O'Leary Library at its ends. The South Campus Mall provides the academic communities of the College of Fine Arts, Humanities, and Social Sciences, College of Health Sciences, and School of Education with a traditional campus green for assembly, study, recreation, and social engagement while increasing pervious landscaped

open space, addressing longstanding barriers to handicapped accessibility, and greatly enhancing the aesthetic appeal of the campus. Final landscaping is expected to be completed by fall 2016.

Central Services and Facilities Operations Buildings

In May 2016, the University purchased two vacant commercial buildings located on Middlesex Street approximately one and a half mile from South Campus. These buildings will be renovated and repurposed to house campus service and facilities functions, including Central Receiving, Print Services, Mail, Carpentry and Paint Shops, and the Grounds Maintenance Garage. When the new facilities open in spring 2017, the spaces on the North and South academic campuses currently occupied by these functions will be able to be repurposed to support expansion of teaching and research uses without new building construction.

4.2.3 East Campus

Perkins Properties

In July 2016, the University acquired the Perkins Properties, which includes more than four acres of land, 271,000 square feet of restored mill buildings, and a parking structure. This property will be repurposed to accommodate approximately 650 beds of student housing, addressing UMass Lowell's projected increase in housing demand without the impacts of new construction, while also continuing to house the University's Advancement Office. The acquisition also expands the campus's parking inventory without increasing the total number of spaces or overall vehicle trips in Downtown Lowell.

Part of the former Lawrence Mills complex, the Perkins Properties were formerly owned by the Commonwealth under the care and control of UMass Lowell. They were sold for private redevelopment in the early 2000s. The fully renovated buildings will now be returned to their former role as a core component of the University's East Campus.

To minimize and mitigate the impacts of this acquisition, the University is implementing a generous, flexible, and sensitive program to assist the apartment residents with relocation. Relocation is expected to be implemented over the 2016-17 academic year and full University occupancy will begin in fall 2017, following modest renovations in the summer.

Fox Hall Elevator Addition

Fox Hall, an 18-story high-rise, is the largest dormitory building owned by the University. This residence hall houses over 800 students but relies on undersized and unreliable elevators which were designed to handle a resident population of 420 students. The project will add two new full-size code-compliant passenger elevators and fully modernize the two existing passenger elevators. When completed in fall 2017, the project will significantly enhance the student experience in this building, increasing safety, convenience, and comfort for residents and visitors.

Aiken Street Recreation Fields

In December 2015, the University purchased the five-acre property located at 225 Aiken Street. Centrally located on the predominantly residential East Campus, this property will be redeveloped to support the rapid growth of outdoor recreation programs for students, including two full-size artificial turf multi-sport athletic fields. The fields, which will incorporate on-site sustainable stormwater management, will replace a 67,000 square-foot one-story late-1960s industrial warehouse building and over two acres of paved parking lots with virtually no drainage infrastructure. The project is expected to be completed in fall 2017.

Pawtucket Street Riverfront Park

In September 2015, the University purchased two existing tenement buildings on Pawtucket Street adjacent to the new Howe Bridge. The University acquired these properties with the intent to demolish the existing buildings and replace them with a riverfront park that overlooks and celebrates one of the more dramatic sections of the Merrimack River as well as the historic Northern Canal. The completed park will address significant accessibility and safety issues on the primary pedestrian route between the residential East Campus and the academic North Campus. Currently, 7,000 pedestrians are forced to walk on a narrow sidewalk between the three-story tenement buildings and one of the most congested intersections in Lowell up a steep grade that exceeds ADA maximums. The park project will relocate the pedestrian path away from traffic toward the canal and river overlook while also freeing space for installation of a bicycle lane that can reduce vehicle trips between campuses.

Historic officials have expressed concerns that the tenement buildings, which have most recently been used as private off-campus student apartments, are contributing structures an historic district. In response, the University has explored a number of alternatives to demolition with various partners but has been unable to identify a feasible option that preserves the buildings for any purpose while also achieving the project goals. As a result, the University hopes to collaborate with local and state historic officials to identify and implement appropriate and reasonable mitigation measures in conjunction with the project.

4.2.4 Accelerated Energy Program (AEP)

The Commonwealth of Massachusetts launched the Accelerated Energy Program (AEP) in 2012 with an ambitious goal of retrofitting over 700 Commonwealth facilities for energy efficiency improvement. As one of the largest participants in this program, UMass Lowell, with financing assistance from the Commonwealth, is investing a total of $27 million in a massive design-build contract to upgrade lighting, mechanical control systems, plumbing fixtures, HVAC equipment, building envelopes, and laboratory exhaust hoods, as well as the installation of a solar thermal domestic water heating system at the ICC and parking canopy solar photovoltaic panels at the South Campus Garage. The AEP, involving 32 campus buildings, 106 energy conversation measures, and over 6,700 pieces of equipment, is anticipated to be completed in late 2017. It will generate $1.2 million from annual energy savings and address over $10 million in deferred maintenance. It is estimated that the project will reduce annual campus utilities usage by 6 million kWh of electricity, 500,000 therms of gas, and 2.5 million gallons of water, while lessening the University's carbon footprint by approximately 5,070 MTCO2e/yr.

4.3 TWO-TO-FIVE-YEAR PROJECTS

4.3.1 Olsen/Life Sciences

The increasing depth in interdisciplinary work around the life sciences is a primary priority for the University's Science and Engineering disciplines, and a major source of the research and development which supports the regional innovation economy. The Olsen / Life Sciences project will provide the necessary specialty spaces and capabilities to further this work at UMass Lowell. Replacing and modernizing the technical facilities in a shared multidisciplinary center is the most cost effective and efficient way to ensure that the campus can remain competitive in these areas of study. A shared center further fosters increased cross-disciplinary innovation. Biology, Chemistry, Behavioral Psychology, Biophysics, Bioengineering, Pharmacy Sciences, and others are among the anticipated users of this resource.

Olsen Hall was built for Biology in 1974, and has not been significantly updated since. The obsolete and undersized facilities in this 134,000 square foot building are already limiting the research program and academic recruiting for both schools and negatively impacting the instructional experience for the over 7,500 students enrolled in classes in Olsen each academic year. Olsen is also burdened by a significant backlog of deferred maintenance obligations and code compliance challenges.

4.3.2 Coburn Hall

The restoration and modernization of Coburn Hall, the oldest academic building at UMass Lowell, is urgently needed to address severe accessibility and code compliance challenges and restore its status and functionality as the signature teaching facility for the College of Fine Arts, Humanities, and Social Sciences and the School of Education.

The historic 60,000-square-foot facility opened in 1897 as the Lowell Normal School. Originally home to science laboratories, art studios, a gymnasium, and auditorium, as well as general purpose classrooms and offices, periodic renovations have removed most of the equipment and fixtures from the specialty facilities. This work has not addressed inefficient use of space nor included upgrades to accessibility, toilet rooms, basic building infrastructure, fire and life safety systems, or energy conservation. The lack of attention to these areas has left a highly inefficient building without a single room that is accessible under the provisions of the Americans with Disabilities Act and the regulations of the Architectural Access Board. As a result, the burden of addressing the severe code compliance challenges renders incremental modernization of portions of the building infeasible.

This project, developed with DCAMM as part of the University's 2012 South Campus Sector Plan, calls for the construction of an addition to the rear of the building which would include additional academic space needed to accommodate growth of the South Campus's programs, as well as an elevator to service the four-story structure, toilet rooms on all levels, and core infrastructure. This will enable comprehensive renovation and modernization of the existing building to maximize efficiency of space utilization and reduce the need for new construction.

4.3.3 New Residence Hall

Although it is not expected to be completed before 2021, UMass Lowell anticipates beginning planning and design for an additional traditional dormitory building to be constructed on South Campus. This building will allow the campus to continue to house nearly half of its undergraduate students on campus even as enrollment continues to increase. It is expected to address expanded demand for more affordable traditional dormitory-style housing to complement the sufficient numbers of suite-style and apartment-style residence hall beds available both on campus and off campus.

4.4 TRANSPORTATION INFRASTRUCTURE IMPROVEMENTS

The *2011-2016 SDP* references the UMass Lowell *Campus Transportation Plan* (*CTP*) that the transportation consulting firm Vanasse Hangen Brustlin completed in December 2011, which identified a number of physical deficiencies in transportation infrastructure around UMass Lowell, particularly impacting to bicycling and walking experience. Since then, the University has worked with municipal, state, and federal partners in ongoing collaborative efforts to make infrastructure improvements recommended in this plan. Current initiatives are detailed below.

4.4.1 Lowell Canal Bridges

Lowell, Massachusetts is known as the "Birthplace of the American Industrial Revolution" and was designated in the late 1970s as the first urban National Park to celebrate the country's industrial heritage. Chief among Lowell's significant historic resources is an unparalleled intact 5.6-mile network of power canals. One of the unusual legacies of this otherwise celebrated heritage is that eight canal bridges on and near the UMass Lowell campuses remain in private ownership. Seven of the bridges are currently in various states of disrepair or deterioration, necessitating weight restrictions that adversely impact public safety, commerce, economic development, traffic congestion, and transportation efficiency in the City to a significant degree. Buses, fire trucks, and commercial vehicles are prohibited from crossing some or all of these spans and therefore must use cumbersome and circuitous alternate routes.

UMass Lowell assisted the City of Lowell in obtaining a $13.4 million TIGER grant from the U.S. DOT to replace or repair all of these bridges. The project is currently in design and, upon

completion of construction in 2020, it will greatly improve intercampus travel and reduce the associated environmental impacts.

- By eliminating weight restrictions on the bridges between South and East Campus, campus transit will become more efficient, direct, and convenient, increasing ridership and reducing emissions.
- Removing sidewalk closures and other barriers will greatly enhance safety, convenience, and comfort for pedestrian travelling between campuses and will likely increase the proportion and volume of intercampus trips conducted on foot as opposed to in vehicles.
- Introducing new bicycle accommodations on the bridges will improve bicycling infrastructure and safety, facilitating expansion of the share of intercampus travel conducted on bicycles.

For more detailed information on this project, visit www.lowellbridges.com.

Figure 32 and Table 15 on the following pages illustrate the locations, types of projects involved, and funding sources of the bridges, alongside with that of other major infrastructure improvements to enhance bicycling, walking, driving, and public transit access in the vicinity of UMass Lowell.

Figure 32. Priority Infrastructure Roadway Improvements in the Vicinity of UMass Lowell, FY2016

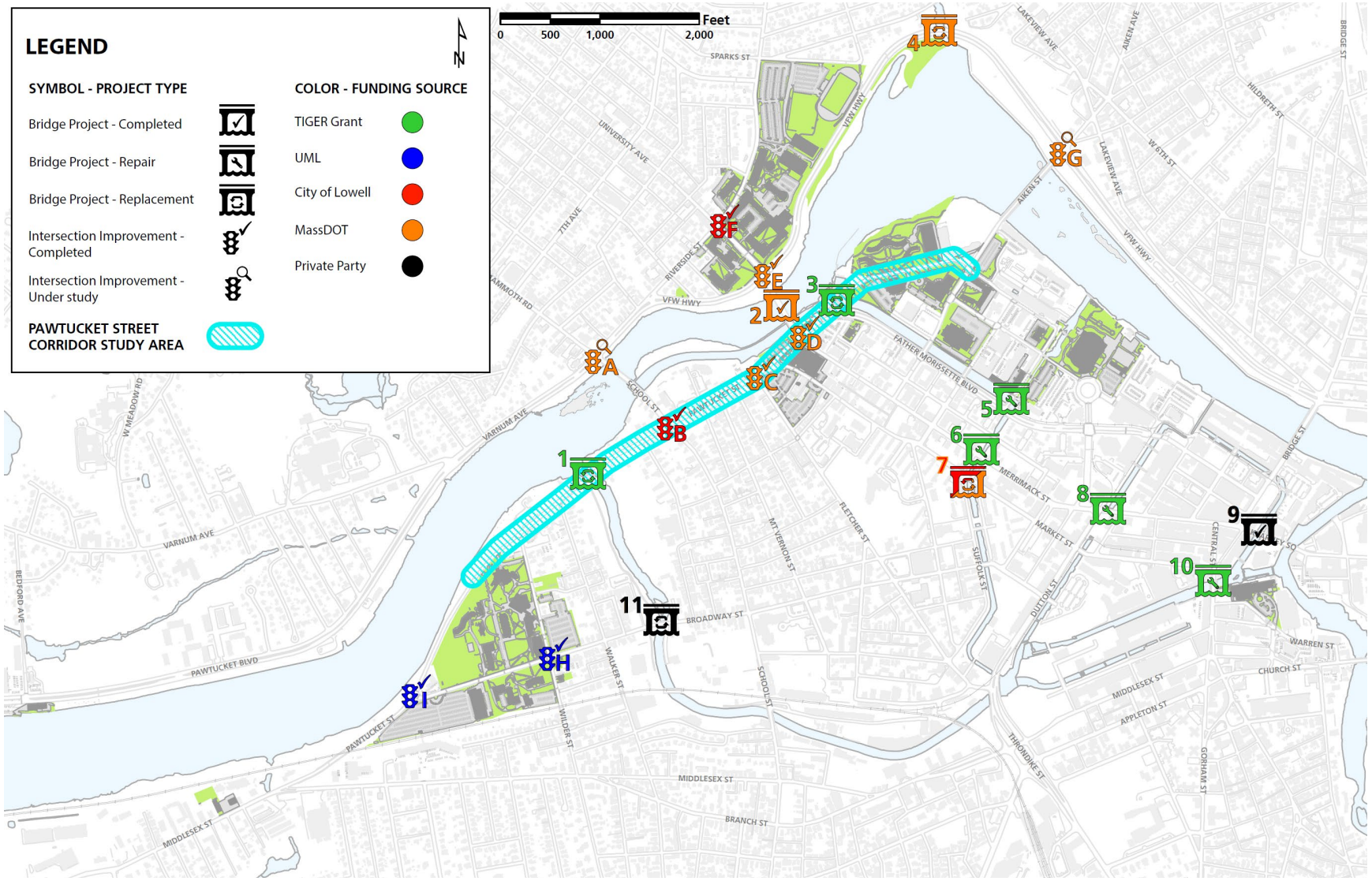


Table 15. Priority Infrastructure Roadway Improvements in the Vicinity of UMass Lowell, FY2016

#	Project Name	Project Type	Funding Source
Bridge Projects			
1	Pawtucket St. over Pawtucket Canal	Bridge Replacement	TIGER Grant
2	University Ave. over Merrimack River	New Bridge (Completed)	MassDOT
3	Pawtucket St. over Northern Canal	Bridge Replacement	TIGER Grant
4	VFW Hwy. over Beaver Brook	Bridge Replacement	MassDOT
5	Suffolk St. over Northern Canal	Bridge Repair	TIGER Grant
6	Merrimack St. over Western Canal	Bridge Repair	TIGER Grant
7	Market St. over Western Canal	Bridge Replacement	City of Lowell / MassDOT
8	Merrimack St. over Merrimack Canal	Bridge Repair	TIGER Grant
9	Kearney Sq. over Eastern Canal	Bridge Replacement (Completed)	Private bridge owner
10	Central St. over Lower Pawtucket Canal	Bridge Repair	TIGER Grant
11	Broadway St. over Pawtucket Canal	Bridge Replacement	Private bridge owner
Intersection Improvement Projects			
A	Varnum Ave. / Riverside St. at Mammoth Rd.	Intersection Improvement Study	MassDOT
B	Pawtucket St. at Mammoth Rd.	Intersection Improvement (Completed)	City of Lowell
C	Pawtucket St. at Fletcher St.	Intersection Improvement (Completed)	MassDOT
D	Pawtucket St. at Merrimack St.	Intersection Improvement (Completed)	MassDOT
E	VFW Hwy. at University Ave.	Intersection Improvement (Completed)	MassDOT
F	University Ave. at Riverside St.	Intersection Improvement (Completed)	City of Lowell
G	VFW Hwy. at Aiken St.	Intersection Improvement Study	MassDOT
H	Broadway St. at Wilder St.	Intersection Improvement (Completed)	UMass Lowell
I	Pawtucket St. at Broadway St.	Intersection Improvement (Completed)	UMass Lowell
Pawtucket Street Corridor Study			
	Pawtucket Street Corridor from East Campus to South Campus	Bike and Pedestrian Improvement Study	UMass Lowell / City of Lowell

4.5 UMASS LOWELL IN 2021

UMass Lowell in 2021 will be a university that is distinctive in its approaches to curriculum, pedagogy, and extracurricular experiences. Undergraduate and graduate students who achieve a UMass Lowell degree will be able to contribute to the world's complex business, community, and cultural challenges because of the quality of their education. Differentiators of the UMass Lowell student experience will be widespread cross-disciplinary learning experiences, intensive involvement in research labs, co-op, and other applied learning opportunities. Notably, UMass Lowell students will continue to uphold the reputation of today's alumni as being tenacious, innovative, hardworking, and well-prepared individuals ready to contribute to their professions, communities, and families.

UMass Lowell graduate and research programs will be strengthened in quality and quantity, and new programs will be developed, including distinctive doctoral programs that are interdisciplinary. UMass Lowell will have continued the current upward arc of research and scholarship, including creative work. There will be greater external funding from all sources and the University will have strengthened collaboration with other UMass campuses and with industry. The University will also enhance the quality and experience of graduate and undergraduate students through their participation in research projects.

Globalization has made the world a small place and the need to succeed in that world has become critical. Future UMass Lowell alumni will be globally competent through meaningful and substantive international learning experiences, including traditional study abroad and experiential learning.

Strengthened engagement with industry and businesses, nonprofit organizations, K-12 schools, and municipalities will be an even more central component to academic and scholarly activity on campus. These efforts will enrich the intellectual, personal, and cultural development of students as well as foster economic development in the region and the state. UMass Lowell will become an example for how fine public universities can maximize the use of precious resources it receives from the state, its students, and supporters and give back to its community.

UMass Lowell will become even more well-known for its entrepreneurial approach to management and will include efficient and effective budgetary, technical, and facilities infrastructure. A sustainable financial plan that maps out strategies for controlling costs while increasing revenue will support well-maintained facilities, including a robust and reliable information technology infrastructure and a secure and environmentally friendly campus.

Finally, the University will improve its rankings and will be nationally and internationally recognized for its academic and research excellence. UMass Lowell will be known as a comprehensive university that has strength in science and engineering, as well as in the arts, social sciences, business, health, and education.

This vision will be supported by a campus that continues to develop, guided by the principles and plans outlined in Chapter 3. The following sections more fully describe the physical conditions of the campuses anticipated in 2021.

4.5.1 North Campus

The 2017 opening of the Pulichino Tong Business Center as the new home for the Manning School of Business will anchor the northern end of the University's North Campus Innovation District. Improvements to Lydon Library and Alumni Hall to support student experience and a new plaza flanked by these buildings will complement the research activities in the Saab Emerging Technology and Innovation Center to form a cohesive interdisciplinary hub of student engagement and academic entrepreneurship. Food service offerings on North Campus will be enhanced on both sides of University Avenue to complement and support the Innovation District.

The renovated Perry Hall will serve as the centerpiece to the Francis College of Engineering and will be complemented by enhanced and improved laboratories, offices, and teaching spaces in the North Quad, Grounds Maintenance Garage, and Ball Hall. Enhanced landscaping and reconfigured parking and access around Perry and Cumnock Halls will strengthen the identity, safety, and cohesion to the Engineering College campus.

Inside the historic North Quad complex, the Southwick Courtyard will be a welcoming greenspace after its conversion from surface parking to landscaped open space. With the business school relocated, the School of Engineering and Kennedy College of Sciences will share revamped office and research spaces in these buildings, with departments strategically located for interdisciplinary collaboration. These efforts will be complemented by renovations and improvements to research, teaching, and academic offices in Olsen, Olney, Pinanski, and Ball Halls.

Further north, pedestrian, delivery vehicle, and parking access will be enhanced at the redesigned Pinanski-Costello Parking Lot. Continual landscaping improvement will take place around the Cushing Field Complex to enhance pedestrian access and recreational spaces. The indoor and outdoor Athletics facilities will be enhanced to meet the expectations associated with NCAA Division I athletics.

4.5.2 South Campus

The new South Campus Mall will serve as an iconic campus green and central quadrangle for the South Campus, strengthening its identity as home to the College of Humanities, Fine Arts, and Social Sciences, and the College of Health Sciences. Continued enhancement of the South Campus landscape will complement the centerpiece Mall.

The renovated and revitalized Coburn Hall will anchor the southern end of the Mall in celebration of the campus's historic roots in the Liberal Arts and Education. Also embracing the South Campus Mall, McGauvran Student Union and O'Leary Library will be the activity hub for South Campus, where students can socialize, dine, and study between classes.

South Campus will continue to serve as a residential campus, particularly for students enrolled in the Health Sciences, Fine Arts, Humanities, and Social Sciences, as well as emerging undergraduate programs in Education. Renovations and improvements to offices, teaching, and research spaces, particularly in Weed, Dugan, O'Leary, and Durgin Halls, will support the academic vitality of the South Campus Colleges.

Further west, the new Central Services and Facilities Operations Buildings on Middlesex Street will house consolidated shops, storage spaces, and garages for the University's Facilities

Management and campus support services, enabling the spaces vacated by these functions on North and South Campuses to accommodate academic growth.

4.5.3 East Campus

East Campus will expand on its role as the center for student life on campus. With the acquisition and occupancy of the Perkins Properties, East Campus will be home to nearly 3,000 students in residence halls, the largest dining facility on campus, an enhanced Campus Recreation Center, and the University's largest athletics and events venues. The new Aiken Street Recreation Fields will serve as a gateway and central green for the East Campus.

At the intersection of Pawtucket Street and University Avenue, University Crossing will continue function as a central gateway and activity hub for students across the three campuses, symbolically and literally supporting the University's "One Campus" vision. In addition to housing student clubs and organizations, student-centered administrative functions, and the senior leadership of the campus, University Crossing serves as a multi-modal transportation center for the University.

The Wannalancit Business Center will continue to be renovated to support expanded use and occupancy by the University's administrative functions, freeing space on the North and South campuses to support the growth of academic departments.

4.5.4 Off Campus

In support of its entrepreneurial and economic and community development mission, UMass Lowell maintains several off-campus facilities, generally in leased and partnership spaces. These include industry partnerships, business incubation centers, community research centers, and a new satellite campus in leased space in Haverhill, MA.

The University selectively responds to opportunities to expand its campus through strategic real estate acquisitions, particularly of blighted or underutilized properties in close proximity to its existing campuses.

4.5.5 Land Use in 2021

The figures and tables in this section illustrate the major projects planned for the next five years, as well as the anticipated 2021 campus land use conditions which will emerge following the successful completion of these projects.

Figure 33. Projected North Campus Building Use, 2021

NORTH CAMPUS *(18 buildings)*

Existing Buildings

#	Building Name	Year Built
1	Alumni Hall	1950
2	Ball Hall	1958
3	Costello Athletic Center	1967
4	Cumnock Hall	1954
5	Falmouth Hall	1907
6	Kitson Hall	1902
7	Lydon Library	1969
8	North Campus Garage	2012
9	North Power Plant	1910
10	Olney Hall	1974
11	Pinanski Hall	1968
12	Saab Emerging Technologies & Innovation Center (ETIC)	2012
13	Southwick Hall	1902

New Building

#	Building Name	Expected
14	Pulichino Tong Business Center (PTB)	2017

Major Renovation Projects

#	Building Name
15	Grounds Maintenance Garage
16	Olsen Hall
17	Pasteur Hall
18	Perry Hall

Exterior Spaces

#	Exterior Space Name
A	Cumnock Lawn
B	Cushing Field Complex
C	Pinanski Quad
D	Riverside Parking Lot
E	Saab ETIC Quad
F	Saab ETIC Riverview Terrace

New Exterior Space

#	Exterior Space Name
G	North Quad / Southwick Courtyard

Figure 34. Projected South Campus Building Use, 2021

SOUTH CAMPUS *(17 buildings)*

Existing Buildings

#	Building Name	Year Built
1	150 Wilder St.	1905
2	820 Broadway St.	1890
3	Allen House	1854
4	Concordia Hall	1966
5	Dugan Hall	1962
6	Durgin Hall	1976
7	Health & Social Sciences Building (HSSB)	2013
8	Mahoney Hall	1960
9	McGauvran Student Union	1974
10	O'Leary Library	1974
11	Sheehy Hall	1989
12	South Campus Garage	2013
13	South Power Plant	1966
14	Weed Hall	1972
15	1485 Middlesex St.	1969
16	1499 Middlesex St.	1977

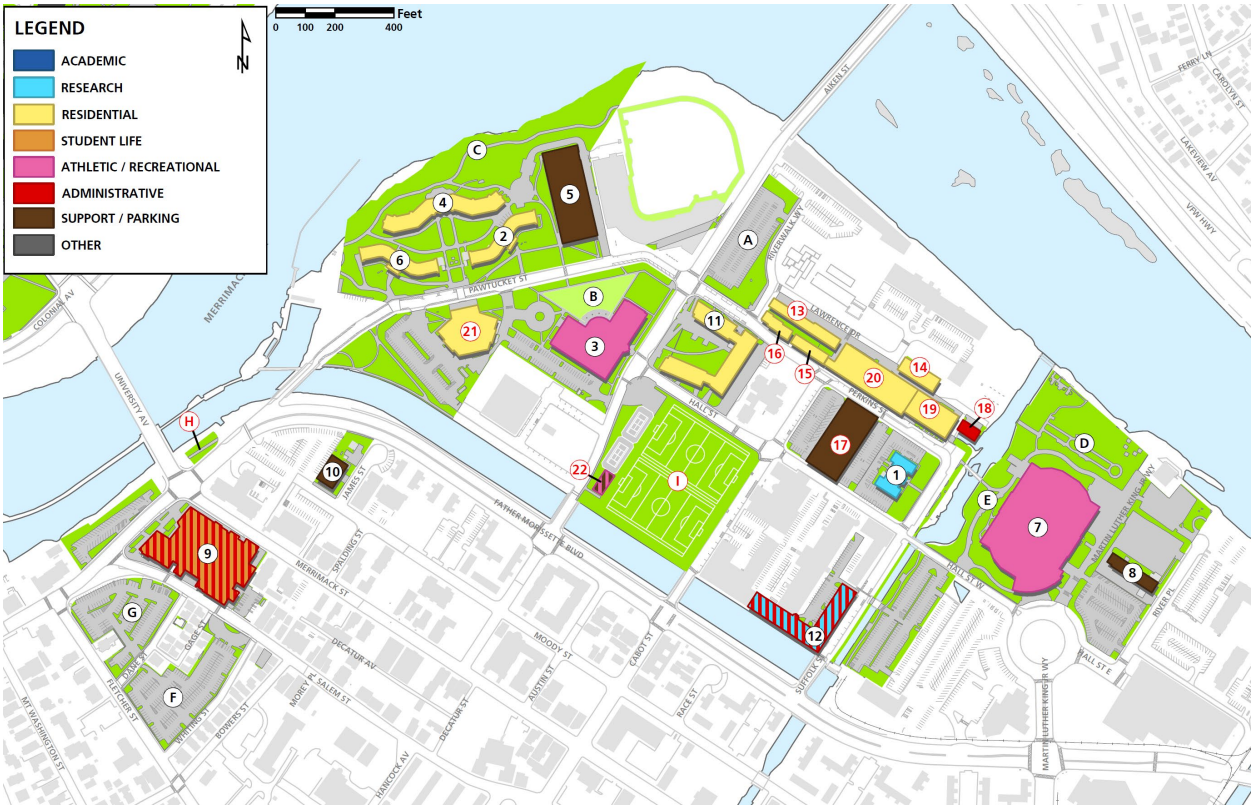
Renovation & Addition Project

#	Building Name
17	Coburn Hall

Exterior Spaces

#	Exterior Space Name
A	Broadway Riverview Lot
B	Riverview Field
C	South Campus Quad & Mall
D	Wilder Staff Lot

Figure 35. Projected East Campus Building Use, 2021



EAST CAMPUS *(22 buildings)*

Existing Buildings

#	Building Name	Year Built
1	Ames Textile	1968
2	Bourgeois Hall	1967
3	Campus Recreation Center (CRC)	2001
4	Donahue Hall	1989
5	East Campus Garage	2007
6	Leitch Hall	1967
7	Tsongas Center	1997
8	Tsongas Garage	1968
9	University Crossing	1959
10	8 James St. / UC Building 6	c.1985
11	University Suites	2013
12	Wannalancit Mills	1862

Property Acquisitions

#	Building Name	Year Built
13	5-21 Lawrence Dr.	1880
14	45 Lawrence Dr.	1880
15	61 Perkins St.	2013
16	77 Perkins St.	2013
17	Hall Street Garage	2009
18	Hoff Alumni Center	1900
19	Hub Hosiery Building	1909
20	McQuade Building	1834

Addition Project

#	Building Name
21	Fox Hall - Elevator

New Building

#	Building Name
22	Aiken Fields Support Building

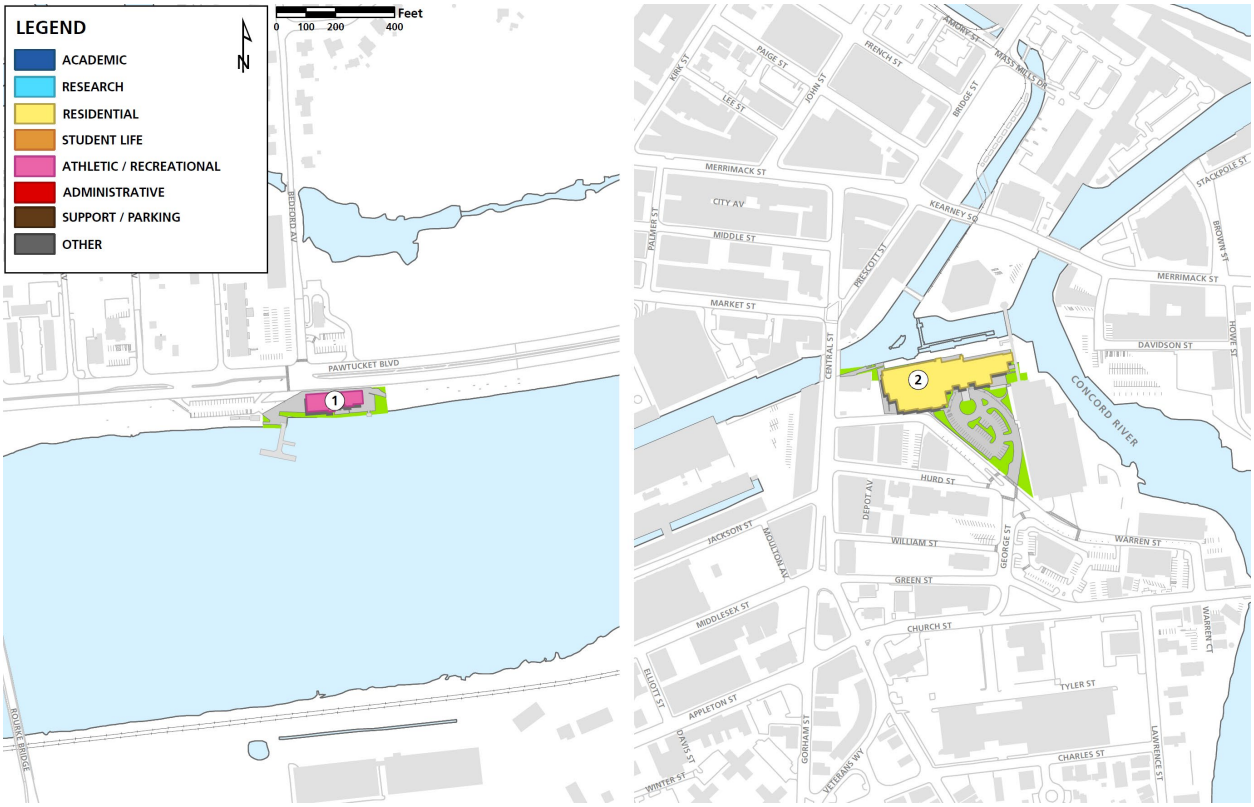
Exterior Spaces

#	Exterior Space Name
A	Perkins Lot
B	Rec Center Quad
C	Riverwalk (City of Lowell)
D	Tsongas North Lawn
E	Tsongas West Lawn
F	Fletcher Lot
G	Salem Lot

New Exterior Space

#	Exterior Space Name
H	Pawtucket Street Riverfront Park
I	Aiken Street Recreation Fields

Figure 36. Projected ICC and Boathouse Building Use, 2021



INN AND CONFERENCE CENTER & BELLEGARDE BOATHOUSE *(2 buildings)*

Existing Buildings

#	Building Name	Year Built
1	UMass Lowell Bellegarde Boathouse	1984
2	UMass Lowell Inn & Conference Center (ICC)	1984

Table 16. Existing Building Use at UMass Lowell, 2016

Building Use	North Campus	South Campus[2]	East Campus[3]	UMass Lowell Total
Academic	350,524	242,663	17,724	**637,816**
Research	160,732	5,348	35,420	**175,097**
Residential	0	65,413	373,353	**438,766**
Student Life	38,787	47,366	134,811	**205,821**
Athletic/Recreation	55,718	17,566	113,936	**187,220**
Administrative	58,296	26,787	130,768	**230,492**
Support	29,135	17,558	56,048	**102,741**
Parking	169,818	207,722	183,637	**561,177**
Other[1]	8,053	8,957	8,040	**25,050**
Total Net Assignable Square Feet (NASF)	**871,063**	**639,380**	**1,053,737**	**2,564,180**
Gross Square Feet (GSF)	1,308,439	955,642	1,653,635	**3,917,716**

Does not include the following:
- Leased buildings (345,884 NASF)
- Pulichino Tong Business Center (55,841 GSF under construction)
- Central Services and Facilities Operations Buildings on Middlesex St. (9,424 GSF under renovation)
- 193 Pawtucket St., 199 Pawtucket St., and 225 Aiken St. (73,263 GSF of vacant properties awaiting demolition)

(1) "Other" consists of currently unassigned spaces and assignable spaces under renovation
(2) South Campus includes UMass Lowell Bellegarde Boathouse
(3) East Campus includes University Crossing and the UMass Lowell Inn & Conference Center

Table 17. Projected Building Use at UMass Lowell, 2021

Building Use	North Campus	South Campus[1]	East Campus[2]	UMass Lowell Total
Academic	374,000	270,000	18,000	**662,000**
Research	184,000	5,000	30,000	**219,000**
Residential	0	65,000	539,000	**604,000**
Student Life	42,000	47,000	132,000	**221,000**
Athletic/Recreation	56,000	18,000	115,000	**189,000**
Administrative	50,000	27,000	144,000	**221,000**
Support	36,000	33,000	67,000	**136,000**
Parking	170,000	208,000	268,000	**646,000**
Total Net Assignable Square Feet (NASF)	**912,000**	**673,000**	**1,313,000**	**2,898,000**
Gross Square Feet (GSF)	1,380,000	1,003,000	2,033,000	**4,416,000**

Does not include the following:
- Leased buildings (not projected)

(1) South Campus includes UMass Lowell Bellegarde Boathouse
(2) East Campus includes University Crossing and the UMass Lowell Inn & Conference Center

Figure 37. Projected Building Use at UMass Lowell, 2021

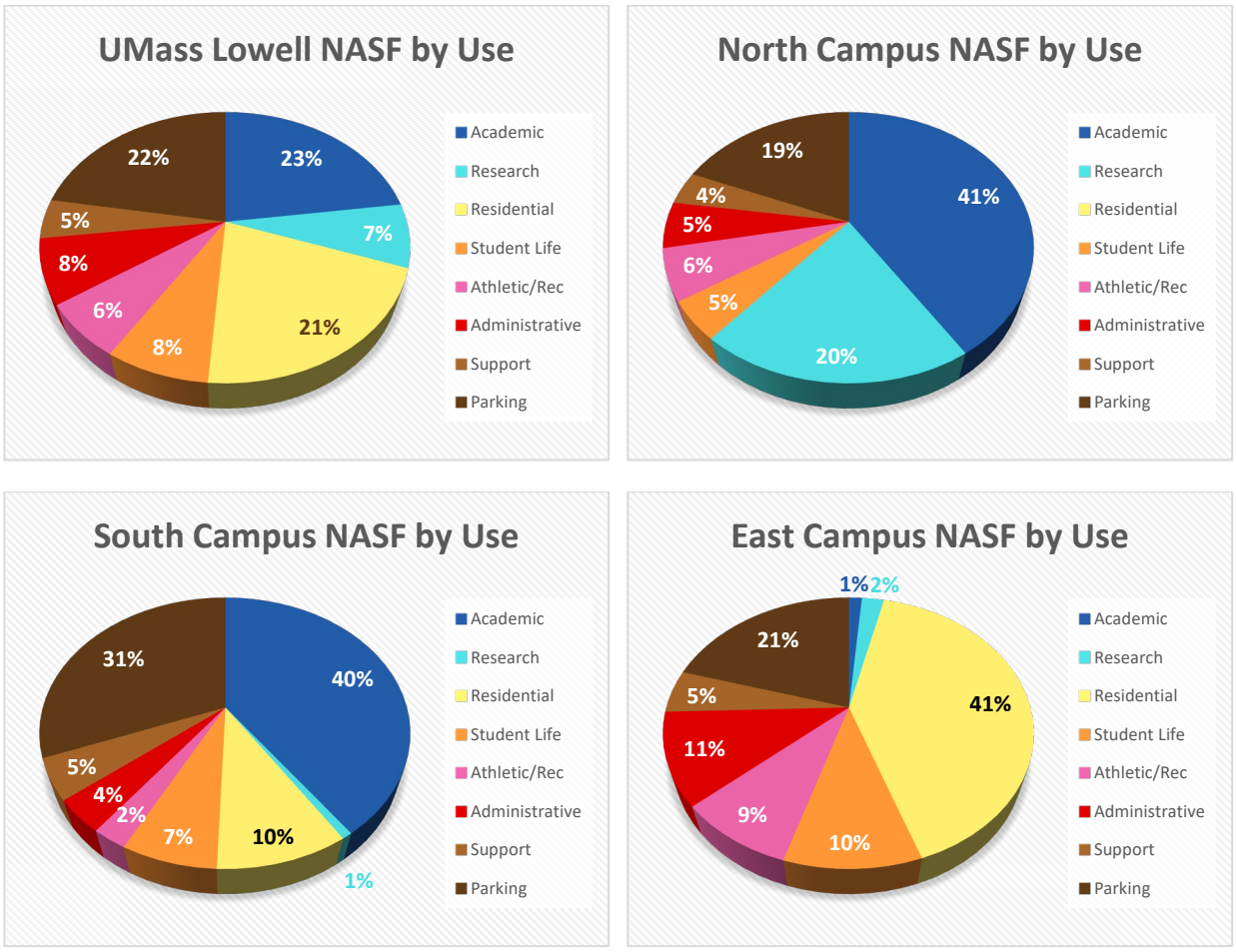
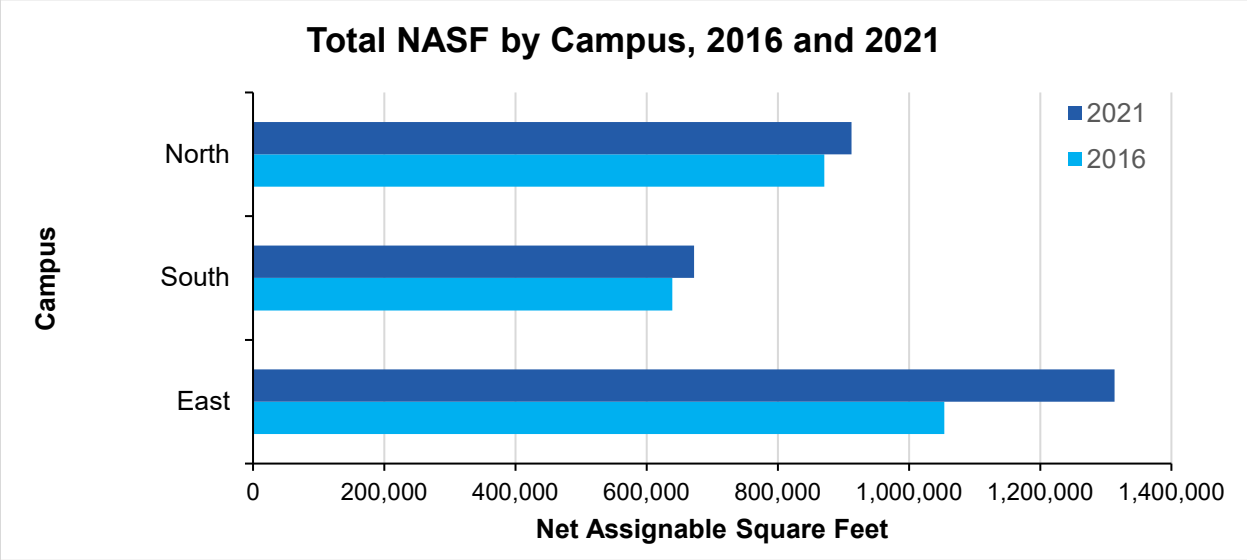


Figure 38. Building Use Comparison between 2016 and 2021



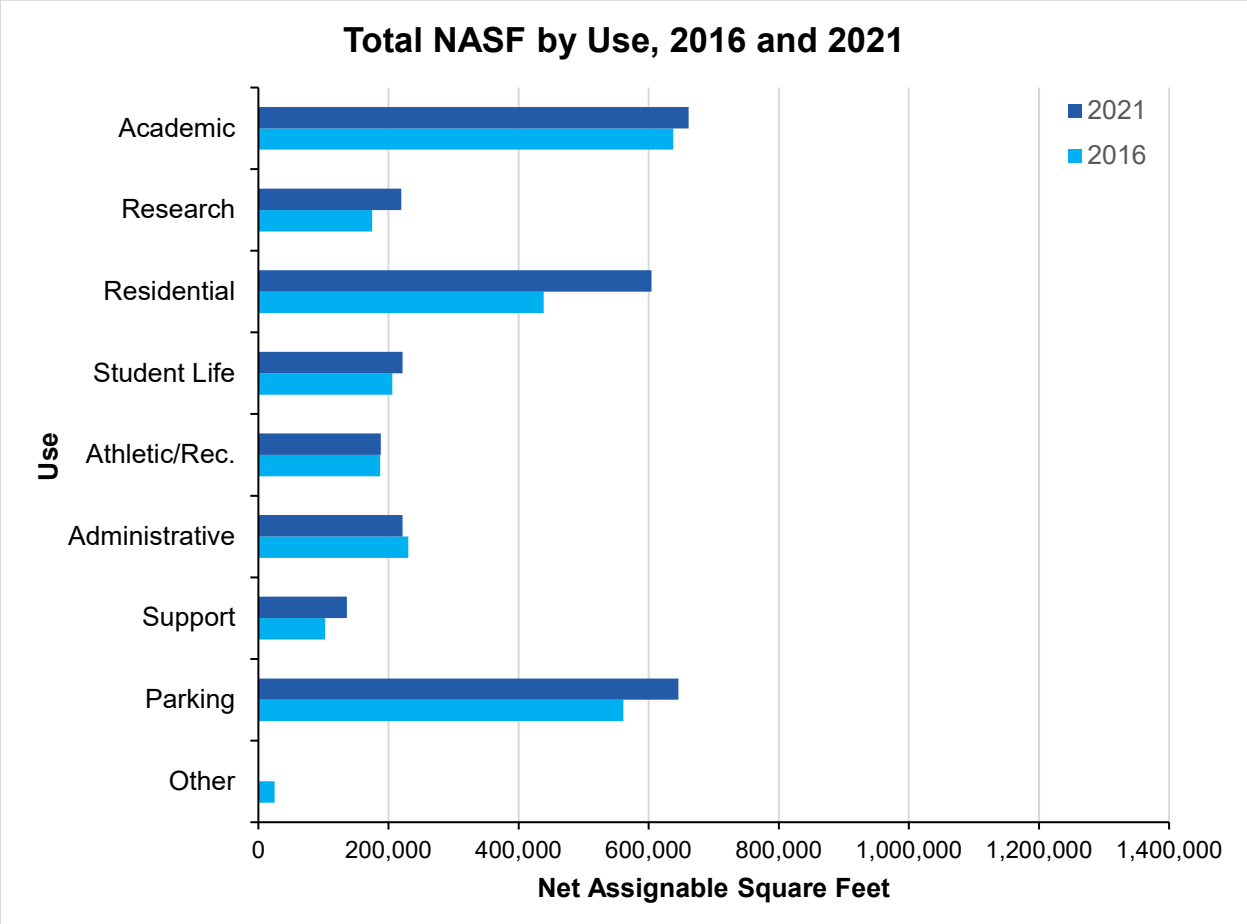


Table 18 and Table 19 provide a comparison of the pervious and impervious surfaces between 2016 and 2021. The only significant change between pervious and impervious surfaces will occur on East Campus with the demolition of existing buildings to make way for the Aiken Street Recreation Fields and Pawtucket Street Riverfront Park, both of which will include a significant portion of pervious surfaces.

Table 18. UMass Lowell Pervious and Impervious Surfaces, 2016, in acres

	North Campus	South Campus[1]	East Campus[2]	University Total
Roof Areas	8.60	6.48	12.05	27.12
Other Paved Areas	15.38	16.77	19.98	52.13
Total Impervious[3]	**23.98**	**23.24**	**32.03**	**79.26**
Pervious Areas	**18.89**	**19.23**	**17.58**	**55.70**
Total Area	**42.87**	**42.47**	**49.61**	**134.96**
Pervious %	44%	45%	35%	41%

Does not include leased properties and spaces.
(1) South Campus includes the Bellegarde Boathouse.
(2) East Campus includes University Crossing and the Inn & Conference Center.
(3) Sum may not equal to total due to rounding errors.

Table 19. UMass Lowell Pervious and Impervious Surfaces, 2021 Projected, in acres

	North Campus	South Campus[1]	East Campus[2]	University Total
Roof Areas	8.60	6.71	13.09	28.41
Other Paved Areas	15.38	16.69	19.93	52.00
Total Impervious[3]	**23.98**	**23.40**	**33.03**	**80.41**
Pervious Areas	**18.89**	**19.07**	**21.02**	**58.98**
Total Area	**42.87**	**42.47**	**54.05**	**139.39**
Pervious %	44%	45%	39%	42%

Does not include leased properties and spaces.
(1) South Campus includes the Bellegarde Boathouse.
(2) East Campus includes University Crossing and the Inn & Conference Center.
(3) Sum may not equal to total due to rounding errors.

5. CHAPTER FIVE – ENVIRONMENTAL EFFECTS

The continued modernization of UMass Lowell campus is expected to have positive environmental effects over the next five years. Through a combination of new construction, ongoing upgrade, and renovation of older buildings, demolition of obsolete buildings, along with a focus on deferred maintenance, accessibility, and landscaping, the University is moving toward greater sustainability and energy efficiency. With continued improvement on operational practices in transportation, site and building management, recycling, and construction management, UMass Lowell is working to limit and reduce environmental effects.

5.1 AASHE STARS

UMass Lowell participates in the Sustainability Tracking, Assessment & Rating System (STARS) administered by the Association for the Advancement of Sustainability in Higher Education (AASHE) to evaluate the University's sustainability progress.

Described by AASHE as "a transparent, self-reporting framework for colleges and universities to measure their sustainability performance", STARS rates higher education institutions based on sustainability credits grouped into 5 categories and 17 impact areas. The five categories are Academics, Engagement, Operations, Planning & Administration, and Innovation & Leadership. Self-reporting institutions are recognized as a STARS Reporter and those that achieved certain scores are eligible to earn a STARS Bronze, Silver, Gold, or Platinum rating.

UMass Lowell submitted its first STARS report in May 2015 and achieved a Silver rating. The framework and the first report helped the University to identify areas of concern and opportunities for improvement for sustainability.

Subsequently, the University implemented a series of sustainable programs and guidelines, such as a more comprehensive sustainable procurement policy, a green cleaning policy for campus facilities, and more robust engagement programs with students, faculty, staff, and the public. In addition, the University increased its offering of sustainability-related courses and emphasis in sustainability across the academic curriculum. UMass Lowell also promoted sustainability innovations and, as part of the University of Massachusetts system, took part in divesting its endowment from direct holdings in fossil fuels.

The University submitted its second STARS report in August 2016 and achieved a Gold rating – a recognition of the extensive sustainable efforts UMass Lowell has undertaken within the short timeframe. As with the *CAP* and the GHG reduction effort tracked through Second Nature, the University is committed to continually advancing its sustainability efforts in line with its strategic plan – *UMass Lowell 2020*.

The STARS reports are available on the AASHE's website[3].

[3] https://stars.aashe.org/institutions/university-of-massachusetts-lowell-ma/report/2015-05-01/

5.2 WATER MANAGEMENT

5.2.1 Water and Wastewater

Actual water use in FY2016 (as billed by the Lowell Regional Wastewater Utility) exceeded the water use projection in the *2011-2016 SDP*, as shown in Table 20 below. Actual water use intensity, incorporating the actual total floor area on campus, is also higher than what was projected. While overall campus growth contributes to the water use increase, the University is also experiencing some inconsistency in tracking water use in the past years due to missing, incomplete, or delayed water meter readings dating back to before 2011, which leads to an underestimation of the "FY2016 Projected" in the SDP and over-counting of the "FY2016 Actual" due to delayed metering and billing of a portion of FY2015 water use.

Recent improvements in metering and billing practices at LRWU have enabled the University to model water use more accurately than was possible five years ago. With this better data, the University is projecting that it will be able to document a decline in water use intensity over the next five years. Higher water efficiency through fixtures upgrades and replacements in renovated spaces, as well as water-efficient design standards for new buildings, will limit water use increase and lower water use intensity.

Table 20. Summary of UMass Lowell Water Use, FY2016 vs. FY2021

	FY2016 Projected	FY2016 Actual(2)	FY2021 Projected
Gallons/day (GPD) of Water Use – Average/Peak(1)	192,000/384,000	214,153/428,307	220,000/440,000
Total Water Use (CCF)	93,690	104,500	108,000
Building Floor Area (sq.ft.) (3)	4,027,441	4,322,931	4,820,931(4)
Water Use Intensity (ft^3*100/sq.ft.)(5)	2.33	2.42	2.23

(1) Average is based on water meter readings. Peak estimated as twice the average.
(2) FY2016 data is based on meter readings on water bills issued by Lowell Regional Water Utility.
(3) Building Floor Area used for utilities use reporting, which may include leased buildings, include buildings under construction, and exclude existing building spaces that are vacant, is calculated differently from how the campus building floor area is calculated in this SDP Update. The calculation of this different floor area is reported in the *Leading by Example Program Energy Tracking and Reporting Form* submitted annually by UMass Lowell.
(4) For projecting the Water Use Intensity for FY2021, the Building Floor Area for FY2021 is projected using the FY2016 basis in this table, with the addition of the new floor area in FY2021 as projected in this SDP Update (see Table 19), which is about 498,000 sq.ft.
(5) Water Use Intensity (ft^3*100/sq.ft.) = Total Water Use (CCF) ÷ Building Floor Area (sq.ft.) x 100

The University has had water-efficient fixtures in its Design Standards since the first Plumbing Standard and Sustainability Guidelines were written in early 2011, which had been gradually implemented as buildings have been renovated. The Accelerated Energy Project (AEP) also includes the replacement of hot water heaters, boilers, and plumbing fixtures with more water-efficient models in several existing buildings.

UMass Lowell is also in the process of procuring and integrating a cloud-based remote water management system with the University's irrigation system. The water management system can track soil moisture, water use, and leaks in real-time, automatically adjust irrigation based on need, and shut off irrigation remotely. Anticipated to be in place by the end of 2016, the water management system can save up to 35% of water used for irrigation. This effort will complement

ongoing programs to install native, drought-resistant plantings on the campus to reduce irrigation demands.

Wastewater generation mirrors water usage. Shared billing programs between the Lowell Regional Water Utility and Lowell Regional Wastewater Utility result in a similar variance between the wastewater projections included in the *2011-2016 SDP* and the amounts reflected in actual 2016 billings.

Similarly, the University's ongoing efforts to reduce water usage and improve water efficiency will commensurately lower wastewater generation. Notwithstanding a projected 14.6% increase in student enrollment, with associated growth in faculty and staff size, land acreage, and building floor area, the University is only projecting FY2021 wastewater generation to be approximately 198,000 GPD, a 2.5% increase over the five-year period. Water conservation efforts described above are primarily responsible for the projected decline in per capita wastewater generation.

In order to prevent wastewater contamination, the University maintains a "no pour down the drain" policy in all laboratories and requires prior approval and completion of a "Non-Hazardous Waste Determination Form" for any exception to the policy. These procedures are designed to help ensure that chemical wastes are collected through the University's controlled waste accumulation program.

In addition, the University's main laboratory buildings are equipped with acid waste neutralization sumps where approved acidic wastewater is neutralized before merging with sanitary wastewater. UMass Lowell Environmental Health and Safety (EHS) office inspects and maintains the limestone chip tanks in all sumps annually.

The University's newly updated Industrial Sewer User Permit is effective from January 1, 2016 to May 29, 2020, covering three specific wastewater outfalls: Wastewater storage system for the Nuclear Reactor at Pinanski Hall, wastewater generated at the Ames Photonics Center of Wafer Formation Research, and wastewater generated at the Saab ETIC involving its Air Scrubbing System and wafer research laboratory. The permit requires self-monitoring on flow, pH, Chemical Oxygen Demand (COD), Copper, Lead, Zinc, Arsenic, Mercury, Nickel, Silver, and Total Toxic Organics (TTO). There were no violations in the previous 2011-2016 review period.

The University is also actively coordinating and assisting the City of Lowell with projects to separate combined sanitary and storm drainage infrastructure on and near its three campuses.

5.2.2 Stormwater

Using the New York State Simple model and adjusting for projected changes in total campus acreage and impervious area, it is estimated that the UMass Lowell will generate 103,000 CCF of stormwater runoff FY2021. This modeling approach does not account for the fact that nearly all new buildings and parking areas constructed since 2011, including those currently planned, contain more stormwater on-site than pre-development conditions. In many cases, the groundwater recharge systems retain 100% of stormwater on-site. As a result, this number is extremely conservative.

Stormwater Management Program Update

The University is currently updating its storm drainage piping and outfall maps. The ongoing map update will inform a comprehensive update of the *2009 Stormwater Management Program* that the University is planning to develop by the end of FY2018. The updated stormwater management program will align with the requirements of the new Massachusetts Small MS4 General Permit effective on July 1, 2017.

Reducing Impervious Surface

On the North Campus, the ongoing North Quad Pod Addition Project includes the conversion of the Southwick Courtyard from impervious surface parking to landscaped open space. This project is expected to be completed in fall 2016.

On the South Campus, the University demolished and removed the former South Dining Building, which occupied a large footprint despite its relatively small total square footage. This formerly impervious area was replaced by the landscaped South Campus Mall.

On the East Campus, the University is planning to demolish the large one-story warehouse and adjacent parking lot on the recently acquired 4.8-acre 225 Aiken Street property to make way for new athletic and recreational fields, which will significantly reduce impervious area and stormwater runoff. Even though the playing surface will be artificial turf, the fields will contain a full drainage system that collects stormwater that falls on the fields to recharge the groundwater table. The project is in the design phase and is expected to be completed in fall 2017.

In addition to these projects, which will replace large impervious areas with pervious landscaping and other materials, the campus is committed to minimizing stormwater runoff from the sites of its major construction projects. On-site stormwater retention and groundwater recharge systems were incorporated into recent projects, which will reduce net runoff to levels relative to pre-development conditions. The runoff will be diverted to separated drainage systems or appropriately permitted outfalls where available. Drainage designs will allow for easy future connections to separated drainage infrastructure when the Lowell Regional Wastewater Utility makes it available.

5.2.3 Wetlands

There are no jurisdictional wetland resources or tidelands on occupied portions of the UMass Lowell campuses. A number of UMass Lowell properties are adjacent to Lowell's historic canals. Prior to development and construction activity, the University reviews projects on sites adjacent to the canals with the Lowell Conservation Commission. The University also owns a linear riverfront parcel of land between the Merrimack River and The VFW Highway on its North Campus. This area, which includes riverbank, bordering vegetated wetlands, and riverfront area as defined in the Massachusetts Wetlands Protection Act and associated regulations, is currently undeveloped. The University has no plans to alter the use or activities conducted on this parcel.

5.3 SOLID AND HAZARDOUS WASTE

5.3.1 Solid Waste Management and Recycling

UMass Lowell has a well-developed recycling & waste diversion program in place and continues to see reductions in solid waste and increases in recycling. The University's primary goal is to

reduce the overall output of waste. The majority of recycling occurs through a single stream recycling program, which is coordinated through the University's waste contractor, Casella Resource Solutions. Since 2008, solid waste has plummeted by 46% while single-stream, or unsorted, recycling has increased by more than 200%. These impressive figures were two key reasons why UMass Lowell received MassRecycle's 2015 University Recycling Award.

During FY2015 the University's compost program expanded to cover all food service operations campus-wide. In addition, the Office of Sustainability has continued to refine fall and spring move-out waste diversion and donation drives. Instead of ending up in landfills, goods are donated to local charitable organizations, including the Wish Project, the House of Hope, the UMass Lowell Navigators Club, St. Vincent de Paul, the Merrimack Valley Food Bank, the Lowell Humane Society, and the Massachusetts Society for the Prevention of Cruelty to Animals (MSPCA).

In 2016, student residents' move-out donations weighed in at a record 14,144 pounds, more than double the 6,045 pounds collected in 2015 and four times more than what was collected in 2014, the first year the University formalized its move-out donation process.

UMass Lowell expects to reinforce the success of these programs and continue reducing its overall waste generation over the next five years. New and expanded initiatives include:

- Front of house composting at all campus dining locations;
- Campus wide trash/recycling signage updates;
- Upgrading of communal recycling/trash locations in all residence halls;
- Expansion of the move-out donations/diversion program;
- Improved e-waste recycling and reporting processes;
- Implementation of a new paper purchasing and printing policy; and
- Adoption and implementation of a new electronics purchasing policy.

5.3.2 Hazardous Materials Management

UMass Lowell strictly adheres to the Massachusetts construction and demolition materials waste bans. Additionally, UMass Lowell's commitment to sustainable design and LEED-certifiable construction reinforces its strict contractual requirements for construction waste reduction and recycling.

Testing for hazardous construction materials is done for all projects during the design phase. If hazardous materials are discovered, they are abated before construction begins and disposed of according to the applicable laws and regulations. Disposal of hazardous materials discovered during construction is coordinated among the University, UMBA or DCAMM, the design team, and the contractors, in compliance with applicable state regulations and the project's permit(s) for removal of hazardous materials.

Through its Department of Environmental Health and Safety (EHS), UMass Lowell also has robust hazardous material purchasing and management programs in place to monitor hazardous materials entering and in storage on campus. EHS administered programs include hazardous

waste management, laboratory safety, training and inspection programs, stormwater, waste water, air emission management, permitting, and reporting for regulatory compliance.

University faculty and staff planning to work with hazardous materials for teaching, research, or operational purposes must utilize the University's on-line purchasing program called Buyways to procure their materials, which ensures they will be properly tracked and documented even before they arrive on campus. Faculty and staff are prohibited from using University issued credit cards for purchasing hazardous materials. Requisitions for hazardous materials purchasing are reviewed by multiple Departments including EHS to ensure materials requiring pre-registration are approved and that there is proper oversight of the hazardous materials being used on campus.

Upon review and approval, all hazardous materials are delivered to the EHS hazardous materials chemical receiving stockroom. EHS staff reviews the shipping paperwork and enters the chemical, biological, or radiological specific information into a web-based hazardous materials inventory program. Bar codes are printed and assigned to containers and the materials then are delivered by EHS staff members to the labs for storage and use.

During the process of reviewing hazardous materials requisitions made by faculty and staff, EHS staff also cross references the on-line inventory program to promote re-use of unwanted or excess chemicals on campus. EHS also acquires chemicals during lab clean-outs. These materials are offered for re-use during the review of chemical requisitions when someone is trying to purchase a material that is on hand. These programs allow the University to reduce the total volume of hazardous materials on campus.

EHS staff and environmental hazardous waste management contract employees conduct weekly inspections of all satellite waste accumulation areas on campus. This ensures all hazardous and non-hazardous wastes generated on campus are properly labeled, stored, and shipped in compliance of all Mass DEP, US EPA, and DOT regulations.

In the near future, the EHS office is planning to re-introduce a front end fee for all hazardous materials purchasing on campus. This fee will be added to the cost of acquiring hazardous materials to support hazardous materials disposal on campus. The front end fee will also discourage bulk buying or accumulation of hazardous materials that may not otherwise be needed, thus further reducing the amount of hazardous materials on campus.

5.4 COMMUNITY OUTREACH AND CONSTRUCTION PERIOD CONSIDERATIONS

UMass Lowell is committed to minimizing and mitigating the negative effects of construction, on behalf of both academic and urban neighbors. The University is also committed to regular and consistent communication with both its internal campus community and external neighbors to ensure proactive dissemination of information and prompt response to questions and concerns.

5.4.1 Community Outreach

Engagement with the broader Lowell community has been and is a major priority of the University throughout the planning and execution phases of campus renewal. Over the last few years as construction activity has commenced, University officials at all levels have been engaged in meetings with their counterparts in the City of Lowell, neighborhood groups, business groups,

community organizations, and officials from the Lowell National Historical Park. Meetings were designed to provide up-to-date information on capital project development, current status of work at the University, acquisitions, future plans, and anticipated construction period activity.
The following is a non-exhaustive list of examples of the meetings, briefings, and other activities the University uses and expects to continue to use to support community outreach.

Capital Program and Master Plan

- Presentations on the UMass Lowell capital program and master plan are made to the Lowell City Council and its Committee on Education Partnerships at least annually.
- UMass Lowell senior leadership meets quarterly with the Lowell City Manager and senior City leadership.
- Regular briefings were presented to the Lowell Plan, an organization of political, business, and community leaders, providing updates on the capital plan.
- Several meetings are held with neighborhood groups describing the general capital plan and providing project-specific updates, with particular attention paid to groups representing the neighborhoods immediately adjacent to the University – Pawtucketville, East Pawtucketville, the Highlands, and the Acre.
- Correspondence or in-person communications are shared with neighborhood stakeholders, property owners, and abutters as needed regarding construction updates, particularly in the Acre and Pawtucketville neighborhoods.
- The Chancellor hosts student forums twice yearly to discuss the ongoing capital program and physical transformation of the University and University's master plan.
- Timely updates and communications regarding the capital program and ongoing progress are provided on a regular basis through UMass Lowell publications, including the website, social media, alumni magazine, and other outlets.
- A public ceremony to announce the acquisition of the St. Joseph's Hospital property was held in 2011. Besides the Chancellor and the City of Lowell Manager, leaders from the local neighborhood groups and non-profits also spoke at the ceremony.
- The University co-founded the Upper Merrimack Street Redevelopment Task Force with the City of Lowell to discuss how the new University Crossing student center will engage and contribute to the surrounding community. Task force membership includes key businesses, nonprofit organizations, and neighborhood group leaders of the nearby Merrimack and Salem/Market Street corridors and adjacent streets.
- Project-specific meetings are held with neighbors to major projects like University Crossing, University Suites, and the Pulichino Tong Business Center to discuss project design, construction schedule, and quality of life, including ideas for improving traffic conditions in the area.
- An extensive public engagement process was used to identify opportunities for improvements along the Pawtucket Street Corridor, including well-advertised open public forums and focus groups of stakeholders.
- Two community walks were organized with UMass Lowell Community Relations staff, students, UMass Lowell Police Officers, City of Lowell Police Officers, and neighborhood residents from the Acre and East Pawtucketville. The walks were organized to identify

areas in need of improvement in the Pawtucket Street Corridor. Staff from the UMass Lowell's Campus Planning and Development created a Phone App for participants to provide feedback.

- At the request of the City of Lowell and Acre Neighborhood Group, the University provided an easement for the Salem Street entrance to Decatur Way. This easement enabled the City to provide much needed and required storm drainage updates. It also transformed Decatur Way from a crime-ridden and overgrown alley to "Decatur WAY…Water, Art, and You," a new, outdoor walkway and art space in Lowell's Acre neighborhood, created by Lowell schoolchildren, artists, neighborhood leaders, UMass Lowell and City of Lowell representatives.
- Since 2014, UMass Lowell has made over $7.5 million in contributions and commitments to improve and maintain municipal infrastructure in the areas near its campuses.
- UMass Lowell and the City of Lowell have reached a Strategic Partnership Agreement which details and affirms the parties' partnership and collaboration to address provision and use of public services, improvement and maintenance of public infrastructure, civic initiatives, and means of financing investments in these areas. This agreement includes over $400,000 in one-time financial contributions to the City by the University as well as recurring financial and in-kind commitments totaling more than $400,000 annually.

5.4.2 Construction Period Considerations

UMass Lowell's Project Construction and Management team works to ensure the success of projects from scoping and programming all the way through design, construction, and move-in. Throughout the process, the team is committed to minimizing and mitigating environmental impacts through best practices and thoughtful programming. Green building standards, building material recycling, traffic access and safety, noise and dust control, snow and stormwater management, excavation and vibration monitoring, responsive communication with the community, and contaminated material treatment and disposal are several of the team's key area of considerations.

For all current and planned capital construction projects, including those described in this report and other smaller on-campus renovations, construction waste management and disposal plans are developed. All waste is identified by generation point, quantity/weight, estimated waste percentage, and target for salvage or recycling. The construction management firm uses all reasonable means to divert construction and demolition waste from landfills and incinerators. All hazardous materials waste is fully monitored and tracked throughout the abatement process.

For projects which affect public rights-of-way or have significant delivery activity, traffic management plans are prepared and submitted to the City of Lowell for review by the City Engineer and other municipal departments. The construction management firm or general contractor provides the traffic management plans, as well as site logistics plans, to all subcontractors to ensure they understand the requirements of the project and address traffic and pedestrian safety throughout the duration of the project. The site logistics plans also describe the location of construction access gates and erosion control measures. These plans are revised to deal with each subsequent phase of a project.

Ground vibration is monitored during pile driving when necessary.

The construction management firm or general contractor works with each subcontractor to address noise, dust, and vibration issues associated with construction to ensure that any adverse effect on the surrounding buildings is minimized. The site logistics plans describe location of construction access gates and erosion control measures. Construction site fencing with solid scrim are used on each project site in applicable locations to control dust and debris. Additional dust prevention measures include watering down all debris on site. When a project involves demolition or hazardous materials removal, dust monitoring and dust prevention measures are employed as required by applicable laws, regulations, and policies.

Storm Water Pollution Prevention Plans are established by the construction management firm or general contractor and Environmental Protection Agency (EPA) Notices of Intent are filed as needed. Stormwater management plans are submitted to the City Engineer and Lowell Regional Waste Water Utility for review. Stormwater Management Plans are also submitted to the Lowell Conservation Commission for their review when project sites are located in proximity to resources under their jurisdictional authority.

5.5 HISTORICAL AND ARCHEOLOGICAL RESOURCES

In 2012, UMass Lowell engaged a qualified historic preservation consultant, Wendy Frontiero, to complete an Historic Resources Survey of campus buildings. This study included the preparation of standard Massachusetts Historical Commission (MHC) Historic Survey Forms (Form B's) for 18 campus buildings. In addition to documenting their historic and architectural status and significance (if any), this exercise established the eligibility of campus buildings for listing on the National Register of Historic Places.

The following campus buildings are currently listed on the National Register:

1. Allen House
2. Wannalancit Mill (formerly Tremont & Suffolk Mills)
3. Perkins Properties / 1-65 Perkins Street (various buildings of the Lawrence Manufacturing Company)

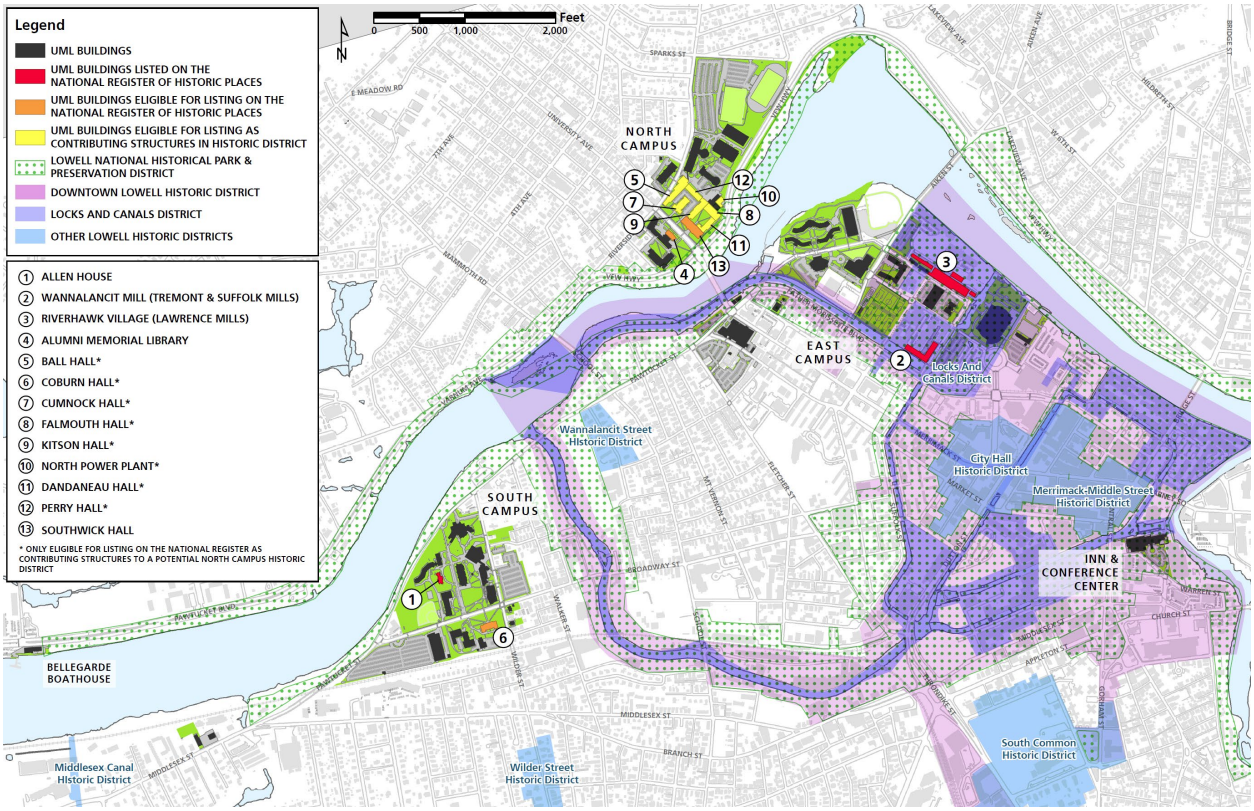
The following campus buildings are eligible for listing on the National Register (buildings marked with an asterisk "*" are eligible only as contributing structures to a potential North Campus historic district, not individually eligible):

4. Alumni Memorial Library
5. Ball Hall *
6. Coburn Hall
7. Cumnock Hall *
8. Falmouth Hall *
9. Kitson Hall *

10. North Power Plant *
11. Pasteur Hall *
12. Perry Hall (formerly Engineering Building) *
13. Southwick Hall

In addition, portions of the East Campus and North Campus of the University, as well as the Inn and Conference Center, fall within the boundaries of various historic districts listed on the National Register of Historic Places, as shown in Figure 39. Buildings related to listing on the National Register are numbered according to the list above.

Figure 39. UMass Lowell Historic Buildings, Buildings Eligible for Listing, and Local Historic Districts, 2016 Existing plus Perkins Properties



Consistent with the MHC's guidelines and regulations, the University and its partner agencies involved in capital construction and renovation projects file Project Notification Forms for projects involving the above-listed buildings or campus areas located within listed historic districts.

5.6 TRANSPORTATION

Transportation enhancements have been a key component of the sustainable growth model at UMass Lowell. The University has embraced GreenDOT – MassDOT's Comprehensive Sustainability Initiative – by encouraging transportation that is less carbon-intensive, such as transit, as well as active transportation that produces zero emissions, such as biking and walking. Through its newly formed Office of Sustainability, UMass Lowell maintains its commitment to reducing the environmental effects of transportation by providing alternatives to driving alone that are environmentally friendly, promote health and well-being, and reduce transportation costs, both at the individual and institutional level.

Moreover, UMass Lowell is committed to maintaining a low traffic impact on the local community through limiting the use of single-occupancy vehicles by the campus population. This commitment goes hand-in-hand with the GHG emissions reduction commitment. The GreenDOT initiative, together with the aggressive TDM program and support for public transit and active transportation, reduce both GHG emissions and ADT (Average Daily Traffic) generated by the University.

The University's Scope 3 GHG emissions per FTE have decreased significantly since FY2011, from 2.20 MTCO2e to 1.58 MTCO2e in FY2015. More specifically, commuting emissions per FTE have decreased by 28%.

Review of historical traffic volume data from the City of Lowell, NMCOG, and MassDOT indicates that traffic volumes immediately surrounding the UMass Lowell campuses have increased by approximately 0.5% per year since 2010, and 0.17% per year for major arterial corridors throughout the city. Although both represent only marginal levels of traffic increase, the deviation between the roadways near the campuses and the background conditions city-wide is likely due to a combination of University growth and increases in volumes of regional commuter traffic accessing the limited number of Merrimack River crossings, most of which are located on or adjacent to UMass Lowell's campuses.

The success of UMass Lowell's TDM program is one of the main reasons for the GHG emissions reduction and limited ADT increase over the past years. Increased focus on campus housing, biking, walking, carpooling, and public transit have also contributed in lessening the traffic impact. The following sections highlight the ongoing initiatives, programs, and services of UMass Lowell's TDM program and the University's continued commitment to reducing the environmental effects of transportation and provide an ADT projection for the next five years.

5.6.1 Ongoing TDM Programs

UMass Lowell Shuttle Services

UMass Lowell operates its own day, evening, and weekend shuttle system, the Riverhawk Roadster, that provides connections on campus as well as a newly instituted downtown Lowell loop. The campuses and their parking facilities are separated geographically, generating significant demand for staff and students to travel between sites. The shuttles currently transport approximately 7,500 passengers each day when school is in session, which significantly reduces transportation related greenhouse gas emissions versus the alternative of driving alone. Strict

parking policy (such as “park once”) and enforcement ensure students are using the shuttle, biking, or walking between campuses, which again reduces the impact of transportation emissions.

Lowell Canal Bridges TIGER Grant

The Lowell Canal Bridges project will help the University to greatly reduce its transportation related Greenhouse Gas (GHG) emissions as documented in its Climate Action Plan. By providing more direct links between south and east campuses, the project will create environmental and sustainability benefits by reducing air pollution associated with transit travel emissions, as a result of a reduction in vehicle miles traveled (VMT). Initial study estimates that the entire project would yield an annual VMT reduction of 51,608 among UMass Lowell buses, LRTA buses, and Lowell Public School buses.

Bicycle Accommodations

In 2015, UMass Lowell was named a “Bicycle Friendly University” by the League of American Bicyclists (LAB), joining Harvard University and the Massachusetts Institute of Technology as the only schools in the Commonwealth to earn the distinction. A major factor in the University’s distinction was the continued growth of the Freewheelers bike-share program. The UMass Lowell Freewheelers bike-share program provides free bike rental to students, faculty, and staff. What started in 2007 with five bicycles at the Campus Recreation Center has grown to a fleet of 35 bicycles (30 for daily checkout, five for weekly loan) at five locations across campus: University Crossing, O’Leary and Lydon libraries, Riverview Suites, and the Campus Recreation Center. From July to October this year there were 1,738 bicycle checkouts, a 16.6% increase from 2014. The number of unique participants, meanwhile, increased 15.2%, from 368 to 424.

Carpooling & Vanpooling

Carpool and vanpool matching is coordinated through a partnership with MassRIDES. These services are marketed to commuters at new employee and student orientations, on commuter bulletin boards throughout the campus, on the University’s website (uml.edu), in the Transportation Options brochure, and during transportation events held throughout the year. UMass Lowell will continue to work toward increasing its carpooling/vanpooling population and to ensure that all commuters are aware of existing benefits.

UMass Lowell offers a preferential parking program for commuters who carpool to the campus. The University also provides a 50% discount to carpoolers for premium parking permits, along with 120 carpool-permit only parking spaces on a first-come first-serve basis. The carpool spaces are conveniently located on all of our campuses: North Campus, Riverside Lot B (faculty, staff, and commuter students); South Campus, Wilder Lot (faculty and staff); South Campus, Broadway/Riverview (commuter students); and University Crossing (faculty and staff).

Transit Passes

The University is 1.3 miles from the Lowell Regional Transit Authority (LRTA) Gallagher Transit Terminal, which provides access to the MBTA’s commuter rail system and Merrimack Valley RTA bus service. Three LRTA routes serve UMass Lowell (#s 6, 7, and 9). According to the most recent MassDEP Rideshare survey, nearly 10% of respondents use public transportation to get to the campus. Faculty and staff are able to purchase, at a discount, monthly MBTA and/or LRTA

transit passes through payroll deduction and the University's Benefits Strategies Qualified Transportation Benefits Plan.

Preferential Parking for Fuel-Efficient Vehicles

UMass Lowell offers 13 preferential parking spaces for Fuel Efficient Vehicles (FEVs) in the Fletcher Lot at University Crossing. The spaces are 100% utilized on each weekday and contribute to the University's goal of transportation-related GHG reductions.

Zipcar

UMass Lowell commuters can sign up for Zipcar at a rate considerably lower than the rate offered to the general public. Students, faculty, and staff can join for only $15 for the first year and pay no application fee, no monthly minimum, and no membership deposit. The University works with Zipcar to coordinate and promote their presence on campus, encouraging resident students to utilize on-campus Zipcars instead of bringing a personal vehicle to campus. In the last year, UMass Lowell added six new Zipcars to campus, bringing the total to ten. UMass Lowell's Zipcar program is one of the fastest growing in the country and will continue to grow as more resident students come to campus.

Electric Vehicle Charging

Partnering with MassDEP, UMass Lowell introduced a network of EV Charging Stations on campus in mid-2015. There currently are five EV charging stations on campus with an ability to charge ten vehicles at any one time. In less than a year, the UMass Lowell community has saved over 3,000 kg of GHG emissions through combined charging of over 1,100 hours. UMass Lowell is committed to expanding its EV charging infrastructure and providing increased opportunities for further mitigation of transportation related GHG emissions.

Live in Lowell Program

Launched in 2015, UMass Lowell provides direct financial incentives for its faculty and staff to purchase or rent housing in the City of Lowell, thereby shortening their commutes, expanding their transportation options, and reducing the environmental impacts of their commuting activity. Several private and not-for-profit partners have added complementary incentives and benefits to this program.

5.6.2 Parking in 2021

A detailed accounting of the existing and projected future parking supply at UMass Lowell can be found in Chapter 2. In order to minimize parking demand, the University will continue its effort in promoting sustainable transportation alternatives to single-occupancy vehicle driving through the combination of policy, programs, infrastructure, and parking decal pricing, as previously discussed. As a result, the University anticipates that the planned 7% increase in on-campus parking capacity to 6,627 parking spaces (mainly through acquisition of existing parking from other owners) will support 16% day-time student enrollment growth over the next five years.

5.6.3 Vehicle Trip Generation in 2021

UMass Lowell engaged TEC, Inc. to calculate the projected trip generation associated with the planned enrollment growth and projects described herein. This analysis conservatively assumed that the current rates of vehicle usage among campus populations would remain proportional to growth at the 2016 levels despite the continued and increased TDM programs employed by the campus.

UMass Lowell requires nearly all drivers who park on campus to purchase parking decals and maintains detailed records of parking decal purchases; this data set, presented in Chapter 2 of this document, provides an excellent basis for calculating vehicle trips to and from the campus. Trip generation is assumed to be consistent with the proportion of each campus populations' parking rates. A small number of University-affiliated drivers may park off-campus to avoid parking decal costs, but the City of Lowell has instituted either parking meters or resident-only parking restrictions in nearly all locations close to the campuses, so it is unlikely that more than a minimal number of drivers find this alternative viable.

Continuing education students do not generally obtain parking decals because they are typically only on campus late on weekdays or on weekends when campus parking enforcement is not in effect. Graduate students either obtain faculty/staff decals in conjunction with their research and teaching assistantships or are infrequent visitors to campus. Nevertheless, 100% of the projected growth of these populations is conservatively assumed to drive to campus for TEC's modeling due to the lack of more precise data.

As Table 21 indicates, TEC's modeling projected that UMass Lowell's enrollment growth and campus development will generate up to 2,200 new Average Daily Traffic (ADT) by 2021.

Table 21. 2016 to 2021 - Net New Average Daily Vehicle Trip Generation

Enrollment	Fall 2015 Actual[a]	Fall 2020 Projection[b]	Net Increase	Auto Ownership Net Increase[c]	Mode Share Net Increase	Weekly Weekday Trips per Vehicle	Daily Weekday Trips
Undergraduate	10,457	12,400	1,943				
On-Campus	4,238	5,306[d]	1,068	320	288	6	**346**
Off-Campus	6,207	7,094	887	541	487	10	**974**
Graduate	4,184	4,700	516				
M.S. or Ph.D.	3,275	3,750	475	475	428	6	**513**
Non-Degree Day	909	950	41	41	37	4	**30**
Other	2,809	2,900	91				
Cont. Educ.	1,405	1,450	45	45	41	4	**33**
Online	1,404	1,450	46	-	-	-	
Faculty	1,116	1,266	150				
Full Time	565	661	96	91	82	10	**164**
Part Time	551[e]	605[e]	54	35	32	4	**26**
Staff	1,443[f]	1,530[g]	87				
Full Time	1,071	1,129	58	55	50	10	**100**
Part Time	372	401	29	19	17	4	**14**
						New Daily Traffic	**2,200**

[a] Enrollment values are approximate as enrollment fluctuates throughout the school year and by semester
[b] Data from *UMass Lowell 2016 Report Card*; UMass Lowell; Lowell, Massachusetts; 2016
[c] Based on Table 5 decal ownership percentages for undergraduate students, faculty and staff, but assumed conservatively that all graduate students and continuing education students own an automobile
[d] Projected 4,876 on-campus beds plus 430 additional beds within known private housing marketed to students near campus (conservative for near-campus housing)
[e] Part-time faculty headcounts from UMass Lowell IR faculty/staff data
[f] Staff headcounts from UMass Lowell IR faculty/staff data
[g] Academic and student services staff positions are projected to increase proportionally to projected student enrollment growth

TEC further modeled the distribution of these vehicle trips onto the roadway network serving the University. This exercise concluded that the additional ADT generated will lead to an average of a 0.41% per year ADT increase on the primary roadways in proximity of the University, a negligible difference even less than the ADT increase over the past five years. The Campus Transportation Update in Appendix D more fully explains the methodology and data sources of the traffic modeling and projections.

It is likely that the University's continued efforts to expand TDM and promote walking, biking, and transit alternatives will result in even lower ADT growth than this highly conservative model suggests. Such an outcome would be consistent with the experience of the past five years when ADT measured on roadways in proximity to the campus either declined or grew at a rate below that projected in the *2011-2016 SDP*.

5.7 STEAM AND POWER

UMass Lowell continuously upgrades its steam generation and heating infrastructure with cutting-edge technology and equipment. The 2012 boiler replacement/upgrade project in North Power Plant reduced input energy by more than 17% (approximately 20 billion BTUs), sulfur dioxide by 53.4 tons/yr, NOx by 23.25 metric tons/yr, and greenhouse gas emission by 4,750 MTCO2e/yr. These reductions were made possible through the fuel conversion from heating oil to natural gas, new economizer components, new VFD drives, and O_2 trim features.

A similar boiler replacement project is underway at the South Power Plant (SPP) as of this writing. Boilers from the 1950s and 1960s are being replaced with new low emission natural gas boilers. Together with other building upgrades at the SPP, this project is expected to be completed by the end of December 2016. The University expects significant decreases in facility-wide unrestricted potential emissions and energy savings, similar to those experienced at the NPP following its 2012 upgrade.

To maintain the efficiency of the heating infrastructure, the University will also keep up its periodic steam trap maintenance, which would eliminate steam leakage equivalent to approximately 2,000 dekatherms of energy loss per year.

5.8 ENERGY USE

The ongoing Accelerated Energy Project (AEP) is expected to save over 6,000,000 kWh annually when completed in FY2018. Together with other energy efficiency projects over the next five years, UMass Lowell projects only very modest increases in energy consumption between 2016 and 2021, well below the levels of enrollment growth.

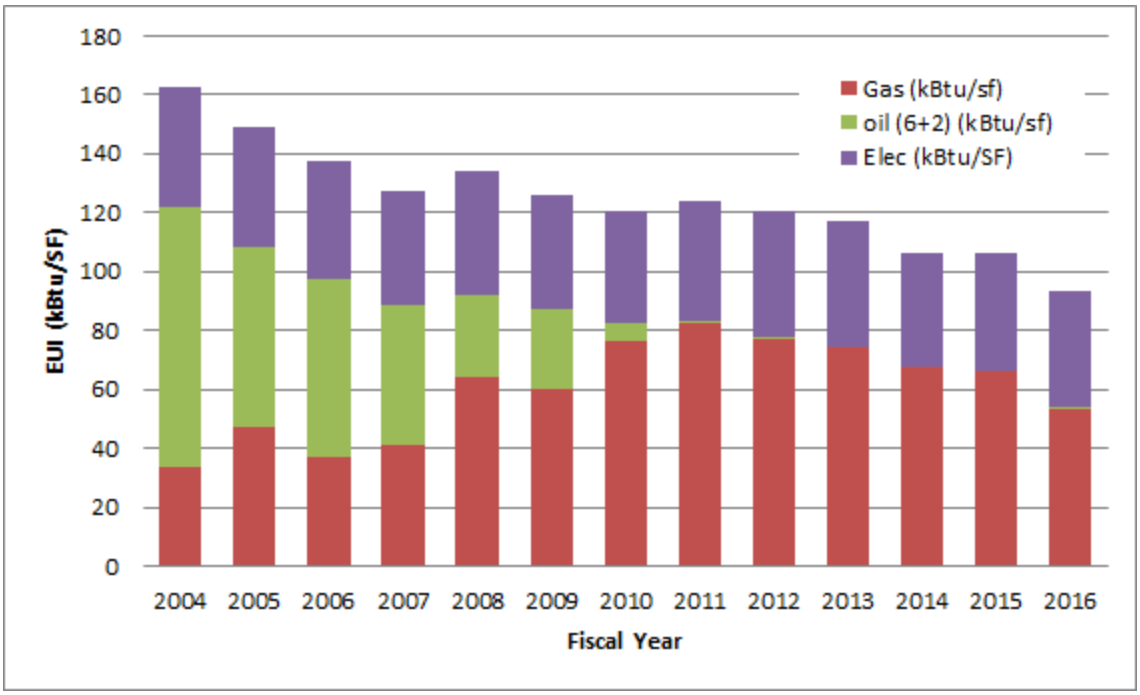
Table 22. Summary of UMass Lowell Energy Use, FY2016 vs. FY2021

		FY2016 Actual(1)	FY2021 Projected
Electricity (kWh)		49,918,811	48,500,000
Gas (DTH)		231,762	240,000
Oil (mmBTU)		227.39	0.00(2)
Total Energy Consumption (MMBTU)		402,308	405,482
Building Floor Area (sq.ft.)(3)		4,322,931	4,820,931(4)
Energy Use Index (kBTU/sq.ft.)(5)		93.06	84

(1) FY2016 data is based on meter readings and utility bills issued by National Grid (for electricity and gas) and state-approved oil suppliers.
(2) From FY2017 onwards, oil will be used only as a backup fuel for steam boilers at heating plants, which normally burn natural gas.
(3) Building Floor Area used for utilities use reporting, which may include leased buildings, include buildings under construction, and exclude existing building spaces that are vacant, is calculated differently from how the campus building floor area is calculated in this SDP Update. The calculation of this different floor area is reported in the *Leading by Example Program Energy Tracking and Reporting Form* submitted annually by UMass Lowell.
(4) For projecting the Energy Use Index for FY2021, the Building Floor Area for FY2021 is projected using the FY2016 basis in this table, with the addition of the new floor area in FY2021 as projected in this SDP Update (see Table 19), which is about 498,000 sq.ft.
(5) Energy Use Index (kBTU/sq.ft.) = Total Energy Consumption (MMBTU) ÷ Building Floor Area (sq.ft.) x 1,000

While total energy consumption in FY2021 is projected to be slightly higher than that in FY2016, the University's Energy Use Index (EUI), which incorporates changes in building floor area on campus, is expected to decrease. As illustrated in Figure 40, this will be the continuation of a consistent trend of declines dating back more than a decade. UMass Lowell's EUI has dropped in 10 out of the past 13 years – a total of a 42.9% decrease between 2004 and 2016.

Figure 40. UMass Lowell Energy Use Index, FY2004 – FY2016



In addition to improving overall energy efficiency, UMass Lowell is actively participating in demand response during peak demand hours. Recent EnerNOC upgrades and active monitoring help the University respond in real time, raising temperature settings for automated climate control systems, reducing automated lighting, and sending out email notifications to advise everyone on campus to turn off unused and non-vital equipment, turn off manually switched lights, close shades, binds, and windows, and shut down or raise the temperature setting of window air conditioning units. This demand response program has helped UMass Lowell avoid considerable energy costs while reducing the load on power generation facilities during peak demand periods.

5.9 GREENHOUSE GAS EMISSIONS

The University attained its *Climate Action Plan* (*CAP*) 2020 Greenhouse Gas (GHG) reduction milestone five years ahead of schedule. For this and related accomplishments, UMass Lowell was recognized by Second Nature as an example of excellence in climate action planning, noting, "UMass Lowell's approach highlights the fact that moving towards a low carbon energy system can be compatible with high growth."

In addition, the University's CAP Steering Committee was recognized in 2015 by Massachusetts Governor Charlie Baker with a Commonwealth Citation for Outstanding Performance for the UMass Lowell's commitment to sustainability, climate change, and resiliency.

Announced on Earth Day, 2016, UMass Lowell became one of the only 84 colleges and universities across the United States as charter signatories to Second Nature's new "Climate Commitment." Being a signatory provides the University with the necessary support and direction to advance its efforts in conjunction with the success of the *CAP*.

5.9.1 Climate Action Plan Phase 2

Looking forward, the University faces a more challenging Phase 2 of the *CAP*, which would ultimately lead to full carbon neutrality by 2050. For the Phase 2 milestone, UMass Lowell will need to:

- Reduce Scope 1+2 GHG emissions to 6.0 MTCO2e/1000 SF or below;
- Reduce Scope 3 GHG emissions to 1.50 MTCO2e/Student FTE or below;
- Reduce and/or offset annual GHG emissions to 47,100 MTCO2e/yr or below; and
- Achieve these goals by FY2030.

The University already estimated that a further reduction of 800 MTCO2e/yr is expected from FY2016 to FY2017, and the ongoing AEP would reduce another 5,070 MTCO2e/y of GHG emissions by 2017. Nevertheless, the growing student enrollment and physical size of the University will continue to be a challenge, requiring campus buildings to be ever more efficient. The many planned renovation projects, large and small, as well as additional renewable energy projects will help toward this goal, alongside sustainable initiatives in the University's operations and services.

The acquisition of the Perkins Properties will also increase on-campus housing, thus mitigating GHG emissions from future students who would otherwise commute to the University. Continued commitment in TDM policies and programs, close monitoring of parking demand, and the upcoming bridge replacement projects would all contribute toward reducing Scope 3 GHG emissions.

6. CHAPTER SIX – RESPONSE TO COMMENTS

As recommended by the MEPA Office, the table below provides a direct response to each suggestion raised or comment made by the Secretary and others in their review of the 2012 Expanded NPC. The full text of the Certificate and comments showing the coding of the individual comments abstracted for response is found in Appendix A.

Code	Comment	Response
	Certificate of the Secretary of EEA on the Expanded NPC – October 12, 2012	
C-1	I strongly encourage the Proponent to continue to work with various stakeholders, such as the Northern Middlesex Council of Governments, to ameliorate concerns raised in its comments on the Expanded NPC.	UMass Lowell is committed to maintaining ongoing communication with NMCOG and other stakeholders on matters raised through the Strategic Development Plan process, as well as ongoing initiatives. We welcome their constructive input and are striving to address areas of concern, including those detailed below. Representatives of UMass Lowell met with NMCOG on March 4, 2016 to discuss their comments and suggestions. Key topics included: NMCOG's comments on the *2011-2016 SDP*, a preview of the *2016-2021 SDP Update*, and improvements to the Pawtucket Street Corridor.
C-2	MassDEP has stated in its comments that implementation of the new projects [through 2016] will generate a total of 346,000 gallons per day of peak wastewater flow, although the basis of this flow estimate has not been provided.	The four major new construction projects with significant water demand that were completed in last five-year period – the Saab Emerging Technology and Innovation Center (ETIC), the Health and Social Sciences Building (HSSB), University Suites, and University Crossing – utilized a total of 12,300 CCF in FY2016, approximately 25,208 GPD. If peak flow is assumed to be 2.0 times the average GPD, this would have yielded a peak increase of 50,416 GPD. Overall peak campus flows have been estimated for 2016 and projected for 2021 as part of the NPC filing. See Section 5.1 of this SDP Update for additional details.
C-3	In addition, the Expanded NPC does not include any detailed information on the wastewater infrastructure, need for improvements to the system, or for mitigation to offset new flows. These actions should to	UMass Lowell has included Water Conservation fixtures in its Design Standard since the first Plumbing Standards and Sustainability Guidelines were adopted in early 2011. All LEED-designed buildings

Code	Comment	Response
	be incorporated into the planning, design, and potential wastewater permitting for the projects. The Proponent should provide additional detail on these aspects of the proposed projects and consult with MassDEP staff to discuss permitting requirements for the projects.	were fitted out with water conservation fixtures. These include the ETIC, the HSSB, University Suites, and University Crossing. Examples include low-flow plumbing fixtures, vegetated stormwater swales, and green roof installations. The University's ongoing Accelerated Energy Program (AEP) also includes the installation of low-flow plumbing fixtures that will focus on older building stock on campus. When complete, the AEP is estimated to reduce water consumption by 2.5 million gallons a year. A more detailed discussion of wastewater management at present and in the future is found in Section 5.1 of this SDP Update.
C-4	The Expanded NPC, however, does not include a discussion of how the stormwater management system will comply with the Stormwater Management Regulations, including the ten standards for stormwater quality and quantity control. Compliance must be achieved via the implementation of Best Management Practices (BMPs) identified in the MassDEP Stormwater Handbook.	In 2009, UMass Lowell adopted a *Stormwater Management Program* (*SWMP*), which includes a commitment to comply with the Commonwealth of Massachusetts Stormwater Management Regulations for any redevelopment or new development projects that trigger these requirements. The SWMP also includes an ambitious goal of zero stormwater discharge from new projects and, to the extent achievable, from the existing campus. The *2009 SWMP* is attached as Appendix C to this SDP Update.
C-5	According to the Expanded NPC, stormwater management plans have been prepared for all three campuses. The contents of the storm water management plans and their implementation should be provided to MassDEP, with any necessary additional information to understand the applicable regulatory requirements.	The UMass Lowell three campuses require coverage under the Municipal Separate Storm Sewer System (MS4) Permit due to having a separate combined sewer system and stormwater discharges to the Merrimack River. The University hired AMEC Earth & Environmental to develop the *SWMP* in March 2009 to meet the requirements of the University's 2003 MS4 Permit. The 2003 MS4 Permit expired in 2008 and was reissued on April 4, 2016. It will go into effect on July 1, 2017. Completed activities on implementing the *SWMP* includes: drainage system mapping; delineation of drainage catchments; development of an Illicit Discharge Detection and Elimination (IDDE) Plan; dry weather MS4 interconnection and outfall inspections;

Code	Comment	Response
		public education activities (e.g., storm drain marking, website development); and employee training. These activities will be reviewed and revised as necessary before the new MS4 Permit goes into effect. The *2009 SWMP* is attached in Appendix C.
C-6	I note that storm water from the project site ultimately discharges to the Merrimack River, which is listed on the Massachusetts Year 2012 Integrated List of Waters among the waterbodies subject to total maximum daily loads (TMDLs). Therefore, to the extent practicable, stormwater BMPs for this project should be designed to control pathogens, which are sources of impairment in the river.	The current stormwater management approach focuses on minimizing or controlling pathogens through good housekeeping measures, which will be further updated with the new MS4 Permit requirements. BMP's to address pathogens will be considered during the design phase of each project.
C-7	The Proponent should consult with MassDEP to provide stormwater management plans and detailed information on the BMP designs so that MassDEP may assess whether the stormwater management system would be consistent with the total maximum daily loads established for the Merrimack River.	Representatives of UMass Lowell conferred with the MassDEP Northeast Regional Office in March and April 2016 to discuss their comments. Going forward, MassDEP will be consulted to determine the applicability of TMDL requirements during the design phase for new projects. Currently there is no TMDL or stormwater pollutant load allocation for the Merrimack River.
C-8	As noted in the Massachusetts Department of Energy Resources' (DOER) comments the Expanded NPC does not substantially comply with the requirements of the MEPA Greenhouse Gases Policy and Protocol, which requires that for each of the planned building projects as described in the "UMass Lowell Capital Projects Update/March 2012" the Proponent would be required to include a GHG analysis. However, because the Expanded NPC is not subject to the preparation of a mandatory EIR the project is not subject to the MEP A Greenhouse Gases Policy and Protocol.	The MEPA Certificate states that the 2012 Expanded Notice of Project Change (NPC) was not subject to the Greenhouse Gas (GHG) Policy because the planned projects did not trigger a mandatory Environmental Impact Review. Even so, UMass Lowell has pursued aggressive GHG emission reductions, as outlined in its *Climate Action Plan* (*CAP*). Between FY2011 and FY2015, full time equivalent (FTE) student enrollment has increased by 18% and the area of the campus has grown by 24%. The campus net GHG emissions have decreased by 15% since the *CAP* was adopted in 2012. UMass Lowell has already achieved its FY2020 Phase 1 Interim GHG Reduction Goals established in the *CAP* for Scope 1, 2, and 3 emissions. In addition, through the end of FY2016, UMass Lowell has reduced its Energy Use Index (EUI), as measured in

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		KBTU/SF, by 25% since FY2011 and 38% since FY2005. Further details of GHG emissions and mitigation are provided in Section 3.5 and Section 5.9 of this SDP Update.
	MassDEP Northeast Regional Office – October 5, 2012	
1-1	Basic information, such as the square footages…are not provided in the SPD. Consequently, it was not possible to add the project elements to calculate the total square footage….	Then existing (2011) and proposed (2016) building square footages by use were outlined in Table 4.1 and Table 4.2 of the *2011-2016 Strategic Development Plan*. An updated table with actual 2016 data is provided in Chapter 2 and proposed 2021 data is provided in Chapter 4 of this SDP Update.
1-2	Similarly, there is a need for basic information, to understand how a project of this magnitude has held new impervious surfaces to less than an acre. Supporting information with the impervious cover tables…would be useful.	Nearly all of the new construction activity undertaken by UMass Lowell has occurred on sites that were previously developed with impervious surfaces, such as parking areas, paved tennis courts, or existing buildings. In addition, the University has converted some former surface parking areas to landscaped open space following construction of multi-level garages. A detailed summary of pervious and impervious surface calculations is provided in Chapters 2 and 4 of this SDP Update.
1.3	It also would be important to know which building(s) or structure(s) would be 170 feet in height, and how that compares with other building heights in the city of Lowell.	None of the projects constructed between 2011 and 2016 exceeded 170 feet in height. The only project planned for 2016-2021 that exceeds this threshold is the elevator shaft addition to Fox Hall, whose height will be consistent with the existing building.
1-4	Estimated water use and wastewater generation for the project elements are not available, and information appears to be very limited on the renovations and utility and infrastructure work proposed. As a result, there also is a question whether new water and sewer lines are needed, even though the ENPC does not indicate any increase in the length of water and sewer mains.	Water use and wastewater generation for the project elements is presented in Section 5.1 of this SDP Update. Other than connections to water and sewer lines in adjacent streets, no new water and sewer lines have been required, nor are any required for the upcoming project elements. However, the University has worked with the City of Lowell and regional utilities to make improvements to drainage, sanitary, and water infrastructure in

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		the vicinity of the campus in conjunction with several campus projects.
1-5	The-contents of the stormwater management plan and its' implementation should be made available, with any necessary additional information to understand the regulatory requirements applicable to the project site, and in order to comment on the plan and have an opportunity to verify the statement in the SDP indicating, "(d)ischarges from storm and sewer drains will not affect the watershed's endangered species."	A copy of UMass Lowell's *2009 Stormwater Management Program* is attached to this SDP Update as Appendix C.
1-6	[T]o the extent practicable, stormwater best management practices (BMPs) for this project should be designed to control pathogens, which are sources of impairment in the river.	See response to C-6 above.
1-7	[T]he ENPC submitted by UMASS Lowell for the SDP does not include any detailed information on the wastewater infrastructure, need for improvements to the system, or for mitigation to offset the new flows to be generated by implementation of the plan. These actions need to be incorporated into the planning, design, and permitting for the projects. The project proponent should provide additional detail on, these aspects of the proposed projects, and meet with LRWWU and MassDEP staff to discuss permitting requirements for each phase of the project.	See response to C-3 and 1-4 above.
1-8	[T]here is not enough information about the [GHG] models or the sources of the emissions data to assess whether the information conforms to the [*MEPA Greenhouse Gas Emissions Policy and Protocol*] requirements. It also is a concern that a single, conforming model was not used to generate the data, and that input and default values for the simulation models were not provide to have the opportunity to verify the conclusions. It also is not clear that this approach would be consistent with the [*MEPA Greenhouse Gas Emissions Policy and Protocol*], because the building descriptions are insufficient to understand the "(c)onfiguration, occupancy, envelope attributes, operation schedule, and building systems (e.g., HVAC, and lighting,	UMass Lowell already responded to this comment before the Certificate was issued. The project was not subject to GHG Protocol. Nonetheless, careful and detailed GHG modelling was carried out, as described in 2012: "The energy models used for these projects are conforming models referenced in the Policy. Specifically, eQuest 3.63 was used for ETIC, Trane Trace 700 v. 6.2.7 for HSSB, and eQuest for University Suites. Also as described in the Memorandum, the estimates for University Crossing were based on preliminary estimates. These preliminary estimates (the only data available at the time) were generated using the Energy Star Target

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	etc)." Without a more transparent analysis and the ability to understand how the energy demand was assigned to achieve the predicted reductions of the mitigation, it is not possible to evaluate the proposed energy efficiency plans for the capital improvement projects.	Finder software. More refined modeling is currently underway using the Trane Trace software. Energy modeling was not conducted for the parking garage projects as they have only an electrical load for lighting. Modeling for the Manning School of Business has not yet been conducted because the project design is not yet underway. Each building project is being conducted by different architects and design firms with different project schedules. Although the same model was not selected for each project, all of the building projects are evaluated using conforming energy models referenced in the Policy." An update of these GHG estimates and performance for completed buildings is found in Section 3.5 and Section 5.9 of this SDP Update.
1-9	In addition, for conformance with the [*MEPA Greenhouse Gas Emissions Policy and Protocol*], an analysis of mobile sources of emissions is needed.	Even though the project was not subject to the GHG Policy, UMass Lowell began a comprehensive Transportation Demand Management Program in FY2011 that has gone from strength to strength each year. Scope 3 GFG emissions (MT per FTE) have fallen each year, with the University meeting its 2020 *Climate Action Plan* goals in FY2015. New construction and renovation projects at UMass Lowell have been proactive in addressing mobile source emissions. High quality bike parking has been installed throughout the campus as part of these projects. At certain locations, electric vehicle charging stations have been installed. Carpool and FEV/LEV preferred parking are also features associated with the many LEED certified projects completed at UMass Lowell. The University also continues to work proactively with the City of Lowell and numerous state agencies to provide viable transportation options to get to, from, and around campus. Transit use at UMass Lowell has grown to an average of 8,000 unlinked trips per day. In 2015, the University worked with the City of Lowell to adopt a comprehensive 'Complete Streets' Policy that will assist with further

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		reduction of Scope 3 related GHG emissions at UMass Lowell.
1-10	The GHG emissions analysis also should have provided more in-depth information on the mitigation measures and explained why mitigation measures, including renewable energy sources have not be adopted for the capital improvement projects.	Although the project was not subject to the GHG Policy, UMass Lowell has been extremely proactive in implementing energy efficiency initiatives as a requirement of new construction standards and retrofits. The University's Energy Use Index (EUI) has fallen in 10 of the last 13 years as a result. Examples include LEED Silver and Gold rated buildings on campus that result in significant energy savings and direct mitigation measures during building construction and operation. The Commonwealth of Massachusetts is investing $27 million through its Accelerated Energy Program (AEP) to make UMass Lowell more energy-efficient and further reduce its carbon footprint. The AEP will reduce annual campus utilities usage by 6 million kWh of electricity, 500,000 therms of gas, and 2.5 million gallons of water, while lessening the University's carbon footprint by approximately 5,070 MTCO2e/yr. The University also maintains virtual net metering contacts with five off-site solar installations, totaling 15.9 MW of generation capacity. In addition, our four owner-operated and serviced solar arrays located on campus are rated at 246 kW. Further details of these mitigation programs and their GHG emission reductions are found in Section 3.5 and Section 5.9 of this SDP Update.
1-11	[T]he ENPC has not made a commitment to recycling construction debris, UMass Lowell apparently is striving to achieve higher rates of recycling on the campus, so MassDEP anticipates that the project proponent will incorporate C&D recycling activities as a sustainable measure for the project. In addition, the proponent is advised that demolition activities must comply with both Solid Waste and Air Pollution Control regulations, pursuant to M.G.L. Chapter 40, Section 54.	Recycling and diverting waste from disposal has become a consistent strategy for UMass Lowell's large construction projects to achieve USGBC points for LEED Silver certification. As part of this practice, UMass Lowell actively engages environmental consultants to identify applicable regulations, monitor the process, and ensure compliance as well as maintain air quality. See the response to Comment 1-16 for additional details.

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1-12	ABC [asphalt, brick and concrete] can be crushed on-site with a 30-day notification to MassDEP. However, the asphalt is limited to weathered bituminous concrete, (no roofing asphalt), and the brick and concrete must be uncoated or not impregnated with materials such as roofing epoxy. If the brick and concrete are not clean, the material is defined as construction and demolition (C&D) waste and requires either a Beneficial Use Determination (BUD) or a Site Assignment and permit before it can be crushed.	UMass Lowell maintains on-call contracts with several environmental consultants and contractors for quick response to a long list of environmental and hazardous materials services. As noted below, standard practice includes having an environmental consultant on board to identify and ensure compliance with all disposal regulations. The UMass Lowell Department of Emergency and Environmental Management also works closely with the consultant and contractor for all environmental-related activities as a second level of support and oversight.
1-13	[I]f the ABC crushing activities are projected to result in the emission of one ton or more or particulate matter to the ambient air per year, and/or if the crushing equipment employs a diesel oil fired engine with an energy input capacity of three million or more British thermal units per hour for either mechanical or electrical power which will remain on-site for twelve or more months, then a plan application must be submitted to MassDEP for written approval prior to installation and operation of the crushing equipment.	If crushing activities are anticipated as part of a construction project, UMass Lowell employs an environmental consultant to identify applicable regulations and monitor daily operations for compliance. As part of standard practice, contractors are required to water down crushing activities to reduce particulate matter in the ambient air. The level of particulate concentration is measured and monitored throughout the day to maintain proper air quality.
1-14	[I]f significant portions of the ·demolition project contain asbestos, the project proponent is advised that asbestos and asbestos-containing waste material are a special waste as defined in the Solid Waste Management regulations, (310 CMR 19.061). Asbestos removal notification on permit form ANF 001 and building demolition notification on permit form AQ06 must be submitted to MassDEP at least 10 working days prior to· initiating work.	UMass Lowell's demolition contract holds the contractor responsible for compliance with all state, federal, and local health, and environmental codes, ordinances, and regulations for remediation and/or removal requirements. Prior to demolition, a complete hazardous materials survey is conducted to include; destructive testing, lab testing, and spot TEV certification to identify all hidden building components and layers including asbestos, lead paint, oil, paints, white goods, tanks, oil drums, PCBs, mercury, pigeon guano, dead animals, miscellaneous chemicals, etc. The contractor is also responsible for confirming, verifying, and reporting all existing environmental conditions which would affect the project. The contract also requires a certified hygienist to monitor all remediation and removal activities. As a condition for final approval and acceptance of hazardous material removal, two affidavits must be submitted, one in support of a manifest or manifests covering the transport and disposal of all regulated hazardous

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		materials, and a second advising that all other material from demolition of the buildings has been appropriately disposed of with identification of the disposal site.
1-15	The demolition activity also must conform to current Massachusetts Air Pollution Control regulations governing nuisance conditions at 310 CMR 7.01, 7.09 and 7.10. As such, the proponent should propose measures to alleviate dust, noise, and odor nuisance conditions, which may occur during the demolition.	As a standard practice for all demolition activities environmental consultants are engaged to identify applicable regulations. UMass Lowell also conducts pre-demolition surveys, monitors compliance, and ensures air quality. Air quality is measured multiple times each day at several locations surrounding the demolition site. Contractors are required to water down debris fields to further contain dust and preserve air quality. Additionally, the level of noise is monitored and officials respond quickly to maintain levels within the decibel tolerances required by local ordinance. Each demolition plan is developed to minimize the effect on nearby resident/occupants and is monitored not only by the contractor and environmental consultant but also by UMass Lowell's Facilities Project Manager and Emergency and Environmental Management Department.
1-16	Adapting the design, infrastructure, and contractual requirements necessary to incorporate reduction, recycling and recycled products into existing large-scale developments has presented significant challenges to recycling proponents. Integrating those components into developments such as the UMass Lowell Strategic Development Plan at the planning and design stage will enable the project's management and occupants to establish and maintain effective waste diversion programs.	In 2011 UMass Lowell created a Guideline for Sustainable Initiatives and Green Design which is incorporated into the design standards for all campus construction and renovation projects. This guide reinforces UMass Lowell's commitment to improving the environmental performance of its facilities and identifies green construction means and methods as a priority to be incorporated into all campus projects. Additionally, Executive Order 484, the *Climate Action Plan*, and the Sustainability Tracking, Assessment, & Rating System (STARS) certification all are used to reinforce the campus commitment to sustainable construction and have become part of all standard design services contracts. Highlights of sustainability in recent projects include: ETIC – 90% of construction waste was diverted from disposal. Wastewater was reused to supply cooling towers, diverting up to 419k gallons a year from treatment plants. 30% of the furniture used in new building was repurposed or recycled.

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		HSSB – 40% construction materials were manufactured within 500 miles of site to reduce GHG emissions. 75% of construction debris was recycled. University Suites – 75% of construction waste was recycled or salvaged. New materials contained at least 20% recycled content. Leitch and Bourgeois – Gut renovation allowed the reuse of the structure and envelope of existing buildings. New flooring with high recycled content was used. University Crossing – Reused soil on site to divert 75% of construction waste. 10% of materials were made of recycled content. 50% of the furniture used in new building was repurposed /recycled. McGauvran – Gut Renovation allowed reuse of the existing structure and envelope. Reused 50% of the interior non-structural components. New materials contained at least 10% recycled content. Low VOC adhesives, paints, and flooring were used.
1-17	The project proponent is advised that excavating, removing and/or disposing of contaminated soil, pumping of contaminated groundwater, or working in contaminated media must be done under the provisions of MGL c.2lE (and, potentially, c.21C) and OSHA.	UMass Lowell complies with MGL c.21E and other applicable local, state, and federal laws and regulations for the management of contaminated soils, groundwater, and other media in conjunction with all construction projects. The campus maintains “house doctor” contracts with multiple Licensed Site Professionals and other environmental consultants to oversee this work. These consultants work closely with the University’s Facilities Management and Environmental Health and Safety offices.
1-18	Parties constructing and/or renovating buildings in contaminated areas should consider whether chemical or petroleum vapors in subsurface soils and/or groundwater could impact the indoor air quality of the buildings.	UMass Lowell requires its designers to address indoor air quality in compliance with applicable local, state, and federal laws and regulations.
1-19	Construction activities conducted at a disposal site shall not prevent or impede the implementation of likely assessment or remedial response actions at the site.	Prior to the commencement of a construction project at a site that is known to or may be a disposal site, MassDEP records are reviewed. If necessary, environmental consultants are engaged to ensure compliance with applicable local, state, and federal laws and

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		regulations and cooperation with assessment and remediation activities.
1-20	Construction of structures at a contaminated site may be conducted as a Release Abatement Measure if assessment and remedial activities prescribed at 310 CMR 40.0442(3) are completed within and adjacent to the· footprint of the proposed structure prior to or concurrent with the construction activities.	If a Release Abatement Measure (RAM) Plan is in place or required at a site impacted by UMass Lowell construction activity, the campus engages a Licensed Site Professional to ensure that activities are conducted in compliance with the provisions of the RAM Plan.
1-21	Excavation of contaminated soils to construct clean utility corridors should be conducted for all new utility installations.	UMass Lowell has not installed new utilities through areas of contaminated soils, but is aware of this requirement should it need to do so in the future.
	Northern Middlesex Council of Governments – October 5, 2012	
2-1	To the best of our knowledge, ITE trip generation rates for LUC 550 are based on actual data provided by universities across the country, We question whether the substantial adjustments made to the initial calculations are appropriate, given that the universities supplying the ITE data likely have student bodies similar to UMass Lowell in composition, and therefore online, graduate and continuing education students are already considered in the development of the trip generation rates produced by ITE.	Even including adjustments, the *2011-2016 SDP* greatly over-estimated the actual vehicle trip generation associated with the development activities on the campus between 2011 and 2016. With the exception of a very modest number of visitors, all parties parking on campus (students, faculty, and staff) are required to purchase and display parking decals. As a result, decal sales and ownership is highly correlated with trip generation. Between 2011 and 2016, decal ownership actually decreased from 7,817 to 7,558. The increase in parking decal prices across the board over the past five years offers an explanation for the decrease. The transportation demand management policies adopted by the University, improved bicycling and walking conditions, new residential halls and private residential development catered to students close to campus, and University-supported sustainable transportation programs all encouraged students, faculty, and staff to drive less. In addition, the difference from the ITE model may be due to the fact that many of the campuses surveyed by ITE are located in less urban, more isolated locations where vehicle

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		trips are required for any activity that involves leaving campus, which is not the case in an urban setting such as Lowell.
2-2	The University has chosen to further revise the trip generation numbers by also basing the revised calculation on the number of employees. While the ITE Trip Generation Manual offers a methodology for such a calculation, it clearly states that trip generation calculations are more accurate when based on students rather than staff.	As an urban campus with large populations of resident students and local commuter students and rapidly declining rates of vehicle usage among all student groups, faculty and staff are a better measure of sustained vehicle trip generation at UMass Lowell (although vehicle use rates are declining among faculty and staff as well).
2-3	While the *Campus Transportation Plan*… contains some information on existing operating conditions at area intersections, no analysis is provided on the effect of the University's expansion on these locations.	The University has worked aggressively to minimize the transportation impacts associated with its growth through comprehensive TDM strategies as well as major operating investments in a campus transit system. Section 4.4 identifies intersection and other transportation infrastructure improvements completed or being implemented by UMass Lowell and its partners, consistent with the Campus Transportation Plan. This has resulted in successfully minimizing trip generation as measured by NMCOG and City of Lowell's traffic counting program at locations near the UMass Lowell campuses (see first table following response to comments on page 119). Additional historical counts are documented and summarized in the TEC's Campus Transportation Update in Appendix D.
2-4	Furthermore, the Implementation Plan within the *Campus Transportation Plan* provides general information on potential intersection improvements needed to address deficiencies under existing conditions, but it does not quantify the impact of such improvements from a level of service perspective, nor does it identify what improvements will be needed in the future to address the University's expansion impacts. The Implementation Plan also lacks information identifying the party(ies) responsible for implementing the proposed improvements.	See response to 2-3 above.

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2-5	[G]iven that all three campuses are located within a mile radius and are controlled by the same entity, NMCOG questions whether considering each campus location separately is consistent with MEPA's project segmentation rule.	UMass Lowell employs a successful "park once" program, which includes significant limitations on where various campus parking decal-holders can park as well as a transit system that supports most intercampus travel. As a result, trip generation is largely confined to trips from external destinations to a lot on one campus, with minimal trips among the campuses, supporting the study approach that focuses on the campuses as having independent impacts on surrounding infrastructure.
2-6	Despite the City's unwavering enthusiasm for this plan, the City indicated that if it had more direct permitting jurisdiction over the University, as it does with comparably sized private developments~ it would likely seek additional specific commitments toward concrete actions and contributions to improve the transportation infrastructure most directly impacted by University growth, and look for even more aggressive steps to providing alternatives to the single-occupancy vehicle trip.	Without the need for permitting conditions, UMass Lowell has implemented a broad range of measures to improve the transportation infrastructure serving its campuses. This includes a commitment of considerable technical assistance and $2 million in matching funds to support a TIGER-funded replacement and repair of 8 canal bridges in Lowell; funding and management of a study to improve the Pawtucket Street corridor as a "complete street" promoting bicycling and pedestrian connections between South and East Campuses; and various TDM measures and intersection improvements detailed in Section 5.6 of this SDP Update.
2-7	Likely areas of focus would include Broadway and Wilder Streets near the South Campus and Sparks and Riverside Streets near the North Campus. Additional improvements in these areas would complement the City's recent and planned investments in several other intersections, and in bicycle infrastructure proximate to and between the campuses.	Since 2011, UMass Lowell has funded and completed the design and construction of intersection improvements as Broadway and Wilder Streets and at Broadway and Pawtucket Streets. It has also monitored impacts at Sparks and Riverside Streets. These initiatives are complemented by the City's projects to improve University and Riverside Streets and Pawtucket and School Streets.
	MassDOER – October 9, 2012	
3-1	As such the submittal does not substantially comply with the requirements of the MEPA GHG Policy and Protocol, which requires that for each of the planned building projects as described in the "UMass Lowell Capital	Since the *Climate Action Plan* (*CAP*) was signed by UMass Lowell's Chancellor in January 2012, the CAP Steering Committee has been an active and committed team aggressively driving its implementation.

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	Projects Update/March 2012" the University must include a GHG analysis.	The CAP Steering Committee is organized with leaders from Faculty and Staff including subcommittees for Administration and Finance; Energy Project Identification; Sustainability; Academic; Student Life; Transportation and Public Relations with senior administration oversight and support. The CAP Steering Committee was recognized in 2015 by the Governor of Massachusetts with a Commonwealth Citation for Outstanding Performance due to UMass Lowell's commitment to sustainability, climate change, and resiliency. Between FY2011 and FY2015, full time equivalent (FTE) student enrollment has increased by 18% and the building floor area of the campus has grown by 24%. The total campus greenhouse gas (GHG) emissions per FTE student have decreased by more than 15% since the *CAP* was adopted at UMass Lowell. UMass Lowell has already achieved its FY2020 Phase 1 Interim GHG Reduction Goals established in the *CAP* for Scope 1, 2, and 3 emissions. In addition, through the end of FY2016, UMass Lowell has reduced its Energy Use Index (EUI), as measured in KBTU/SF, by 25% since FY2011 and 38% since FY2005.
3-2	The [Stretch] Code provides both a prescriptive and performance compliance pathways for proposed building projects between 5,000 and 100,000 sf. However, in order to comply with the requirements of the Protocol, the performance path must be used. The performance path option compares a baseline and an as-proposed design established and modeled in conformance with ASHRAE 90.1 2007 Appendix G (energy only). In this case there is a minimum threshold of a 20% reduction in the energy usage of the as proposed design when compared with the base case.	All projects are designed to meet the Stretch Code and provide energy models reviewed by the Engineer, the local Utility company, and the University.
3-3	Some of the energy design mitigation measures (EDMs) which have been included by other similar projects resulting in significant	The following EDMs were incorporated into recent campus projects: **2012**

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	reductions in both energy usage and GHG emissions are: • Energy Recovery Ventilation: Significantly reduces HV AC load through preconditioning of the fresh air supply by transfer of heat from the building exhaust air stream. • Use of highly efficient AC units (DX and Chillers) • Use of oversized cooling towers • Use of VFD drives for pumps and fans • Use of water source heat pumps (WSHP) for dormitories [and] other residential occupancies. • At least a 15% reduction of lighting power density (LPD) below code maximum by use of daylight, automatic dimmer controls, efficient fixtures and custom layout. • Use of condensing boilers and/or furnaces. • Glazing: Minimization of wall to window ratio; use of high performance glazing products. • Increase R-values of roof and walls by at least 20% beyond the code required minimum. • Incorporation of Solar Photo voltaic renewable energy systems wherever applicable (Note: All buildings should be designed to be "solar ready."	ETIC – Energy recovery wheels for pre-treating makeup air using chilled beams; wastewater reused for cooling towers; high efficiency envelope; occupancy control in laboratories; stormwater retention (green roof & garden); daylight reflector in the atrium for daylight harvesting; use of low VOC products and reduction in introduction of pollutants into the building; energy conservation measures for annual energy usage reduction of 33%; indoor water use reduced by 32%; exterior water use reduced by 65%; stormwater runoff reduced by 60%; central, walkable location; bicycle parking for 25% of building occupants; bus lines/bus stop provided; and preferred parking for fuel efficient vehicles. North Campus Garage – LED lighting with daylight sensors and stormwater retention system. **2013** HSSB – Chilled beams; efficient MEP and lighting with occupancy controls; low flow plumbing; high efficiency glazing and building envelope; and stormwater retention on site. U-Suites – 77% Certified Wood by the Forest Stewardship Council (FSC); low VOC paints; energy efficient lighting with occupancy sensors; low flow fixtures; high performance glazing and building envelop; condensing boilers; heat recovery; valance units; and stormwater retention (roof runoff for irrigation). South Campus Garage – LED lighting with daylight sensors; and stormwater retention and infiltration system. **2014** Leitch and Bourgeois - FCS wood; low VOC paints; energy efficient lighting with occupancy sensors; reuse of existing buildings (very sustainable approach); low flow fixtures; and new flooring with high recycled content. University Crossing – 33% reduction in energy use from high performance envelope and glazing; high efficiency lighting; daylight controls and occupancy sensors; energy efficient MEP's with BMS; reduced

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		stormwater runoff by 60% with retention system and green roofs, and water efficient landscaping. **2015** McGauvran – High performance envelope and glazing; high efficiency lighting; daylight controls and occupancy sensors; energy efficient MEPs with BMS; and 40% water reduction by efficient MEPs and low flow fixtures.
3-4	The DOER notes that the proposed Emerging Technologies and Innovation building will include wet labs and cautions the proponent that HVAC loads imposed by the fume hoods associated with this usage should be minimized through the use of approved control systems.	The ETIC lab air handling units are equipped with an energy recovery wheel using chilled beam technology. The heat recovery loop from exhaust fans preheats or pre-cools outside air for the makeup air unit. Hoods are controlled through a building management system and tied to occupancy to deliver lower air changes during unoccupied periods.
3-5	In conclusion, in its role as an example to and leader of the Lowell and surrounding community, the DOER is confident that a goal of the University in the implementation of the strategic plan will be to demonstrate approaches and technologies that will provide powerful examples of how to achieve buildings which combine beauty, function, and efficiency.	UMass Lowell appreciates the support and is confident that it has successfully demonstrated continued leadership in the area of sustainability through in its construction and renovation projects.
	MassDOT – October 9, 2012	
4-1	I do not believe that this project will require a Vehicular Access Permit; therefore, MassDOT will not be providing official comments.	Agreed.
4-2	[T]he methodology used by the Proponent to calculate the trip generation for the project seems inconsistent with the recommendation of the ITE Trip Generation Manual. The Proponent provided ITE Trip Generation estimates using both employees and students as variable resulting in trip generation of 1,252 and 5,700 daily vehicle trips respectively. For this particular Land Use Code, the ITE Trip Generation Manual recommends the use of students as a more reliable variable for trip	As an urban campus with large populations of resident students and local commuter students and rapidly declining rates of vehicle usage among all student groups, faculty and staff are a better measure of sustained vehicle trip generation at UMass Lowell (although vehicle use rates are declining among faculty and staff as well). As noted in the response to comment 2-1 above, the declining parking decal ownership over the past years reflects that the actual net new trip generation

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	generation calculations; therefore the unadjusted trip generation for this project should be 5,700.	between 2011 and 2015 was considerably below either estimates based on the ITE models.
4-3	[T]he overall project is spread among three campus that are apart from each other, and if the 5,700 daily vehicle trips were to be distributed among the three campus, it would unlikely result in a significant impact on traffic that would necessitate the implementation of traffic signal and/or highway improvements on state infrastructures.	Agreed.
4-4	The University has identified a TDM program in its Campus Transportation Plan, which include a range of measures to reduce site vehicle. The University should pursue the implementation of the program that should be monitored and updated as need.	UMass Lowell's Transportation Demand Management Program is committed to helping students and employees commute to and between University campuses in ways which are environmentally friendly, healthy, and economical through providing programs, services, events, and education about walking, bicycling, carpooling, and public transit. Since its implementation in FY2011, the program has grown from strength to strength. Parking decal ownership have dropped significantly since the program was instituted (see second table following response to comments on page 119). The University has been recognized by MassDOT as a Pinnacle Award winner for Excellence in Commuter Options from FY2014 – FY2016. In addition, UMass Lowell was recognized as a Bicycle Friendly University by the League of American Bicyclists in the Fall of 2015. UMass Lowell has also installed five electric vehicle charging stations at strategic locations on campus.
	WalkBoston – October 3, 2012	
5-1	[T]he proponent should develop a more robust wayfinding system within and between UMass Lowell's campuses. Because walkers tend to think in terms of times (minutes of walking rather than miles), signs that give the walking time to given destinations such as:	UMass Lowell has a comprehensive campus sign program includes building lettering, freestanding identification signs, parking identification signs, and both vehicular and pedestrian wayfinding signs which include maps.

Code	Comment	Response
	"Fox Hall – 11 minutes" or "O'Leary Library – 9 minutes," should be installed where there are high pedestrian volumes and/or where directional information is needed.	Sign components are modular, enabling sign panels and graphics to be replaced without having to replace an entire sign. UMass Lowell's Office of Sustainability has also initiated a project that will use strategically placed signage and informational boards in proximity to the UMass Lowell bus stops on East and South Campus. This 'University Walk' project will encourage more of the University population to consider walking or biking between East and South Campus along Pawtucket Street. This is a distance of approximately 1.0 mile. In addition to the informational boards at both anchor locations, there will be attractive and clearly legible wayfinding signage posted at strategic points along the corridor. Examples include the Pawtucket/Merrimack Street intersection (University Crossing) and the Pawtucket/School Street intersection.
5-2	WalkBoston also applauds the "park once" policy mentioned under Policy Initiatives: Action Steps. If embraced by the UMass Lowell community, this initiative will help decrease congestion and also generate more pedestrian activity on and around the campuses.	UMass Lowell's "park once" policy is a voluntary initiative established as part of the overall TDM program. In support of the goals of this policy, a robust parking management program limits parking availability to certain locations on campus during peak demand hours. Students that wish to pay for parking on campus are restricted to certain lots and must use campus transportation, bike, or walk between locations during the day.
5-3	The university might consider a marketing effort that highlights the pluses of walking such as: Choose your Mode for a South Campus to East Campus Trip ***1. Walk the* 15 *minutes to East Campus*** • Burn XX calories • Get some fresh air • Pass a friend and chat briefly on the way • Relax and arrive on time ***2. Drive the XX miles which will take XX minutes*** • Walk to parking lot, exit and drive to East Campus, find parking space, walk from car to building	The 'University Walk' project outlined above will have a significant impact on the University and surrounding community. The perceived distance between South Campus and other locations at UMass Lowell has long been a problem. Some notable effects of this problem include increased traffic congestion along the corridor and an unwelcoming environment along the corridor for the UMass Lowell community. The "anchor" signage at each bus stop will be seen by in excess of 7,000 people a day (FY2015 – Riverhawk Roadster ridership data). If a portion of these people choose to absorb the information and follow the "University Walk" along Pawtucket Street, it

Code	Comment	Response
	• Get stuck in traffic - grrr! • Create XX tons of GHG emissions • Arrive a bit frazzled Which choice feels better? Help UMass Lowell Get Fit and Go Green - Walk!	will have an enormously positive impact on the corridor. Those who choose to walk the corridor will be given positive reinforcements in the form of strategically placed signage. The signage will have a distinct and attractive brand that relates to the "anchor" signs and will promote the accessibility of the particular route e.g. University Crossing 0.3 miles. The signage will be accompanied by an updated walking and biking route app that is currently under development.

Table for Response to Comment 2-3: Average Annual Growth Rate of Traffic Counts for Four Street Intersections

Location	Avg. Annual Growth Rate
Pawtucket Street West of Wilder Street	-0.13% (2004-2014)
University Avenue North of VFW Highway	2.22% (2005-2010)
VFW Highway East of University Avenue	-0.69% (2004-2012)
Wilder Street South of Pawtucket Street	-0.18% (2005-2014)

Table for Response to Comment 4-4: Parking Decal Ownership - FY2011 vs. FY2016

Year	Faculty & Staff	Commuter Students	Resident Students
FY11	87.40%	80.00%	40.22%
FY16	84.63%	61.10%	29.78%

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APPENDICES

Appendices may be found at the
UMass Lowell Strategic Development Plan 2016-2021 website[4]

Appendix A	Certificate of the Secretary of Energy and Environmental Affairs on the Expanded Notice of Project Change, October 12, 2012, and Attached Comments
Appendix B	UMass Lowell 2011-2016 Strategic Development Plan
Appendix C	UMass Lowell 2009 Stormwater Management Program Prepared by AMEC Earth & Environmental
Appendix D	UMass Lowell Campus Transportation Update prepared by T.E.C.
Appendix E	UMass Lowell 2012 Climate Action Plan
Appendix F	UMass Lowell 2015 ACUPCC Climate Action Plan Interim Report
Appendix G	*UMass Lowell 2020* Strategic Plan – Mar 2016 Plan Update and 2016 Report Card

[4] https://www.uml.edu/Facilities/Planning/Strategic-Development-Plan-2016-2021.aspx

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