DEARBORN

# COMPREHENSIVE CAMPUS PLAN

DEARBORN


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01

# Executive Summary

# Plan Introduction

Located on the former Henry Ford Estate grounds, the University of Michigan-Dearborn (UM-Dearborn) boasts 120 acres of protected natural areas. The university, comprised of the Main Campus and the Fairlane Center, is bordered by the Rouge River to the west. It is connected to Downtown Dearborn through the Rouge River Gateway Trail, which passes through the Main Campus.

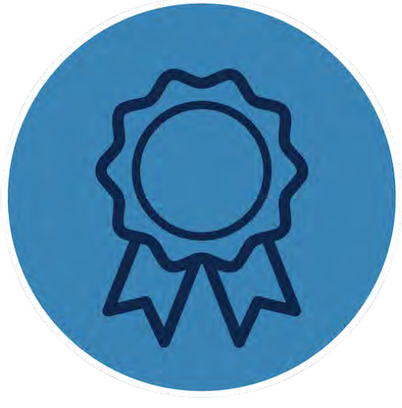
For over 60 years, UM-Dearborn has provided educational services to southeast Michigan by offering practice-based learning, ensuring small class sizes, and integrating innovative technology and research. Recently, UM-Dearborn engaged in an extensive engagement process to create a Strategic Plan that defines the institution's vision. After the Strategic Plan was finalized, the university developed the Comprehensive Campus Plan to achieve the Strategic Plan's goals through physical changes on the campus. The Comprehensive Campus Plan emphasizes the physical spaces on campus and the beautiful natural surroundings.

# Strategic Plan Alignment

The Comprehensive Campus Plan was crafted to align with UM-Dearborn's Strategic Plan, "The GO BLUEprint for Success." UM-Dearborn takes pride in providing its students with a practice-based learning environment and its status as Michigan's premier practice-based learning university. The leadership team and campus community collaborated to develop a comprehensive Strategic Plan reflective of this identity.

The Comprehensive Campus Plan outlines the university's priorities and goals, and includes Key Performance Indicators (KPI's) to measure the success of each priority. The university is currently in the implementation phase of the Strategic Plan, which involves exploring the feasibility of short- and long-term goals and identifying the resources and timelines required for their achievement.

**Student Experience and Success**



**Faculty and Staff Excellence**

**Holistic Excellence**

**Economic Sustainability**

The Comprehensive Campus Plan provides recommendations to enhance the physical assets of the university in support of the goals outlined in the Strategic Plan. This comprehensive approach ensures that UM-Dearborn remains committed to achieving sustained success and providing its students with a top-quality education.

# An Inclusive Approach

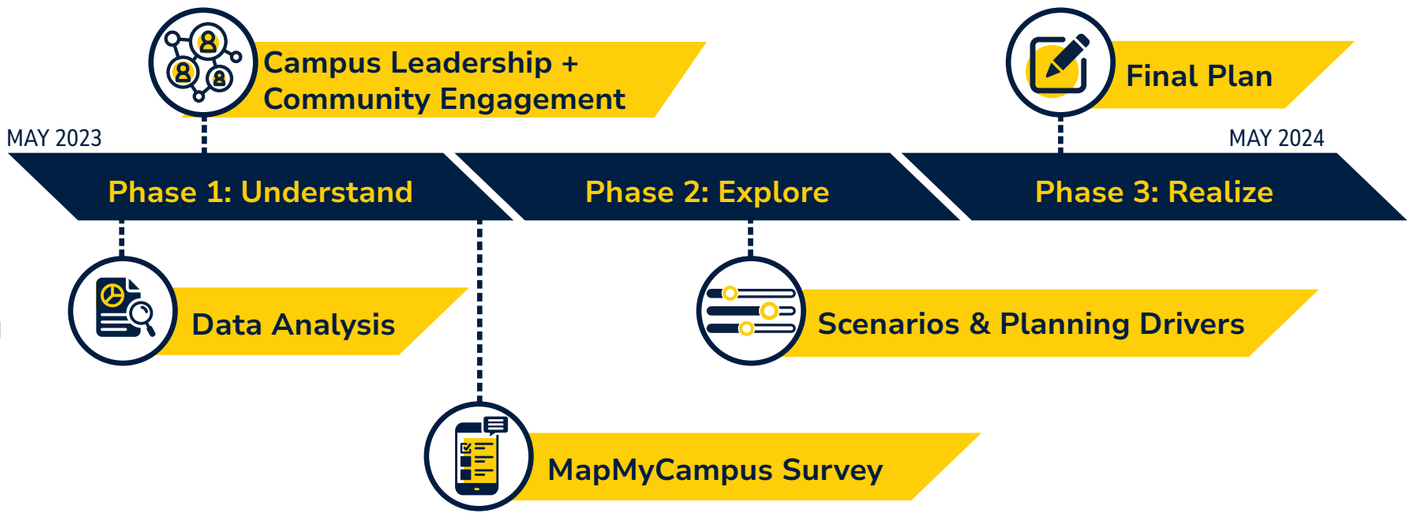
The Comprehensive Campus Plan is rooted in UM-Dearborn's core values and as mentioned earlier in this report, aligns closely with UM-Dearborn's Strategic Plan. As a tool for building consensus, the planning process included workshops, open forums, an online survey, stakeholder meetings, and committee meetings. Input was solicited at every major decision point within the process. UM-Dearborn's leadership also understood that not everyone has the flexibility or capability to participate in-person, therefore a Comprehensive Campus Plan website was established to gather input at any time of the day, and throughout the entirety of the planning process.

A very inclusive and transparent process was achieved by involving individuals from all facets of the UM-Dearborn campus community. The process required on-going commitment from UM-Dearborn's leadership and committee members, as well as participation from students, faculty, staff, and alumni. A wide range of dedicated individuals from the campus community also provided thoughtful input which helped guide the planning process and contributed to the resulting final plan.

# The Planning Process

## PROJECT INITIATION

The Comprehensive Campus Plan was developed in three phases over twelve months. The planning process was launched in May 2023 and finalized the following year. The data and priorities presented in the “GO BLUEprint for Success” Strategic Plan provided a foundation to support analysis, engagement, and ultimately the goals identified within the Comprehensive Campus Plan.



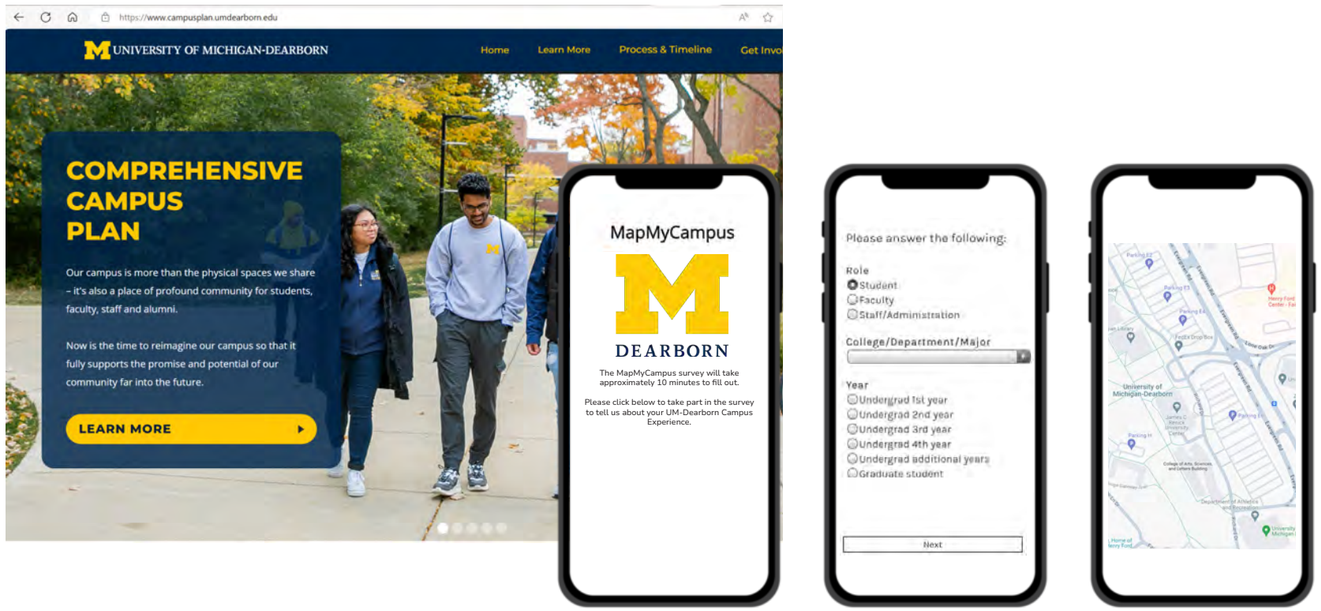

## PHASE 1: UNDERSTAND

The Comprehensive Campus Plan was driven by a robust, inclusive campus engagement process that engaged the leadership team and key stakeholders across campus through a variety of in-person and online sessions.

A Comprehensive Campus Plan website was developed to serve as an information hub and outreach tool for the campus community. The website also served as a repository for feedback with interactive features to provide input on the future of the campus.

Beyond the website, student feedback was collected at in-person engagement events and through mobile surveys. The MapMyCampus mobile survey collected 611 responses from students, faculty, staff, and alumni, providing unique insights on the campus experience.

> Data analysis and campus engagement completed in Phase 1 served as the foundation for the exploration of planning drivers in Phase 2.



## PHASE 2: EXPLORE

The exploration phase synthesized data and input collected in Phase 1 to develop a thorough understanding of campus needs and opportunities. Goals were developed to guide recommendations and planning drivers were identified to support proposed solutions.

Integral to the explore phase was a detailed space needs analysis and sustainability assessment. These analyses identified key operational changes and physical planning solutions to best utilize campus resources and plan for future energy use and carbon neutrality. The space needs analysis was built upon quantitative inputs regarding the course inventory and scheduling practices from Fall 2022, instructional space utilization for classrooms and teaching laboratories, a qualitative assessment of instructional space, and one-on-one interviews with academic, administrative, and student life leadership.

This phase resulted in the development of alternative campus scenarios which explored physical interventions to address planning goals and drivers. These alternative campus scenarios were presented to university leadership for evaluation.

### PLANNING GOALS

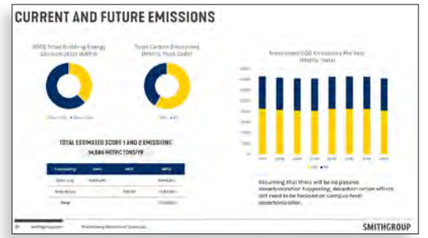
**Elevate the Campus Experience**

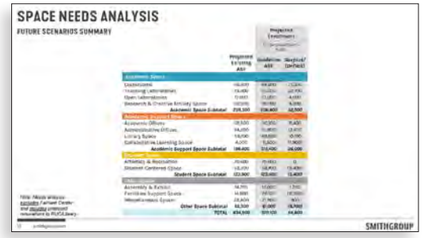
**Enhance Campus Identity**

**Optimize Space on Campus**

**Implement Climate Action**

### PLANNING DRIVERS



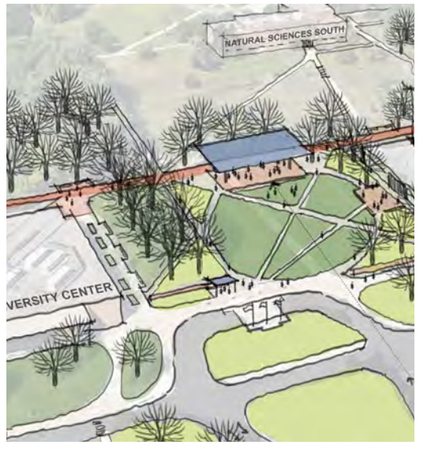



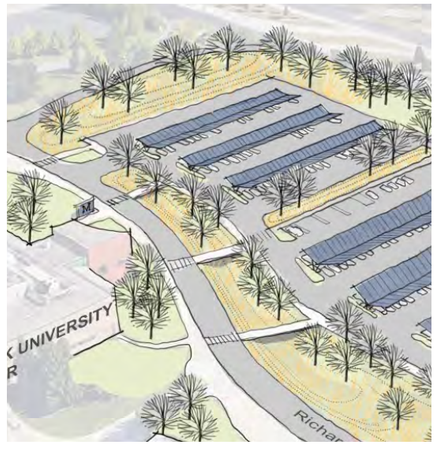

Planning goals and planning drivers helped define the campus needs assessment. Future scenarios were derived from the key themes and opportunities identified during Phase 2.

## PHASE 3: REALIZE

The final phase of the planning process focused on refining alternative scenarios to identify realistic near- and long-term solutions. In most cases, the concepts illustrated in this plan represent a combination of initiatives designed to optimize institutional resources and adjacencies. Implementation of these projects will be a multi-step process and require coordination across multiple campus stakeholders.

The plan aims to achieve a balance of vision and realism while acknowledging that higher education is constantly evolving. It is because of this, that implementation strategies and cost estimates were also developed to help guide the future of campus. The result is the final Comprehensive Campus Plan, which summarizes planning goals, key findings, and recommendations, setting the stage for future enhancements to the UM-Dearborn campus.

The final plan presents solutions for both the near- and long-term. These opportunities are the synthesis of the analysis, engagement, and planning frameworks developed in Phases 1 and 2.

# Planning Goals

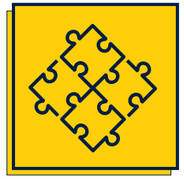
The Comprehensive Campus Plan is meant to establish a flexible, forward-thinking physical blueprint for the university over the next 10 years. The planning goals were developed as a guiding framework for the future physical aspects of campus. The goals consider several factors that depict a slower growth rate of in-person students and a higher rate of hybrid students. Because of this, the plan aims to optimize existing available space through sustainable facility upgrades and careful placemaking.

## Elevate the Campus Experience

**Enhance the campus experience for students, staff, faculty, and the Dearborn community.**

## Enhance Campus Identity

**Create an inclusive and welcoming campus by enhancing the university's unique identity.**



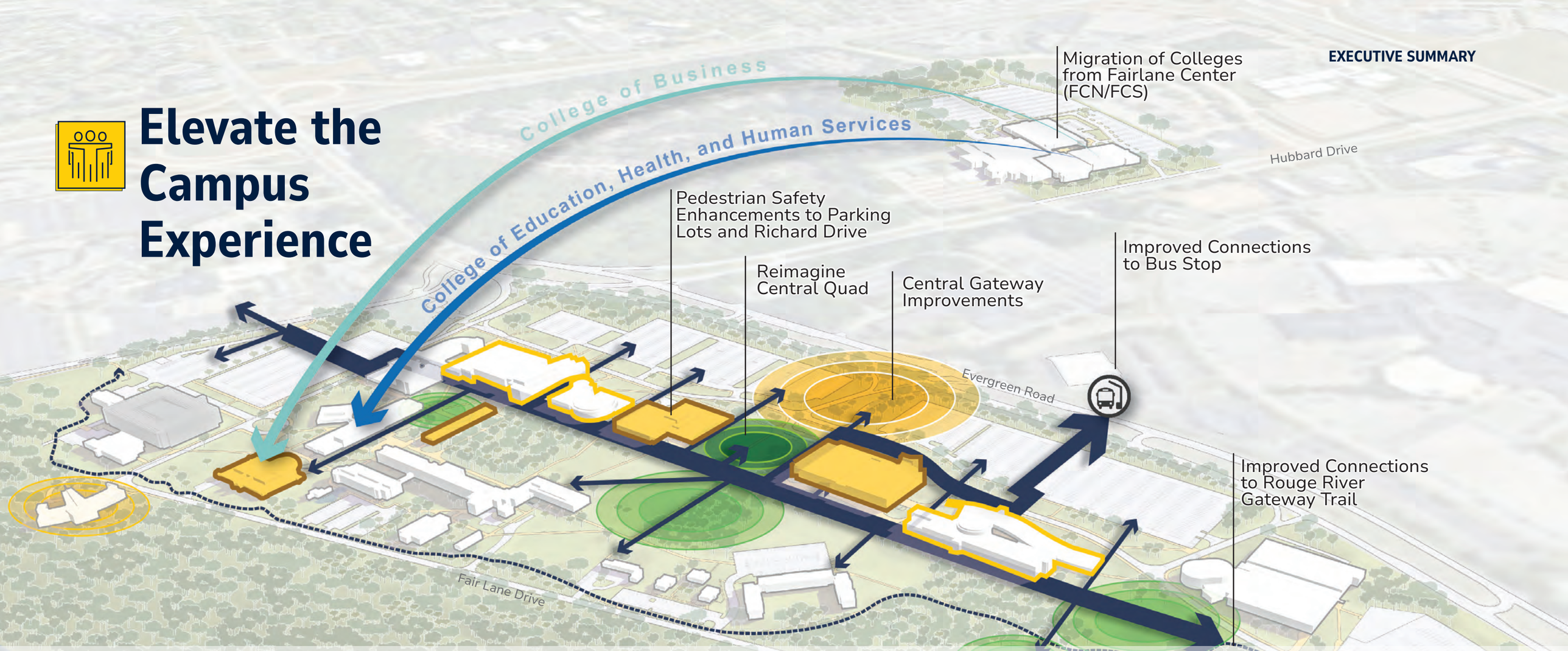
## Optimize Space on Campus

**Optimize the space on campus to support the changing nature of work and education.**

## Implement Climate Action

**Align sustainability goals with UM's Planet Blue initiative.**

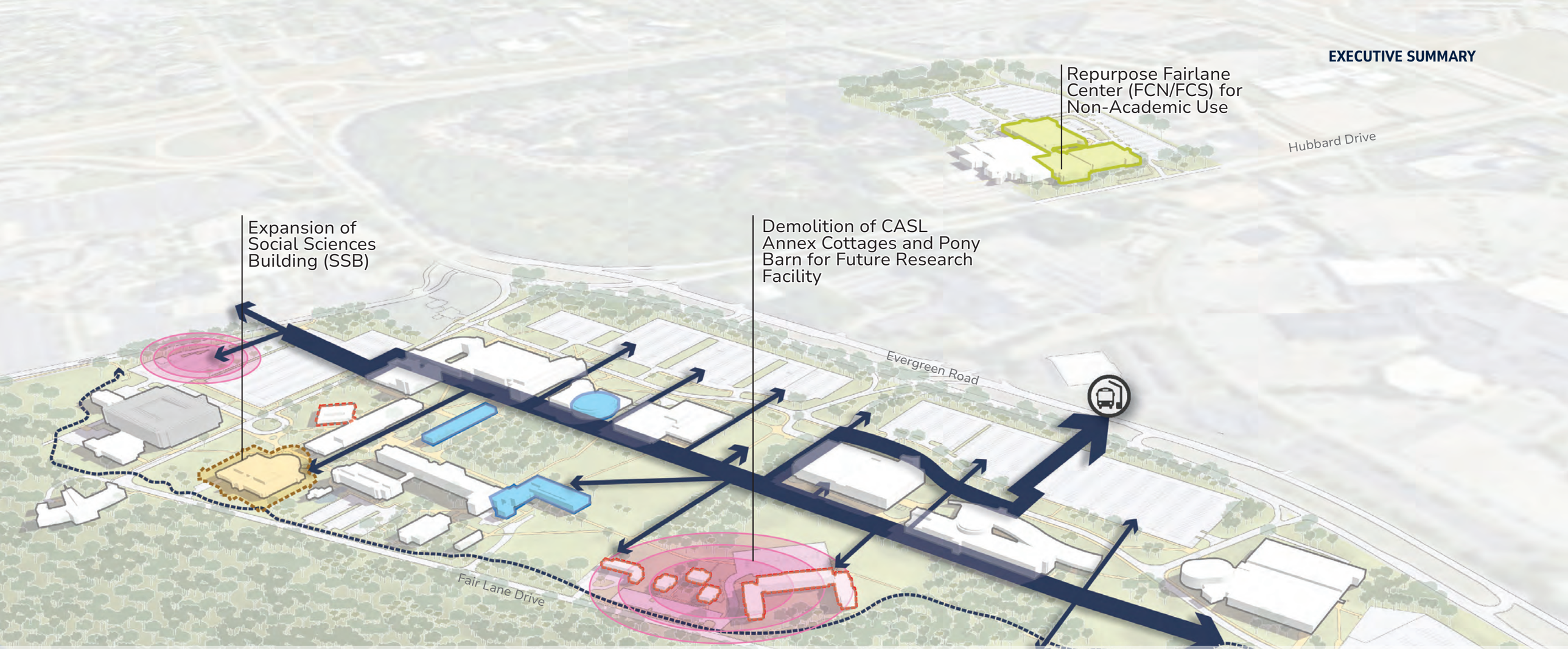
# Elevate the Campus Experience




## NEAR-TERM OPPORTUNITIES

In the near-term, the Comprehensive Campus Plan focuses on the migration of colleges from the Fairlane Center to the Main Campus to create a stronger campus core. The strategic creation of collaboration spaces in existing buildings and outdoor spaces, as well as pedestrian circulation and safety improvements improve the overall campus experience.

- **Existing Student Collaboration Space:** Renovate buildings on campus with student collaboration spaces.
- **New/Enhanced Student Collaboration Space:** Retrofit student collaboration spaces and improvements for better connections between buildings.
- **Outdoor Collaboration Space:** Provide new spaces for students to collaborate along Wolverine Walk and the Central Quad.
- **Enhanced Entry Experience**: Improve placemaking and landscaping at the Central Gateway.
- **Improving Pedestrian Circulation:** Enhance Wolverine Walk to create a distinct pedestrian spine.
- **Connecting to the Rouge River Gateway Trail:** Enhance connections between Main Campus and the Rouge River Gateway Trail.




## LONG-TERM OPPORTUNITIES

In the long-term, the Comprehensive Campus Plan aims to build upon new adjacencies and focal points that will result from the migration of programs back to the core of campus and through enhancements identified in near-term opportunities.

**Repurposing Existing Space:** Repurpose buildings (ROC, CIS, NSBS, and IAVS) to accommodate rising space needs.

**Future Facility Opportunity Areas:** Plan for future facilities in areas that will reinforce campus organization and build upon near-term investments.

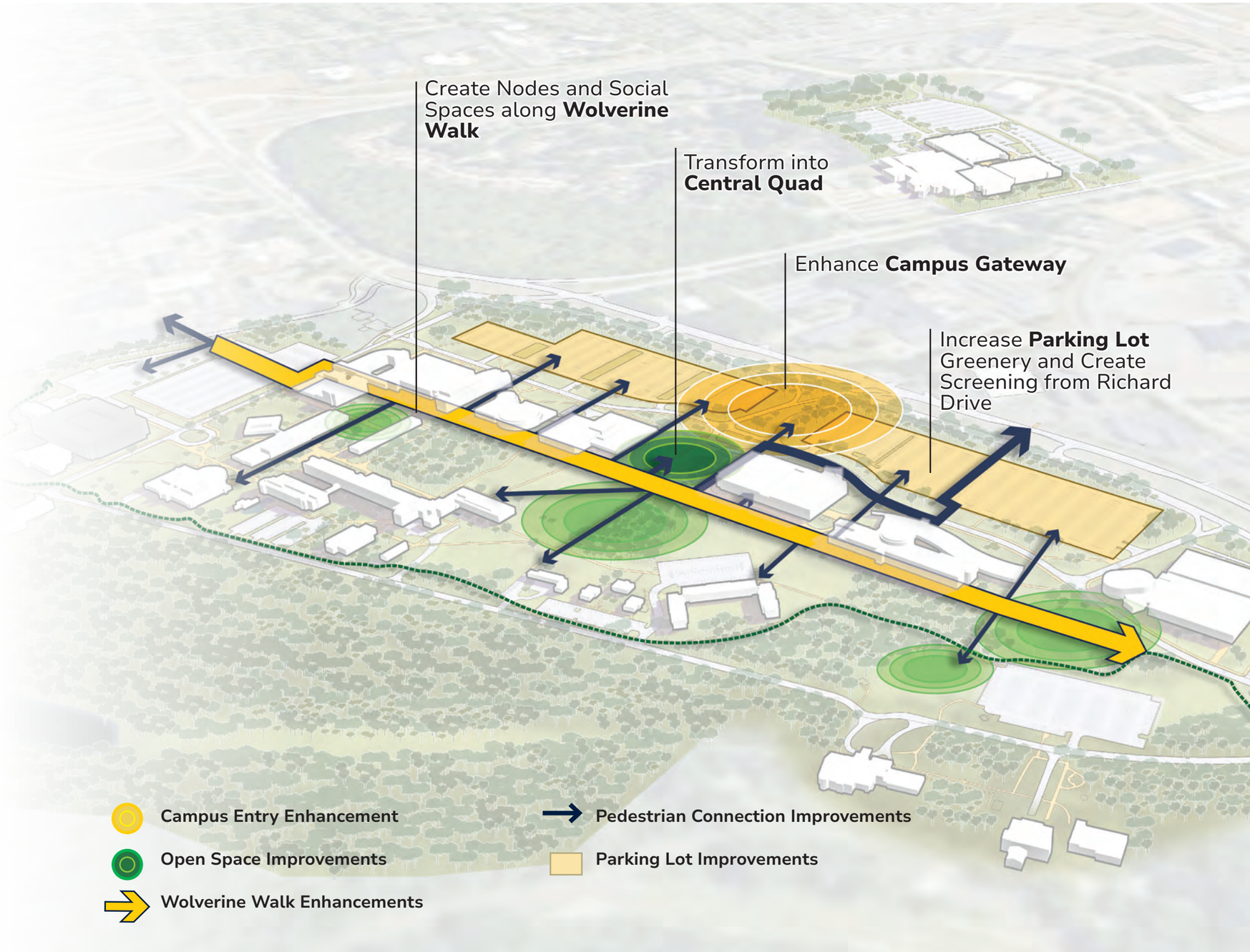
**Future SSB Expansion Option:** Expand the Social Sciences Building as an option to accommodate needs for the College of Business.

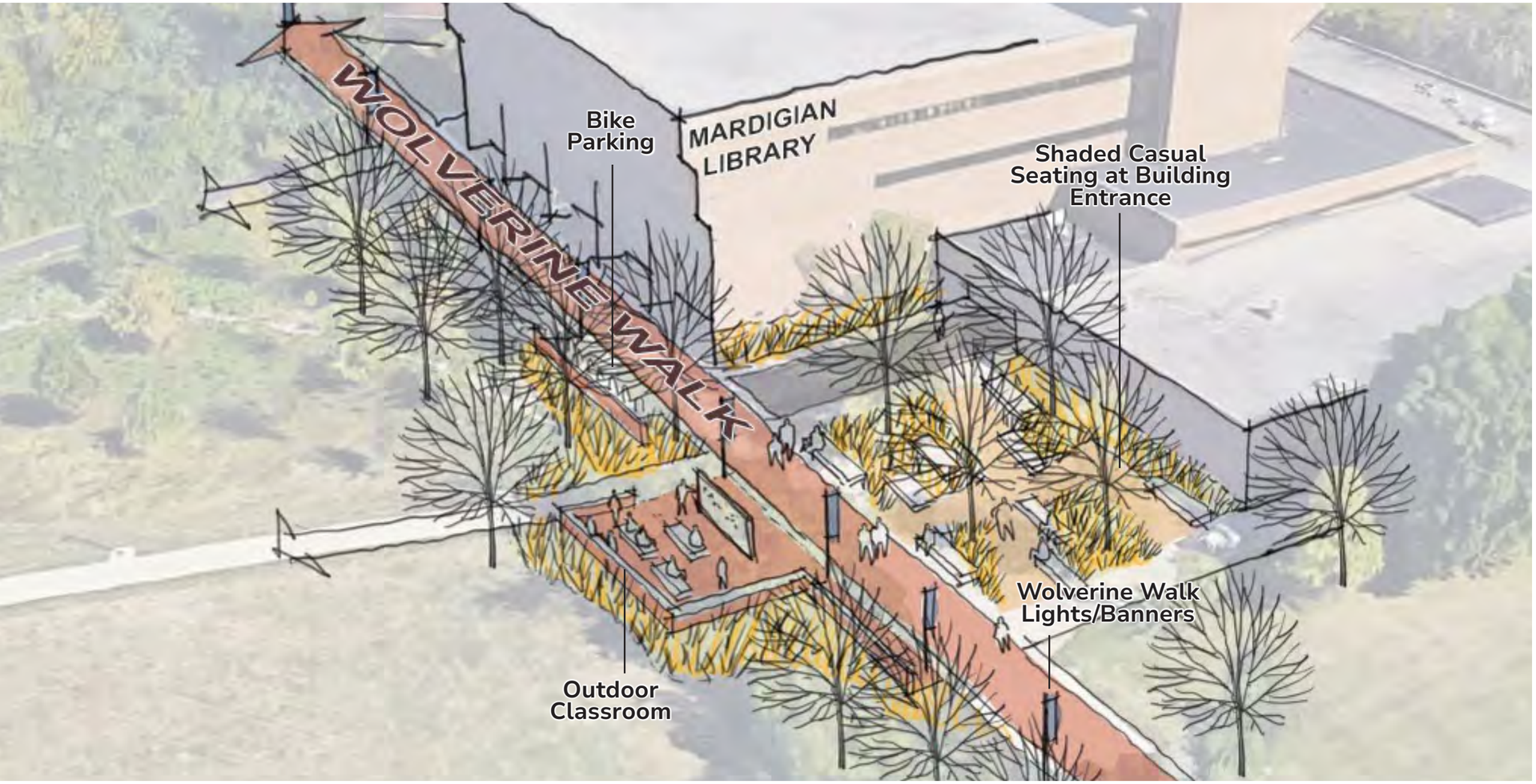
**Building Demolition:** Demolish buildings that have deteriorated or no longer meet quality standards such as, CASL Annex, Fair Lane Cottages, and Fair Lane Pony Barn.

**Future Non-Academic Space**

# Enhance Campus Identity

Place-making capitalizes on a campus's unique assets to propagate vitality and culture. Several locations have been identified as opportunities to upgrade or transform as a means to strengthen the university's identity.

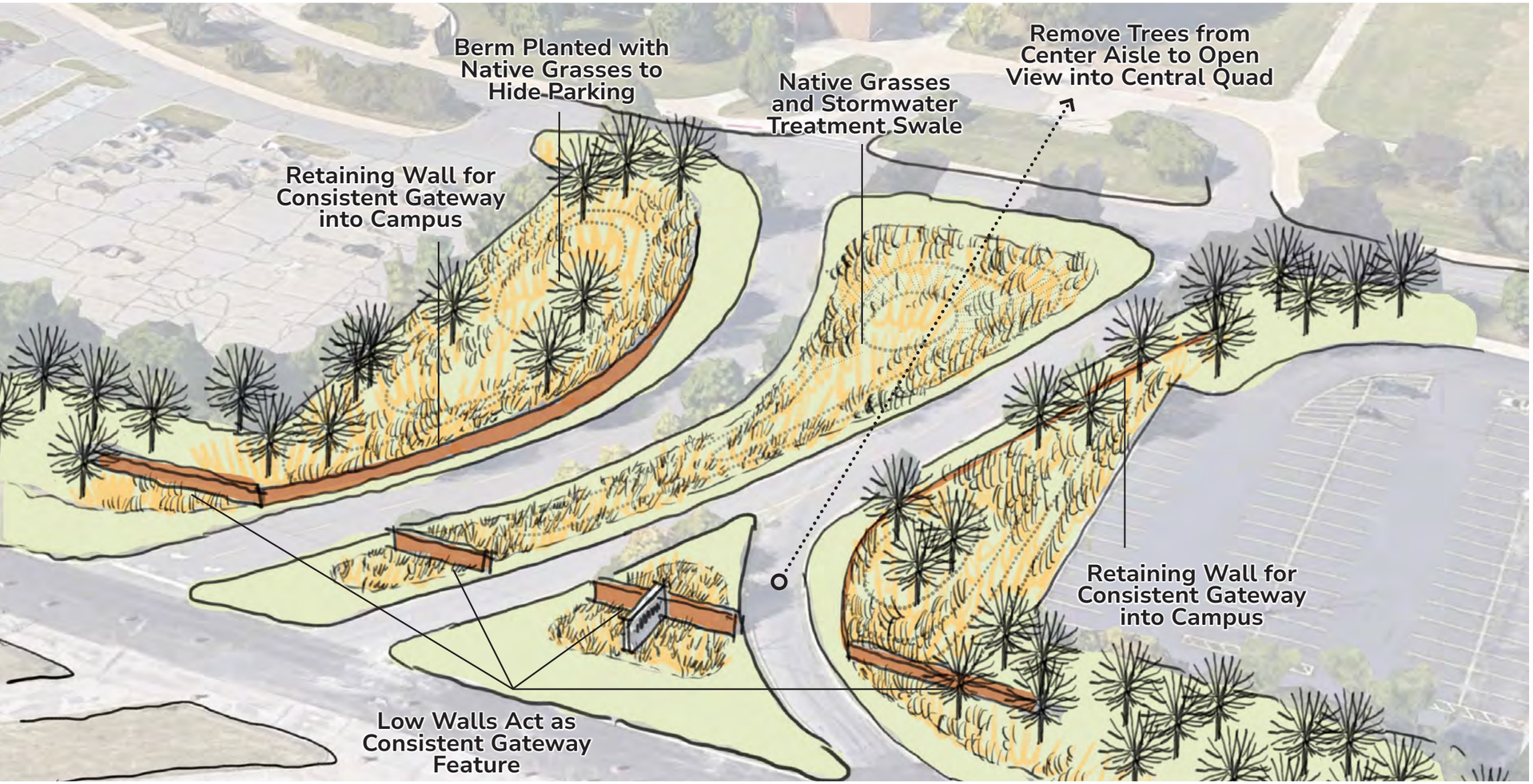





U-Wisconsin La-Cross Pedestrian Mall

# Wolverine Walk

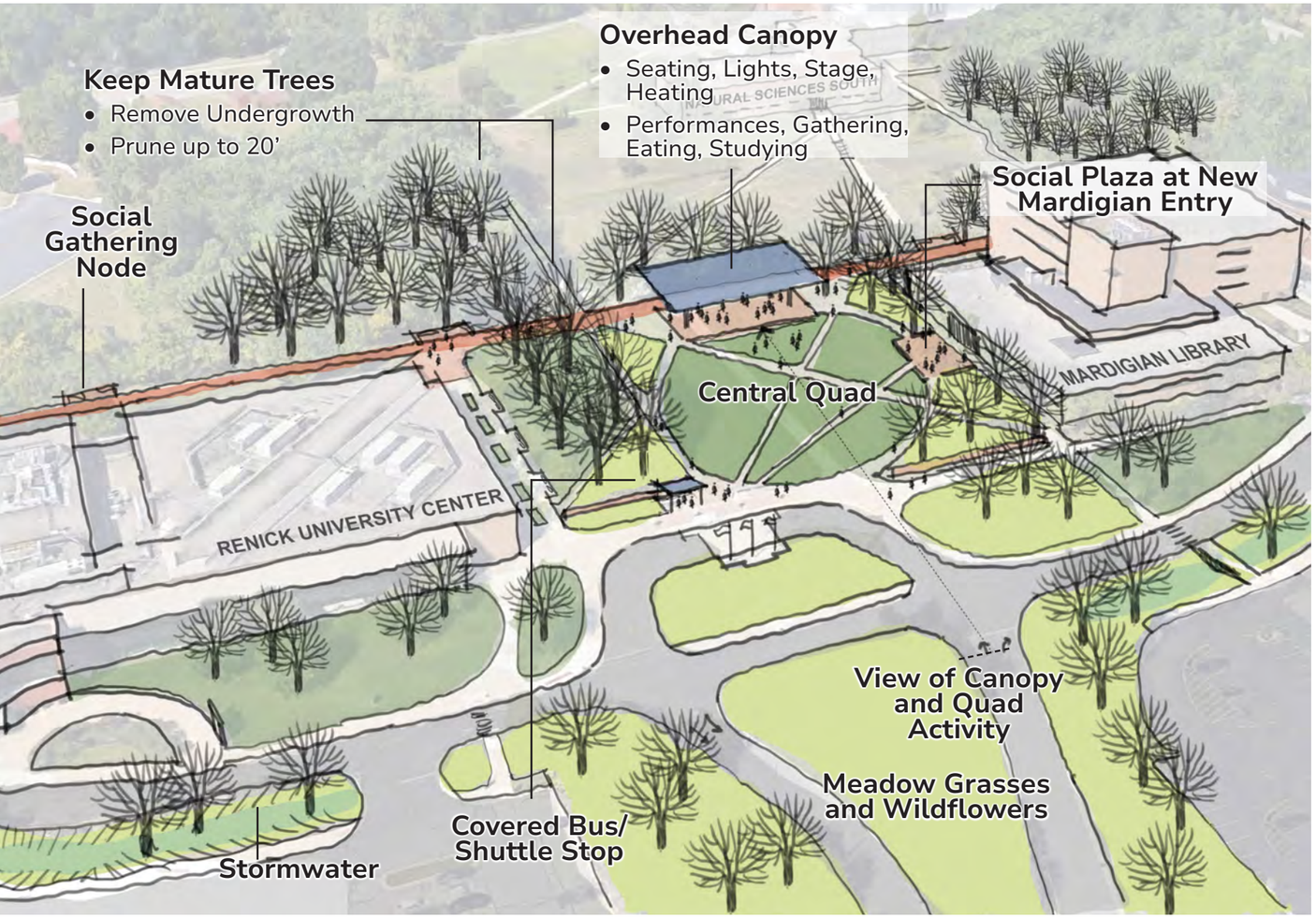
Wolverine Walk is envisioned as the main pedestrian thoroughfare of campus, seamlessly connecting key buildings and outdoor spaces. The addition of intimate outdoor nodes designed to be versatile collaboration spaces and outdoor classrooms is proposed along its path. Emphasizing sustainability, the nodes will harmonize with the natural environment, offering tranquil and functional spaces for the campus community.




NCMA Berm and Half Wall

# Gateway

To improve the entrance experience, the plan proposes a low wall with the UM-Dearborn logo to complement existing flags. The half wall terminates into a berm to obscure the visitor's view of the parking lot as they enter the campus. Trimming some shrubs and trees while still maintaining screening for the parking lots, would allow for better visibility into the campus. Introducing native planting throughout the campus, especially in the central aisle, could also enhance the arrival experience.

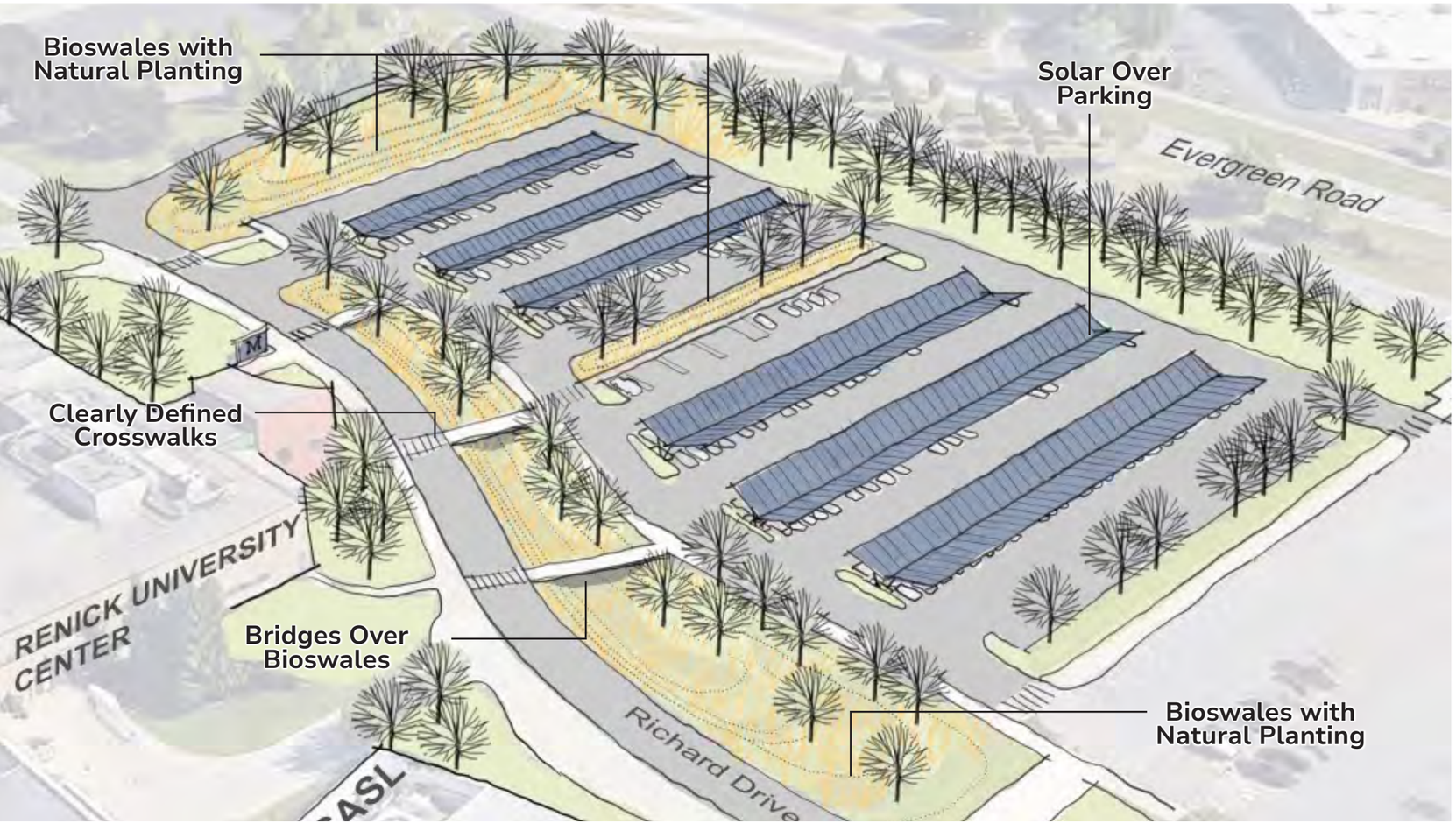


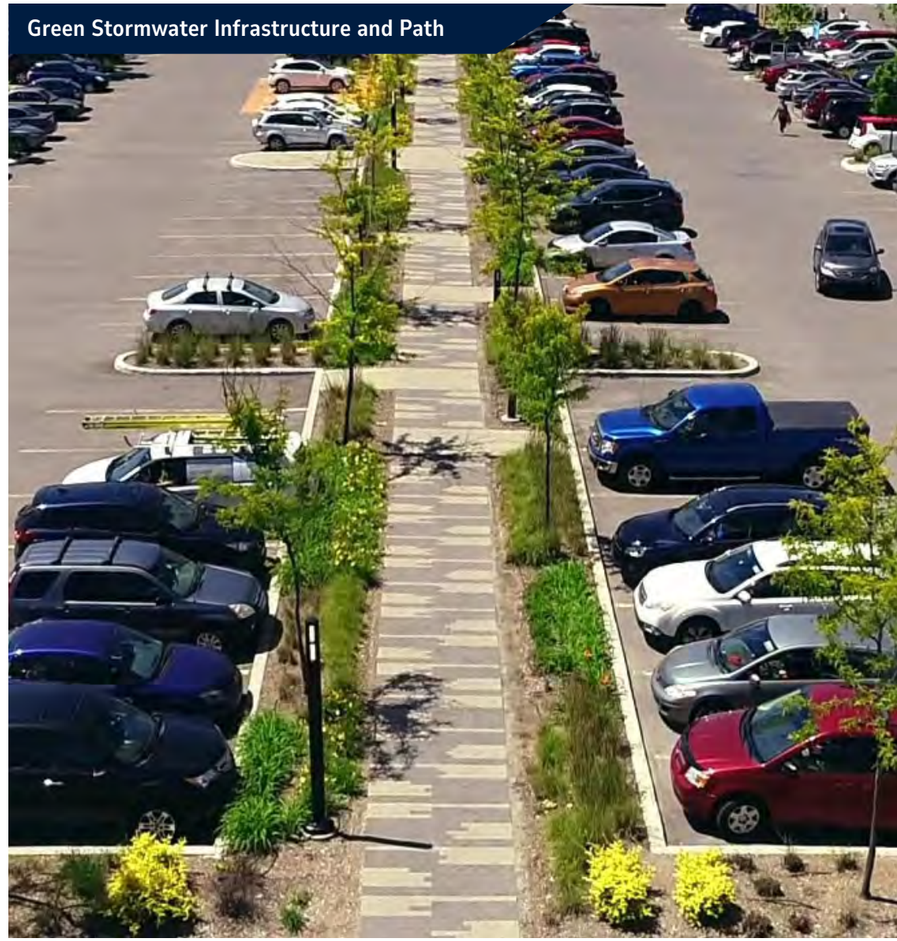


Klyde Warren Park Overhead Structure

# The Central Quad

The Central Quad can be designed to improve its functionality, comfortability, and aesthetics, while serving as a gateway to the campus interior. The flow between buildings could be improved with connected pathways that lead to new building entrances on the Quad. In addition, site furniture and an overhead structure could provide a space for students and faculty to gather, work, and collaborate between classes. Solar panels on the roof of the structure could provide power to charge electronic devices and provide a visible reminder of the university’s commitment to climate action.



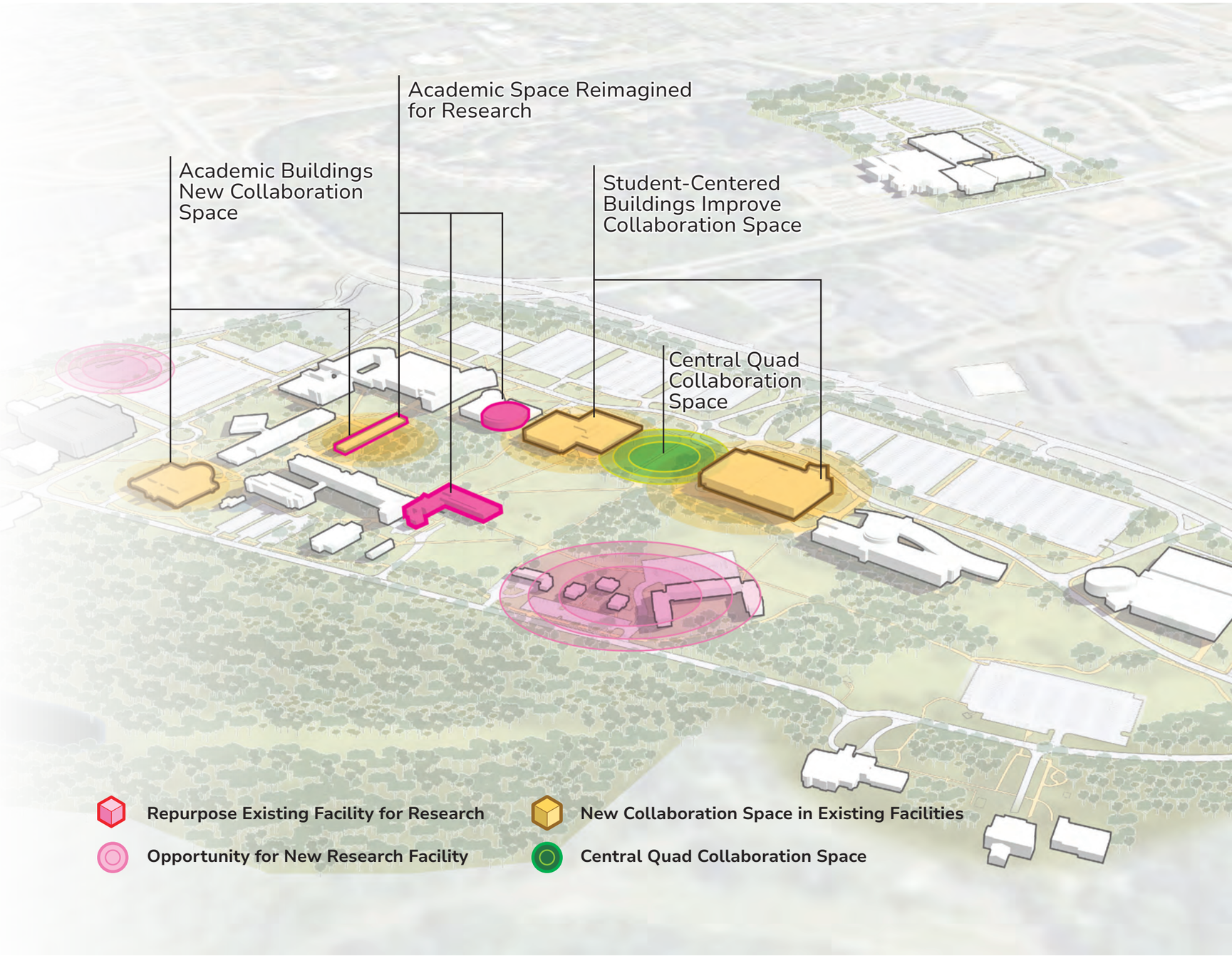




# Parking Lots

Enhancements to the parking lots improve pedestrian safety and aid in campus placemaking. Native plantings and green stormwater infrastructure would create a more pleasant experience, while supporting the university's sustainability goals. The addition of sidewalks with permeable pavers and raised crosswalks from the parking lots across Richard Drive would allow commuters to move from their vehicles to campus safely and with ease. Installing raised solar panels can double as shade structures for cars, ensuring installation is coordinated with the campus parking lot geothermal strategy and implementation.

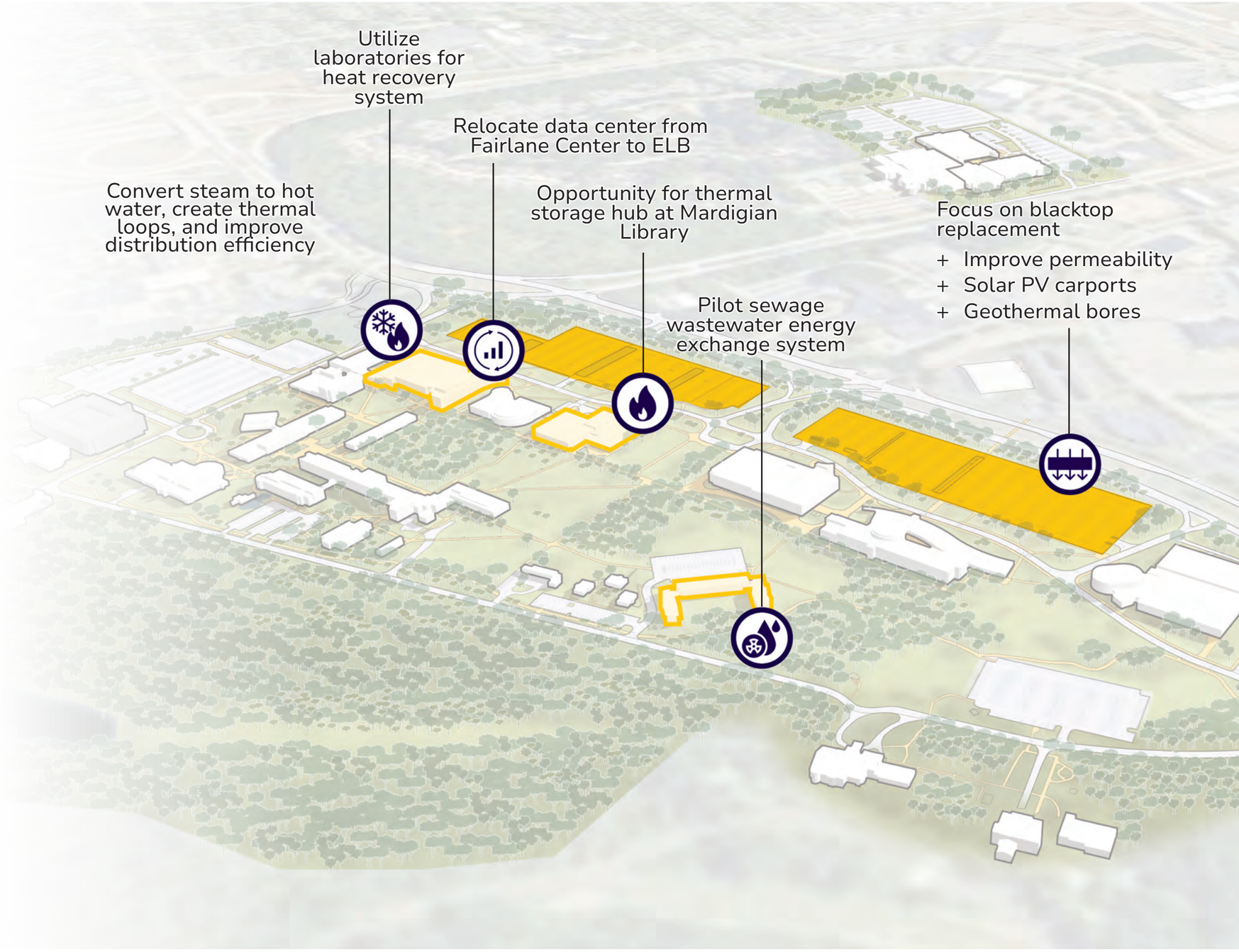
# Optimize Space on Campus

As the plan aims to optimize existing space on campus, underutilized space was identified and reimagined to better support UM-Dearborn's students, faculty, and staff. New or repurposed space for research facilities supports the university's goals to grow research expenditures. Since the campus consists of mostly commuter students, additional collaboration spaces to congregate or socialize between classes are important.



# Implement Climate Action

Plan recommendations cover various aspects such as energy-efficient technologies, renewable energy systems, and waste management practices which will significantly contribute to reducing the university's environmental impact. The implementation of this Comprehensive Campus Plan will ensure that the university is environmentally responsible and sustainable, thus contributing to a better future for everyone.

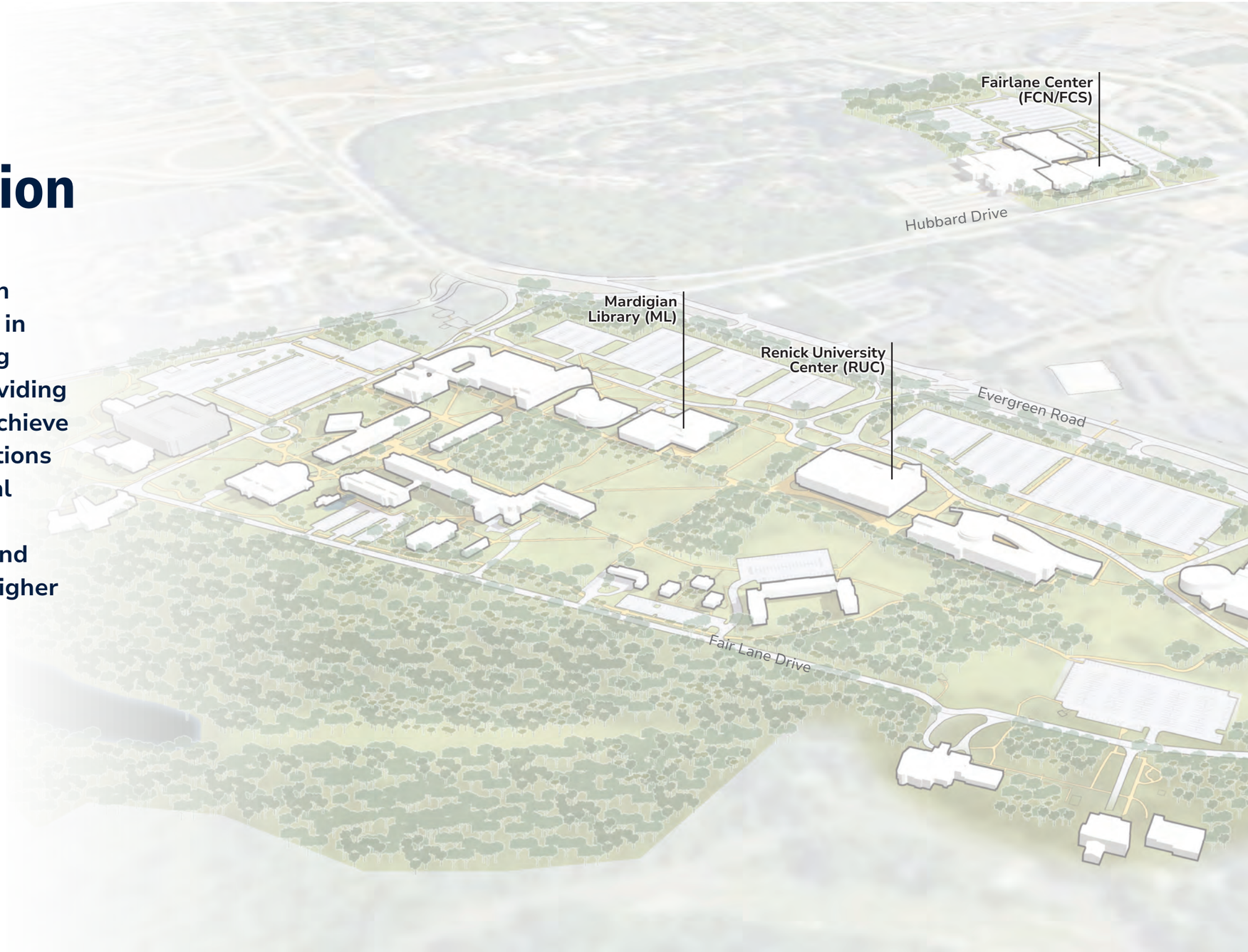


02

# The Comprehensive Campus Plan

# Campus Plan Vision

**This plan is a long-term tool that can adapt to unexpected future changes in enrollment, technology, and teaching methods, while placing focus on providing realistic and visionary solutions to achieve the university's goals. Recommendations are designed to optimize institutional resources and adjacencies. The plan aims to achieve a balance of vision and realism, while acknowledging that higher education is constantly evolving.**



# Planning Goals

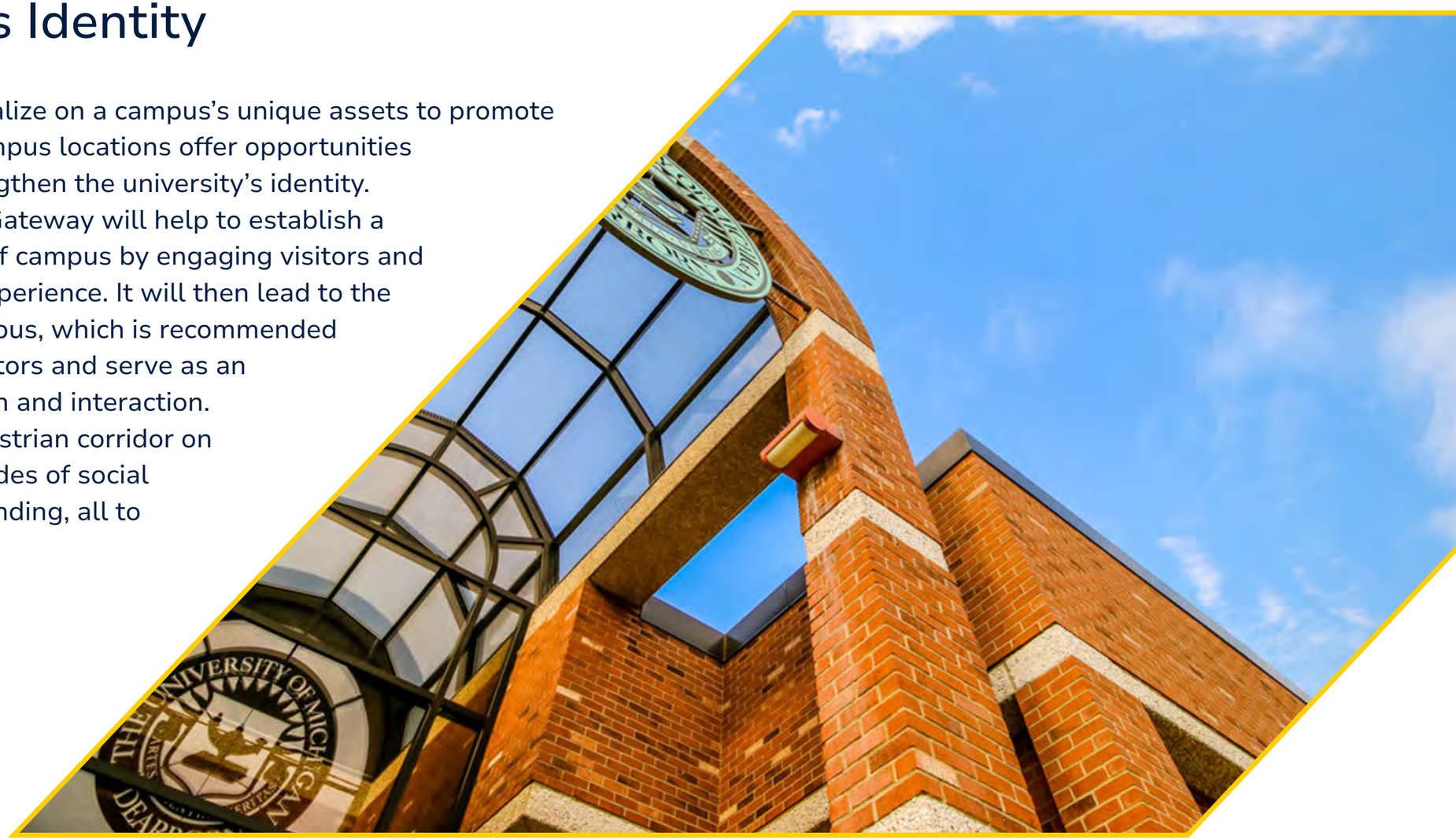
**The Comprehensive Campus Plan aims to guide the physical development and growth of the campus.** As a result of a collaborative planning process, four main planning goals emerged. These goals were formulated based on a comprehensive analysis of numerous factors that could potentially impact the growth and development of the campus and are intended to serve as a road map for achieving the university's strategic mission. These goals are interrelated and reinforce each other; therefore, achieving one goal can contribute to the success of another.

# Elevate the Campus Experience

After engaging in numerous conversations with students at UM-Dearborn, it has become clear that there is a strong desire to elevate campus vibrancy and enhance the student experience. By uniting academics on one campus through the migration of programs from the Fairlane Center, the university can help cultivate improved student collaboration. In addition, the enhancement and addition of student-centered spaces, both indoor and outdoor, will help to encourage students to linger on campus throughout the day. Lastly, improving pedestrian wayfinding and circulation will help to foster a stronger sense of identity for UM-Dearborn's campus.

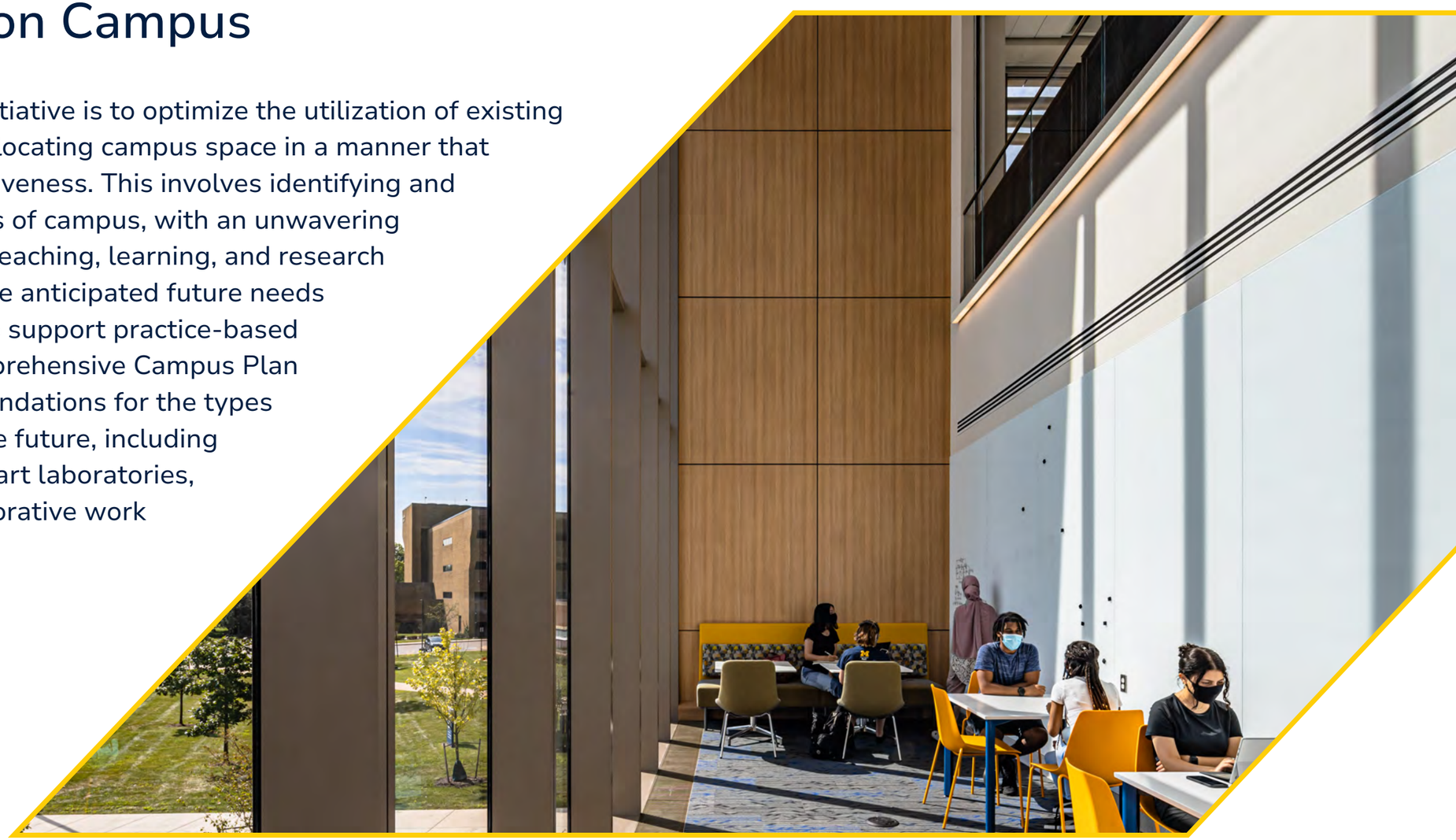
# Enhance Campus Identity

Identity and placemaking capitalize on a campus's unique assets to promote vitality and culture. Several campus locations offer opportunities to reimagine in ways that strengthen the university's identity. Transformation of the Central Gateway will help to establish a strong framework for the rest of campus by engaging visitors and creating a welcoming arrival experience. It will then lead to the Central Quad, the heart of campus, which is recommended for redesign to better greet visitors and serve as an anchor for student collaboration and interaction. Wolverine Walk, the main pedestrian corridor on campus, can be accented by nodes of social interaction and improved wayfinding, all to foster a greater sense of place.



# Optimize Space on Campus

The primary objective of this initiative is to optimize the utilization of existing facilities on the campus by reallocating campus space in a manner that maximizes efficiency and effectiveness. This involves identifying and repurposing underutilized areas of campus, with an unwavering focus on creating high-quality teaching, learning, and research spaces that not only support the anticipated future needs and research activities, but also support practice-based learning experiences. The Comprehensive Campus Plan encompasses specific recommendations for the types of spaces that are needed in the future, including but not limited to state-of-the-art laboratories, flexible classrooms, and collaborative work and gathering spaces.



# Implement Climate Action

In order to successfully achieve the goal of decarbonization by 2040, a significant shift in the university's current approach to buildings and infrastructure is necessary. This shift involves examining current practices and identifying areas where changes can be made to reduce UM-Dearborn's carbon footprint. One of the crucial areas of focus is to reduce energy consumption on campus. Solar panels and other energy saving infrastructure can be seamlessly integrated into campus open space to help achieve this goal. This step will not only reduce energy consumption, but also create a healthy and enjoyable campus environment for all.

# The Physical Plan

**The Physical Plan is a response to established planning goals to determine how and where the goals can be achieved.** The plan outlines a near- and long-term vision for the university, as well as highlights the strengths and weaknesses of the campus. Recommendations aim to enhance identified strengths and transform weaknesses into opportunities. While the primary aim of the plan is to stay within the campus's current footprint and reassign and enhance existing spaces, the plan also includes recommendations to expand the campus if needed in the future.

# Near-Term Opportunities

In the near-term, the Comprehensive Campus Plan focuses on the migration of colleges from the Fairlane Center to the Main Campus and the strategic creation of collaboration spaces in existing buildings and outdoor spaces. Key near-term opportunities include:

**Existing Student Collaboration Space**

+ Renovate buildings on campus to provide new student collaboration spaces.

**New/Enhanced Student Collaboration Space**

+ Retrofit student collaboration spaces.
+ Improve connections between building interior and exterior.

**Outdoor Collaboration Space**

+ Provide new spaces for students to collaborate along the Wolverine Walk and the Central Quad.

**Enhanced Entry Experience**

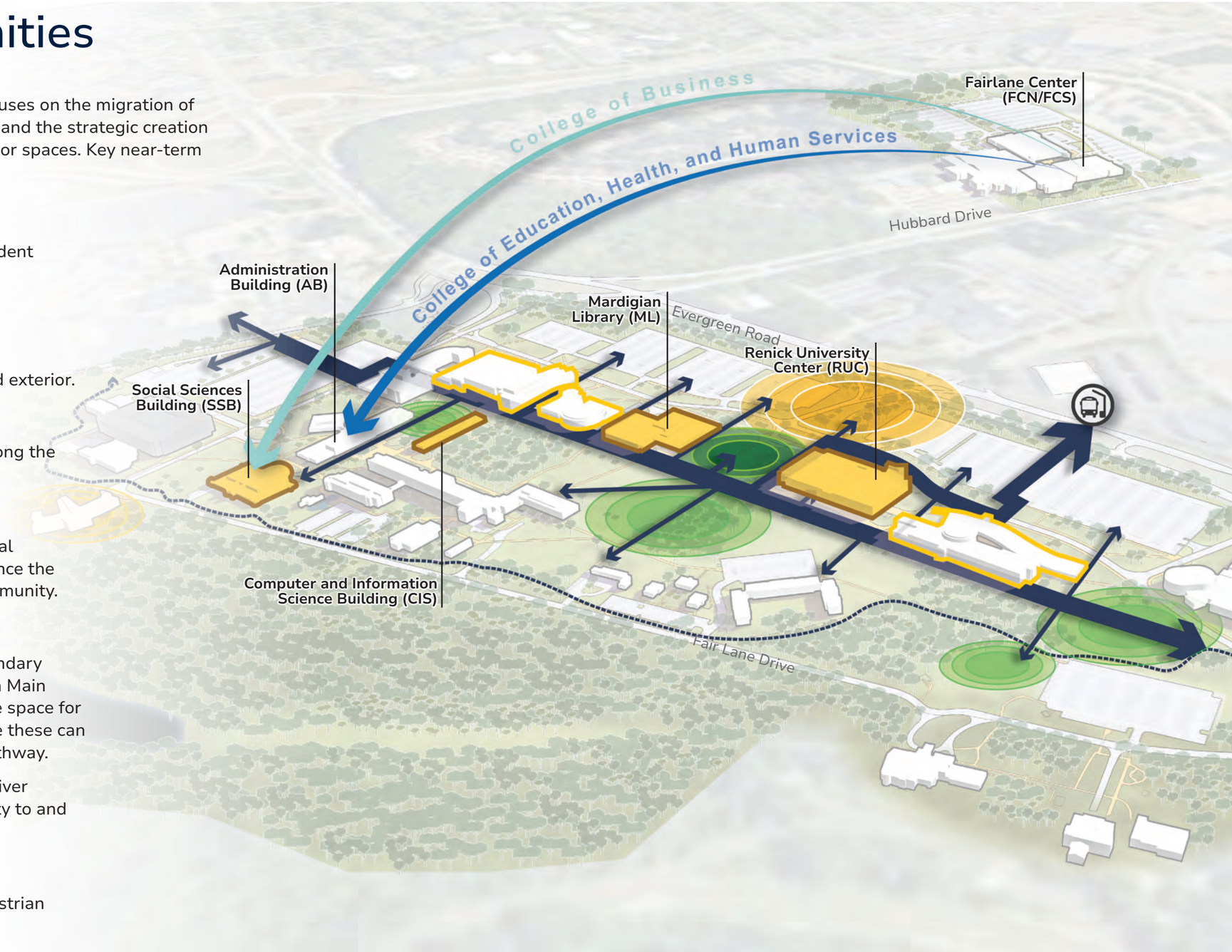
+ Improve placemaking and landscapes at the Central Gateway to campus from Evergreen Road to enhance the arrival experience for visitors and the campus community.

**Improving Pedestrian Circulation**

+ Enhance the Wolverine Walk experience and secondary paths to create a distinct pedestrian spine through Main Campus. The path can be widened to include more space for seating and outdoor classrooms. Social spaces like these can bring more life and social interaction along the pathway.
+ Extend Wolverine Walk to connect to the Rouge River Gateway Trail, improving bikeability and walkability to and through campus.

**Connecting to the Rouge River Gateway Trail**

+ Enhance connections between Main Campus pedestrian circulation and the Rouge River Gateway Trail.



# Long-Term Opportunities

In the long-term, the Comprehensive Campus Plan aims to build upon new adjacencies and focal points that will result from the migration of programs from the Fairlane Center, as well as campus enhancements identified in the near-term opportunities. Key long-term opportunities include:

**Repurposing Existing Space**

+ Repurpose buildings to accommodate potential future space needs as identified by the university.
+ Reconfigure ROC, CIS, SSB and IAVS.

**Future Facility Opportunity Area**

+ Plan for future facilities in areas that will reinforce campus organization and build upon near-term investments.

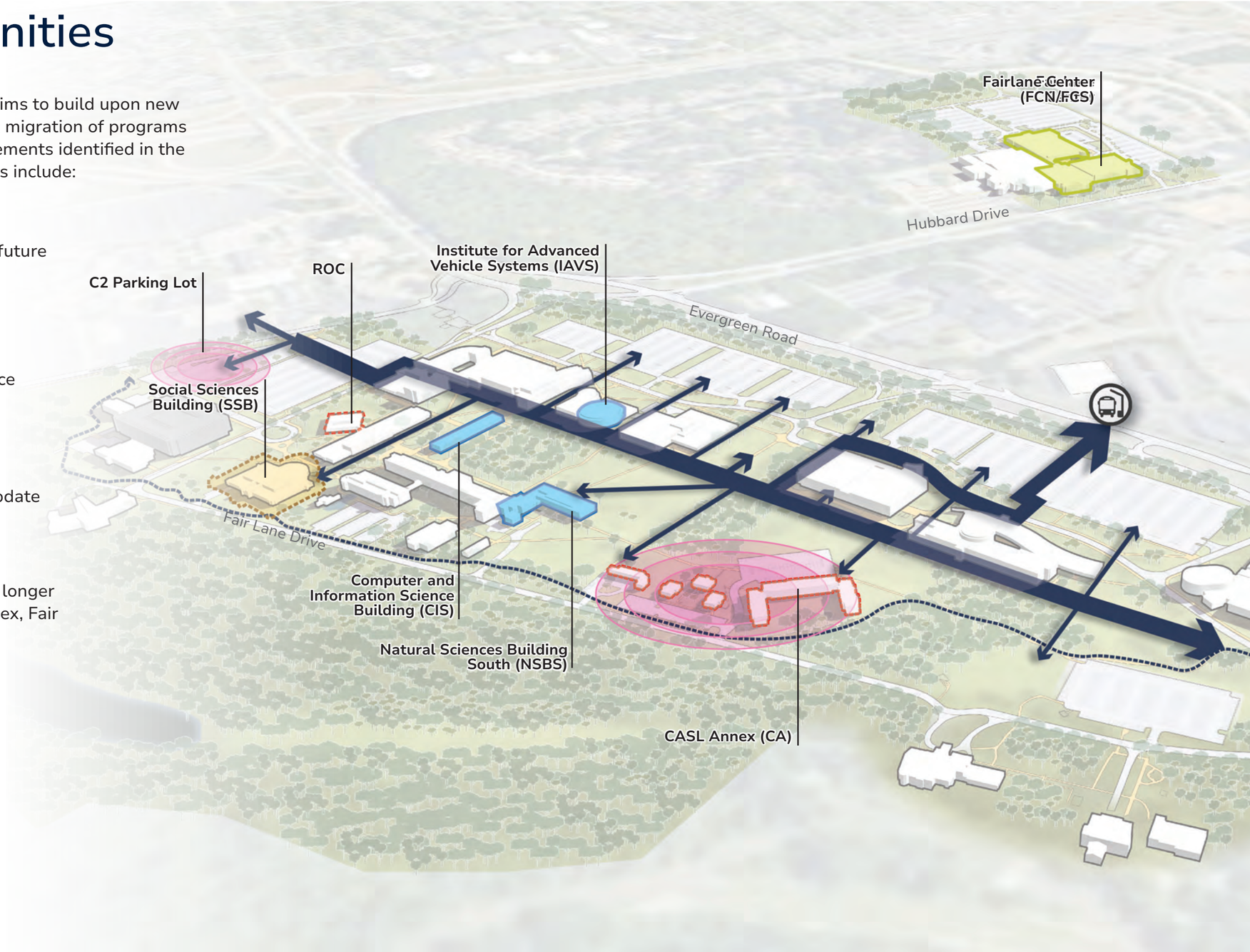
**Future SSB Expansion Option**

+ Expand the Social Sciences Building to accommodate future needs for the College of Business.

**Building Demolition**

+ Demolish buildings that have deteriorated or no longer meet quality standards such as, ROC, CASL Annex, Fair Lane Cottages, and Fair Lane Pony Barn.

**Future Non-Academic Space**





## FUTURE OF THE FAIRLANE CENTER

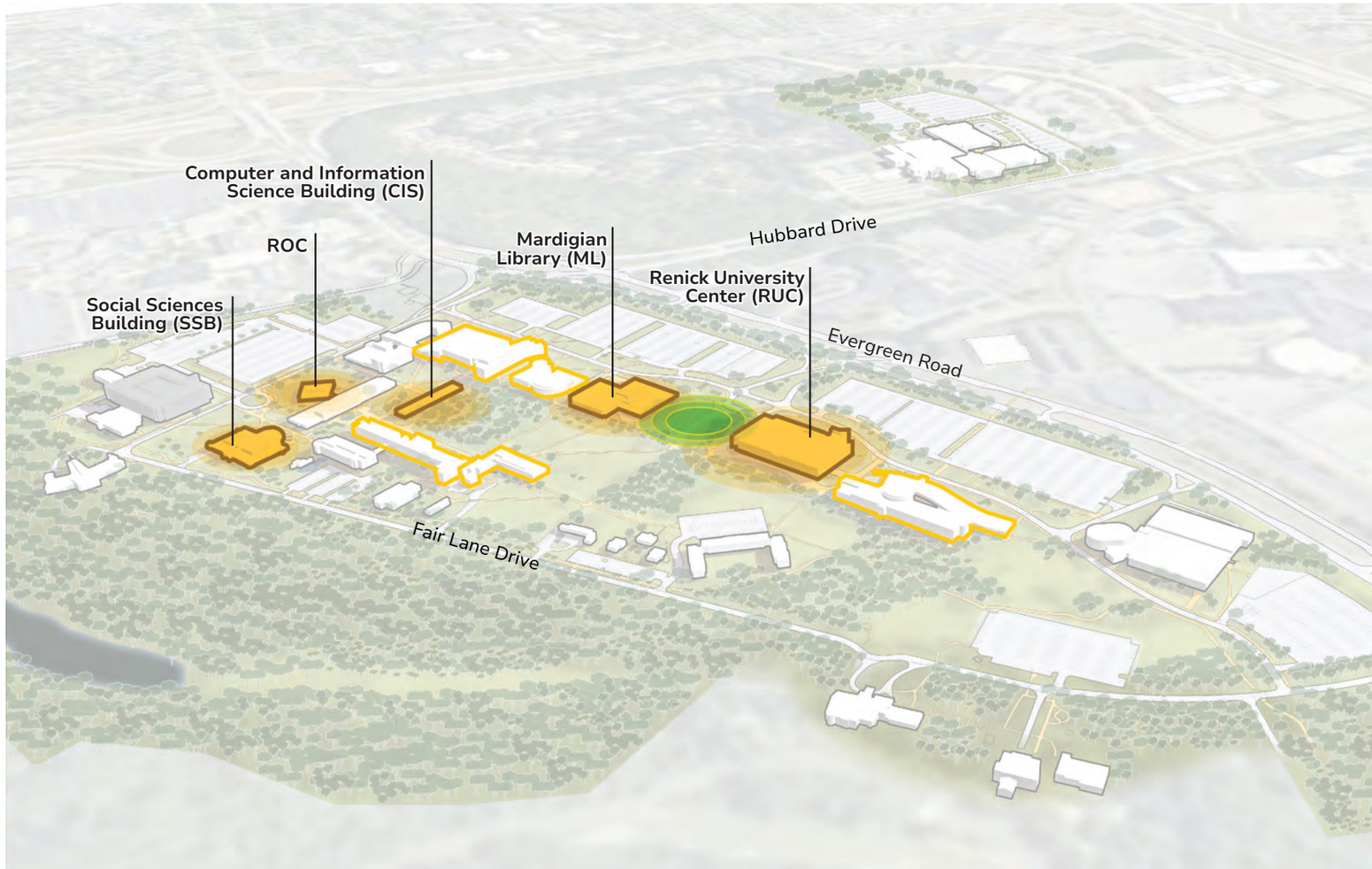
Once the College of Business and College of Education Health and Human Services have fully migrated to Main Campus, the Fairlane Center is available to become a resource for non-academic uses. The possibilities for this space will depend upon the future needs of the university. This asset has the potential for retrofits depending upon the specific need. Attention should be paid to ensuring that walkways and bike paths from Main Campus are developed further to provide a safe transition between both campuses if continued use of the Fairlane Center is anticipated.

# Facilities Recommendations

## COLLABORATION SPACE

Campus engagement efforts revealed a lack of collaboration space on campus. In addition, the ground-level of all buildings have more assigned space (classrooms) than common space that could be used for collaboration space. The university has multiple ongoing projects that aim to create such spaces; however, there are still many buildings that could benefit. Since the campus consists of mostly commuter students, spaces to congregate or socialize between classes are very important. Options outside of Mardigian Library provide spaces to study or gather for group projects, offering students more reasons to linger on campus throughout the day.

The campus community expressed a preference for such spaces, both indoors and outdoors. The Comprehensive Campus Plan identified good examples of buildings that have existing collaboration spaces, as well as buildings where they are lacking. Outdoors, the Central Quad, nodes along Wolverine Walk with supporting furniture, and a new outdoor classroom could function as collaboration space. Understandably the weather is not always ideal, but outdoor space with flexible furniture, Wi-Fi, and outlets could be a good addition to the campus to make learning more engaging and interactive.

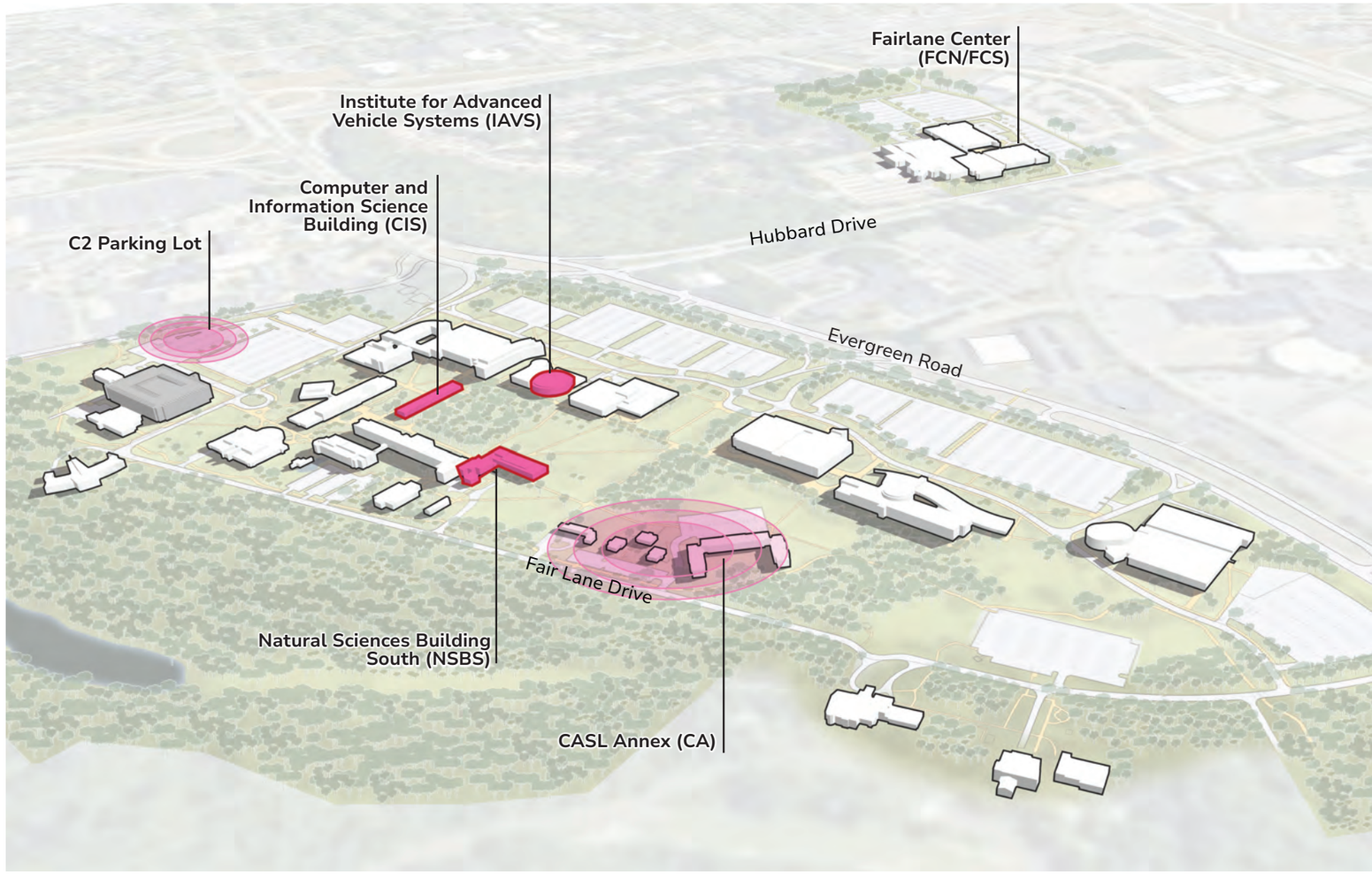



### LEGEND

- Existing Student Collaboration Space
- New/Enhanced Student Collaboration Space
- New Outdoor Collaboration Space

# RESEARCH EXPANSION

Research expansion is one of the main priorities set forth by the university. The Comprehensive Campus Plan has looked at various ways to accommodate expansion within the physical footprint of the campus. The first option would be to repurpose underutilized space on campus. The rotunda in the Institute for Advanced Vehicle Systems and portions of the Natural Sciences Building South could be repurposed for research. In addition, the Computer and Information Science Building could be expanded to accommodate more research space. Lastly, with the College of Business moving to Main Campus, the Fairlane Center could be reimagined as a research facility. The Comprehensive Campus Plan also looked further at ways to accommodate future research growth, if the need arises. The Comprehensive Campus Plan has identified recommendations for areas where new facilities could be located. One option is to build on the underutilized portion of Parking Lot C2, while another option is to remove and replace the CASL Annex, Fair Lane Cottages, and Fair Lane Pony Barn.

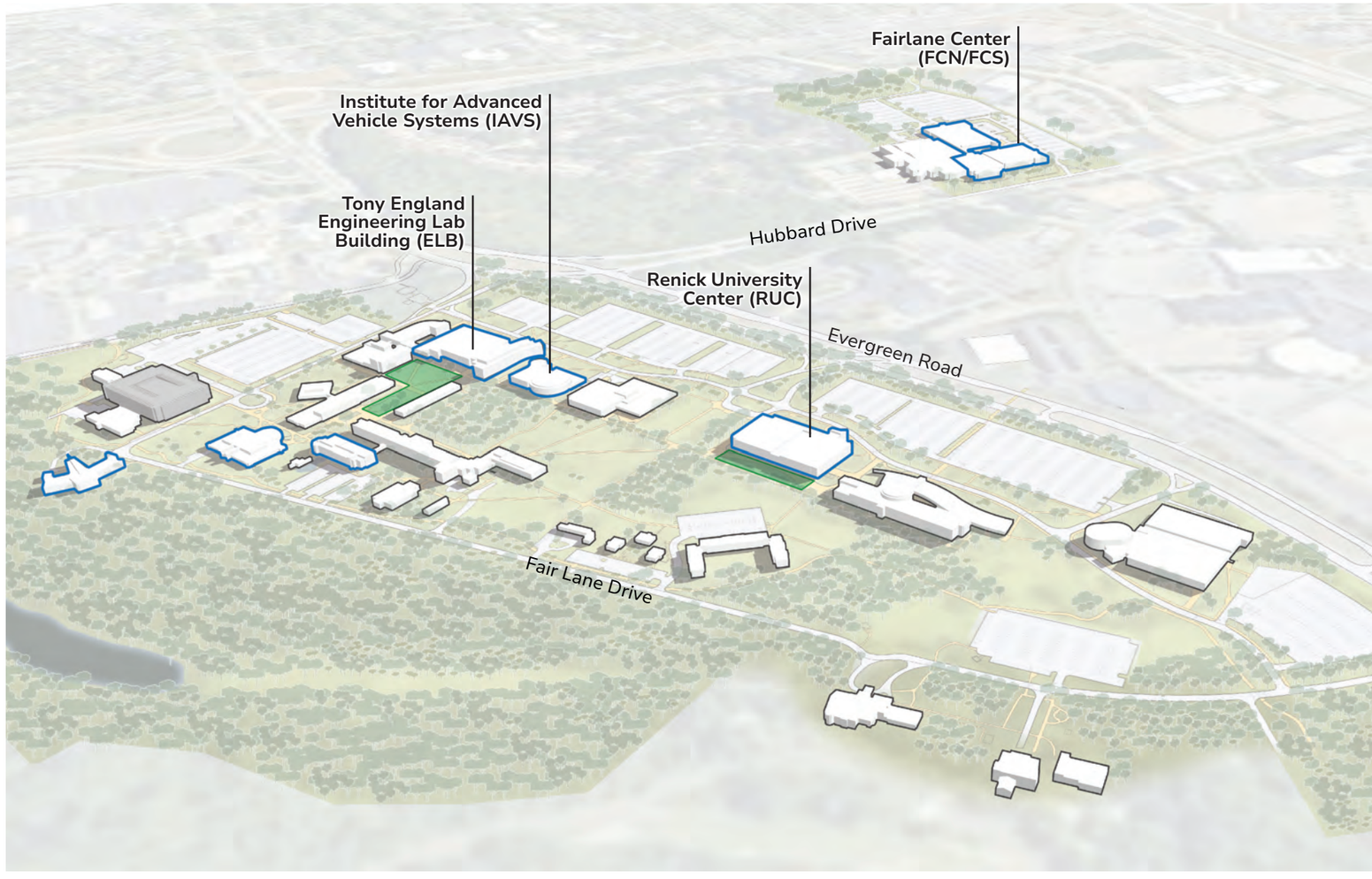



## LEGEND

- Repurpose Space in the Building
- New Facility Option

# EVENT SPACES

Currently, the campus boasts two outdoor event spaces, nine formal indoor event spaces, and four informal indoor event spaces. With the potential migration away from the Fairlane Center, there are valid concerns about where to establish new event spaces on Main Campus. The renovation of the Renick University Center (RUC) enhances the event spaces on the main campus, adding breakout rooms adjacent to the Kochoff Halls as well as informal gathering spaces.  The newly renovated Tony England Engineering Lab Building (ELB) features a large atrium for college as well as university-wide events. Outdoor events spaces are also identified in the Comprehensive Campus Plan. This includes renovation of the Central Quad with an overhead structure that could serve as a performance venue, when needed, for outdoor events.




## LEGEND

- Buildings with Existing Event Spaces
- Existing Outdoor Event Space
- Rouge River Gateway Trail

# MIGRATION STRATEGY

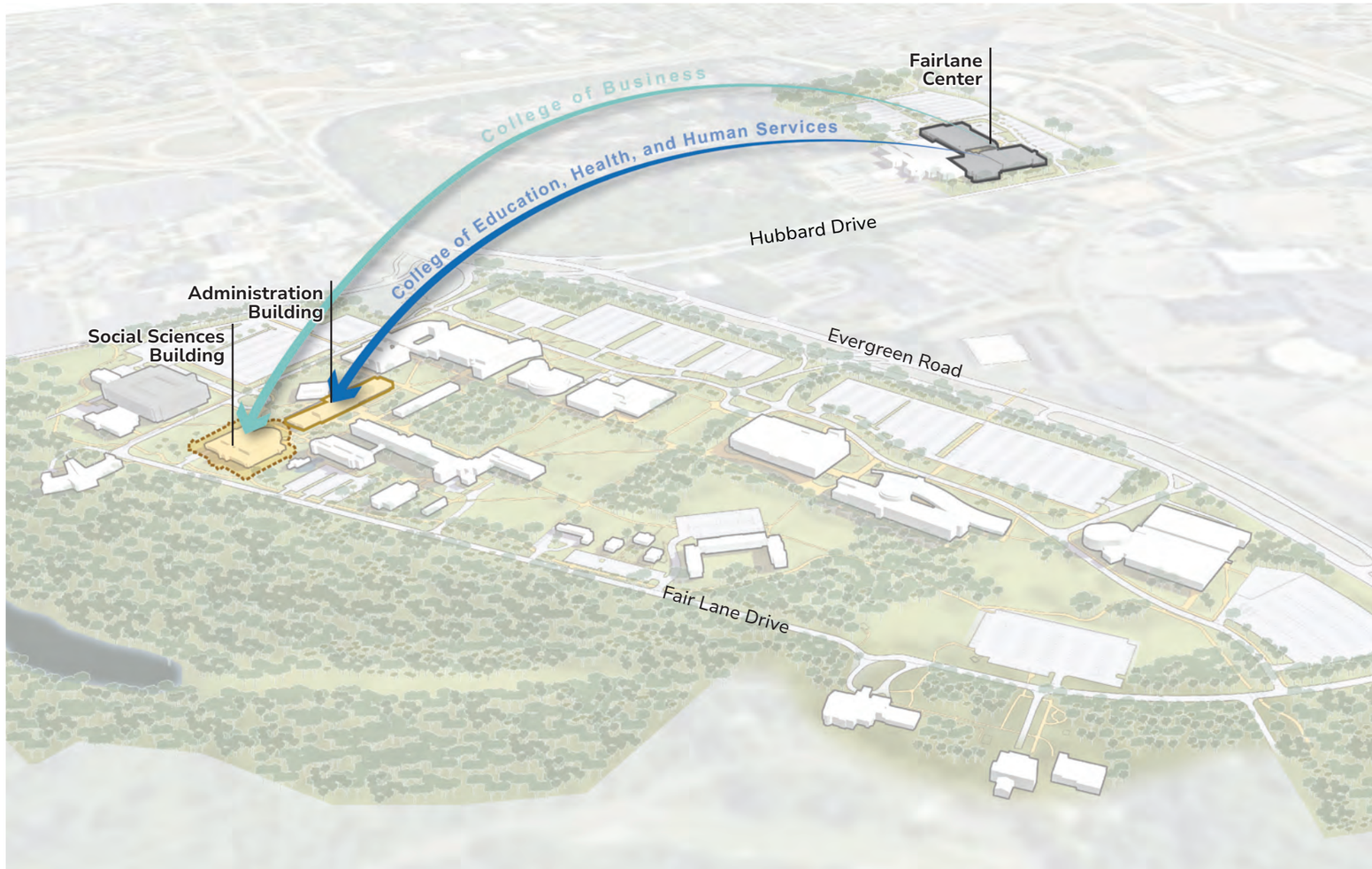
The Comprehensive Campus Plan conducted a thorough feasibility study on relocating the College of Business and the College of Education, Health, and Human Services from the Fairlane Center to the Main Campus. Discussions were informed by stakeholder feedback, as well as data from the MapMyCampus survey and the website.

Key concerns included:

+ The distance of the Fairlane Center from the Main Campus.
+ A lack of daytime activities in the building.
+ Access to food options.

UM-Dearborn conducted a trial run in the summer of 2023, moving both colleges to the Main Campus. The trial proved successful in reducing energy consumption and increasing campus activity. The study also examined personnel numbers, and space requirements for the College of Business, and conducted a test fit study in the Social Sciences building to assess the feasibility of the Comprehensive Campus Plan proposed strategies. As an outcome of this effort, the plan recommends future renovations to the Social Sciences Building and the Administration Building to accommodate the needs of the respective colleges.

The feasibility study proposed relocating the College of Business to the Social Sciences Building and the College of Education, Health, and Human Services to the Administration Building, providing students access to Main Campus amenities, such as collaboration and event spaces, and food options.



# Open Space Recommendations

Placemaking capitalizes on a campus's unique assets to promote vitality and culture. Enhancing the collective spaces at UM-Dearborn has the power to strengthen the university's identity.

**Enhanced Gateway**

+ Provide new, prominent signage and native landscaping representing UM-Dearborn to greet visitors as they enter through the main gateway.

**Outdoor Activation Opportunities**

+ Create an active student hub in the heart of campus with the Central Quad, located between Mardigian Library and the Renick University Center.
+ Enhance the natural gateway to the academic buildings around campus with Wolverine Walk, the university's primary pathway.

**Wolverine Walk**

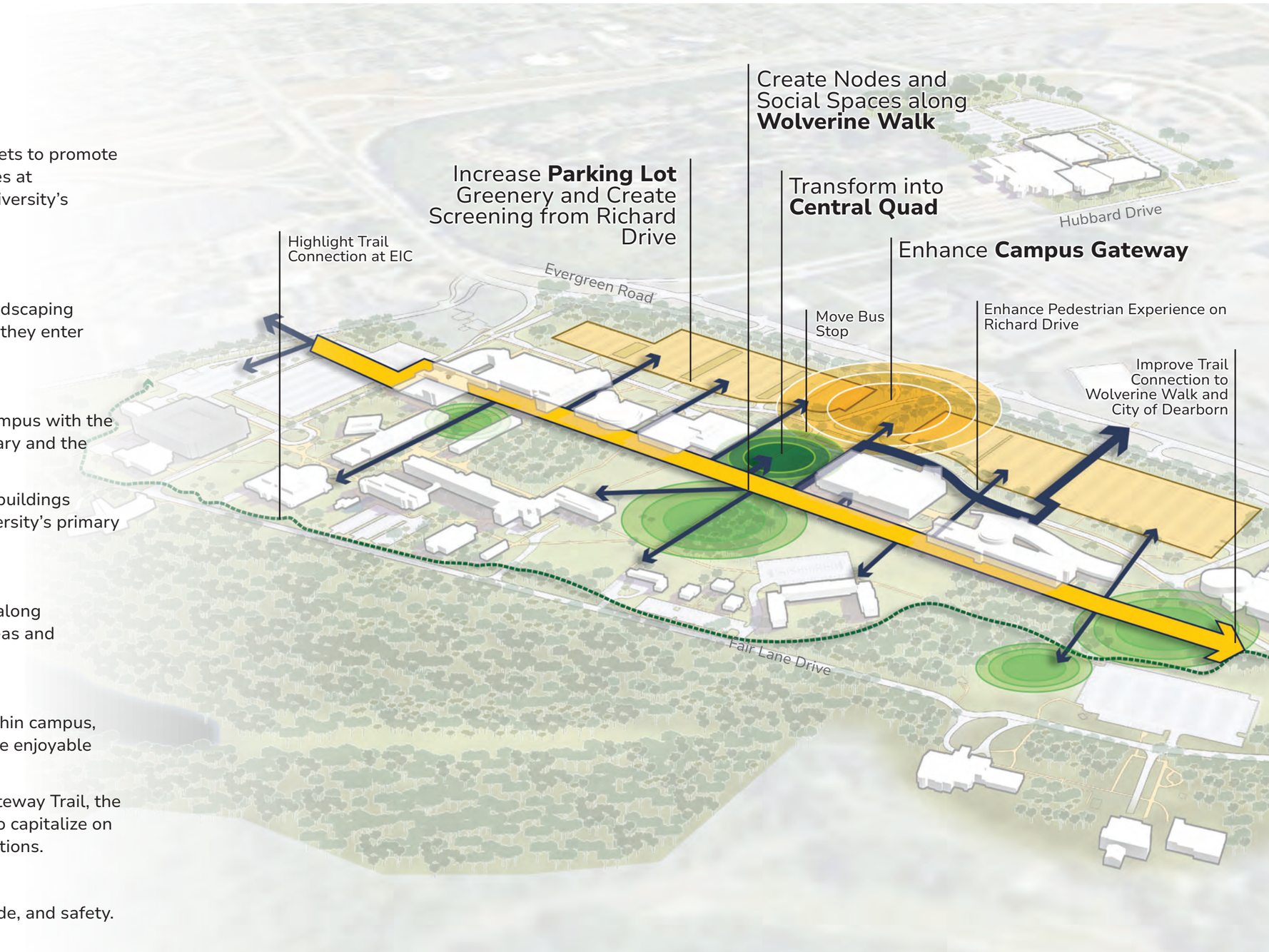
+ Expand and/or add learning and social spaces along Wolverine Walk to promote an exchange of ideas and conversation.

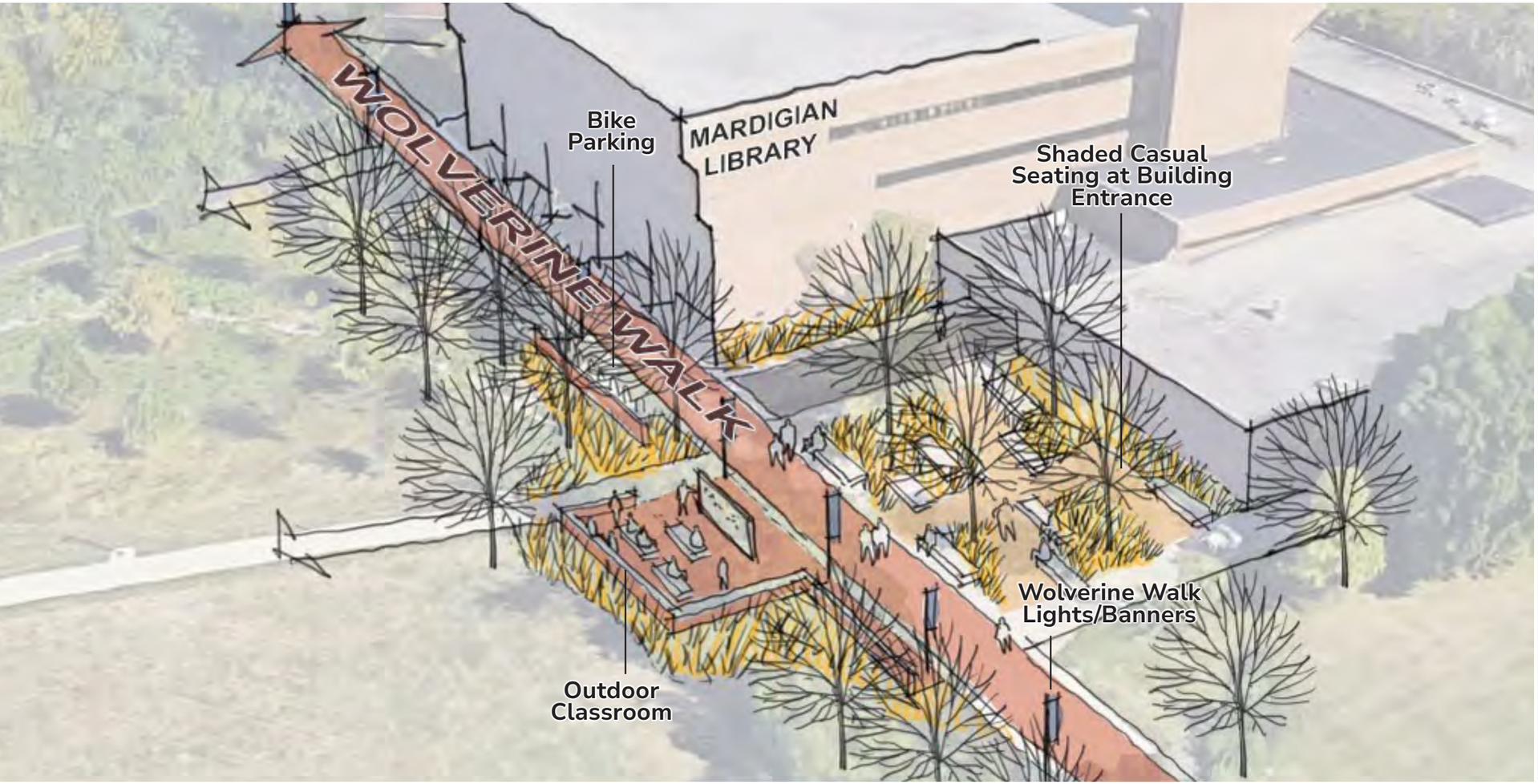
**Pedestrian Connection Improvements**

+ Improve pedestrian connectivity and safety within campus, especially across Richard Drive to create a more enjoyable campus experience.
+ Strengthen connections to the Rouge River Gateway Trail, the Henry Ford Estate, and Fairlane Town Center to capitalize on UM-Dearborn's proximity to prominent destinations.

**Parking Lot Enhancements**

+ Increase greenery, sustainability features, shade, and safety.

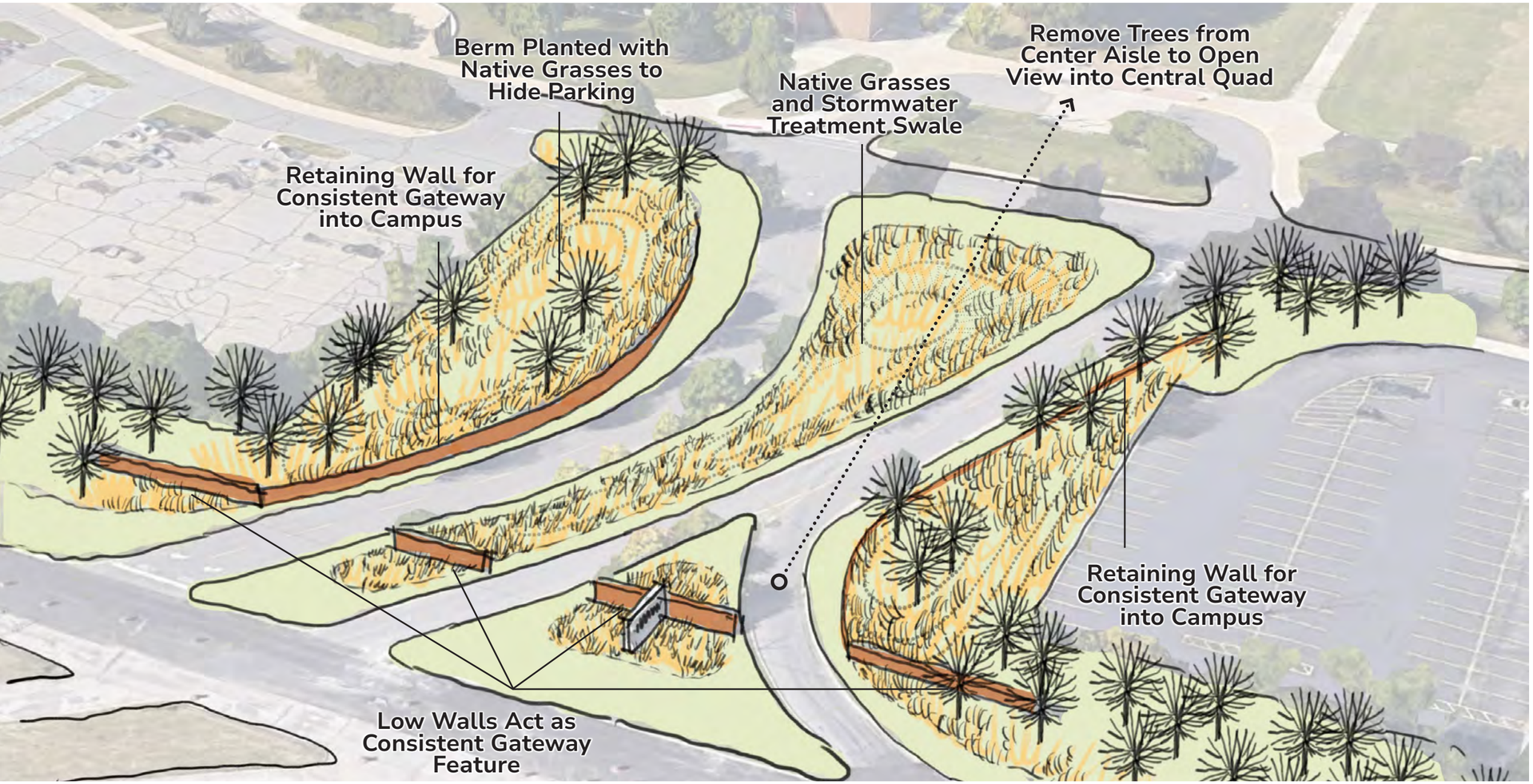





U-Wisconsin La-Cross Pedestrian Mall

# Wolverine Walk

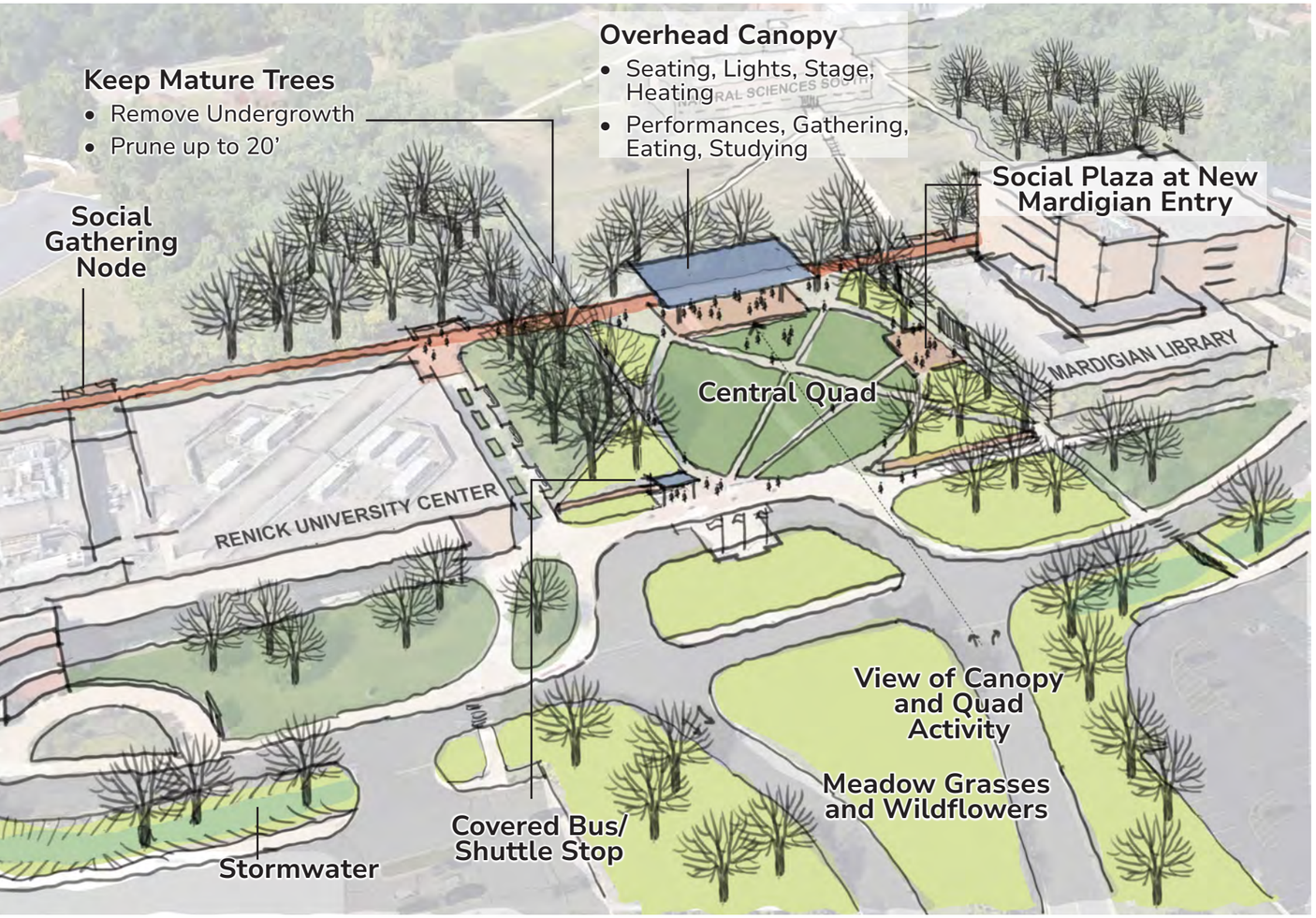
To strengthen the north-south axis of the university, the Comprehensive Campus Plan recommends enhancing the already existing walkway and renaming it Wolverine Walk. This walkway is envisioned as the main pedestrian thoroughfare of campus, seamlessly connecting key buildings and outdoor spaces. The plan extends the pathway south to connect with the Rouge River Gateway Trail that links the campus to the City of Dearborn. On the north side, the walkway strengthens its connection to Henry Ford College. In addition, the plan envisions the creation of intimate outdoor nodes designed to be versatile collaboration spaces and outdoor classrooms, intended for use during temperate months. Emphasizing sustainability, the nodes will harmonize with the natural environment, offering tranquil and functional spaces for the campus community.




NCMA Berm and Half Wall

# Gateway

The main entrance to the campus leads to the Central Quad and drop-off area. However, the entrance is currently easy to miss due to trees blocking the view and discreet signage. To improve the entrance experience, the Comprehensive Campus Plan proposes a low wall with the UM-Dearborn logo to complement the existing flags. The half wall terminates into a berm to obscure the visitor's view of the parking lot as they enter the campus. Trimming vegetation and trees, while still maintaining screening for the parking lots, would allow for better visibility into the campus and the Central Quad. Introducing native planting and green infrastructure throughout the campus, especially in the central aisle, could also enhance the arrival experience, highlighting the university's dedication to sustainability and establishing a sense of place.

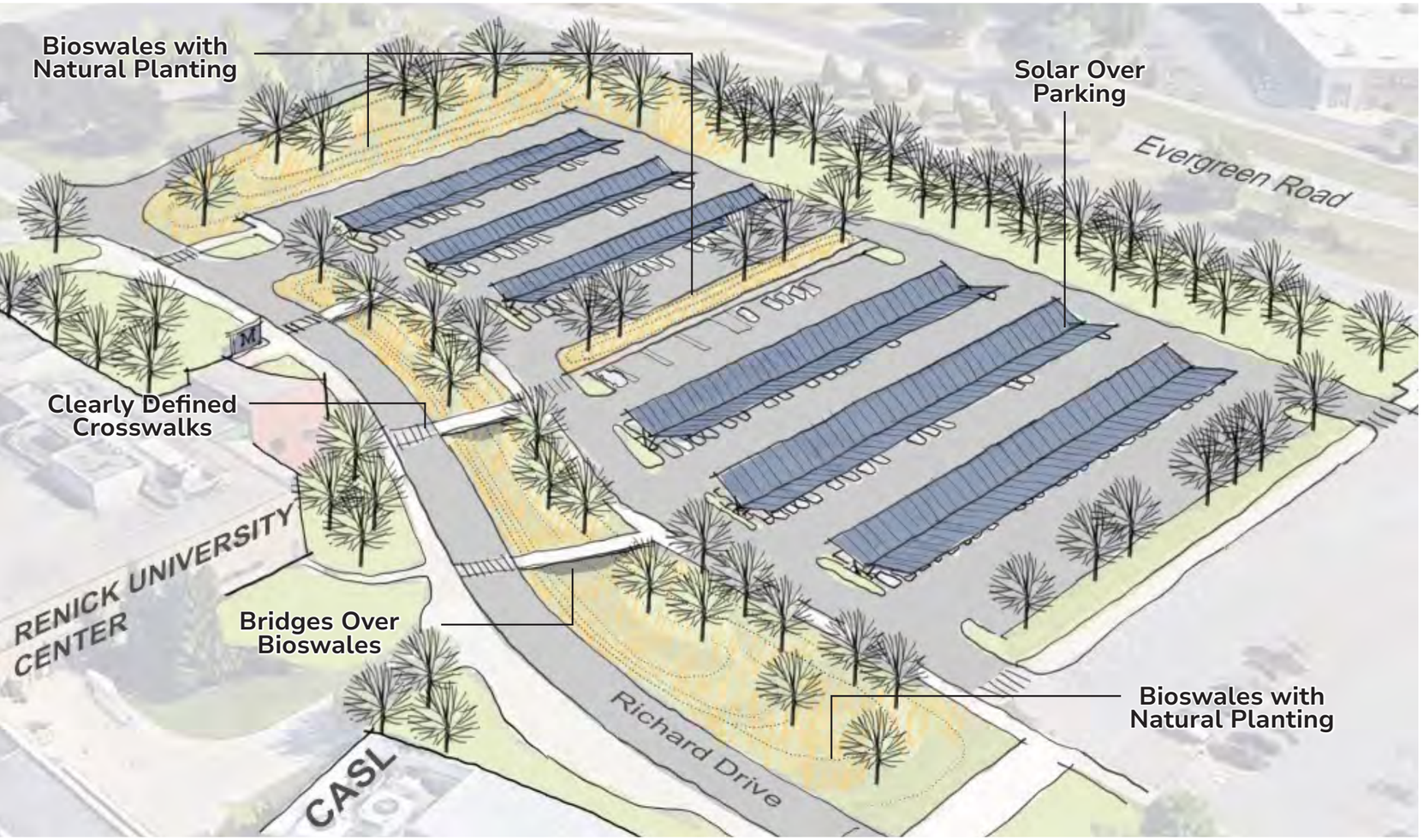




Klyde Warren Park Overhead Structure

# The Central Quad

The Central Quad is located between two student-oriented buildings: Mardigian Library and Renick University Center. In its current state, it is not well used despite its key location. The flow between buildings could be improved with connected pathways that lead to new building entrances on the Quad. In addition, site furniture and an overhead structure would provide a space for students, faculty, and staff to gather, work, and collaborate between classes. This space could also double as an event space for the campus and can serve as a destination on campus. The Central Quad can be designed to improve its functionality, comfortability, and aesthetics, while serving as a gateway to the campus interior.





# Parking Lots

UM-Dearborn is a commuter campus and requires ample parking for students, faculty, staff, and visitors. Most of the parking lots border the east side of the campus. In the near term, adding more greenery to the parking lots through trees, planting, and green stormwater infrastructure would enhance the parking lot and entry appearance, while simultaneously aid in achieving campus sustainability goal. Existing medians and grassy swales can be transformed into bioswales or rain gardens. By installing sidewalks with permeable pavers and raised crosswalks from the parking lots across Richard Drive, commuters can move from their vehicles through campus safely and with ease. In the long term, developing geothermal fields beneath several parking lots can generate low-entropy energy used to heat and cool the campus. Additionally, installation of raised solar photovoltaic panels in parking lots would offset energy costs, while doubling as shade structures for vehicles.

# Sustainability Recommendations

The Comprehensive Campus Plan recommendations cover various aspects, such as energy-efficient technologies, renewable energy systems, and waste management practices, which will significantly contribute to reducing the university's environmental impact. The implementation of this plan will ensure that the university is environmentally responsible and sustainable, thus contributing to a better future for everyone.

**Building-level Upgrades**

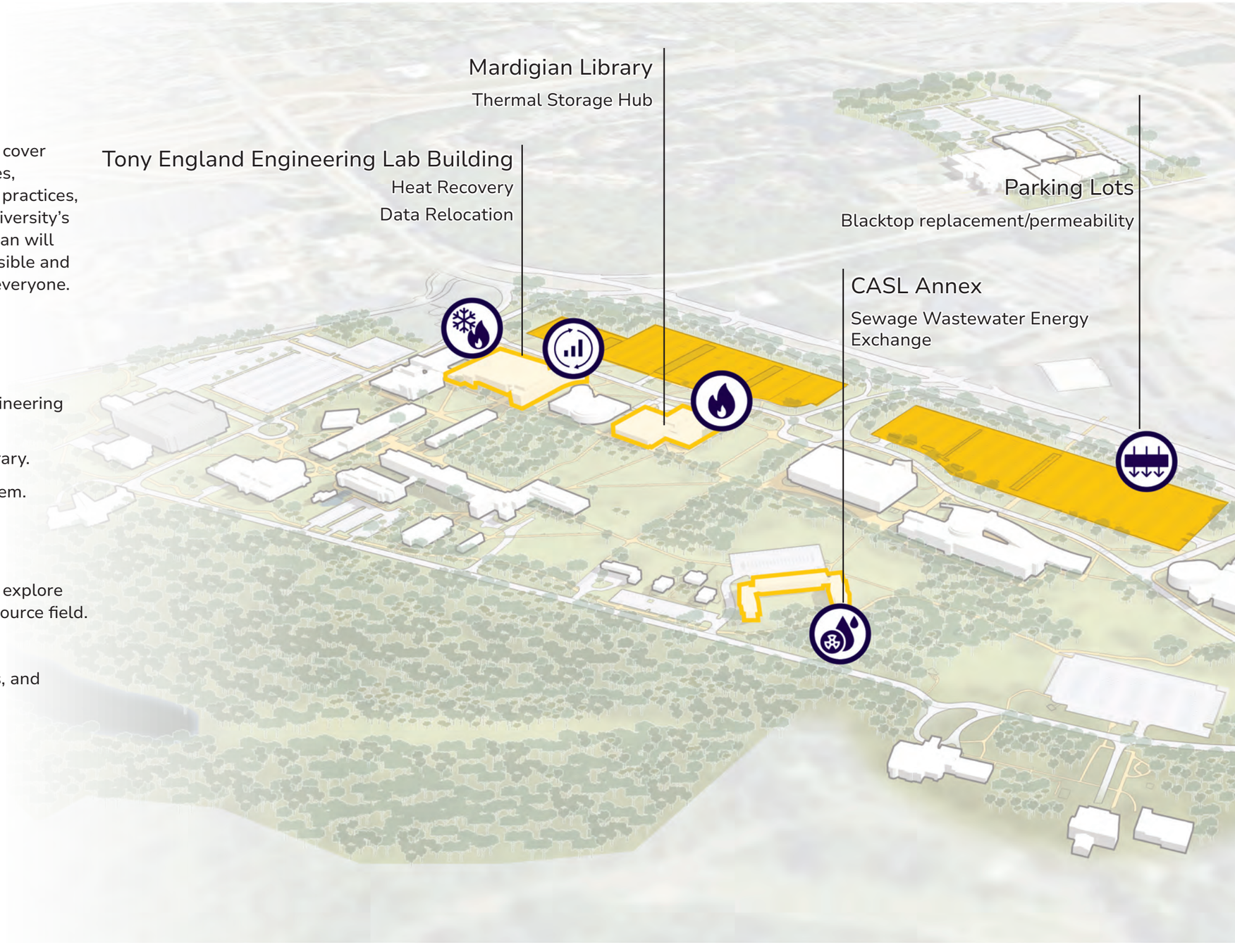
+ Utilize laboratories for heat recovery system.
+ Relocate data center from Fairlane Center to Engineering Building.
+ Consider a thermal storage hub at Mardigian Library.
+ Pilot Sewage Wastewater Energy Exchange System.

**Parking Lot Upgrades**

+ Focus on blacktop replacement.
+ Improve permeability, add solar PV carports, and explore geothermal bores for ground source heat pump source field.

**Campus-Wide Upgrades**

+ Convert steam to hot water, create thermal loops, and improve distribution efficiency.



03

# Campus Today

# Campus Environment

## CAMPUS CHARACTER

The UM-Dearborn campus is located on former Henry Ford Estate land, and consists of the Main Campus and the Fairlane Center. The backdrop of Main Campus is a 200-acre nature preserve and is bordered by the Rouge River. The center of campus boasts a protected forest area as part of its LEED certification. Other notable landmarks include the Rouge River Gateway Trail that runs along the west side of campus and Chancellor's Pond. Despite its rich heritage and natural surroundings, the campus interior is characterized by lackluster lawn areas and a monotone plant palette.  While functional, the large parking lots that greet visitors at the campus entry are dominant and uninviting. Finding one's way into and around campus on foot can be challenging with the lack of signage and adequate pedestrian conflict points in vehicular corridors. Aside from Chancellor's Pond, the few outdoor gathering spaces that do exist lack furniture, shade, or atmosphere. The following section describes existing notable spaces on campus that have been identified as areas of opportunity.

## CENTRAL QUAD

A quad is a social space that students and faculty cross to get to classes, recreational facilities, or dining. It is also a space where campus goers spend time socializing, studying, or relaxing. UM-Dearborn does not currently have a quad; however, there is potential to transform the large, nondescript lawn space between Renick University Center and Mardigian Library. The space currently serves little purpose, but due to its prominent position at the terminus of the Central Gateway and between two student-centered buildings, it is well-positioned to become UM-Dearborn's Central Quad.

## WOLVERINE WALKWAY

The main walkway that connects the campus from the Engineering Lab Building at the north end to the College of Arts, Sciences, and Letters at the south end serves as the main pedestrian spine. It connects many academic and student life buildings. While well-traveled, the walkway only serves the purpose for getting from point A to point B, lacking areas for socialization and chance encounters. An opportunity exists to provide seating and nodes of activity along the walkway to make it a much more inviting corridor on the UM-Dearborn campus.


## CAMPUS SOCIAL NODES

The campus has two notable social nodes along its main pathways. The first is the Chancellor's Pond. This pleasant space includes formal areas for sitting, eating, studying, and socializing outside of class. The second social node is the area outside of Mardigian Library, adjacent to the walkway. This space is used for tabling events because of its proximity to the entrance to the Renick University Center, however it lacks furniture and formalized social space. Both areas present excellent opportunities for enhancement.

## OUTDOOR CLASSROOMS

Outdoor classrooms provide the chance for students to learn and collaborate in an engaging environment, improving mental health and academic performance. For example, UM-Dearborn's Environmental Study Area provides a unique opportunity to learn in a natural setting. While not a typical instructional space, it acts as a living laboratory for biology, environmental science, and ecology students. Students would benefit from more outdoor classrooms, especially ones suited for traditional instruction. These could include flexible furniture, chalkboards, shade structures, power outlets, and a strong Wi-Fi connection.

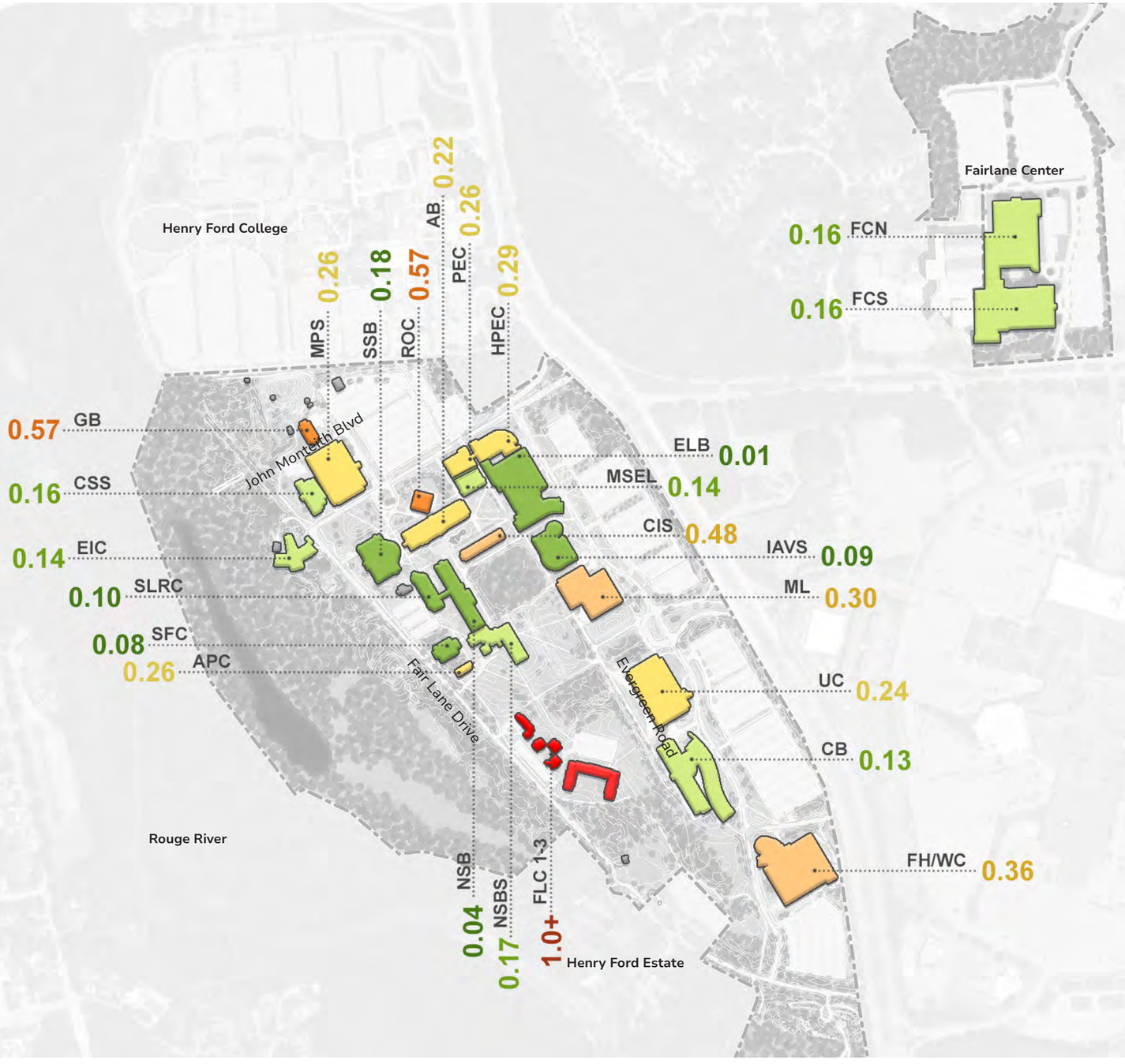
# Campus Facilities

## FACILITIES CONDITIONS

As part of the current planning effort, a review of the 2019 Facilities Condition Needs Index report was completed. It provided a comprehensive overview of maintenance needs for campus facilities. The university has since made a few updates to its facilities, including the Tony England Engineering Lab Building, which was renovated recently to meet current standards and requirements. To ensure the assessment was comprehensive, the university provided deferred maintenance data to identify and prioritize maintenance needs. This data included information on areas that required immediate attention and those that could be deferred. This, along with the space utilization data and educational adequacy survey results, helped the planning team understand the current condition and future potential of each building.

### LEGEND

- Excellent
- Good
- Fair
- Below average
- Poor
- Replacement indicated
- N/A



# RECENT AND ONGOING DEVELOPMENT

Along with the Facilities Conditions Assessment, the planning team considered exciting projects that are currently underway or have been recently completed. These projects have an impact on future space needs and campus planning efforts.

## NEWLY RENOVATED TONY ENGLAND ENGINEERING LAB BUILDING (ELB)

The Tony England Engineering Lab Building (ELB), after extensive renovation, re-opened in 2021 as a modern engineering facility. The goal was to equip the building with the latest industry technologies, and design the curriculum around projects, problem-solving, and entrepreneurship. The new building, with its numerous collaboration spaces, abundant technology, and flexible research space serves as a tremendous asset on the UM-Dearborn campus.



## COMPUTER AND INFORMATION SCIENCE BUILDING RENOVATION AND EXPANSION

As part of UM-Dearborn's strategic enrollment strategy, the university has experienced a higher demand of enrollment in Computer and Information Science, and as a result has increased its faculty to support this growth. The existing building, however, lacks the space to accommodate program expansion. The Computer and Information Science Building requires an updated design and improved infrastructure to adequately serve as the primary teaching and research laboratory facility for the Computer and Information Science Department. This project includes an approximately 10,000 to 12,000 gross square feet (GSF) addition to support current pedagogies and increase enrollment. This project has been identified as a key priority for the institution.

## RENICK UNIVERSITY CENTER / MARDIGIAN LIBRARY BUILDING AND SITE TRANSFORMATION

The university has proposed transforming the Renick University Center and Mardigian Library, as well as the open space between the two buildings (i.e. Central Quad). Updates include improved functionality of interior rooms, flow of building corridors, and realignment of primary entrances to better assist in campus circulation and wayfinding. This project seeks to add more event space, lounge spaces, zoom rooms, and collaboration spaces to advance the university towards its strategic goals.

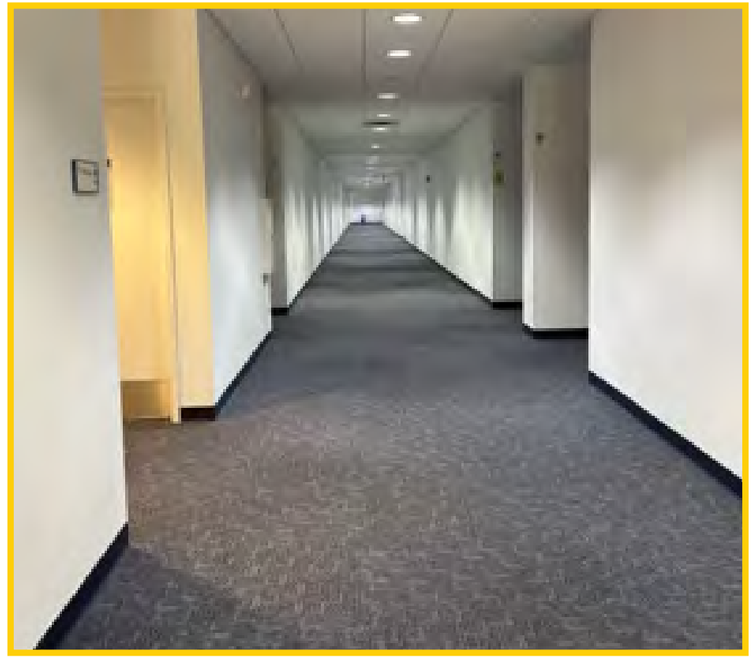
# GROUND-FLOOR EXPERIENCE

With the exception of the fully-renovated Natural Sciences Building, Engineering Lab Building, and the previously noted proposed projects, the interior corridors of many academic buildings lack informal space for collaboration or socialization between classes. Most buildings are designed with formal instructional space connected by narrow hallways that leave little room for a lobby or informal gathering space. There is opportunity to create more spaces in buildings for student and faculty collaboration.

The ground-floor experience also includes circulation and flow between buildings. This is important for interdisciplinary collaboration and social opportunities. Currently, many of the campus's entrances to buildings lack a welcoming "front door," which could cause confusion to campus goers. For example, the main entrance to Renick University Center is not well marked and on the opposite side of the building from where most students are arriving from —the parking lot or drop-off area. In addition, pathways between building entrances, such as Mardigian Library and Renick University Center, are not well coordinated and therefore reduce the opportunity for interaction.

## LEGEND

- Restricted Access
- Public Access
- Entrance

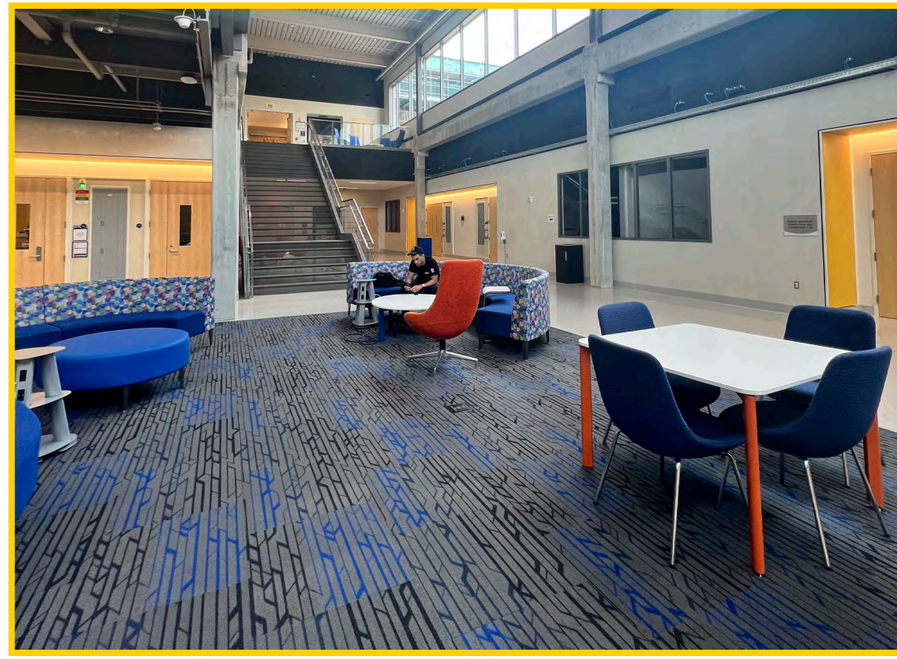


**BUILDING CORRIDORS AT CASL AND FAIRLANE CENTER**

The existing corridors of many buildings like those at the CASL and Fairlane Center have no space for students to socialize or gather in-between classes.

**BUILDING CORRIDORS AT TONY ENGLAND ENGINEERING LAB AND NATURAL SCIENCES BUILDINGS**

Newly renovated spaces feature both quiet study areas and collaboration space for students to spend time between classes.

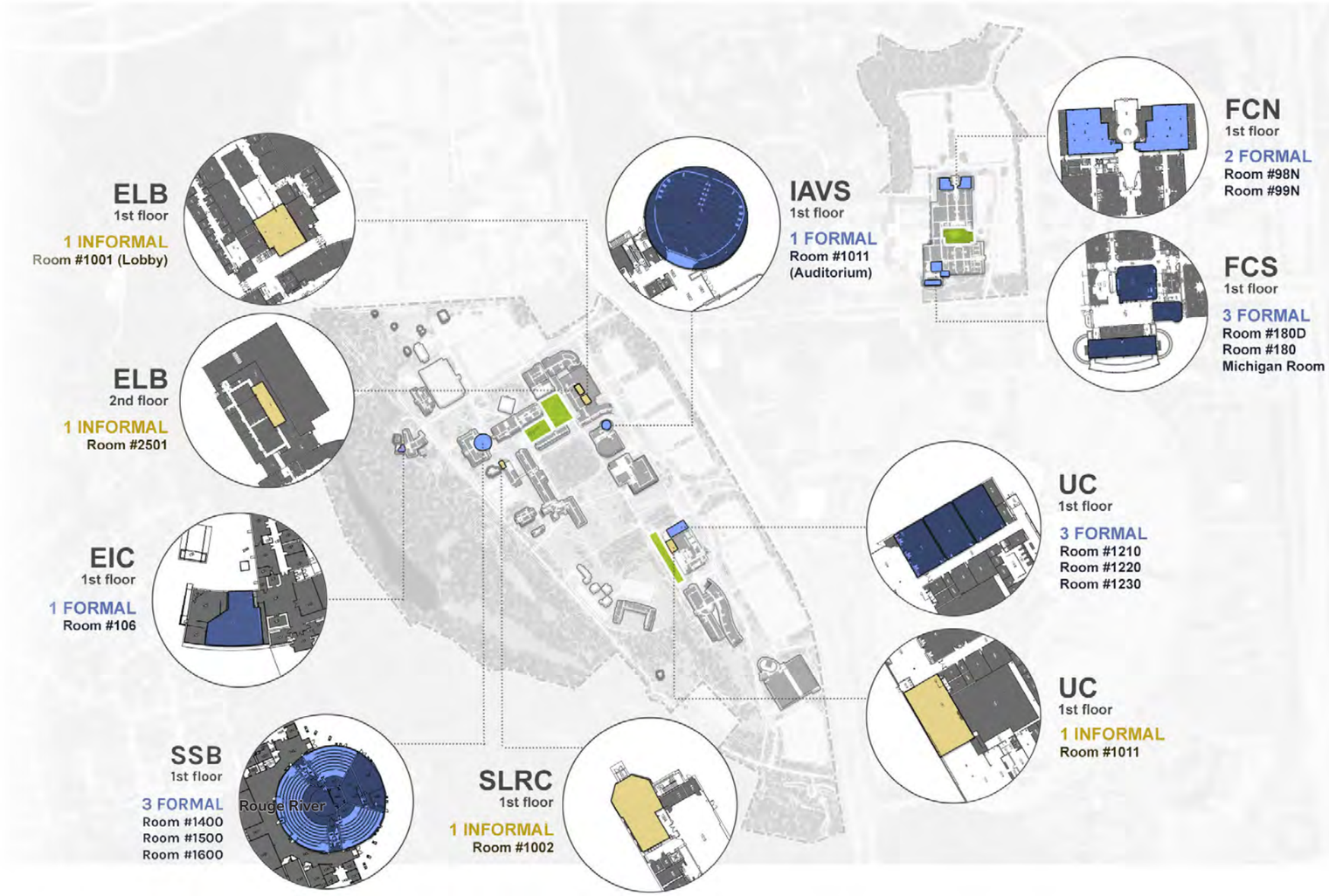


# EVENT SPACES

UM-Dearborn's campus boasts two outdoor event spaces, nine formal indoor event spaces, and four informal indoor event spaces. The Fairlane Center has approximately 22,000 square feet of meeting, conference, and formal event space across the two buildings. The largest event space at Fairlane Center is the Michigan Room which is used for high-level ceremonies and formal presentations. On the Main Campus, the Renick University Center (RUC) features a premier multi-purpose room, Kochoff Hall, which can be divided into three individual rooms or used as one, 5,500 square foot room for larger events. Current renovations of the RUC will also add breakout rooms and informal gathering spaces adjacent to Kochoff Hall. In the ELB, The Weiser Family Atrium is used for both CECS and university events. The Chancellor's Pond and Renick University Center Patio serve as programmable spaces for outdoor events.

## LEGEND

- Formal Event Space
- Informal Event Space
- Outdoor Event Space



# Circulation and Connectivity

Gateways, pathways, roads, viewsheds, and building entrances all contribute to the experience of finding one's way through a campus. While the campus has a straightforward layout and path hierarchy, the campus faces several wayfinding and connectivity challenges.

## VISIBILITY AND EDGE CONDITIONS

Viewsheds and visibility of campus locations are important aspects of wayfinding and orienting oneself on a campus. There are several areas on campus that have partial or fully blocked visibility. When entering campus from Evergreen Road, thick trees block views into campus. While this helps screen the parking lots upon entry, it does not help signify that one is entering campus. Improving sight lines into campus as well as enhancing signage could create a grander and more welcoming campus entry.

Trees in the interior of campus also block visibility across campus. Wolverine Walk is lined by dense trees at Mardigian Library, Renick University Center, and the College of Arts, Sciences, and Letters, blocking views to the west portion of campus. As this is the most active pathway on campus, there is opportunity to thin vegetation to improve sight lines. The LEED protected forest, while important to the campus's sustainability efforts, poses visibility challenges in the center of campus between Wolverine Walk and the Natural Sciences Building. Signage and other wayfinding tools can address this issue.


### LEGEND

- Blocked Visibility
- Dense Trees
- LEED Protected Forest Area

# GATEWAYS

There are four campus entrances along Evergreen Road. While flags with UM-Dearborn logos line the road, the entrances are not well defined due to the dense tree cover that blocks views into campus, and discreet signage. As most visitors are entering campus by vehicle, the existing signage is not well placed or prominent enough to direct traffic appropriately.

The most well utilized entrances are the North Entrance and Central Entrance. The North Entrance at John Monteith Boulevard is partially obscured by vegetation and does not have any directing signage ahead of the turn for vehicles, and can therefore be easily missed. The Central Entrance has similar issues and also lacks clear sight lines into campus. As this is the main entrance that leads to the Central Quad and drop-off area, there is room to improve the arrival experience.

The entrance on the south end leading to the Henry Ford Estate creates a better gateway example. The directing signage ahead of the turn, as well as the stone walls lining the entrance, help direct traffic and create a grander arrival experience.


North Entrance

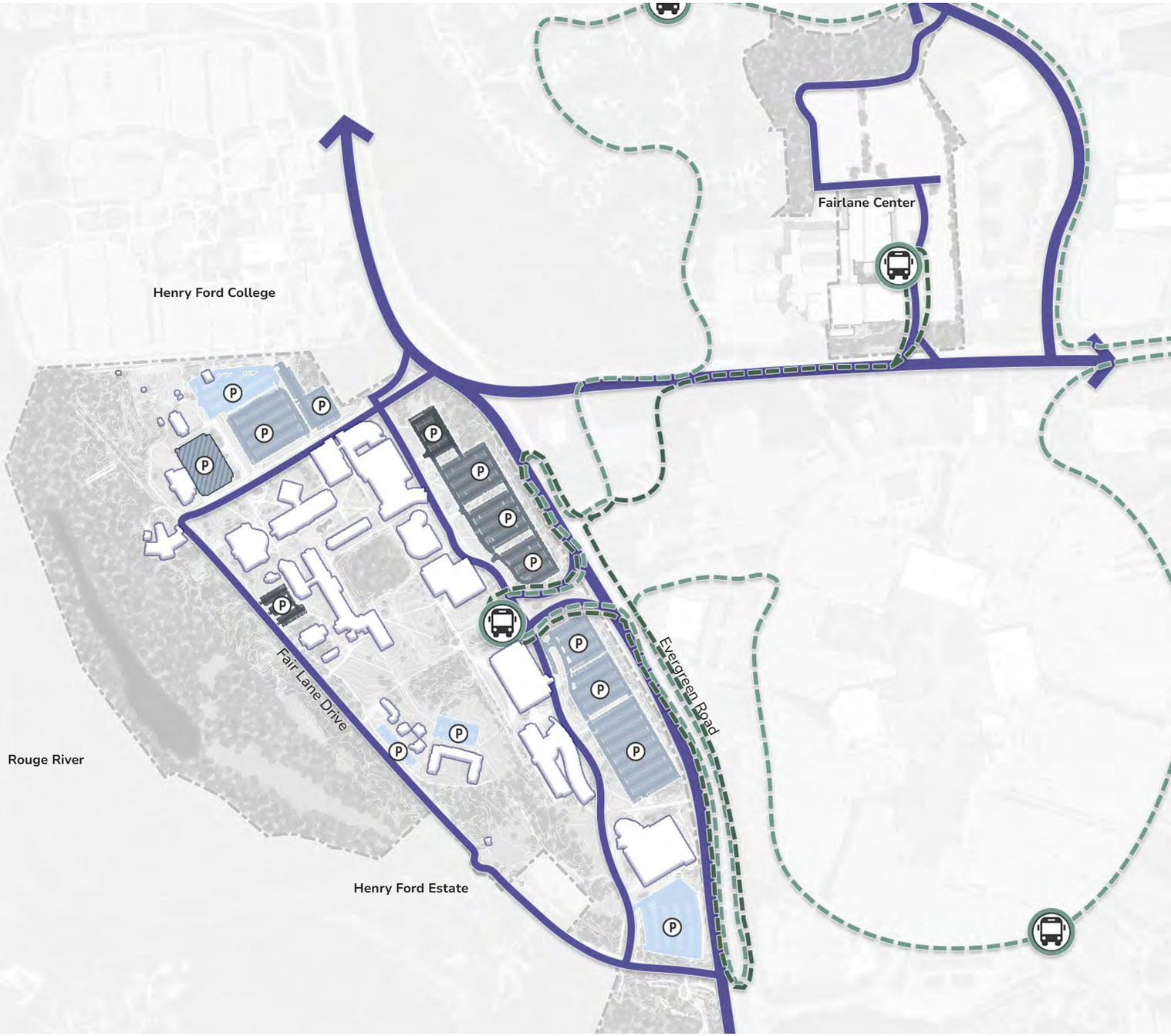
Central Entrance

# VEHICULAR CIRCULATION

While the interior of campus is pedestrian-oriented, the campus exterior and surrounding context is vehicle dominated. The main road leading to campus, Evergreen Road, provides access into campus. There is a vehicular loop that surrounds campus. John Monteith Boulevard serves as the entry to the north side of campus, while Fair Lane Drive runs along the west side of campus and provides southern access. Richard Drive is the main vehicular road that connects John Monteith Boulevard and Fair Lane Drive on the east side of campus, and to the drop-off area and parking. Access to the Fairlane Center and College of Business is easiest by private vehicle.

There is ample parking available on campus adjacent to Richard Drive and John Monteith Boulevard. The most heavily used lots are those located on the northeast side of campus servicing the Engineering Building, Institute for Advanced Vehicle Systems, and Mardigian Library. The lot behind the Natural Sciences Building is also consistently full.

The university provides two weekday shuttles.  One shuttle goes between the Renick University Center (RUC) and the Fairlane Center (FC).  The second shuttle circulates between a few local apartment complexes, the RUC, and the FC.




## LEGEND

Lot Fill at Peak Times

- Full
- Moderate
- Ample
- Empty
- Parking Garage
- Shuttle Stops
- Shuttle Route (Maize)
- Shuttle Routes (Blue)
- Vehicular Network

# PEDESTRIAN CIRCULATION

The interior of UM-Dearborn's campus is fairly compact and walkable. Most of the campus buildings are within a 1/4-mile radius and be reached in under 10 minutes. Various academic and student life buildings line the main pedestrian spine, Wolverine Walk. The Rouge River Gateway Trail also connects through the campus interior, providing access to recreation and natural areas. With that said, there is opportunity to strengthen Wolverine Walk by improving access to adjacent buildings, adding social nodes, and better connecting to the greenway.

The campus edges pose challenges to pedestrians. Vehicular traffic and parking lots hinders pedestrian flow and creates various dangerous conditions, specifically on Richard Drive. There is opportunity to slow and limit traffic along Richard Drive, while improving safety crossings and pedestrian walkways in parking lots. Furthermore, students traveling to and from the Fairlane Center must cross Evergreen Road, which is vehicular-dominated and dangerous to pedestrians. There is opportunity to implement safer pedestrian crossing at Evergreen Road.

## LEGEND

- 1/4 mile radius
- Pedestrian/Vehicular Conflict
- Main Pedestrian Spine
- CB to SSB Walk Simulation (10 min, .5 mi)
- Pedestrian Network
- Greenway/Trail
- Building Entrances

# CONNECTING TO ROUGE RIVER
## GATEWAY TRAIL

UM-Dearborn's campus is conveniently located by the Rouge River Gateway Trail. The Rouge River Gateway Trail crosses over the Rouge River through densely wooded areas to Michigan Avenue to the south, which connects to downtown Dearborn. It provides access to nature and wildlife, recreation, and provides learning opportunities with its proximity to the Environmental Interpretive Center.

Currently, the trail entries are not well marked and run along what feels like the back of campus. Building service access and parking interrupt the trail flow. There is opportunity to connect the trail with Wolverine Walk. This would prevent the abrupt ending of Wolverine Walk and could better highlight the entrance to the trail. In addition, it would facilitate better connectivity through walking and biking to downtown.

04

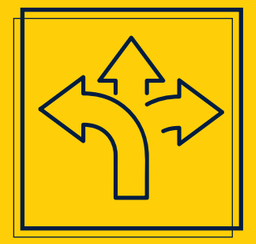
# Planning Drivers

# Campus Engagement

An essential component of developing the Comprehensive Campus Plan was to hear from UM-Dearborn's students, faculty, staff, and alumni. Several key themes emerged from the MapMyCampus survey, stakeholder interviews, and student specific engagement activities that helped inform the Planning Goals and Opportunities.

**Provide more accessible pedestrian circulation**

**Renovate classrooms and teaching laboratories**



**Consider future role and identity of Fairlane Center**

**Enhance the arrival experience**

**Celebrate the unique identity of UM-Dearborn**

**Foster a more inclusive and vibrant campus experience**

**Create intentional spaces for students between classes**

**Improve diversity of food offerings and availability**

# MapMyCampus

MapMyCampus was an innovative tool used during the engagement process. The survey, consisting of 17 targeted questions, was distributed to the campus population to understand the unique campus experience of students, faculty, staff, and alumni. Participants were directed to drop pins based on their daily activity and provide comments as needed. A total of 611 student, faculty, staff and alumni responses were mapped and analyzed, which informed decision-making during the planning process.

## 325 Students

4% of total students responded

## 119 Faculty

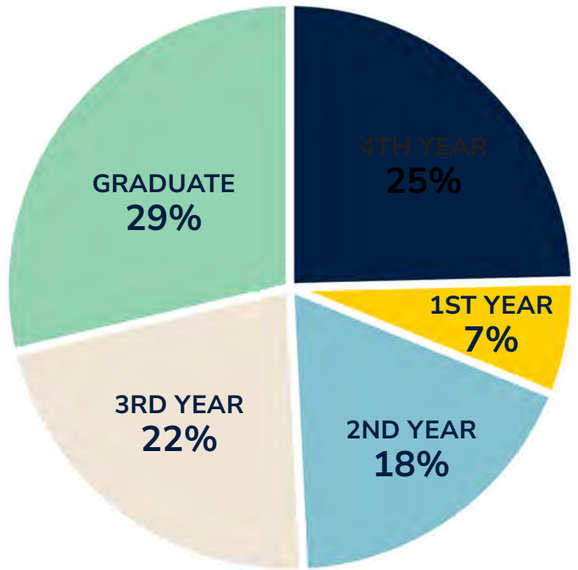
47% of total faculty responded

## 161 Staff

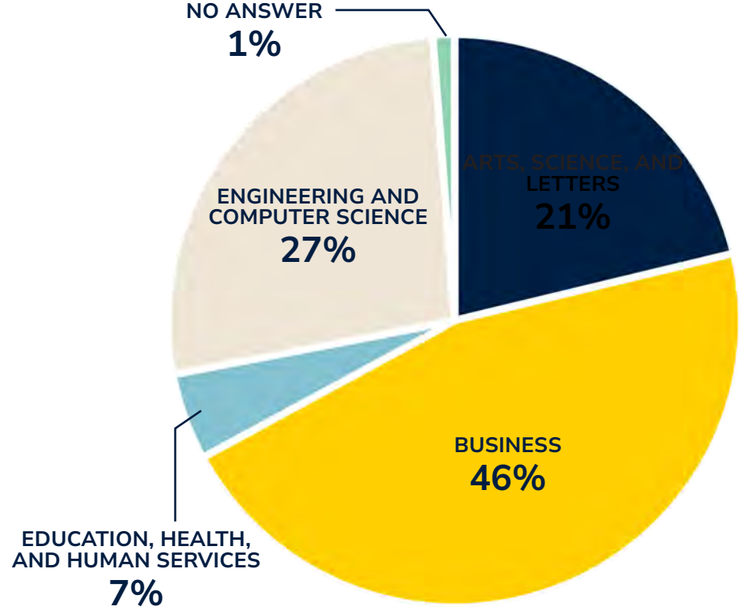
12% of total staff responded

## STUDENT PARTICIPANT SUMMARY

### YEAR




### COLLEGE



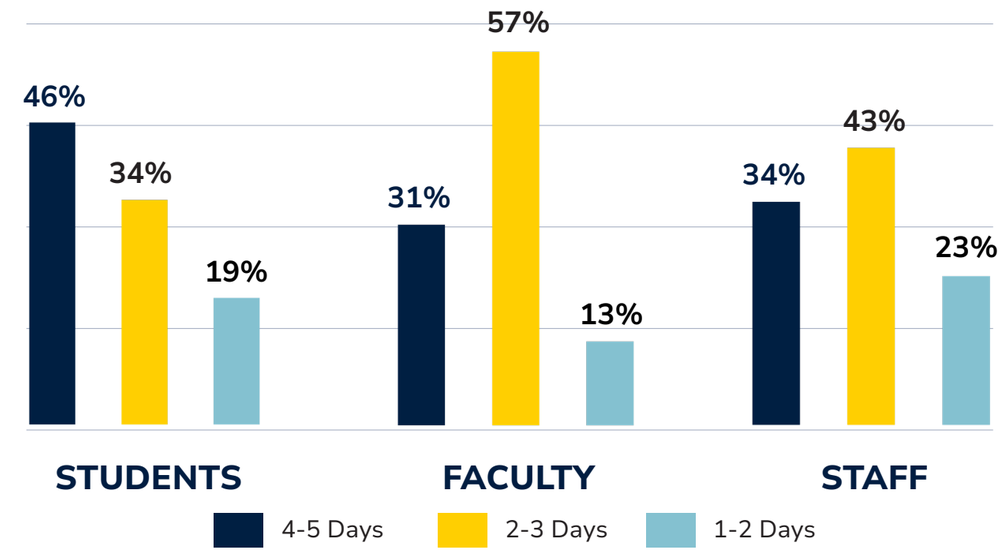
# Survey Summary

Students, faculty, staff and alumni were asked qualitative and quantitative questions about their campus experience. Quantitative data supported anecdotes that the campus is a commuter campus: almost 50% of students live more than 10 miles aways, while 70% of staff and 83% of faculty live more than 10 miles away. However, approximately a quarter of students live under 3 miles from campus and could walk or bike to campus.

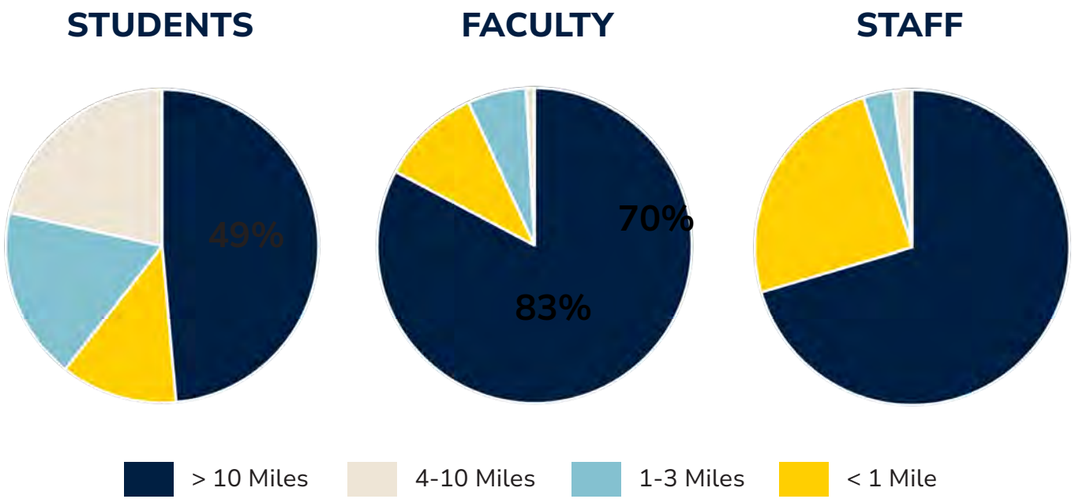
While trends are shifting towards more remote learning, the campus community still spends a significant amount of time on campus. 46% of students come to campus four to five days per week and spend at least four hours on campus.  While faculty and staff are on campus less frequently than students, they spend more time, with the majority spending at least six to eight hours on campus.

In the pages that follow, qualitative data from mapping exercises reveals information about how and where campus community members spend their time on campus, as well as sentiments about the physical campus environment.

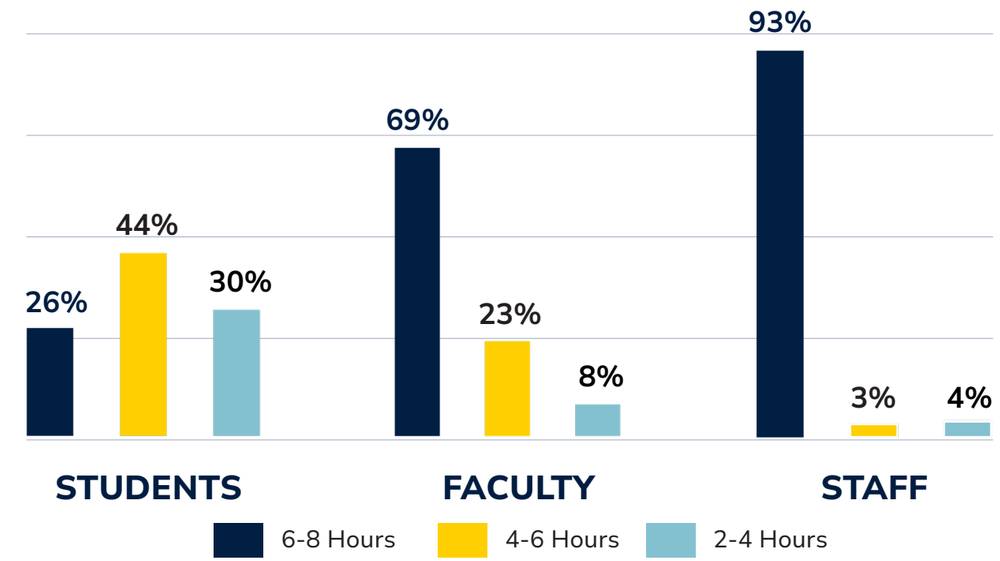
## HOW MANY DAYS ON CAMPUS IN A WEEK?




## HOW FAR DO YOU LIVE FROM CAMPUS?




## HOURS PER DAY ON CAMPUS



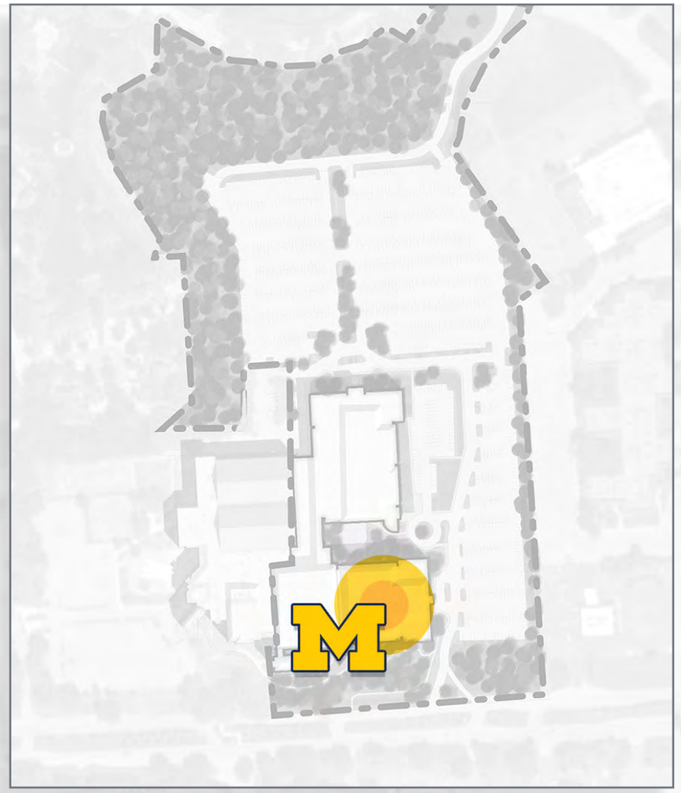
# HEART OF CAMPUS

Tony England Engineering Lab Building

Mardigian Library

Renick University Center

College of Arts, Sciences, and Letters (CASL) Building



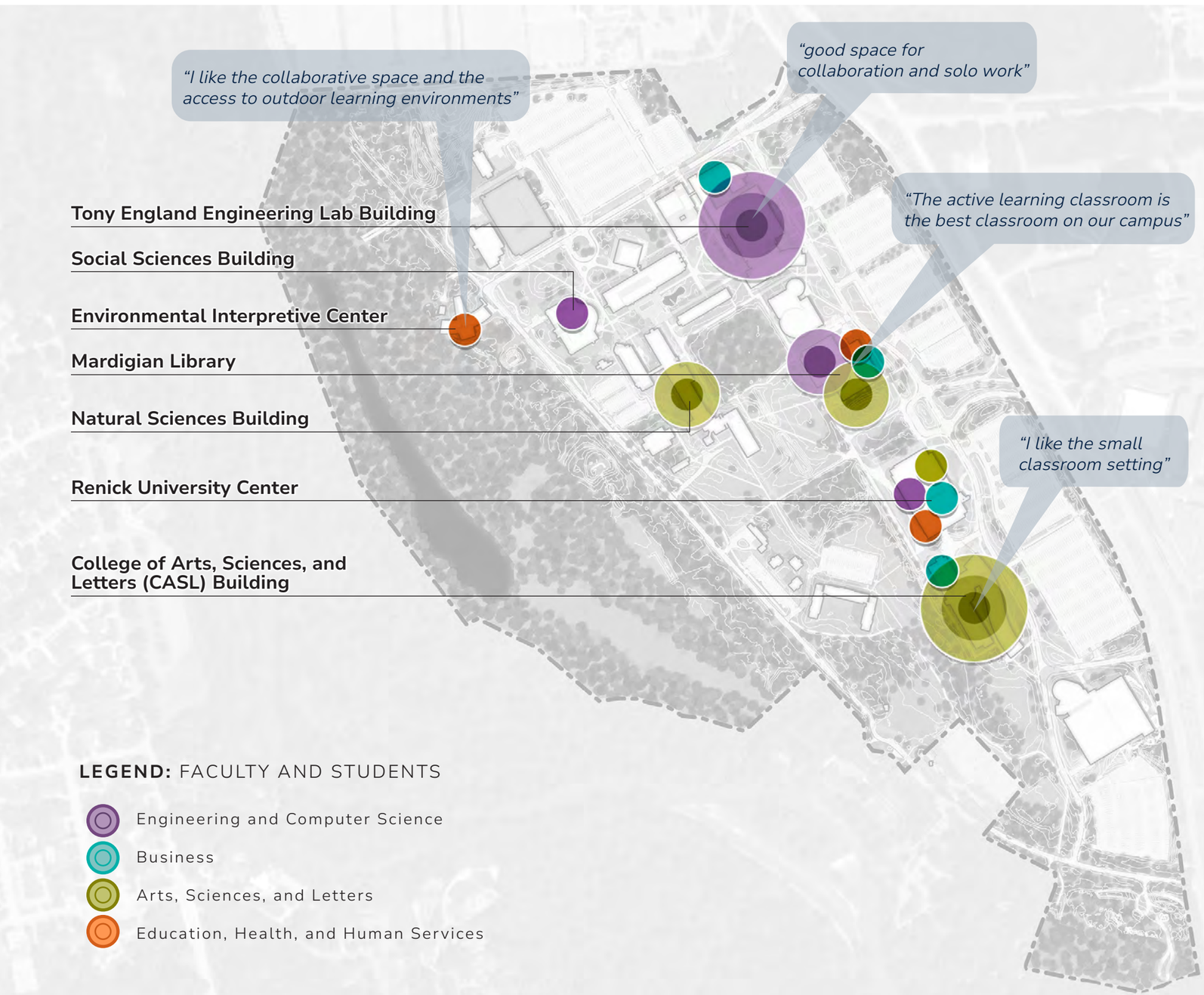
**LEGEND:** FACULTY, STUDENTS, STAFF, AND ALUMNI

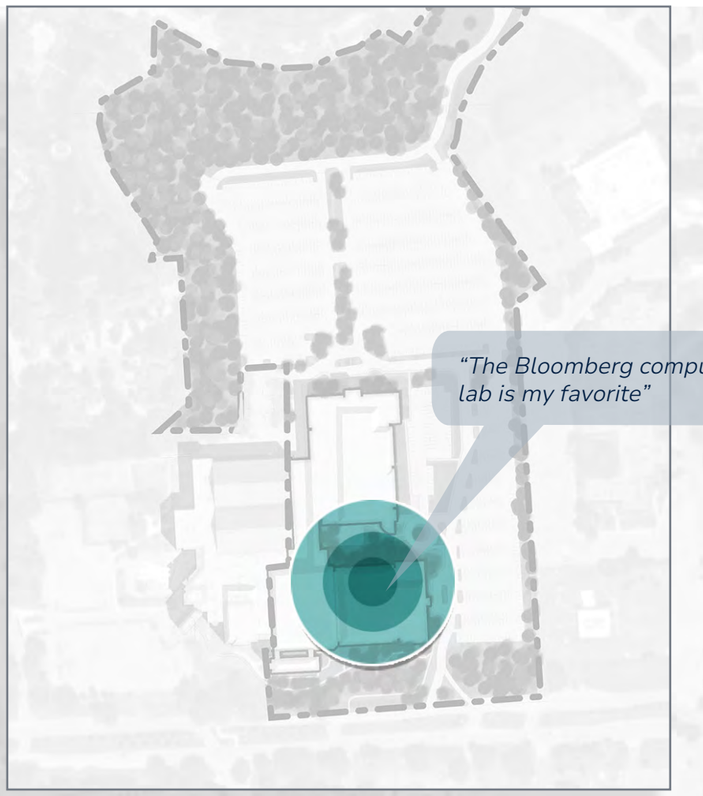
- Heart of Campus
- Favorite Selfie Spot

**Key Takeaways:**

- The preferred selfie spot on campus is the large Michigan “M” displayed in front of Renick University Center. It was the preferred spot for students to take a selfie or graduation picture to show the spirit of the campus. Additionally, a selfie spot was identified at the FCN, mostly for COB students.
- Most students, faculty, staff and alumni identified Renick University Center as the heart of the campus. However, those associated with the College of Business (and some College of Education Health and Human Services students) chose the Fairlane Center as the heart — as many of their classes are located off the Main Campus.

# FAVORITE SPACES BY COLLEGE



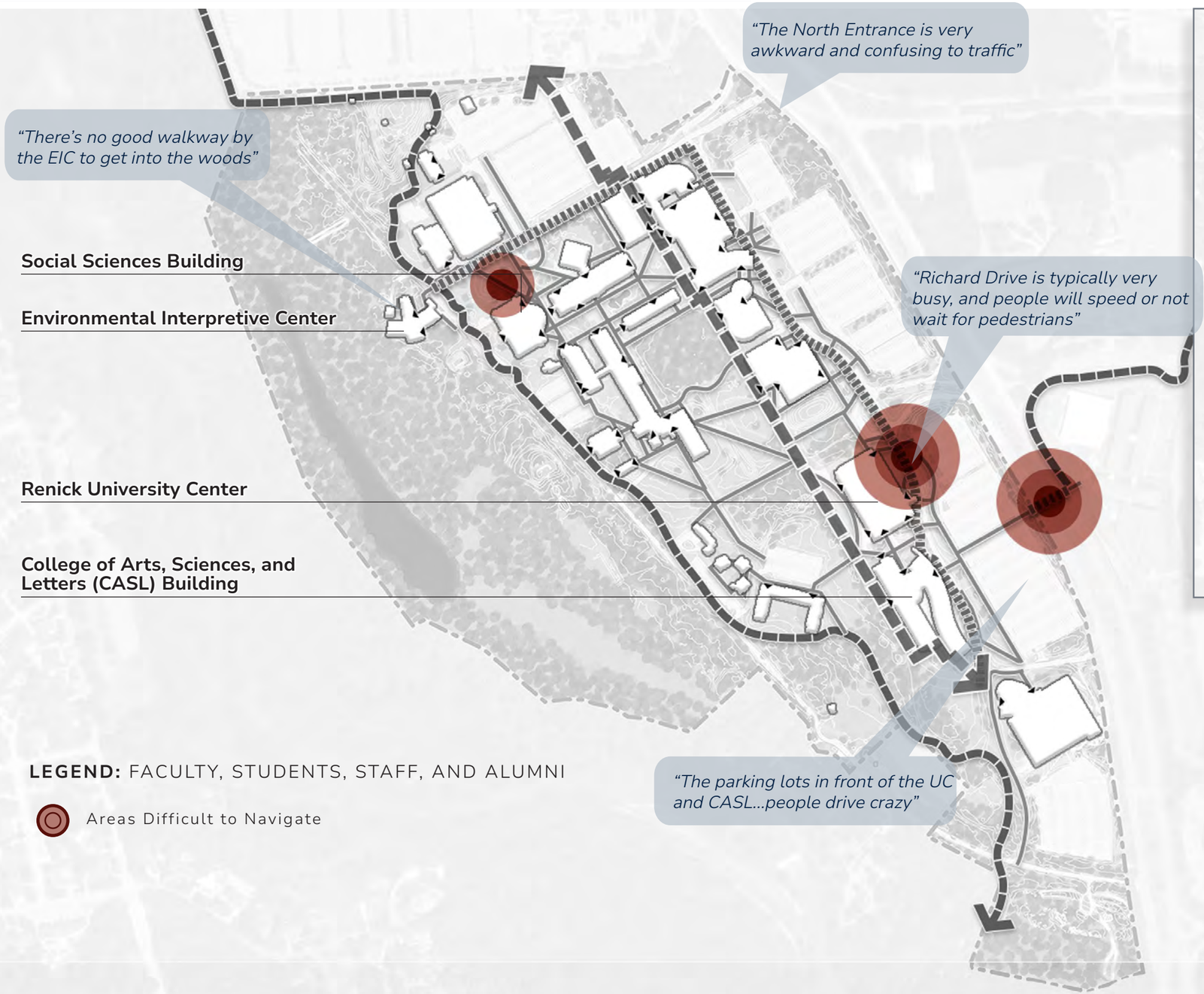

**LEGEND:** FACULTY AND STUDENTS

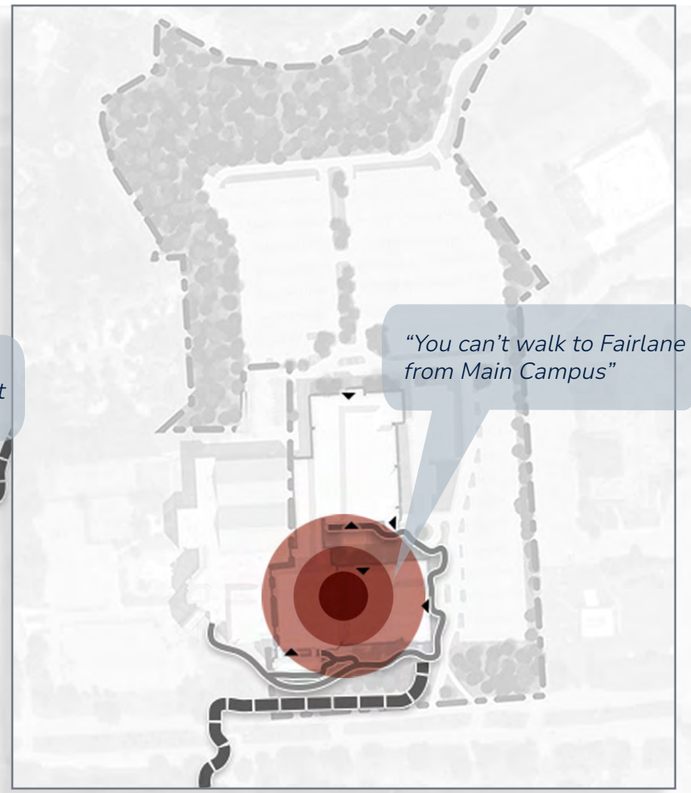
- Engineering and Computer Science
- Business
- Arts, Sciences, and Letters
- Education, Health, and Human Services

**Key Takeaways**

- Renick University Center and Mardigian Library were identified as having the most interdisciplinary activity on campus; however, the ELB and the College of Arts, Sciences, and Letters Buildings do have some interdisciplinary activity because they provide spaces for collaboration and quiet study.
- Survey respondents typically picked a college-affiliated building except for the College of Education, Health, and Human Services — their favorite areas are dispersed throughout campus. Despite specifying the Fairlane Campus as the campus heart, only one CEHHS faculty member identified their favorite space being on the Fairlane Campus.
- Some COB students' favorite areas are interdisciplinary spaces on main campus, but most identified the Fairlane Campus, while almost all COB faculty identified favorite spaces on the Fairlane Campus.

# AREAS DIFFICULT TO NAVIGATE



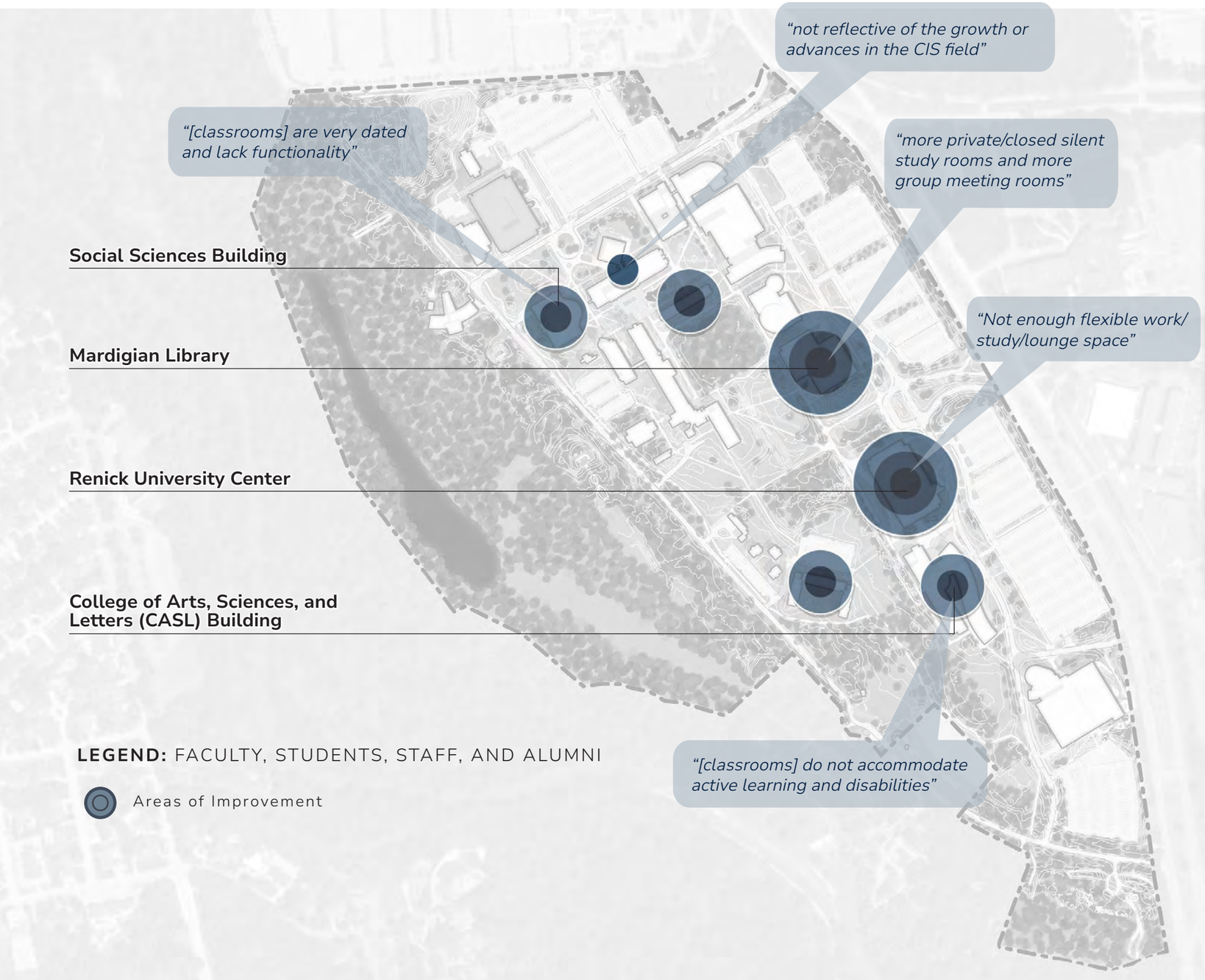

**LEGEND:** FACULTY, STUDENTS, STAFF, AND ALUMNI

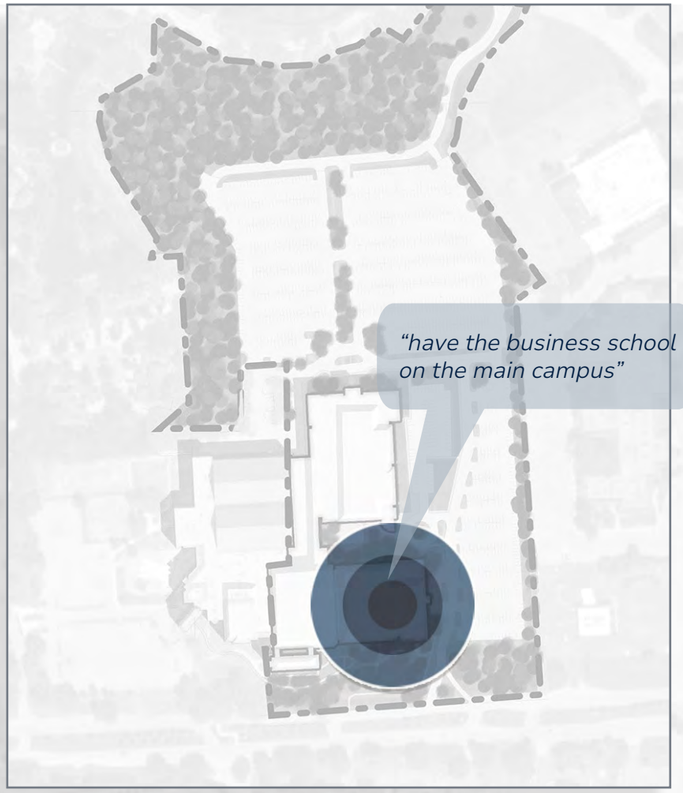
Areas Difficult to Navigate

**Key Takeaways:**

- Areas most impacted are at major intersections with higher levels of pedestrian activity.
- Conflict occurs at Richard Drive in front of Renick University Center where traffic, drop-offs, and pedestrian crossing occurs.
- The pedestrian walkway crossing Evergreen Road is challenging because of multiple lanes of traffic. Many pedestrians cross here for the bus stop, and it is seen as the safest route to the Fairlane Center and Fairlane Town Center.
- Even though Fairlane Center is less than a mile from the Main Campus, the campus community does not prefer walking to the center due to the traffic between both campuses.

# CAMPUS IMPROVEMENTS




**LEGEND:** FACULTY, STUDENTS, STAFF, AND ALUMNI

Areas of Improvement

**Key Takeaways:**

- While Renick University Center and Mardigian Library are preferred spaces among many colleges on campus, there is a need for more flexible space for both groups and individuals.
- Many buildings are dated, and classrooms lack the proper setup and technology for modern pedagogy.
- Multiple comments mention a preference to relocate classes from the Fairlane Center to the Main Campus.

# Stakeholder Outreach

To ensure an inclusive planning process and gather input from various stakeholders, a series of meetings were organized. Follow-up sessions were held with administrative groups to ensure that the concerns and issues were well understood. Valuable feedback from students, faculty, staff, and alumni played a crucial role in shaping the direction of the Comprehensive Campus Plan. During the planning process, the following groups provided input:

+ Advisory Committee
+ Provost and Deans
+ Enrollment Management
+ Registrar
+ Human Resources
+ Facilities Operations
+ Information Technology (ITS)
+ Student Affairs
+ Athletics and Recreation
+ Student Affairs Advisory Committee
+ Student Government Committee

# Dot Exercise

To make interaction with students more activity-based, a dot exercise was initiated during the Student Government Committee meeting. Large 36x24 maps of the campus were provided with red and green stickers to mark places the students liked and disliked on campus. This allowed students the chance to express concerns about UM-Dearborn and helped the planning team better understand the campus more from a student perspective.

# Space Needs Analysis

An essential component of developing the Comprehensive Campus Plan was to evaluate the way in which UM-Dearborn's space inventory supported students, faculty, and staff.

Through the lens of ***Go Blueprint for Success***, a needs assessment was completed with these primary goals:

+ Identify current and future space requirements.
+ Optimize space utilization and functionality.
+ Support informed decision-making.

Recognizing the rapid evolution of the higher education landscape, the space needs analysis informed the physical plan while also identifying operational changes to ensure the best and highest uses of resources.

The space needs analysis process was informed by:

+ Quantitative inputs through four primary datasets – facilities, courses, enrollment, and personnel – for Fall 2022, which served as the snapshot in time.
+ Instructional space utilization for classrooms and teaching laboratories.
+ A qualitative assessment of instructional spaces to identify how the physical environment might impact use.
+ One-on-one interviews with academic, administrative, and student life leadership to understand how current space meets strategic goals.
+ Development of space guidelines for various space typologies, which were based on typical metrics for campuses like UM-Dearborn with similar academic missions and through discussion with campus representatives.

Through discussion with university leadership, three space needs analyses were developed to quantify current needs (Fall 2022), future needs based on the projected enrollment growth (8,300 students), and future needs based on the maximum enrollment the campus can support (10,500 students). Key assumptions to the future scenarios included:

+ Modest enrollment increases via an increased percentage of online classes.
+ Increased research activity.
+ Relocation of existing operations at the Fairlane Center to the core campus.

# Existing Space Use

**843,300**

of assignable square footage (ASF) was included in this study

**36%**

of total space within the study was Academic Space
(classrooms, teaching laboratories, open laboratories, and research/creative activity space)

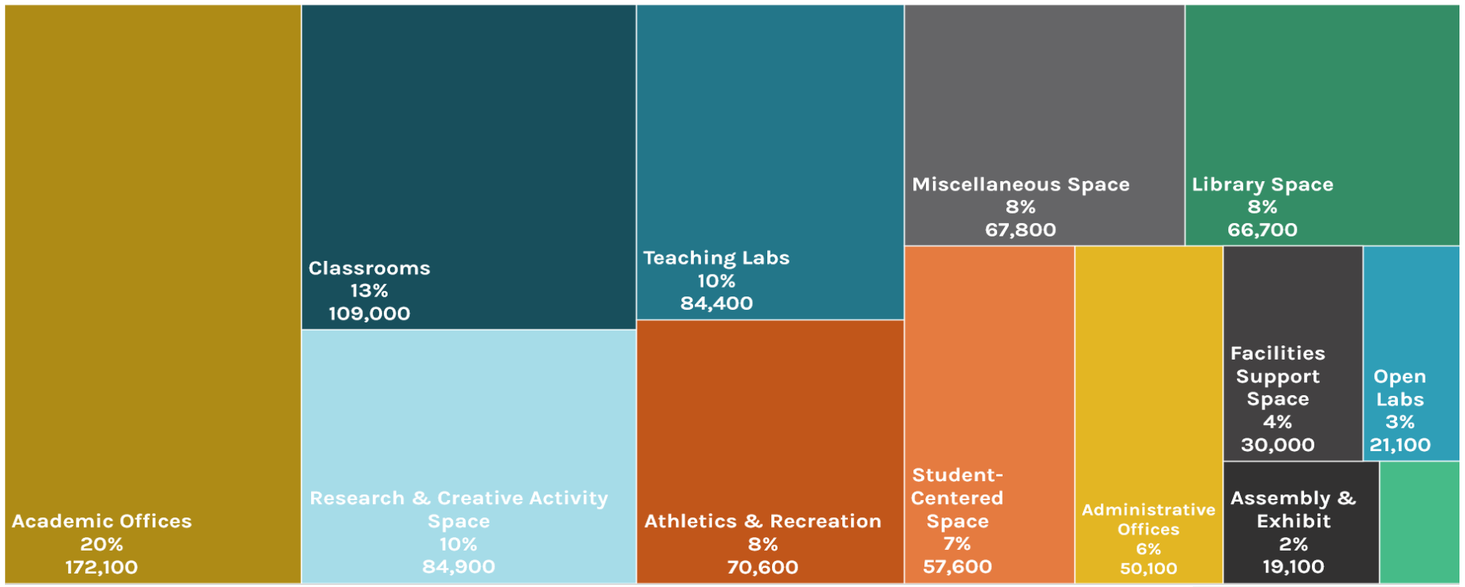
**8%**

of total space within the study was Student Space

The analysis included all assignable space except for outside organizations and inactive space, which totaled 843,300 ASF (Fall 2022). The institution's inventory was developed by UM-Dearborn using a national standard—Facilities Inventory and Classification Manual (FICM) from the National Center for Education Statistics. In this classification system, every room on campus is assigned a use code such as classroom, teaching laboratory, etc., based on the room's primary use. To apply space standards, SmithGroup organized the space inventory into four overarching areas: Academic Space, Academic Support Space, Student Space, and Other Space (**Figure 4.1**). Academic Space, which includes classrooms, teaching laboratories, open laboratories, and research/creative activity space, made up 36% of the total space. Approximately 109,000 ASF was classified as Classrooms and almost 85,000 ASF as Research & Creative Activity Space (13% and 10% of the total ASF, respectively). Teaching laboratory space followed closely at 84,400 ASF.

**Academic Support Space**, including offices, library space, and collaborative learning space, made up 35% of the total space within the study. Academic Offices made up over half of that space category and had the most ASF of any space type at approximately 172,000 (20% of the total space within the study).

**Student Space** consists of athletics and recreation and student-centered spaces. 8% of space was classified as athletics and recreation (70,600 ASF) and 7% as student-centered space (57,600 ASF). The remaining Other Space category includes assembly and exhibit, facilities support, and miscellaneous spaces. These made up 14% of the total space within study.




*Note: Numbers have been rounded for reader ease.*

**Figure 4.1: Space Distribution**

# INSTRUCTIONAL SPACE

To establish space need guidelines for classrooms and teaching laboratories the utilization of these scheduled teaching spaces in Fall 2022 was evaluated. A summary is included here.

## CLASSROOM UTILIZATION

There were 100 scheduled classrooms, out of 101 total, on the UM-Dearborn campus in the Fall 2022 term. Classroom utilization is a function of the number of scheduled courses, class time duration, and course enrollment compared to the number of student seats in the room. A typical utilization target for institutions like UM-Dearborn is 28 to 32 hours of weekly scheduled use per room with 65 to 70% of the seats filled (on average). In Fall 2022, UM-Dearborn classrooms ranged from 0 to 38 weekly room hours with an average of 18.4. Seat fill rate ranged from 0% to 83% with an average of 55%.

## CLASSROOM USE BY DAY AND TIME

Classrooms were most heavily scheduled Monday through Thursday from 10am to 3pm. Of the 101 classrooms, the greatest number in use at one time was 59, or 58%, at noon on Wednesdays (**Figure 4.2**).

## CLASSROOM UTILIZATION BY BUILDING

The average weekly hours classrooms were scheduled was 18.4 with 55% of the seats filled. The average student seat size of approximately 21 ASF is slightly below 25 ASF, which is a typical target for modern learning environments (**Figure 4.3**).

| Time of Day | Monday | | Tuesday | | Wednesday | | Thursday | | Friday | | Average | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rooms in Use | % In Use | Rooms in Use | % In Use | Rooms in Use | % In Use | Rooms in Use | % In Use | Rooms in Use | % In Use | Rooms in Use | % In Use |
| **8:00 AM** | 3 | 3% | 1 | 1% | 3 | 3% | 1 | 1% | 3 | 3% | **2** | **2%** |
| **9:00 AM** | 30 | 30% | 38 | 38% | 32 | 32% | 39 | 39% | 10 | 10% | **30** | **30%** |
| **10:00 AM** | 45 | 45% | 50 | 50% | 43 | 43% | 50 | 50% | 11 | 11% | **40** | **39%** |
| **11:00 AM** | 49 | 49% | 49 | 49% | 47 | 47% | 46 | 46% | 8 | 8% | **40** | **39%** |
| **12:00 PM** | 58 | 57% | 57 | 56% | 59 | 58% | 57 | 56% | 7 | 7% | **48** | **47%** |
| **1:00 PM** | 51 | 50% | 39 | 39% | 44 | 44% | 38 | 38% | 5 | 5% | **35** | **35%** |
| **2:00 PM** | 47 | 47% | 42 | 42% | 39 | 39% | 37 | 37% | 4 | 4% | **34** | **33%** |
| **3:00 PM** | 55 | 54% | 54 | 53% | 49 | 49% | 47 | 47% | 2 | 2% | **41** | **41%** |
| **4:00 PM** | 35 | 35% | 38 | 38% | 30 | 30% | 35 | 35% | 1 | 1% | **28** | **28%** |
| **5:00 PM** | 20 | 20% | 16 | 16% | 14 | 14% | 15 | 15% | 0 | 0% | **13** | **13%** |
| **6:00 PM** | 50 | 50% | 47 | 47% | 43 | 43% | 37 | 37% | 0 | 0% | **35** | **35%** |
| **7:00 PM** | 49 | 49% | 47 | 47% | 43 | 43% | 37 | 37% | 0 | 0% | **35** | **35%** |
| **8:00 PM** | 40 | 40% | 40 | 40% | 34 | 34% | 30 | 30% | 0 | 0% | **29** | **29%** |

*Total # of rooms: 101*

*Darker colors indicate a larger percentage of rooms are scheduled.*

**Figure 4.2: Classroom Scheduled use by Day and Time**

| Building Name and ID | | No. of Rooms | Average ASF per Seat | Weekly Student Contact Hours | Average Weekly Room Hours | Seat Fill Rate |
|---|---|---|---|---|---|---|
| **Administration Building** | AB | 2 | 22.1 | 1,422 | 27.5 | 49% |
| **College Of Arts Science Letters** | CASL | 41 | 18.4 | 18,905 | 17.4 | 62% |
| **Environmental Interpretive Center** | EIC | 1 | 23.6 | 360 | 16 | 48% |
| **Fairlane Center North** | FCN | 6 | 27.3 | 1,641 | 12.5 | 54% |
| **Fairlane Center South** | FCS | 16 | 23.8 | 8,349 | 22.3 | 54% |
| **Heinz Prechter Engineering Complex** | HPEC | 1 | 17.1 | 129W | 12 | 26% |
| **Institute For Advanced Vehicle Systems** | IAVS | 1 | 12.1 | 1,507 | 16 | 43% |
| **Mardigian Library** | ML | 1 | 35.6 | 104 | 4.5 | 58% |
| **Natural Sciences Building** | NSB | 6 | 26.6 | 936 | 10.3 | 51% |
| **Professional Education Center** | PEC | 7 | 21.6 | 2,687 | 19.7 | 40% |
| **Science Learning Research Center** | SLRC | 1 | 10.4 | 1,315 | 24 | 57% |
| **Social Sciences Building** | SSB | 13 | 17.9 | 6,501 | 17.5 | 55% |
| **Tony England Engineering Lab Building** | ELB | 5 | 31.5 | 4,085 | 31.6 | 50% |
| **Grand Total** | | **101** | **20.5** | **47,939** | **18.4** | **55%** |

*Total # of rooms: 101*

*Weekly Student Contact Hours (WSCH) is the sum of the room hours multiplied by the enrollment.*

**Figure 4.3: Classroom Utilization by Building**

## TEACHING LABORATORY UTILIZATION

There were 48 scheduled teaching laboratories, out of 54 total, on the UM-Dearborn campus in the Fall 2022 term. Teaching laboratory utilization is a function of the number of scheduled courses, class time duration, and course enrollment compared to the number of student seats in the room. A typical utilization target for institutions like UM-Dearborn is 18 to 20 hours of weekly scheduled use per room with 80% of the seats filled (on average). In Fall 2022, UM-Dearborn teaching laboratories ranged from 0 to 36 weekly room hours with an average of 14.2. Seat fill rate ranged from 0% to 100% with an average of 71%.

## TEACHING LABORATORY USE BY DAY AND TIME

Of the 54 teaching laboratories on campus, the greatest number in use at one time was 24, or 44%, at 3pm on Tuesdays and 1pm on Thursdays (**Figure 4.4**).

| Time of Day | Monday | | Tuesday | | Wednesday | | Thursday | | Friday | | Average | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rooms in Use | % In Use | Rooms in Use | % In Use | Rooms in Use | % In Use | Rooms in Use | % In Use | Rooms in Use | % In Use | Rooms in Use | % In Use |
| **8:00 AM** | 3 | 6% | 6 | 11% | 3 | 6% | 7 | 13% | 6 | 11% | **5** | **9%** |
| **9:00 AM** | 8 | 15% | 14 | 26% | 10 | 19% | 12 | 22% | 8 | 15% | **10** | **19%** |
| **10:00 AM** | 10 | 19% | 16 | 30% | 10 | 19% | 14 | 26% | 8 | 15% | **12** | **21%** |
| **11:00 AM** | 12 | 22% | 18 | 33% | 12 | 22% | 14 | 26% | 8 | 15% | **13** | **24%** |
| **12:00 PM** | 13 | 24% | 19 | 35% | 15 | 28% | 17 | 31% | 7 | 13% | **14** | **26%** |
| **1:00 PM** | 19 | 35% | 19 | 35% | 21 | 39% | 24 | 44% | 7 | 13% | **18** | **33%** |
| **2:00 PM** | 16 | 30% | 23 | 43% | 19 | 35% | 22 | 41% | 7 | 13% | **17** | **32%** |
| **3:00 PM** | 19 | 35% | 24 | 44% | 22 | 41% | 23 | 43% | 7 | 13% | **19** | **35%** |
| **4:00 PM** | 18 | 33% | 23 | 43% | 19 | 35% | 23 | 43% | 3 | 6% | **17** | **32%** |
| **5:00 PM** | 4 | 7% | 9 | 17% | 7 | 13% | 8 | 15% | 0 | 0% | **6** | **10%** |
| **6:00 PM** | 15 | 28% | 14 | 26% | 17 | 31% | 15 | 28% | 0 | 0% | **12** | **23%** |
| **7:00 PM** | 15 | 28% | 14 | 26% | 17 | 31% | 15 | 28% | 0 | 0% | **12** | **23%** |
| **8:00 PM** | 13 | 24% | 12 | 22% | 13 | 24% | 14 | 26% | 0 | 0% | **10** | **19%** |

*Total # of Teaching Laboratories: 54*

*Darker colors indicate a larger percentage of rooms are scheduled.*

**Figure 4.4: Teaching Laboratory Scheduled use by Day and Time**

## TEACHING LABORATORY UTILIZATION BY BUILDING

The campus-wide laboratory utilization was 14.2 hours per week with 71% of the student seats occupied. Average seat size is dependent on the academic discipline (**Figure 4.5**).

| Building Name and ID | | No. of Rooms | Average ASF per Seat | Weekly Student Contact Hours | Average Weekly Room Hours | Seat Fill Rate |
|---|---|---|---|---|---|---|
| **College Of Arts Science Letters** | CASL | 8 | 34.9 | 3,032 | 17.5 | 74% |
| **Environmental Interpretive Center** | EIC | 2 | 24.9 | 0 | 0 | 0% |
| **Fairlane Center South** | FCS | 6 | 35.6 | 1,613 | 13.3 | 52% |
| **Institute For Advanced Vehicle Systems** | IAVS | 1 | 32.9 | 389 | 20 | 85% |
| **Manufacturing Systems Engineering Lab** | MSEL | 1 | 201.3 | 24 | 3 | 56% |
| **Natural Sciences Building** | NSB | 14 | 50.6 | 4,401 | 18.6 | 33% |
| **Natural Sciences Building South** | NSBS | 6 | 47.2 | 1,238 | 12.3 | 76% |
| **Prechter H C Engineering Complex** | HPEC | 4 | 36.3 | 1,255 | 12.3 | 71% |
| **Science Learning Research Center** | SLRC | 3 | 47.4 | 565 | 14.3 | 56% |
| **Social Sciences Building** | SSB | 1 | 41.8 | 81 | 6 | 52% |
| **Tony England Engineering Lab Building** | ELB | 8 | 41.5 | 1,662 | 11.3 | 76% |
| **Grand Total** | | **54** | **43.8** | **14,260** | **14.2** | **71%** |

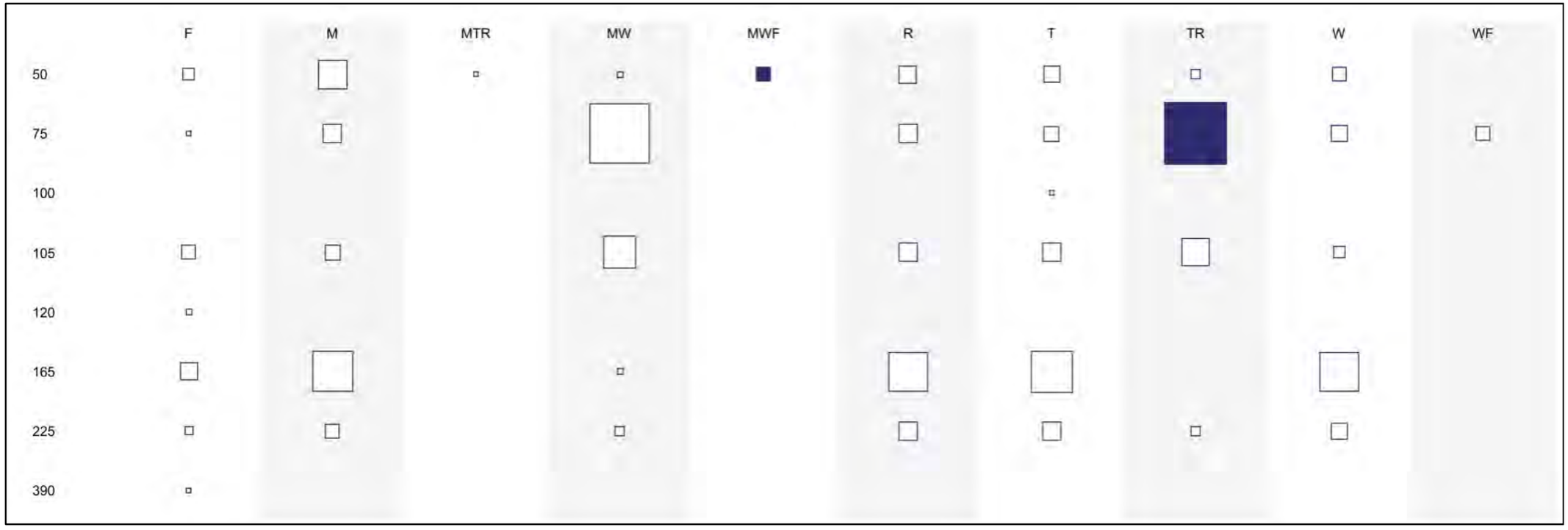
*Total # of rooms: 54*

*Weekly Student Contact Hours (WSCH) is the sum of the room hours multiplied by the enrollment.*

**Figure 4.5: Teaching Laboratory Utilization by Building**

## SCHEDULING VARIANCES

**T**he instructional space utilization highlighted the inconsistent use of standard scheduling blocks (**Figure 4.6**). In Fall 2022, there were 40 variances across 1,100 courses. The impact is inefficient use of classrooms and teaching laboratories and can prove challenging for students to develop a workable class schedule. The analysis found that 40% of courses were taught in 75-minute time blocks. An area of opportunity is to identify ways to streamline the standard time blocks to allow for improved utilization.




*Square are scaled by number of courses.*

**Figure 4.6: Scheduling Variances**

# EDUCATIONAL ADEQUACY

To understand the potential impact of the physical environment on scheduled use, the planning team completed an educational adequacy assessment. In Summer 2023, the planning team visually inspected and evaluated instructional spaces for their educational or functional adequacy using a scoring process developed and based on the EDUCAUSE model (**Figure 4.7**). This scoring process was tailored to fit the specific needs of UM-Dearborn and functional metrics were developed to quantify the quality of existing instructional space.

A total of 161 rooms were identified for the assessment based on their initial use coding as classrooms, teaching laboratories, or utilized open laboratories. A handful of assessed spaces' room use codes were adjusted due to exploration with UM-Dearborn as to the actual use of those spaces in Fall 2022. **Figure 4.8** shows a list of the buildings and number of rooms by space category that were included in the analysis.

The process analyzed several room factors to determine whether a classroom or teaching laboratory appeared adequate for ongoing use without significant renovation or technology updates. This also included an evaluation of whether classrooms and teaching laboratories were sized in a reasonable range for current and future teaching pedagogies and whether their furnishings and utilities reflect current teaching best practices.

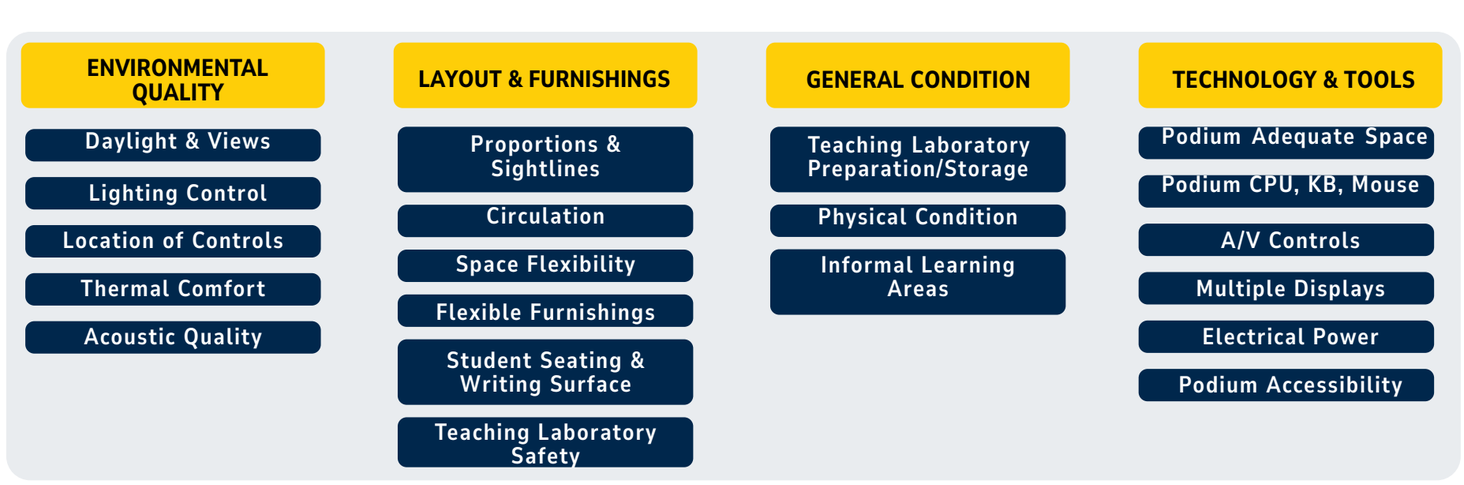
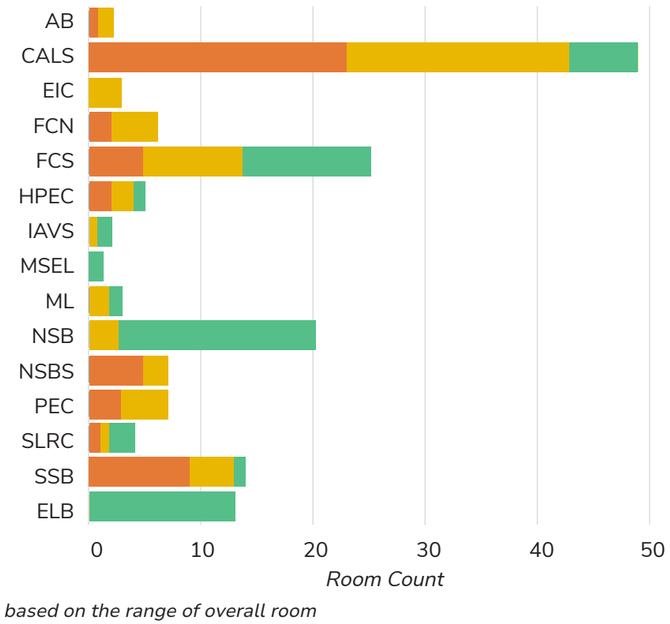



Figure 4.7: Educational Adequacy Criteria

| Building Name | Classrooms | Teaching Laboratories | Other | Total |
|---|---|---|---|---|
| College of Arts Science Letters | 41 | 8 | 0 | 49 |
| Fairlane Center South | 16 | 7 | 2 | 25 |
| Natural Sciences Building | 6 | 14 | 0 | 20 |
| Social Sciences Building | 13 | 1 | 0 | 14 |
| Tony England Engineering Lab Building | 5 | 8 | 0 | 13 |
| Natural Sciences Building South | 0 | 6 | 1 | 7 |
| Professional Education Center | 7 | 0 | 0 | 7 |
| Fairlane Center North | 6 | 0 | 0 | 6 |
| Prechter H C Engineering Complex | 1 | 4 | 0 | 5 |
| Science Learning Research Center | 1 | 3 | 0 | 4 |
| Environmental Interpretive Center | 1 | 2 | 0 | 3 |
| Mardigian Library | 1 | 0 | 2 | 3 |
| Administration Building | 2 | 0 | 0 | 2 |
| Institute For Advanced Vehicle Systems | 1 | 1 | 0 | 2 |
| Manufacturing Systems Engineering Lab | 0 | 1 | 0 | 1 |
| **Grand Total** | **101** | **55** | **5** | **161** |

Figure 4.8: Building by Room Type




*Ratings are based on the range of overall room scores:*

*Low = 31%-56%; Mid = 57%-66%; High = 67%-94%*

Low Mid High

**Figure 4.9: Educational Adequacy Scores by Room**

Each criterion was assigned a numerical score based on the rating. The score for each room was totaled and then a percentage was calculated based on the total score a room could achieve. **Figure 4.9** shows the rooms assessed for each building and how they fall in the range of overall room scores.

The findings of the adequacy assessment are intended to help UM-Dearborn identify whether classrooms and teaching laboratories in a specific building are acceptable for continued use without renovation, require minor or major renovation, or need replacement. **Figure 4.10** shows the average score for the overall building and for the five categories of scoring criteria for each building.

| Building Name | Rooms | Overall | Environmental | Layout | Condition | Technology |
|---|---|---|---|---|---|---|
| **Manufacturing Systems Engineering Lab** | 1 | 91% | 100% | 92% | 75% | 86% |
| **Tony England Engineering Lab Building** | 13 | 81% | 75% | 80% | 96% | 81% |
| **Natural Sciences Building** | 20 | 70% | 69% | 60% | 99% | 73% |
| **Institute for Advanced Vehicle Systems** | 2 | 69% | 78% | 50% | 75% | 79% |
| **Fairlane Center South** | 4 | 63% | 62% | 58% | 68% | 66% |
| **Science Learning Research Center** | 25 | 62% | 78% | 42% | 75% | 68% |
| **Environmental Interpretive Center** | 3 | 60% | 67% | 49% | 83% | 49% |
| **Fairlane Center North** | 6 | 57% | 52% | 52% | 92% | 52% |
| **Mardigian Library** | 3 | 57% | 59% | 43% | 67% | 67% |
| **College of Arts Science Letters** | 49 | 55% | 72% | 35% | 61% | 58% |
| **Heinz Prechter Engineering Complex** | 5 | 55% | 56% | 50% | 50% | 63% |
| **Professional Education Center** | 7 | 54% | 65% | 46% | 39% | 61% |
| **Administration Building** | 2 | 52% | 67% | 35% | 38% | 64% |
| **Social Sciences Building** | 14 | 52% | 55% | 51% | 34% | 59% |
| **Natural Sciences Building South** | 7 | 47% | 53% | 39% | 36% | 59% |

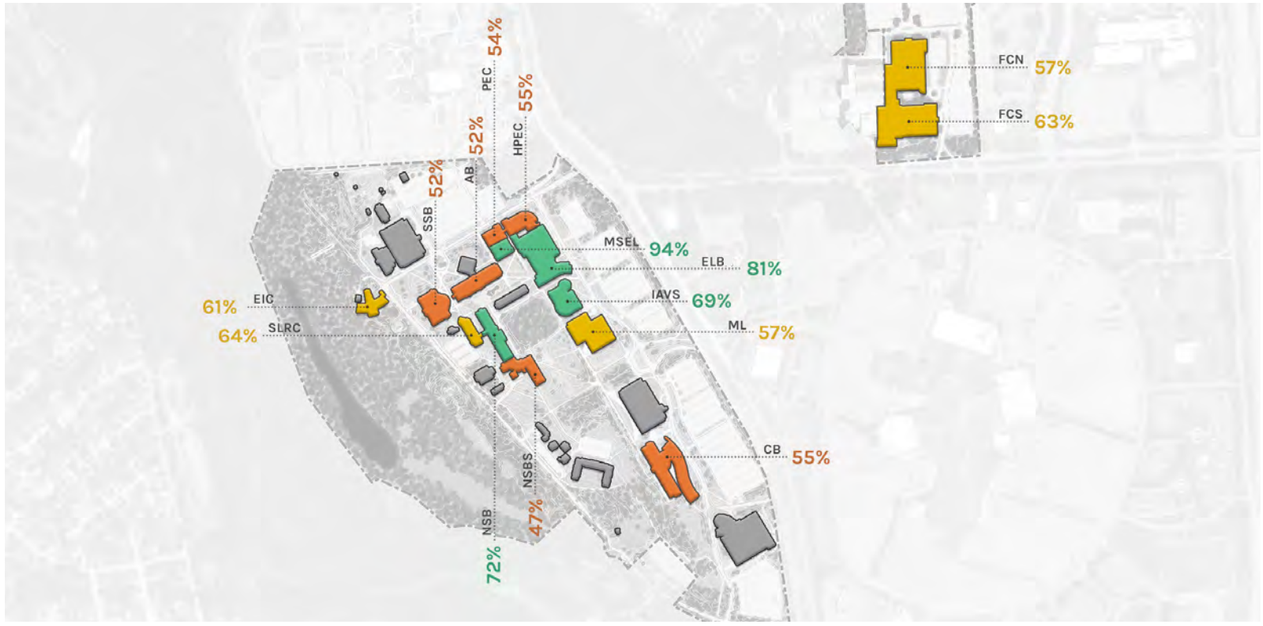



**Figure 4.10: Educational Adequacy Scores by Overall Building and Criteria**

The lowest ranking criteria group was Layout & Furnishings, which highlights inadequate sightlines, flexibility to support various pedagogies through furniture, writing surfaces and multiple fronts of room, and circulation limitations to allow instructors to work with all students easily. An area of further exploration is to look at opportunities to reduce the seat counts in overcrowded rooms to ease circulation challenges, particularly for accessibility. Over 65% of the rooms have poor electrical power access, which falls within the Tools & Technology category. The importance of electrical power for all students is increasing as students are studying, taking notes, and completing assessments on multiple devices. This assessment has led to a current initiative at UM-Dearborn to improve existing classrooms, particularly furnishings and technology.

Key findings in the adequacy analysis were that most rooms were in good physical condition, but approximately 40% had poor access to adjacent informal learning/ collaboration areas. These items contribute to the General Condition score, which is the highest-ranking criteria group. The importance of informal learning and collaboration areas is increasing as students desire comfortable areas either before, between, or after classes to study, chat with peers, meet with instructors, or attend online courses. Approximately  40% of the rooms have poor access to natural daylight, but over 80% have good or fair lighting controls that allow the instructor to dim all or a portion of the lights during a presentation. Lighting is under the Environmental Quality category.

# Space Needs

## ENROLLMENT AND PERSONNEL

The space needs analysis considers that student enrollment could increase from 8,223 students in Fall 2022 to 8,300 students (projected enrollment) or 10,500 students (maximum enrollment). Both scenarios assume modest enrollment increases through an increased percentage of online classes, as well as increased research activity.

As the student population increases, some of the employee population is assumed to change as well. For faculty, a key assumption was an increase in Natural Science, Social Science, and Engineering disciplines. Staff counts are expected to remain the same.

## EXISTING SPACE

In Fall 2022, the campus had approximately 843,300 ASF in the 13 space types included in the study. For the projected and maximum enrollment analyses, UM-Dearborn is expected to have approximately 634,900 ASF, a reduction of 208,400 ASF. This will be accomplished through the relocation of existing operations at the Fairlane Center to the core campus. The analysis also includes proposed renovations to Renick University Center and Mardigian Library.

| | FALL 2022 | PROJECTED | MAXIMUM |
|---|---|---|---|
| | Actual | Projected | Max |
| **Enrollment*** | **8,223** | **8.300** | **10,500** |
| In Person/Hybrid | 6,874 | 6,874 | 6,874 |
| Fully Online | 1,349 | 1,426 | 3,626 |
| *Full-Time Equivalent (FTE)* | *(6,459)* | *(6,519)* | *(8,248)* |
| **Faculty** | **470** | **497** | **497** |
| *(FTE)* | *(351)* | *(376)* | *(376)* |
| **Staff** | **587** | **587** | **587** |
| *(FTE)* | *(532)* | *(532)* | *(532)* |

**Assumes that all enrolled students will utilize support spaces*

Space **Excluded** in Future Scenarios: Fairlane Center

Space **Included** in Future Scenarios: Renick University Center/ Mardigian Library Renovation

**Figure 4.11: Projections Based on Enrollement and Personnel Growth**

# GUIDELINES

Guidelines were developed and applied to quantify current and future space needs, which reflect national best practices and factors and conditions specific to UM-Dearborn. The application of these guidelines is appropriate for campus-level planning to understand the order of magnitude of need and/or opportunity. Not all guidelines should be used for programming and designing new or renovated space.

For each space type, a short definition is provided with the applied guideline.

## CLASSROOMS

Classrooms are defined as any room primarily used for scheduled instruction requiring no special equipment. The rooms are generally referred to as “general purpose” classrooms, seminar rooms, or lecture halls.

The guideline is driven by the utilization target of 30 weekly room hours of scheduled use; 70% seat fill rate; and 25 ASF per seat.

## TEACHING LABORATORIES

Teaching laboratories are defined as rooms used primarily for regularly scheduled classes that require special purpose equipment to serve the needs of a particular discipline for group instruction, participation, observation, experimentation, or practice.

The guideline is driven by the utilization target of 20 weekly room hours of scheduled use and 80% seat fill rate. The space per seat varies by discipline, which ranges from 40 to 150 ASF/seat.

## OPEN LABORATORIES

Open laboratories are rooms available for unscheduled or informally scheduled instruction and student use in a particular discipline. Types of rooms in this category typically include computer laboratories with specialized software, language laboratories, nursing and other health care education laboratories, music practice rooms, maker space, and tutorial and testing facilities.

Based upon the planning team’s experience, the guideline for UM-Dearborn was established at 2 ASF per student FTE.

## RESEARCH & CREATIVE ACTIVITY SPACE

Research space needs at research intensive institutions is typically established by applying a factor per square foot to research expenditures. At regional institutions where all faculty are expected to participate in funded or unfunded research and creative or scholarly activity, an appropriate amount of space in this category can be established by applying a factor per faculty member. This establishes an overall quantity of space to be allocated by the institution as appropriate for individual faculty research, scholarly, and creative endeavors. The table to the right shows the guidelines that were applied at UM-Dearborn.

| College | ASF Range per Faculty (Flat Activity) | ASF Range per Faculty (Activity Growth) |
|---|---|---|
| **Arts, Sciences, & Letters** | **50-475** | |
| *Natural Sciences* | *350* | *475* |
| *Behavioral Sciences* | *175* | *175* |
| *Social Sciences* | *100* | *100* |
| *Mathematics & Statistics* | *85* | *85* |
| **Business** | **60** | |
| **Education, Health & Human Services** | **60-300** | |
| *Health & Human Services* | *300* | *300* |
| *Education* | *60* | *60* |
| **Engineering & Computer Science** | **80-550** | |
| *Computer Science & Information* | *80* | *120* |
| *All other engineering disciplines* | *375* | *550* |

**Figure 4.12: Research and Creative Activity Space Guidelines**

## OFFICE SPACE

Office space usually consists of at least three types of space: offices and workstations; conference rooms; and office service space, which includes workrooms, file rooms, supply rooms, reception areas, and other rooms usually found in an office suite environment.

To develop guidelines for office space, employee groups were considered with a workspace allocation and subsequent support space allocation. These guidelines do not make determinations as to private, shared, or open workspace.

The allocation ranged from 36 to 400 ASF, which reflects a variation of need for those employees whose workspace is not a typical office environment such as maintenance staff. The guidelines are based on existing UM-Dearborn standards and best practice recommendations. An additional allocation of 50% of the office/workspace has been applied to account for service/support space such as conference rooms, kitchenettes, etc.

To reflect the changed workplace environment, future year space needs assumed some employee types would not be on campus every day. The table below shows the guidelines that were applied at UM-Dearborn.

| Allocation by Employee Type | ASF Allocation |
|---|---|
| Chancellor | 400 |
| Vice Chancellor | 240 |
| Dean; Vice/Associate Provost | 170 |
| Provost | 240 |
| Associate/Assistant Dean; Executive Leadership; Chair; Coach | 120 |
| Faculty | 100 |
| Director/Professional Staff | 80 |
| Associate/Assistant Director; Administrative/Tech Support | 60 |
| Adjunct Faculty/Lecturer | 50 |
| Graduate Assistant | 56 |
| Police/Security Staff | 36 |

**Figure 4.13: Workspace Allocation Guidelines by Employee Type**

## LIBRARY SPACE

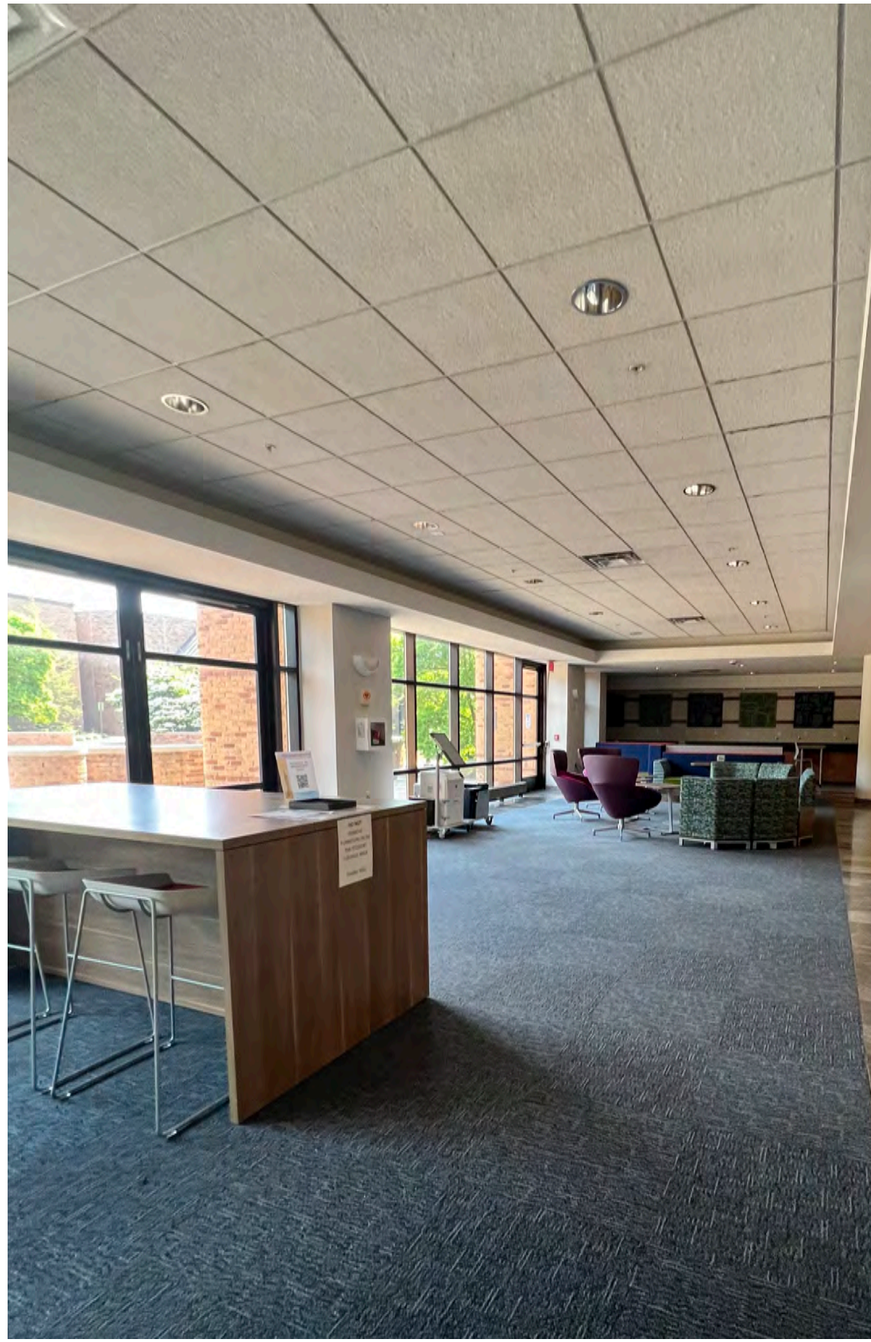
The contemporary academic library is best defined as a blend of the traditions of the past integrated with digital media. Space such as stack areas, individual study space, group study rooms, staff offices, and processing or technical areas comprise the library.

The guideline for this category considers the physical collection size, existing study seats, and service space. Back-of-house functions and circulation and reference desks were included as well. The existing collection includes 380,276 physical volume equivalents with nominal change anticipated over the next 10 years. A conversion factor was used to generate stack space needs. In addition, 20 ASF per student was applied to provide study space for 10% of the undergraduate student population and 5% of the graduate student population.

## COLLABORATIVE LEARNING SPACE

This category recognizes that the tradition of all campus study space being located in the library has been superseded by distributed informal learning and collaborative study space across campus.

Collaborative learning space is informal study space located outside of the library. It is typically adjacent to scheduled teaching space to facilitate group and individual study prior to class and as a place to continue class discussions outside of the classroom. Based upon the planning team's experience, the guideline for UM-Dearborn was established at 2 ASF per student FTE.



## ATHLETICS & RECREATION

Athletics & Recreation space represents gymnasiums, court facilities, weight rooms, indoor running tracks, and fitness centers, as well as supporting locker room and shower/toilet facilities, equipment storage and check-out rooms. Only indoor space is included within this space category.

Through discussion with UM-Dearborn, it was determined the amount of existing Athletics & Recreation space was sufficient.

## STUDENT-CENTERED SPACE

Student-centered space includes non-residential dining facilities, bookstores, ballrooms, student lounges, student recreational facilities (such as game and video rooms, not fitness facilities), and student government/club/organization space. While commonly referred to as a center or a union, these spaces are often distributed throughout a campus.

A factor of 9 ASF per student FTE was applied to establish the space requirement for this category.

## ASSEMBLY & EXHIBIT

Assembly & Exhibit space is any room that is designed and equipped for the assembly of a large number of people and in direct support of academic programs and experiences. Spaces include theaters, auditoriums, concert halls, and art exhibit space.

A factor of 2 ASF per student FTE was applied to establish the space requirement for this category.

## FACILITIES SUPPORT SPACE

Facilities Support Space typically includes shops, central storage, and central services, but can also include other space types assigned to the physical plant. The factors considered when determining the appropriate guideline include purchasing practices that affect warehousing needs, storage space adjustments due to climate, extent of grounds maintenance, and the types of facilities being maintained.

A metric of 4% of all non-physical plant space for the base year was used for this study. The proposed ASF recommended is based upon the recommended square footage using the 4% metric, minus existing physical plant space.

## MISCELLANEOUS SPACE

Miscellaneous space consists of spaces not included in the space categories above, such as media production, instructional clinics, demonstration space, field buildings, non-assigned meeting rooms, and animal facilities.

The guideline of 4 ASF per student FTE is based on the planning team's experience with similar institutions to UM-Dearborn's type and enrollment.

# ASSESSMENT SUMMARIES

The following summaries illustrate the application of guidelines and inputs (assumptions related to space, enrollment, and faculty and staff growth). While some space types will indicate a surplus of space, not all apparent surpluses can be re-purposed to meet an area of quantitative need. Additionally, quality and configuration of space should be considered in space optimization. For example, office space might indicate an excess of space, while the existing configuration does not allow for an easy reallocation to another use. These summaries identify order-of-magnitude need, highlight areas of exploration, and set guidelines for future capital programming and investment.

At the base year of Fall 2022 (**Figure 4.14**), UM-Dearborn had 843,300 ASF, and with application of the guidelines, the campus needs 555,100 ASF. In the future scenarios **(Figure 4.15)**, the total existing space is 634,900 ASF. The projected enrollment scenario has a need for 570,100 ASF, while the maximum enrollment scenario has a need for 637,300 ASF. Both future scenarios exclude the Fairlane Center, while including the proposed renovations to the Renick University Center and the Mardigian Library.

| | Student Headcount = 8,223 | | |
|---|---|---|---|
| **Space Category** | **Existing ASF** | **Guideline ASF** | **Surplus / (Deficit)** |
| **Academic Space** | | | |
| Classrooms | 109,000 | 64,200 | 44,800 |
| Teaching Laboratories | 84,400 | 51,200 | 33,200 |
| Open Laboratories | 21,100 | 12,900 | 8,200 |
| Research & Creative Activity Space | 84,900 | 51,100 | 33,800 |
| ***Academic Space Subtotal*** | ***299,400*** | ***179,400*** | ***120,000*** |
| **Academic Support Space** | | | |
| Academic Offices | 172,100 | 90,100 | 82,000 |
| Administrative Offices | 50,100 | 23,200 | 26,900 |
| Library Space | 66,700 | 49,400 | 17,300 |
| Collaborative Learning Space | 9,900 | 11,700 | (1,800) |
| ***Academic Support Space Subtotal*** | ***298,800*** | ***174,400*** | ***124,400*** |
| **Student Space** | | | |
| Athletics & Recreation | 70,600 | 70,600 | 0 |
| Student-Centered Space | 57,600 | 58,100 | (500) |
| ***Student Space Subtotal*** | ***128,200*** | ***128,700*** | ***(500)*** |
| **Other Space** | | | |
| Assembly & Exhibit | 19,100 | 12,900 | 6,200 |
| Facilities Support Space | 30,000 | 33,900 | (3,900) |
| Miscellaneous Space | 67,800 | 25,800 | 42,000 |
| ***Other Space Subtotal*** | ***116,900*** | ***72,600*** | ***44,300*** |
| **Grand Total** | **843,300** | **555,100** | **288,200** |

**Figure 4.14: Base Year Fall 2022**

| | Stud= 8,223 | Projected Enrollment (Student Headcount = 8,300) | | Maximum Enrollment (Student Headcount = 10,500) | |
|---|---|---|---|---|---|
| **Space Category** | **Projected Existing ASF** | **Guideline ASF** | **Surplus / (Deficit)** | **Guideline ASF** | **Surplus / (Deficit)** |
| **Academic Space** | | | | | |
| Classrooms | 85,500 | 64,200 | 21,300 | 80,300 | 5,200 |
| Teaching Laboratories | 73,900 | 51,200 | 22,700 | 63,900 | 10,000 |
| Open Laboratories | 17,000 | 13,000 | 4,000 | 16,500 | 500 |
| Research & Creative Activity Space | 82,900 | 78,000 | 4,900 | 78,000 | 4,900 |
| ***Academic Space Subtotal*** | ***259,300*** | ***206,400*** | ***52,900*** | ***238,700*** | ***20,600*** |
| **Academic Support Space** | | | | | |
| Academic Offices | 101,500 | 91,100 | 11,400 | 90,100 | 11,400 |
| Administrative Offices | 34,200 | 21,800 | 12,400 | 21,800 | 12,400 |
| Library Space | 59,700 | 49,600 | 10,100 | 52,900 | 6,800 |
| Collaborative Learning Space | 4,000 | 11,900 | (7,900) | 15,000 | (11,000) |
| ***Academic Support Space Subtotal*** | ***199,400*** | ***173,400*** | ***26,000*** | ***179,800*** | ***19,600*** |
| **Student Space** | | | | | |
| Athletics & Recreation | 70,600 | 70,600 | 0 | 70,600 | 0 |
| Student-Centered Space | 53,300 | 58,700 | (5,400) | 74,200 | (20,900) |
| ***Student Space Subtotal*** | ***123,900*** | ***129,300*** | ***(5,400)*** | **144,800** | **(20,900)** |
| **Other Space** | | | | | |
| Assembly & Exhibit | 14,700 | 13,000 | 1,70 | 16,500 | (1,800) |
| Facilities Support Space | 14,800 | 26,100 | (11,300) | 33,000 | (18,200) |
| Miscellaneous Space | 22,800 | 21,900 | 900 | 24,500 | (1,700) |
| ***Other Space Subtotal*** | ***52,300*** | ***61,000*** | ***(8,700)*** | **74,000** | **(21,700)** |
| **Grand Total** | **634,900** | **570,100** | **64,800** | **637,300** | **(2,400)** |

**Figure 4.15: Future Scenario Summary**

# Sustainability Analysis

UM-Dearborn can forge its own history as a resilience innovator, leading the way in decarbonization efforts for university campuses globally.

**Decarbonization As a Priority**
With rising temperatures being felt around the globe, the time for action around decarbonization is now. This plan, in addition to meeting the future academic needs of students on campus, has devised a pathway to decarbonized operations for the university. This pathway is developed in partnership with University of Michigan's currently enacted sustainability strategies and decarbonization mandate, providing targets and goals to achieve carbon neutrality by 2040.

**Existing Conditions**
UM-Dearborn's energy consumption trend shows a pattern of improvement as energy consumption has reduced over the last seven years. This suggests that the new developments and renovations have focused greatly on energy conservation and shows that UM-Dearborn is focused on campus decarbonization goals. An updated detailed stock of campus building conditions, highlighting key areas for notable improvements, will allow for marked phasing efforts to further reduce campus utility consumption.

**Recommendations**
+ Campus mechanical recommendations prioritize the semi-decentralized, multi-phased approach to the elimination of fossil fuels on campus. This phased approach allows for the utilization of existing systems for as much of their usable life as is possible, with pointed improvements to be made over time. Recommendations include the development of ground source heat pump fields underneath university parking lots to provide low-entropy heating and cooling for building operations. This system includes three ambient-temperature water loops, connecting all buildings on campus with water-source heat pumps at the building level, and existing decentralized heating and cooling systems contributing as supplemental thermal energy sources. The semi-decentralized "loop" approach allows the existing steam infrastructure to remain in place for the duration of its usable life, serving a reduced load, with its planned elimination at the end of the decarbonization process.
+ Campus electrical recommendations prioritize reduction of campus reliance on existing electric grid for power. Recommendations include roof solar photovoltaic (PV) array for energy production and battery for energy storage. When coupled together, PV arrays and batteries can greatly reduce reliance on the electric grid.
+ Building-level recommendations focus on energy conservation and utility demand reduction to serve as a foundation for the reduction in carbon emissions. These recommendations are broken out into three time frames to allow proper planning, prioritizing, and phased implementation to ensure effective operation. These recommendations are not intended to be completed all at once but used as guidance to improve overall campus energy efficiency, and resilience.

**Implementation**
The challenges related to decarbonization on university campuses can be deterrents when it comes to making infrastructure improvements. These recommendations often necessitate substantial changes to existing infrastructure such as upgrading mechanical systems, building renovations, and implementing renewable energy sources, each of which would take up significant portions of annual university budgets. The key to the financing of these recommendations is the ability to phase these improvements over a period of time. The combination of phasing these projects with financing strategies such as utilizing tax incentives, debt financing, creating an energy savings fund, and bonds plays a crucial role in the ability to make the key infrastructure shifts towards decarbonization.

# University Decarbonization Mandate

In an effort to combat rising temperatures globally due to carbon dioxide emissions, the University of Michigan has made a commitment to achieve carbon neutrality and foster a shared culture of sustainability with goals outlined for greenhouse gas (GHG) emission reductions by 2025 and 2040. By 2025, the University of Michigan has committed to the reduction of GHG emissions from purchased electricity to net-zero (Scope 2) and plans to have goals established for emission reductions pertaining to indirect emission sources (Scope 3). By 2040 the University of Michigan plans to eliminate emissions from on-campus sources (Scope 1) without the reliance on purchased carbon offsets.

The University of Michigan's Planet Blue initiative is advancing sustainability not only on the University of Michigan campuses, with the carbon neutrality commitments, but also on a global scale, spotlighting University of Michigan as a sustainability leader. University of Michigan President Santa J. Ono states "Planet Blue is an approach that speaks to the urgency of our shared challenge ahead as well to our dedication, as a university community, to be a climate leader." With the University of Michigan's goal to be net-zero university-wide by 2040, it is imperative to take an active role in the advancement of climate action through the innovation in campus infrastructure, built environment, operations, and sustainable investments.

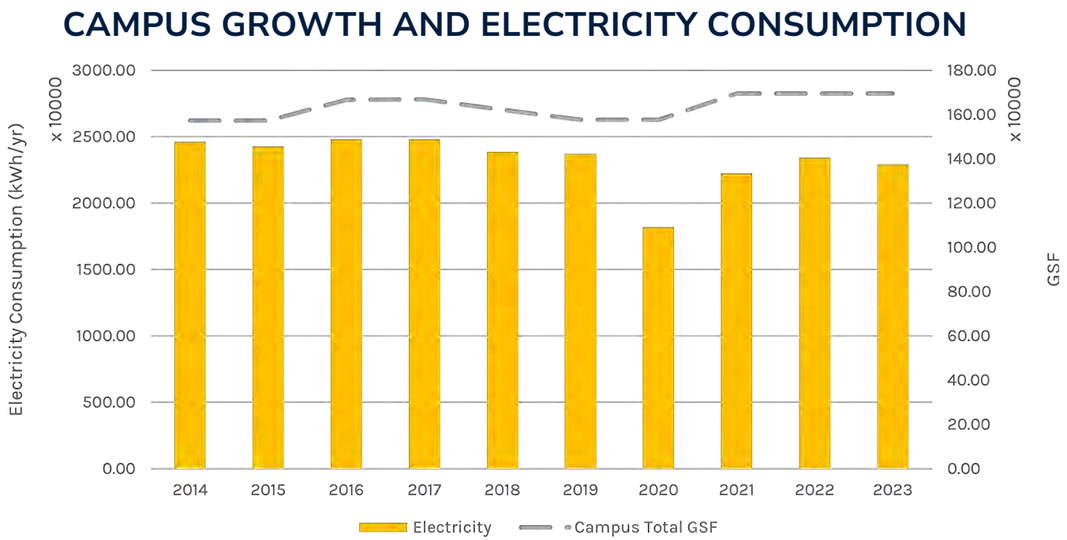



**Figure 4.16: Campus Growth and Electricity Consumption**

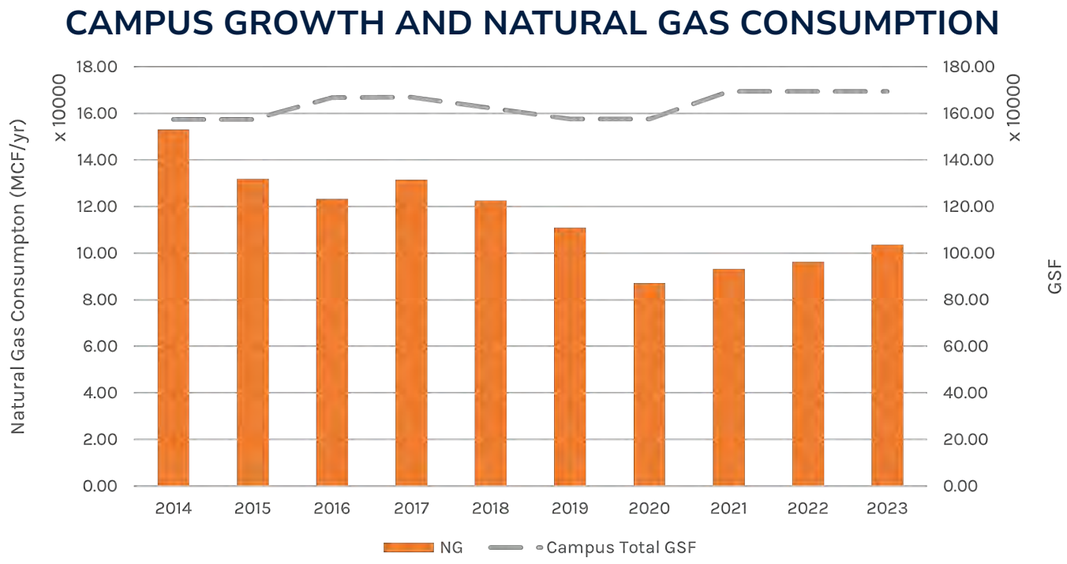



**Figure 4.17: Campus Growth and Natural Gas Consumption**

*Notes: 2013 SB Offline for Renovation 6 months; 2014 SB Offline 12 mos; 2015 SB Offline 12 mos; 2016 NSB Renovation Complete; 2018 ELB Offline for Renovation 6 mos; 2019 ELB Offline 12 mos; 2020 COVID, ELB Renovation Complete; 2021 COVID*

# Analysis of Energy Consumption

## TOTAL ENERGY DEMAND: DESCRIPTION OF ENERGY USAGE

In order to better understand the macro-level trends around energy at the university, the planning team conducted an initial analysis of campus-level utility consumption based on utility bills provided by the university. From this historic analysis, with utility information from 2014 to 2021, the planning team was able to track the overall consumption of the campus against its gross square footage (GSF) growth over those seven years. **Figures 4.16** and **4.17** illustrate that over the last seven years, campus GSF has remained largely consistent, with buildings temporarily offline for maintenance or renovation. The figures also show that within the last seven years, overall energy consumption has reduced. This overall reduction in energy consumption, suggests new development and renovations are focusing on energy conservation measures, and is a promising trend for campus operations as a whole.

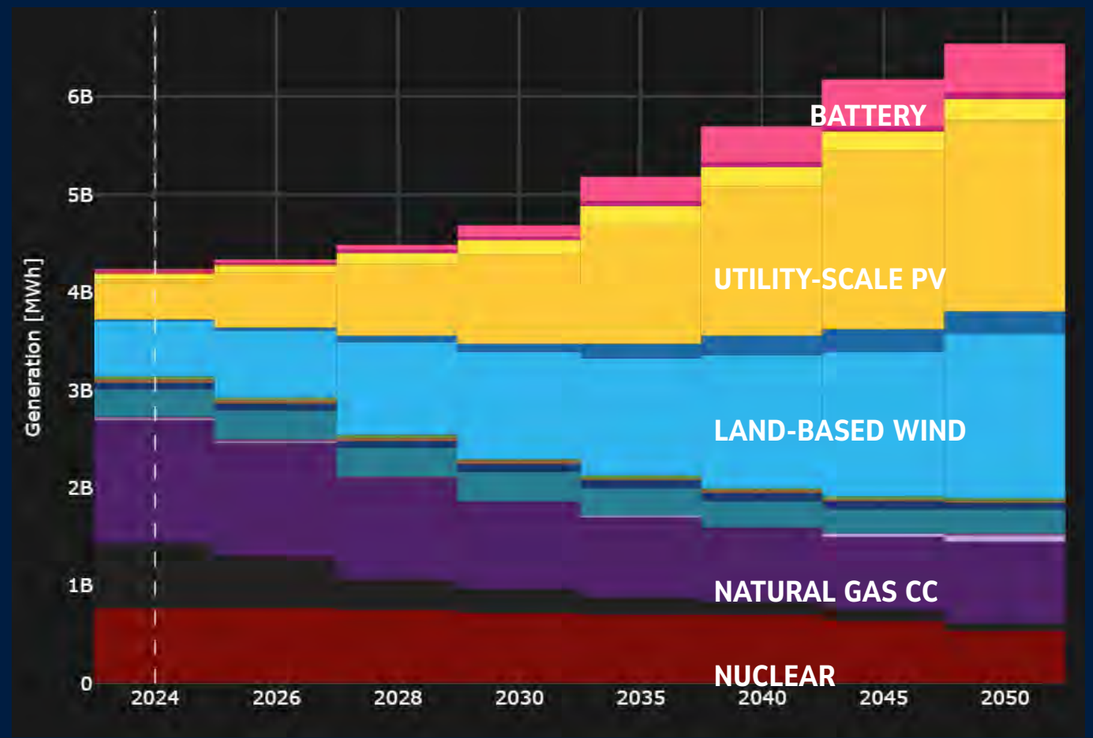



Figure 4.18: Michigan Electric Grid Mix

# UNDERSTANDING ENERGY SUPPLY FOR UM-DEARBORN

From the 2014 facilities conditions assessment of UM-Dearborn's central energy plant, as well as conversations with the facilities team, it is understood that the boilers powering the centralized steam system, serving the core of campus, have been replaced in the last ten years and are in good operating condition. With an existing natural gas boiler infrastructure in place, the planning team has developed a transition architecture that allows for a phased approach to decarbonization and can utilize the full life of the boilers currently in place, while being able to take advantage of low-entropy technologies that will drive down overall emissions.

In nameplate capacity (designed output capacity of each asset), coal assets still comprise a large portion of the state of Michigan's grid (**Figure 4.18**). While important strides are being made to increase the development and deployment of renewable assets into the Michigan grid mix, the team does not believe the Michigan grid can be relied on for passive decarbonization during the bounds of the sustainability mandates. As a result of this condition, the university has two options: strategically partner with the grid or pursue phased decarbonization, which focuses on demand reduction. With a coal-rich grid, quick rushes to building electrification will often cause overall emissions to spike, as burning natural gas on-site can often be a lower emission source of energy than consuming energy from coal. Reductions in demand at the building-level will be critical to the successful phased decarbonization of the UM-Dearborn campus.

# CURRENT CARBON FOOTPRINT

Carbon footprint estimates were developed largely from the utility bills analysis, and a campus-wide analysis of utility consumption, in tandem with state-wide grid analysis, to determine appropriate estimates for carbon dioxide equivalent emissions calculations. These estimates are a combination of existing technologies in place, the life of those assets, and plans in place to develop new assets, which can be summarized into a forecast rate, based on the best available data (**Figure 4.19**).

| Year | Emissions Rate (kg/MWH) |
|---|---|
| 2022* | 596.0 |
| 2023 | 500.0 |
| 2024 | 434.2 |
| 2026 | 421.2 |
| 2028 | 414.9 |
| 2030 | 414.1 |
| 2035 | 429.5 |
| 2040 | 432.4 |
| 2045 | 429.7 |
| 2050 | 415 |

**Figure 4.19: Forecast Emissions Rate**
** Measured 2022 Emissions Rate*

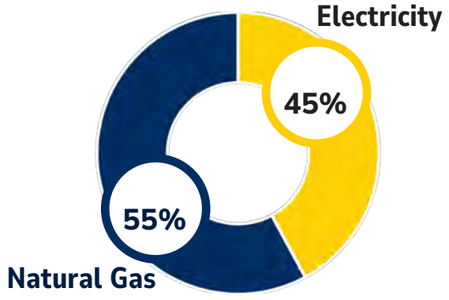
While the 23 million kilowatt-hours of electricity consumed on campus in 2023 makes up 45% of total energy consumption on campus (in kBTU), the estimated emissions from the coal-rich Michigan grid make up 72% of the campus's total emissions, or nearly 10 thousand metric tons of carbon dioxide equivalent. As stated in the supply-side analysis portion of the report, this suggests that building electrification, while a significant improvement in overall efficiency, will not lead to the necessary reduction in overall emissions sought by the university. This, combined with Michigan's forecast grid state by 2040, suggest that active measures to reduce emissions, through both electrification and overall utility demand reduction, will be essential to delivering on the university's decarbonization goals. Demand reduction will be essential to delivering on the university's decarbonization goals.

## TOTAL ESTIMATED SCOPE 1 AND 2 EMISSIONS
### (19,266 METRIC TONS/YR)

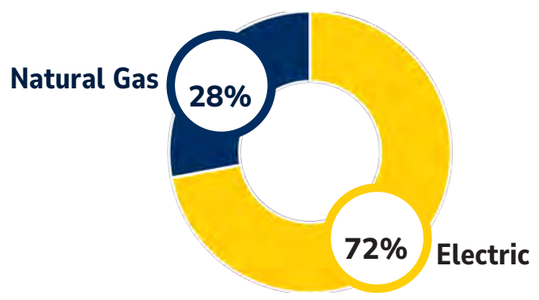
| Commodity | kWh | MCF | kBTU |
|---|---|---|---|
| Electricity | 23,425,856 | - | 79,929,000 |
| Natural Gas | - | 96,262 | 107,648,089 |
| **Total** | | | **178,694,000** |

**Figure 4.20: Estimated Scope 1 and 2 Emissions**

## 2023 TOTAL ENERGY CONSUMPTION (KBTU)




## TOTAL CARBON EMISSIONS
### (METRIC TONS CO2E)




## FORECASTED $CO_2$ EMISSIONS PER YEAR
### (METRIC TONS)

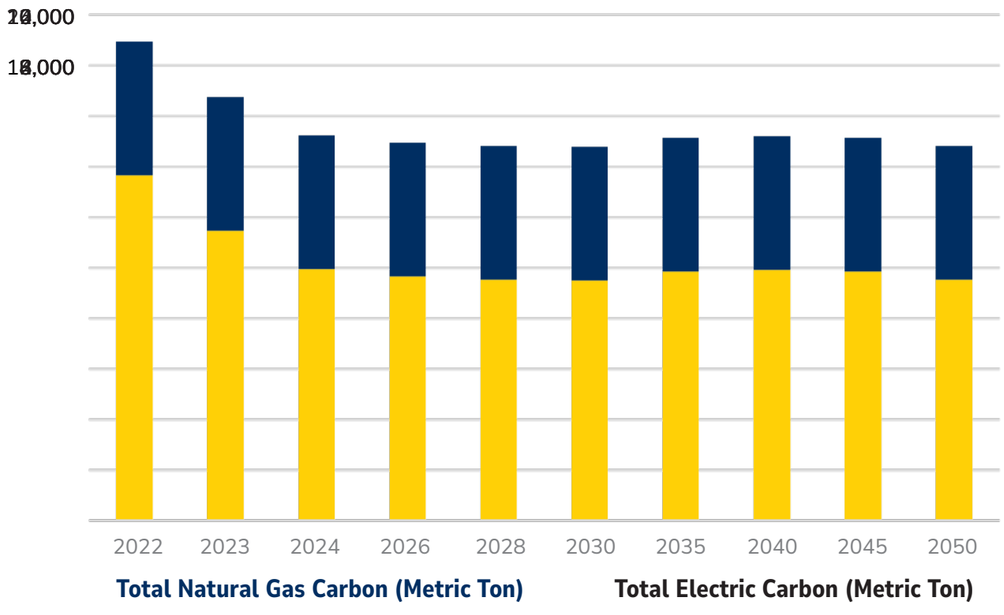



**Figure 4.21: Forecasted $C0_2$ Emissions Per Year**

# DEMAND-SIDE ANALYSIS: BUILDING PERFORMANCE

## EUI VS DISTANCE FROM EUI TARGET – CREATING A MORE USEFUL BENCHMARK

It is important for technical campuses, such as UM-Dearborn, to customize energy utilization index (EUI) targets to match the usage in each building. In order to build this cohesive understanding of building performance, additional benchmarks based upon use type were developed, using ASHRAE, AIA, and USGBC standards, as well as the planning team's industry experience. These targets allow a more accurate accounting of a technical campus's operations, as well as effectively highlighting buildings that truly are outside the norm for their use type. Focusing on distances from targets rather than on the EUIs themselves allows easy identification of buildings with opportunity for targeted improvements, and can help make decisions about where an institution should intervene first. Even these calibrated benchmarks are not fully sufficient on their own. In order to make decisions on intervention points, more holistic data should be considered, including total building energy demand, current deferred maintenance budget, and existing building condition (**Figure 4.22**).

These factors, in combination with the Space Needs Analysis, provided a basis for the phased implementation strategies for the building and campus-level improvement recommendations.

As part of the initial assessment of the UM-Dearborn campus operations, the planning team reviewed the facility condition assessment reports from 2019, conducted by the ISES Corporation, which provided an account of existing campus asset conditions, descriptions of mechanical, electrical and plumbing systems, as well as potential areas of intervention for each building. These reports also estimated a deferred maintenance budget for each building. This information, in conjunction with the performance indexing conducted by the planning team, informed recommendations for future, targeted improvements (**Figure 4.23**). More detailed information on building priorities will be discussed in the phasing section of this report.

| Building Name | EUI (kBTU/ SF/yr) | Target | Distance from Target | Deferred Maintenance from FCA | kBTU/yr |
|---|---|---|---|---|---|
| Administration Bldg | 145.1 | 48 | -202% | $875,000 | 5,225,000 |
| Grounds Bldg | 90.2 | 30 | -201% | $53,000 | 476,000 |
| Social Sciences Bldg | 160.1 | 65 | -146% | $911,000 | 9,901,000 |
| Mardigian Library | 152.3 | 64 | -138% | $5,877,000 | 17,967,000 |
| Campus Support Services | 109.9 | 48 | -129% | $502,000 | 1,695,000 |
| Professional Education Center | 136.2 | 65 | -109% | $327,000 | 2,292,000 |
| College of Arts, Sciences, Letters | 104.2 | 65 | -60% | $668,000 | 17,959,000 |
| Tony England Engineering Lab Bldg | 281.6 | 187 | -52% | N/A | 26,294,000 |
| Fairlane Center South | 71.3 | 48 | -48% | $5,288,000 | 11,523,000 |
| Auxiliary Program Center | 63.2 | 48 | -32% | - | 152,000 |
| Fairlane Center North | 61.7 | 48 | -29% | - | 9,685,000 |
| Natural Sciences Building South | 219.8 | 187 | -18% | $1,814,000 | 9,549,000 |
| Science Learning Research Ctr | 218.1 | 187 | -17% | $147,000 | 8,124,000 |
| Environmental Interpretive Center | 214.8 | 187 | -15% | $125,000 | 3,186,000 |
| Renick University Center | 76.6 | 72 | -6% | $163,000 | 5,797,000 |
| Institute for Advanced Vehicle Systems | 190.3 | 187 | -2% | $60,000 | 8,475,000 |
| Field House and Wellness Center | 130.0 | 130 | 0% | $1,375,000 | 12,786,000 |
| Natural Sciences Building | 177.0 | 187 | 5% | $51,000 | 14,324,000 |
| MFG Systems Engineering Lab | 159.9 | 187 | 14% | $245,000 | 1,827,000 |
| Prechter HC Engineering Complex | 158.2 | 187 | 15% | $973,000 | 7,990,000 |
| Computer Information Science | 137.8 | 187 | 26% | $2,597,000 | 3,350,000 |

**Figure 4.22: Building Performance**

| Typology | Target EUI |
|---|---|
| Office | 48 |
| Learning | 65 |
| Housing | 55 |
| Recreation | 28 |
| Research | 187 |
| Student Services/Dining | 72 |
| Library | 64 |
| Other | 30 |

**Figure 4.23: EUI Targets**

# Recommendations

## SITE-LEVEL RECOMMENDATIONS

The Comprehensive Campus Plan recommends a comprehensive study of existing mechanical and electrical distribution networks to ensure that decarbonization and improvements in efficiency can be implemented effectively. Existing electrical assets such as switchyards and connection points with utilities should be evaluated for additional electrical load as UM-Dearborn electrifies between now and 2040. Mechanically, existing utility lines, corridors and rights-of-way should be cataloged, mapped and coordinated before future distribution lines are added as part of the campus-level mechanical improvements noted below.

## CAMPUS-LEVEL RECOMMENDATIONS

### THERMAL SYSTEMS

**Avoiding the "Switch Point":** Of paramount importance when designing the decarbonization scheme for the UM-Dearborn was cost; ensuring that decarbonization can be achieved on a tight timeline, with an existing infrastructure layout, and limited ability for capital expenditure. With this in mind, the Comprehensive Campus Plan recommends a semi-decentralized, multi-phased approach to the elimination of fossil fuels on campus. Much of the campus's cooling needs are met through decentralized means, as well as several buildings which employ fossil-fuel powered boilers at the building-level. These boilers are not tied into the larger steam distribution system from the campus central energy plant to the north of the Tony England Engineering Lab Building. The plan recommends a system that leverages the existing assets for as much of their usable life as is possible, with pointed interventions, and allows for a reduction in steam generation over the course of the next 15 years, as opposed to a system which hits a "switch point" and requires the campus to rapidly adopt a new operations scheme. Any option with this "switch point" invariably requires the university to remove functioning equipment before the end of its usable life, driving up cost and creating unnecessary waste.

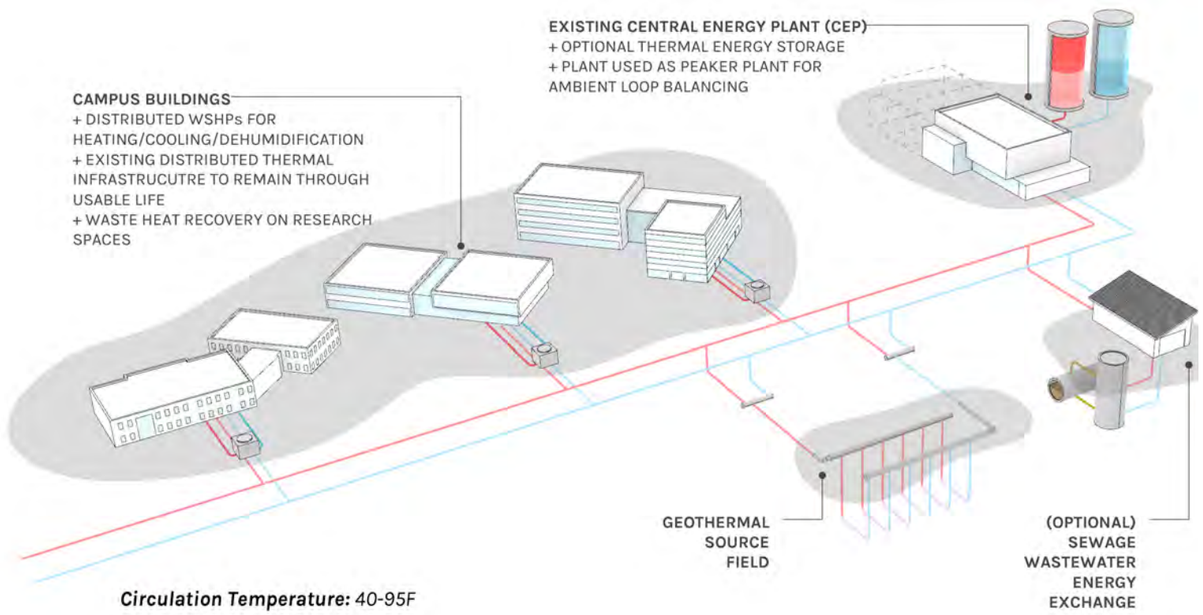



Figure 4.24: Water Loop System

**System Architecture:** The semi-decentralized system that the Comprehensive Campus Plan recommends contains three separate ambient-temperature water loops, connecting all buildings on campus. Water-source heat pumps at the building level, with existing decentralized heating and cooling systems provide supplemental heating and cooling sources (**Figure 4.24**). Current steam operations have heat exchangers at the building level that step down to 180°F for the heating coil source temperature. This existing steam distribution will not be compatible with the new target circulation temperature of between 40° and 95°F. However, this semi-decentralized "loop" approach allows the existing steam infrastructure to remain in place for the duration of its usable life, serving a reduced load, with its planned elimination at the end of the decarbonization process.

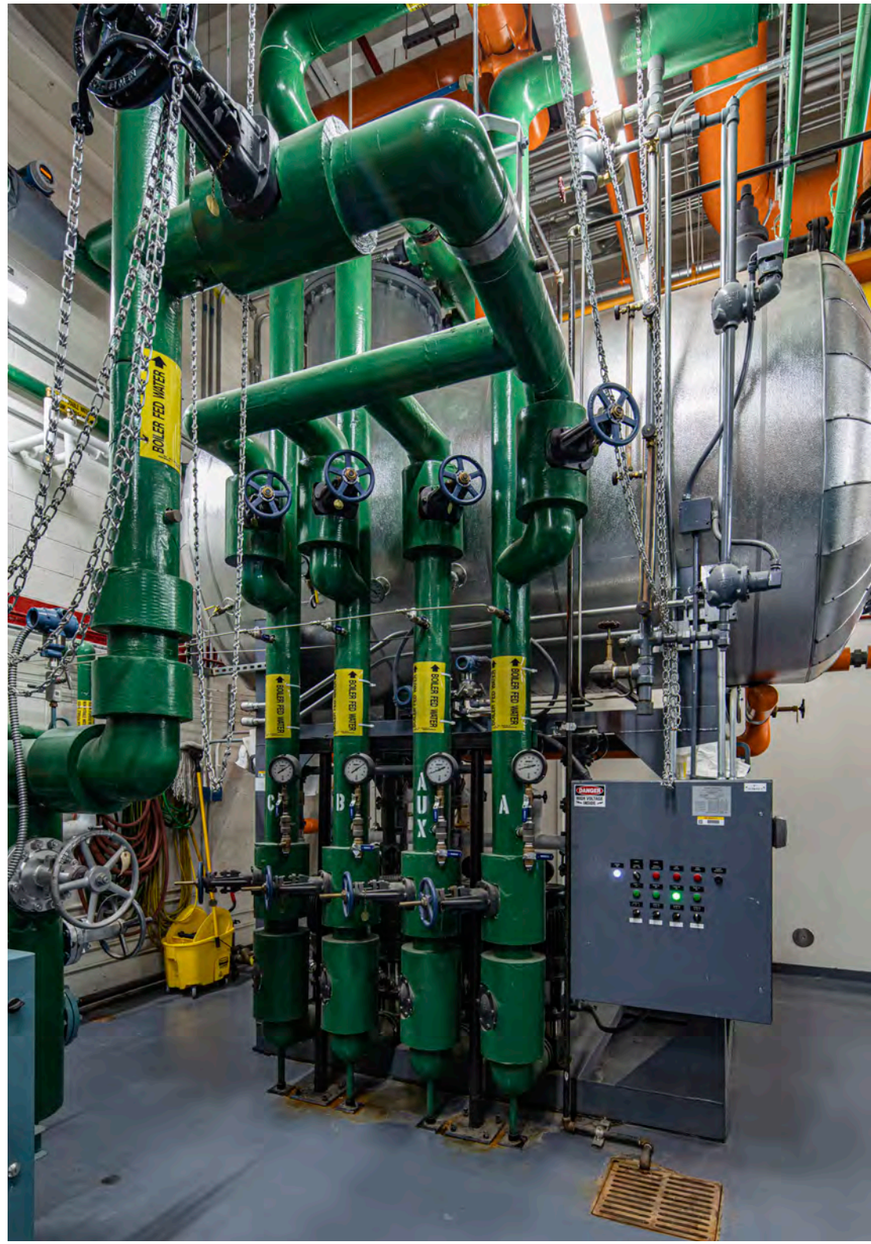
**Distribution System:** In order to accommodate an ambient circulating temperature, new buried hydronic piping will be required for each loop. These loops will connect buildings to pump stations at each field to circulate the ambient temperature water that will be fed to each building in a closed loop. A major advantage of ambient temperature distribution is the reduction of heat lost through ground conductivity. With considerably lower temperatures, ambient-temperature distribution networks can be built using inexpensive plastic piping over more expensive, conventional steel pipes. These systems can be designed to operate independently as three individual loops that serve three separate clusters of buildings. Alternatively, they can be designed to link together upon completion, allowing a better load balance across the entire system. The Comprehensive Campus Plan recommends that the system be designed with full connection in mind.

**At the Building:** Electric, water-source heat pumps will be installed at each building to serve the demands of the buildings throughout most of the year. During peak periods of heating and cooling demand, such as the hottest summer days and the coldest winter nights, on-site boilers and chillers can provide supplemental heating and cooling.

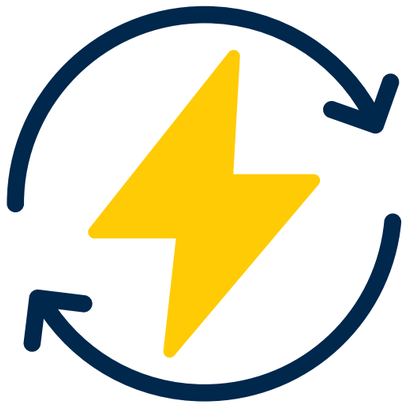
To maximize potential for low-entropy heating and cooling, building-level air handling unit coils will need to be strategically replaced to accommodate lower supply temperatures. Continued use of existing heating sources, such as gas-fired boilers or the existing steam distribution system, will allow building-level demand reduction measures to take place over a longer period of time, with targeted elimination by 2040 when Scope 1 emissions are to be removed.

**Primary Heat Sourcing:** The Comprehensive Campus Plan recommends developing three ground source heat pump fields underneath the three main parking lots to the east and north of campus. Ground source heat pump technology is a thermal energy generation strategy that uses the neutral ground temperature as both a heat source and heat sink in heating and cooling periods respectively. To support UM-Dearborn's balanced need of robust heating and cooling, ground source heat pumps, plus distributed supplemental heating and cooling infrastructure are recommended. This system will provide the best balance of sustainable, low-entropy thermal energy generation while being able to take advantage of existing technologies in place at the university. The planning team's preliminary analysis suggests that approximately 81% of the current campus capacity can be met by installing geothermal wells in existing parking lots.

Reduced circulation temperatures provide opportunities for additional supplemental heat sources, diversifying the options for campus heating, reducing strain on existing systems, and providing additional resilience through on-site thermal generation assets. Examples of supplemental systems are offered on the next page. Additional study is recommended in order to determine sizing, phasing and appropriate use of these systems.



## SUPPLEMENTAL HEAT SOURCES



### Waste Heat Recovery

As computational power continues to drive economic development as well as academic operations and research, high-energy operations like data centers and high-intensity laboratories will become increasingly significant parts of any university's infrastructure. These types of spaces present unique challenges, with some of the most intense cooling demands of any building use type. These cooling demands, however, do present an opportunity for waste heat recovery, especially in low-entropy, heat pump driven building mechanical schemes. This waste heat can be captured at the building level through energy recovery wheels, heat exchangers, or exhaust air recovery units, and fed back into the larger thermal loop as free, rejected heat. They can provide excellent sources for heat pumps operating in simultaneous heating and cooling mode, where heat pumps operate at their peak efficiency. Waste heat recovery units are modular, can be installed at the building-level, and can help serve the other buildings in the thermal loop, as the rest of the campus continues to decarbonize.

### Sewage Waste Energy Exchange

Sewage Waste Energy Exchange (SWEE) systems are designed to capture supplemental heat from sewage waste through closed-loop heat exchangers, and provide a sustainable and safe supplemental heat source that can be added to the campus thermal loop. These systems are largely correlated with campus occupancy, and can provide excellent opportunities for free peak-shaving in heating periods, with very limited infrastructure.

### Thermal Energy Storage

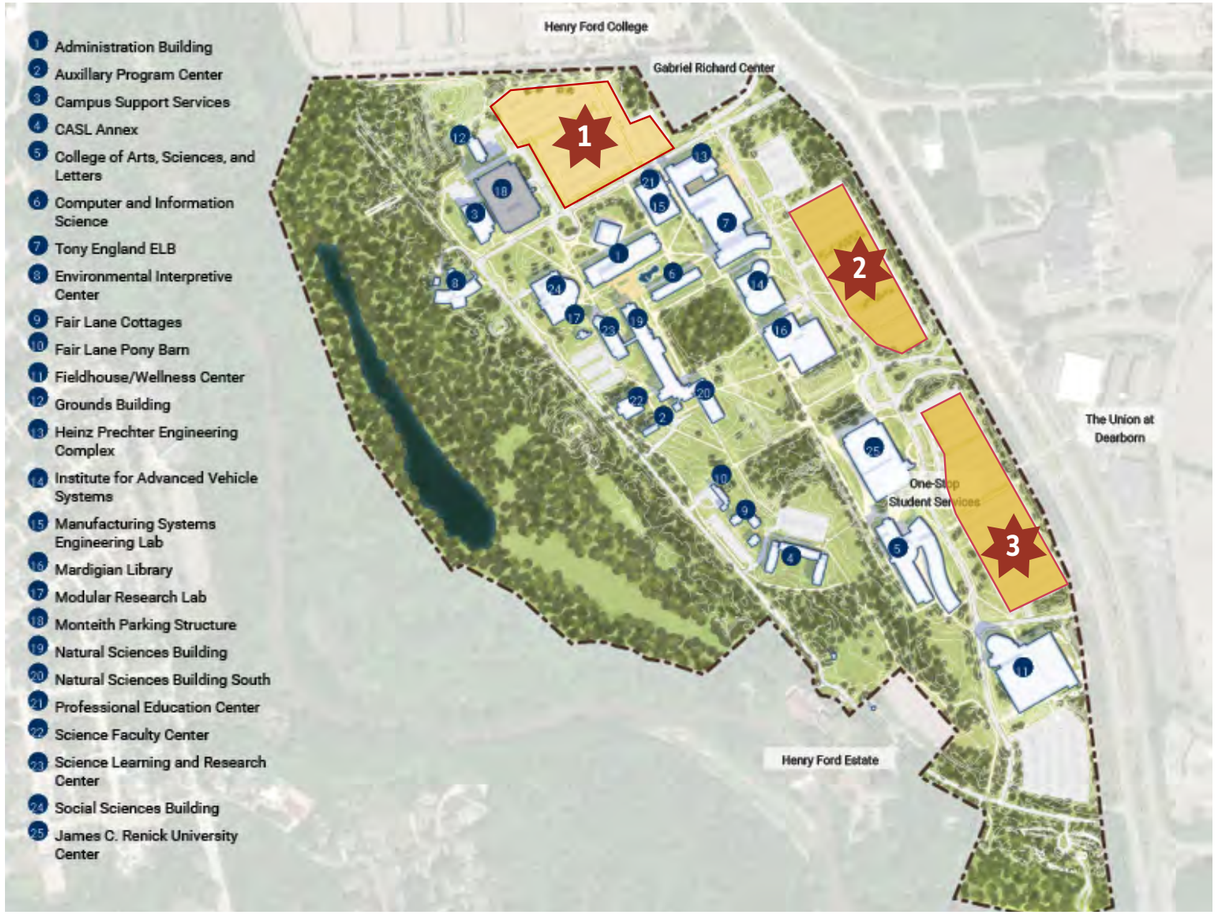
Thermal energy storage, the process of balancing thermal energy loads through equalization tanks, provides opportunities to capture any excess heating or cooling capacity, and strategically deploy it when necessary. These systems are the thermal equivalent of large-scale batteries in a renewable micro-grid system, and are especially useful for keeping water source heat pumps operating at peak efficiency, as well as assisting in the prevention of thermal drift in geothermal source fields.

## ELECTRICAL SYSTEMS

**Carport PV:** To reduce the reliance of the campus on the DTE grid distribution for power and associated Scope 2 emissions, the Comprehensive Campus Plan proposes increasing the use of on-site clean energy generated from solar photovoltaics (PV). Because it is a commuter campus, the University of Michigan-Dearborn has extensive parking lots that can also be retrofitted to produce electricity using solar PV panels mounted above parking spaces. The energy generated from the solar PV helps reduce the daytime power purchased from the grid. PV can also help to reduce peak power requirements for the campus because the university requires the most power during mid-afternoon when solar power is typically most productive. This can greatly offset the costs of purchasing electricity from the grid. On cloudy days when PV produces little, the campus can continue to purchase electricity from the grid or utilize excess solar power stored in batteries.

The parking lot solar PV capacities for the north and east sides of the campus are estimated using NREL's PVWatts as 3.8MWdc (Site 1), 2.5MWdc (Site 2), and 3.2MWdc (Site 3) assuming fixed racks with 45% space utilization. The generated electricity from these PV plants could meet nearly 50% of the campus' electricity historical demand from Fiscal Year 2021.

The annual generation from the proposed carport PV is shown in **Figure 4.25**.




| Proposed Site for solar PV | Estimated PV Systems Size | Estimated Annual Electricity Generation (in kWh/year) |
|---|---|---|
| Site 1 (Parking C1 + C2 +D) | 3.8 $MW_{dc}$ | 4,950,653 kWh/yr |
| Site 2 (Parking E2 +E3 + E4) | 2.5 $MW_{dc}$ | 3,309,294 kWh/yr |
| Site 3 (Paring E5 + E6 + E7) | 3.2 $MW_{dc}$ | 4,258,721 kWh/yr |

**Figure 4.25 Carport PV Potential**

**Battery:** Battery technology has developed significantly over the last decade and is now extensively being used to provide back-up power during emergencies for homes and businesses. Use of larger batteries timed with high utility tariff rate hours-of-use can also help reduce peak energy use costs. The batteries can be charged during the day with excess power generated from solar carports or from the grid during the night when consumption and energy rates are low and discharged during peak energy demand hours that typically occur during the afternoon. Batteries can also help provide power for electric vehicle charging which will help accelerate the transition of the campus fleet to electric vehicles.

A large battery (0.5MW to 3MW) for the campus will be most useful when combined with renewables integration, time-of-use programs, and a load management strategy. These demand response programs help balance energy supply and demand on the campus. Implementation of a battery system will require a detailed capacity study that considers the expected future energy demand, peak loads, and energy generation to optimize cost savings and emissions reductions. The battery system design will consider energy density, lifetime or cycle life of battery, thermal and fire management systems, charging and discharging rates, scalability and cost. Environmental impact of the battery can also be evaluated through the chemistry used to create the battery packs. Batteries with reduced or no rare material content such as lithium or cobalt have greater recycling potential.

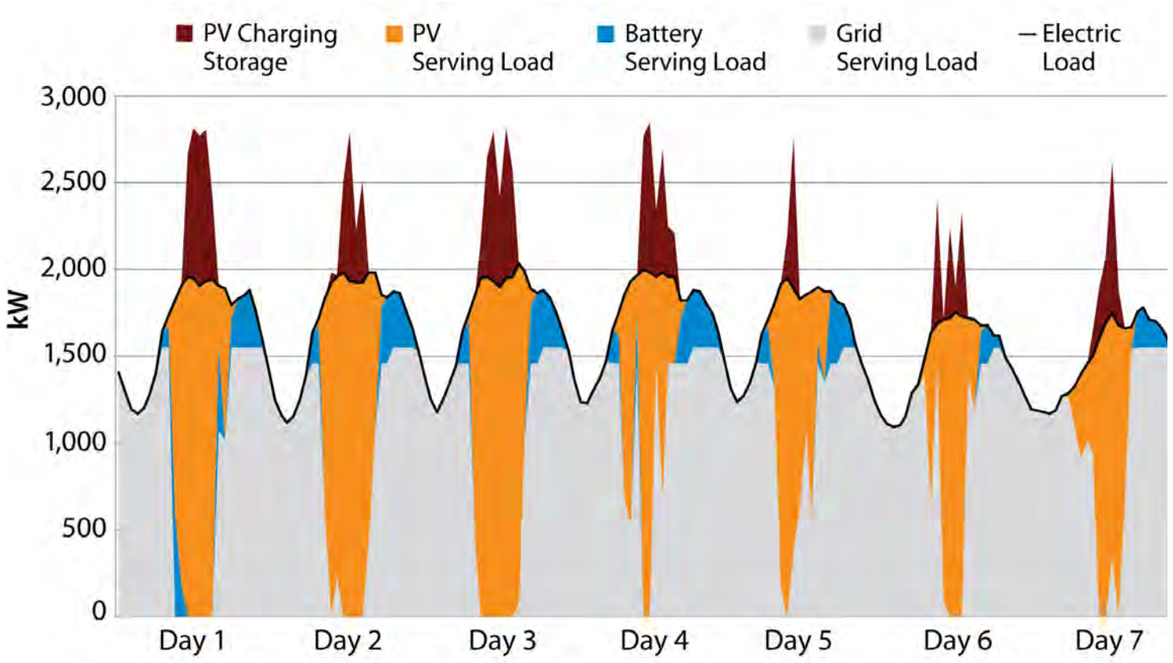



**Figure 4.26: Load Profile of a Typical Battery Energy Storage Application Supported by Solar PV at a University Campus (Source: NREL/Luther College)**

# BUILDING-LEVEL RECOMMENDATIONS

At the building-level, the Comprehensive Campus Plan focuses on areas for energy conservation. The recommendations below represent best practices around sustainability and energy conservation and should be considered with all major building renovations, as existing building systems age. Energy conservation measures will reduce utility demand and carbon emissions and may also reduce the size of the geothermal plant. These recommendations are not intended to be completed all at once but used as a guidance to improve overall campus energy efficiency, and sustainability. This apporach will allow time for proper planning, prioritizing, and phased implementation to ensure effective operation

## IMMEDIATE-TERM: LOW COST, HIGH IMPACT

### *CONDUCT FREE ASHRAE 90.1 AUDITS ON BUILDING AND WEATHERIZATION*

Conducting an ASHRAE 90.1 audit on the campus building stock will provide a comprehensive understanding of overall energy use. These audits delve into various aspects such as building envelopes, mechanical systems, building automation systems, water systems, power distribution/power supply, lighting, plug loads, etc.. The results obtained from these audits serve as a road map, pinpointing critical areas for building enhancement. Ultimately, this process optimizes energy conservation and weatherization considerations, and promotes cost savings, fostering sustainable practices within the campus infrastructure.

### *FINALIZE LED TRANSITION*

Transitioning from existing traditional incandescent or florescent bulbs to LED bulbs, which are highly energy efficient, will consume less energy without a reduction in light quality. LED bulbs have also been proven to have longer lifespans, meaning fewer replacements, which not only saves cost but also reduces maintenance efforts. LED bulbs are also environmentally friendly. The bulbs are often recyclable and possess lower risk of contamination than their fluorescent counterparts.  Overall, switching to LED benefits the campus in terms of energy savings, cost savings, environmental impact, and maintenance efficiency. The campus has largely completed this transition.

### *EXPANSION OF THERMAL SETPOINTS*

Expanded thermal setpoints increase the range of acceptable indoor temperatures for heating and cooling purposes. The reduced operation of the mechanical systems results in lower energy usage and reduced greenhouse gas emissions. While expanding thermal setpoints will increase energy and cost savings, expanding the range of acceptable indoor temperatures can be a culture change and is most successful when building occupants understand and support the reasons for the change. Additionally, combining the expansion of thermal setpoints with improvements to building envelopes can optimize energy efficiency and comfort.

## MEDIUM-TERM: THERMAL ENVELOPE IMPROVEMENTS

### *BUILDING FACADE IMPROVEMENTS*

High performance building envelopes reduce the demand for heating and cooling systems and maintain more consistent and comfortable indoor temperatures while, reducing operational costs. These improvements can include installing additional insulation, upgrading to high-efficiency windows, improving ventilation, shade optimization, and selecting high-quality building materials. Improving a building's facade reduces energy consumption by minimizing heat loss, controlling solar heat gain, optimizing the use of natural light, and enhancing thermal comfort. While these improvements are cost-intensive, the Comprehensive Campus Plan recommends a comprehensive review of improvement opportunities in this area.  These updates may be phased in over time and should be assessed carefully as part of any major renovation and included in new construction projects.

### *BUILDING SEALING/LOWER INFILTRATION*

Sealing gaps in a building facade reduces air leaks, which can account for significant energy loss. Reducing infiltration of outside air and exfiltration of conditioned air improves the building's thermal performance and reduces operational costs. Proper sealing helps to maintain the consistent interior temperatures and may improve indoor air quality by preventing air pollutants and moisture from entering.

LONG

## LONG-TERM: MECHANICAL, ELECTRICAL, AND PLUMBING (MEP) SYSTEM

### *IMPLEMENT SUSTAINABLE BUILDING OPERATION MEASURES*

ASHRAE Guideline 36, High-Performance Sequences of Operation for HVAC Systems, provides guidance on uniform sequences for the operation of HVAC systems. The guidelines provide recommendations for demand-control ventilation, optimal start/stop, night setback, and temperature setpoint adjustment based on occupancy and outdoor conditions. These controls can be monitored in real time, providing fault detection and diagnostics. Additionally, these controls promote the integration of renewable energy sources, thermal energy, and building management systems to further enhance sustainability and resilience. Another strategy is managing plug load controls, focusing on the reduction in energy consumption from electrical devices that are plugged into outlets. Integrating plug load controls into building management systems enables energy consumption tracking to identify areas of inefficiency. This information can be used to reduce plug load energy use.

### *INDIVIDUALLY METER EVERY BUILDING*

Submetering, a method to monitor energy use within a building, is an ideal way to identify waste and inefficiency. Submeters can be strategically placed to acquire data on energy systems that might need repairs or upgrades and can allow for quick response times to system failures if combined with an energy management system. Submetering also provides accountability to maintain compliance with energy efficiency regulations and reporting requirements. These data can be used to demonstrate progress towards campus sustainability goals of energy conservation and emission reductions. These meters can capture hourly energy profiles, which can be combined across the year to create annual energy load profiles, known as "8760 profiles." These profiles are ideal for sizing renewable energy systems and micro-grids, as they account for fine-grain changes in energy demand, and will be essential to UM-Dearborn's development of on-site renewable energy assets.

### *HIGH EFFICIENCY HVAC SYSTEMS*

As existing HVAC systems age and new systems are considered, emphasis should be placed on selecting systems that prioritize reductions in energy consumption.  These systems include variable refrigerant flow (VRF) or other high efficiency thermal delivery systems. VRF systems are efficient because they support cooling or heating of individual spaces, preventing energy waste because occupied spaces are conditioned as needed. VRF systems can also incorporate heat recovery, which minimizes the need for additional energy inputs and enhances overall system efficiency.  In laboratory spaces, chilled beam systems, such as the system in the recently renovated Tony England Engineering Lab Building, should be considered. These systems create passive circulation by separating cooling and ventilation for more effective heat recovery. HVAC systems should also be selected with the intention to tie into the proposed future campus ground source heat exchange loops.

# Implementation

## ACTION ITEMS TO ACHIEVE CARBON NEUTRALITY GOALS

The Comprehensive Campus Plan has developed a pathway to achieve decarbonization within the timelines set by the University of Michigan system (**Figure 4.27**). This pathway prioritizes building-level improvements as the crucial component of emissions reduction efforts, and suggests that the university take a long-term approach to these measures, completing them throughout the timeline of the implementation of other site-level recommendations. Site-level recommendations are structured in such a way that building improvements are able to be completed in a flexible timeline, in order to ensure that the building improvements can continue to be implemented even after site-level recommendations are completed.

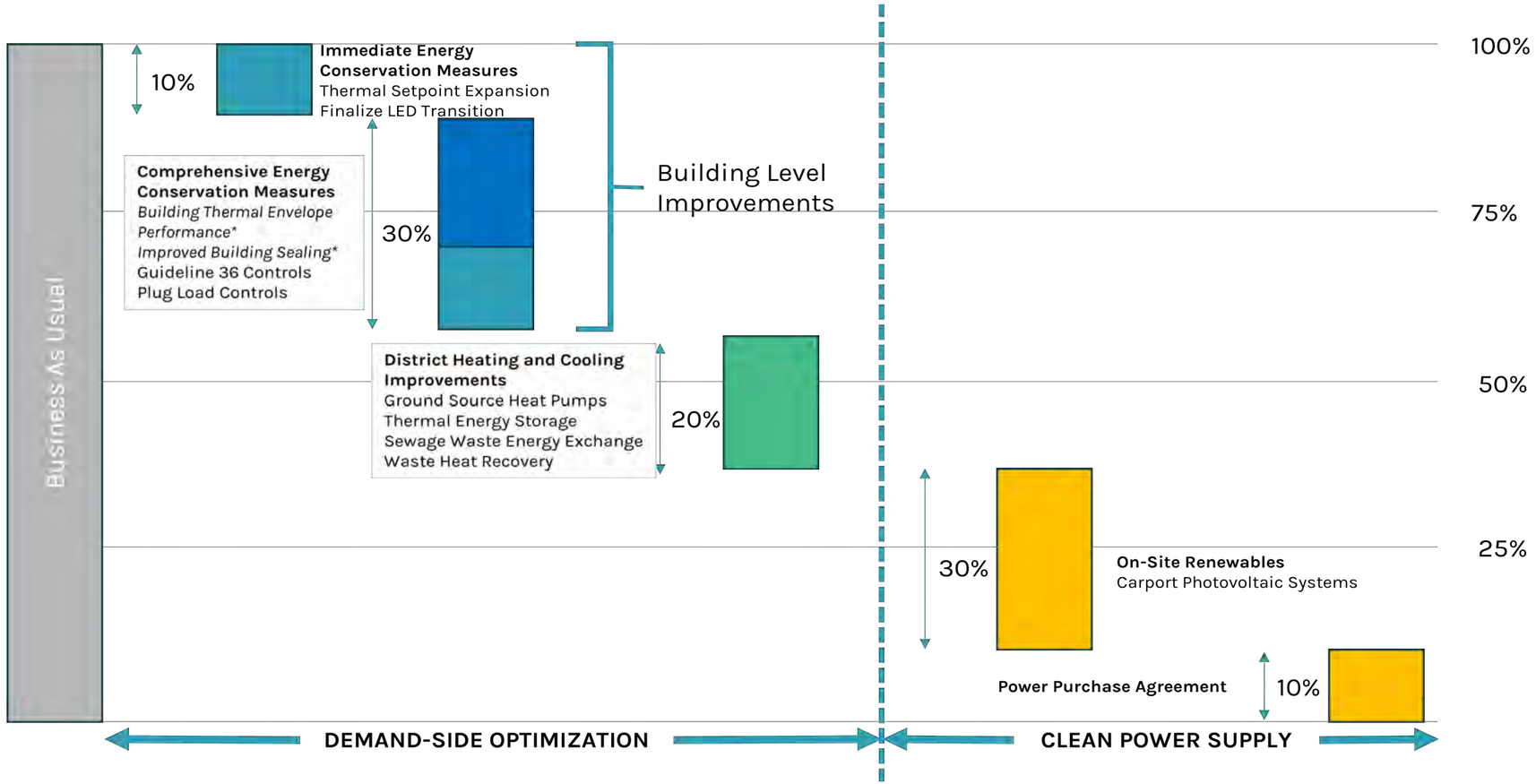



**Figure 4.27: Path to Decarbonization - Emission Impact**

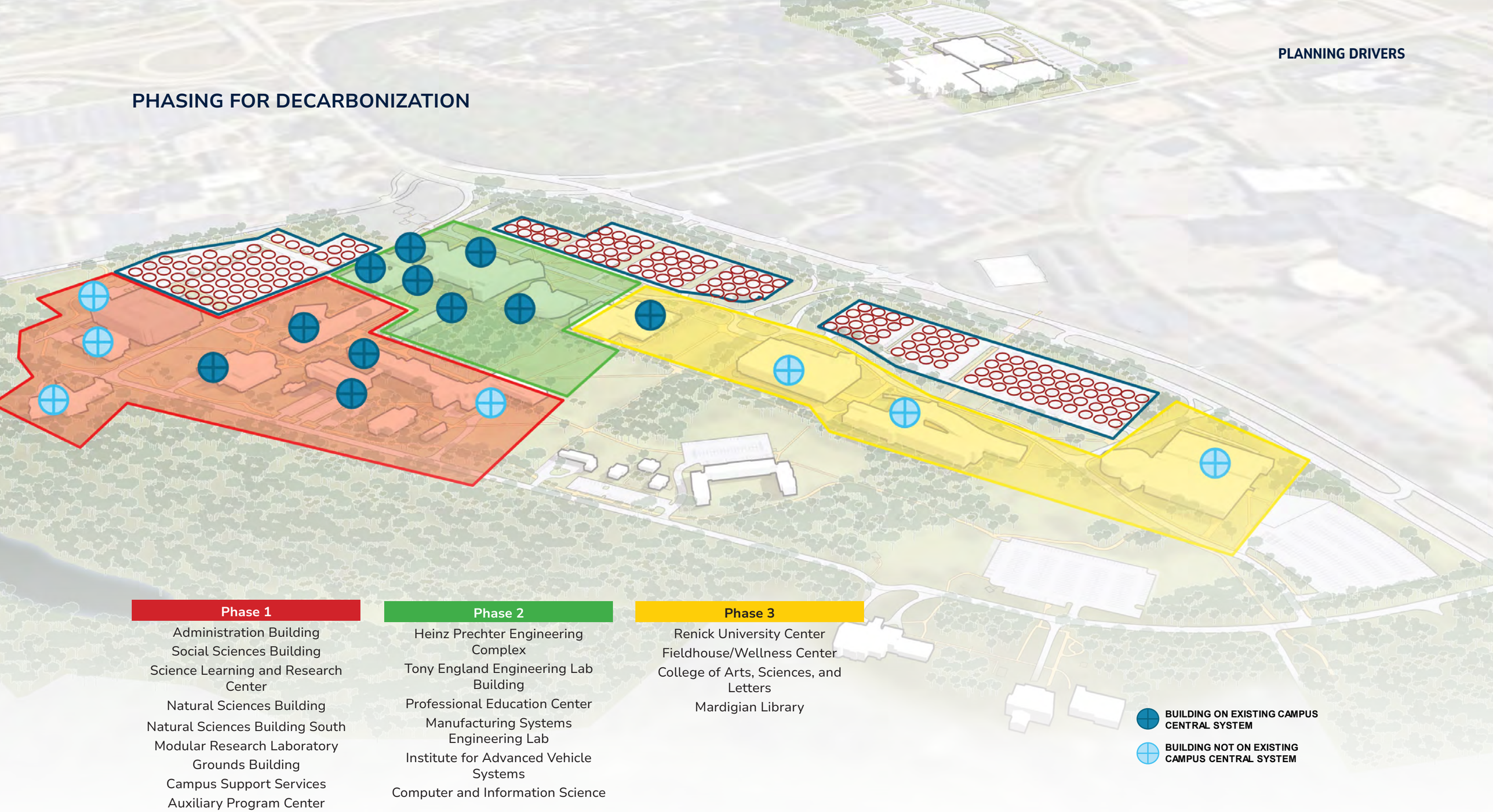
**Energy Conservation Projects Outside of Typical Maintenance Improvement Budgets, and Will Require Sourcing of Additional Funding. Dark Blue Shaded Area to Represent Estimated Total Impact of These Specific Measures.*

# HIGH-LEVEL PHASING/TIMELINES FOR DECARBONIZATION ACTION ITEMS

The Comprehensive Campus Plan recommends the following phases in order to best align decarbonization implementation with the rest of the recommendations. This timeline has been developed based on evaluation of current operations, but will require alignment with UM decarbonization goals broadly, as well as sourcing funds necessary to develop these projects. The phases and timelines (**Figure 4.28**) in the following pages are based on these assumptions.


**Figure 4.28: A Potential Timeline for Decarbonization for The University of Michigan-Dearborn**
**GHSE: Ground Source Heat Exchange*

# PHASING FOR DECARBONIZATION




**Phase 1**

Administration Building
Social Sciences Building
Science Learning and Research Center
Natural Sciences Building
Natural Sciences Building South
Modular Research Laboratory
Grounds Building
Campus Support Services
Auxiliary Program Center

**Phase 2**

Heinz Prechter Engineering Complex
Tony England Engineering Lab Building
Professional Education Center
Manufacturing Systems Engineering Lab
Institute for Advanced Vehicle Systems
Computer and Information Science

**Phase 3**

Renick University Center
Fieldhouse/Wellness Center
College of Arts, Sciences, and Letters
Mardigian Library

# PHASING FOR DECARBONIZATION DETAILS

## *Phase 1*

Aligning with the interest in moving away from the Fairlane Center and focusing on spaces such as the Administration Building, Phase 1 gives an opportunity to focus on several buildings geographically close, that rank highly on the poor performing building index. These spaces can be served by the parking lot to the north, with existing heating and cooling infrastructure available to be used supplementally. Additionally, this phase will still have a fully operational central plant as backup, should any problems arise. Several other smaller buildings, like the Grounds Building and the Auxiliary Program Center, will be included in this phase given their proximity, but extensive investment in utility reduction is likely not a priority for these spaces. The plan recommends design beginning before 2025, and construction completing in approximately 2030.

## *Phase 2*

Phase 2 will focus on the remaining buildings on the existing central plant, focusing largely on fewer, more energy-intensive buildings, in order to eliminate the majority of the existing Scope 1 demand from the central plant. The central plant, designed modularly, can ramp down consumption, with the majority of the existing load taken on through the ambient loops and heat pumps. This loop will be fed by ground source heat pumps underneath the Parking Lots E1-E4. This phase, being largely laboratories and research spaces, may require additional design periods, and its position as the middle of three phases allows for additional time ahead and beyond the timeline set out by this phasing diagram on the following page. The plan recommends design beginning before 2030, and construction completing in approximately 2035.

## *Phase 3*

Phase 3 will comprise the remaining buildings to the southeast of campus, accounting for buildings not currently served by the central plant, as well as Mardigian Library. Mardigian Library is suitable for either Phase 2 or 3, and its inclusion in Phase 3 is an effort to more equally balance costs and construction time across the three phases. Mardigian Library's considerable utility demand suggests it would be best suited for Phase 3, with additional capacity from the parking lot to the southeast. The plan recommends design beginning before 2035, and construction completing in approximately 2040.  Beyond Phase 3's completion in 2040, these loops should connect to a larger, more balanced load profile, connecting all campus buildings and allowing for demand to be circulated between loops, in order to prioritize the operation of distributed building-level heat pumps at their highest efficiency rating possible.

In the immediate-term, the Comprehensive Campus Plan recommends that UM-Dearborn focus on Scope 2 emissions, with a Power Purchase Agreement (PPA) for as large of a portion of the existing operational emissions profile as is possible. Additional renewable energy certificates (RECs) could account for the remaining portion of the emissions. As the campus continues to decarbonize and develop on-site assets, these RECs, and possibly some portion of the PPA, will no longer be necessary. These measures will be required in order to meet the timeline set by the University of Michigan system.

Each phase proposed consists of several smaller phases occurring simultaneously over the course of approximately five years for each phase, beginning in 2025. Building-level demand reduction, the essential component of campus decarbonization, should occur throughout the five-year timeline, with development of campus-level assets, in UM-Dearborn's case ground-source heat exchange (GSHE) source fields, taking place early in the phase timeline, with completion within two years of development. This allows for three years of phased building connection to the new system, a gradual approach that reduces the need for significant up-front capital to invest in many buildings all at once. Electrically, the first three years of the five year cycle should comprise the on-site asset design, procurement and fundraising period, with development taking place after the GSHE source fields have been in operation, to reduce risk of disassembly in order to maintain the fields. This period of operation before solar development should be protected if at all possible, as development underneath existing solar assets can be expensive and disruptive.

# INCENTIVES AND OVERALL FINANCIAL STRATEGY ANALYSIS

## FINANCING DECARBONIZATION AT UNIVERSITY OF MICHIGAN REGIONAL CAMPUSES

The financing challenges related to decarbonization on campuses can be significant. Campuses face the pressure of achieving carbon neutrality or net-zero emissions within short deadlines, which necessitates substantial changes to existing infrastructure. These changes include upgrading energy systems, retrofitting buildings, transitioning to renewable energy sources, and adopting sustainable transportation options. For many institutions, the price-tag associated with decarbonization measures can easily exceed eight figures, representing at times, a decade's worth of infrastructure annual budgets squeezed into half the timeline. This is particularly apparent at regional campuses that may be included in the enterprise aspirations but lack the alumni attention that could make these types of projects financially viable. For all schools, yet especially these regional universities, it is just as important to understand the options for financing the infrastructure and for phasing the various systems identified for decarbonization.

The engineering analysis of vulnerabilities and opportunities in infrastructure and building systems was coordinated with analyses including spend on deferred maintenance, operational and facility budgetary allocation, and feedback from facilities engineers.  This combined qualitative and quantitative analysis identified the optimal system replacements needed to achieve the broader University of Michigan goals. Key to the financing strategy is the ability to phase these infrastructure improvements. The following types of mechanisms can therefore be blended to satisfy the cost of decarbonization, including:

+ Tax incentives provided through the Inflation Reduction Act
+ Tax incentives provided through Build Back Better
+ Debt financing satisfied through bonding with University of Michigan
+ Creation of an "Energy Savings Fund" to create a dedicated revenue stream for repaying the issuance to University of Michigan

These mechanisms help to create a robust portfolio to finance the infrastructure projects detailed in the decarbonization systems. The tax incentives are a straight-forward aspect of creating financial efficiency, but the bonding strategy is slightly more complicated.

## BONDING FOR DECARBONIZATION

Structuring climate bonds at UM-Dearborn involves a strategic approach aimed at achieving strict decarbonization goals. Initially, the university identifies key infrastructure projects crucial for reducing GHG emissions and advancing sustainability on its campus. These projects may encompass energy-efficient building upgrades, renewable energy installations, and electrification of transportation, among others. Through a rigorous assessment process, the university quantifies the climate benefits of each project, ensuring alignment with decarbonization objectives.

To enhance transparency and credibility, the university could seek individual third-party Expertise on Sustainability certification for its climate bonds. This certification assures investors of the bonds' environmental integrity and the positive impact of funded projects. Once certified, the university issues climate bonds earmarked explicitly for financing decarbonization initiatives at its Dearborn campus. These bonds are marketed to investors committed to supporting environmentally sustainable projects and help to satisfy the question of "what to invest in" when divestment from fossil fuels a major point of contention on campus.

Broadly, the proceeds from the issuance of climate bonds are dedicated exclusively to financing decarbonization projects identified earlier. This approach ensures that the funds raised are effectively channeled towards initiatives that directly contribute to the university's strict decarbonization goals. The repayment structure of the bonds is designed to align with the anticipated savings and benefits generated by the funded projects. For instance, energy savings realized from energy-efficient upgrades (such as additional energy conservation mechanisms) can be used to service the bond debt, creating a self-sustaining repayment mechanism.

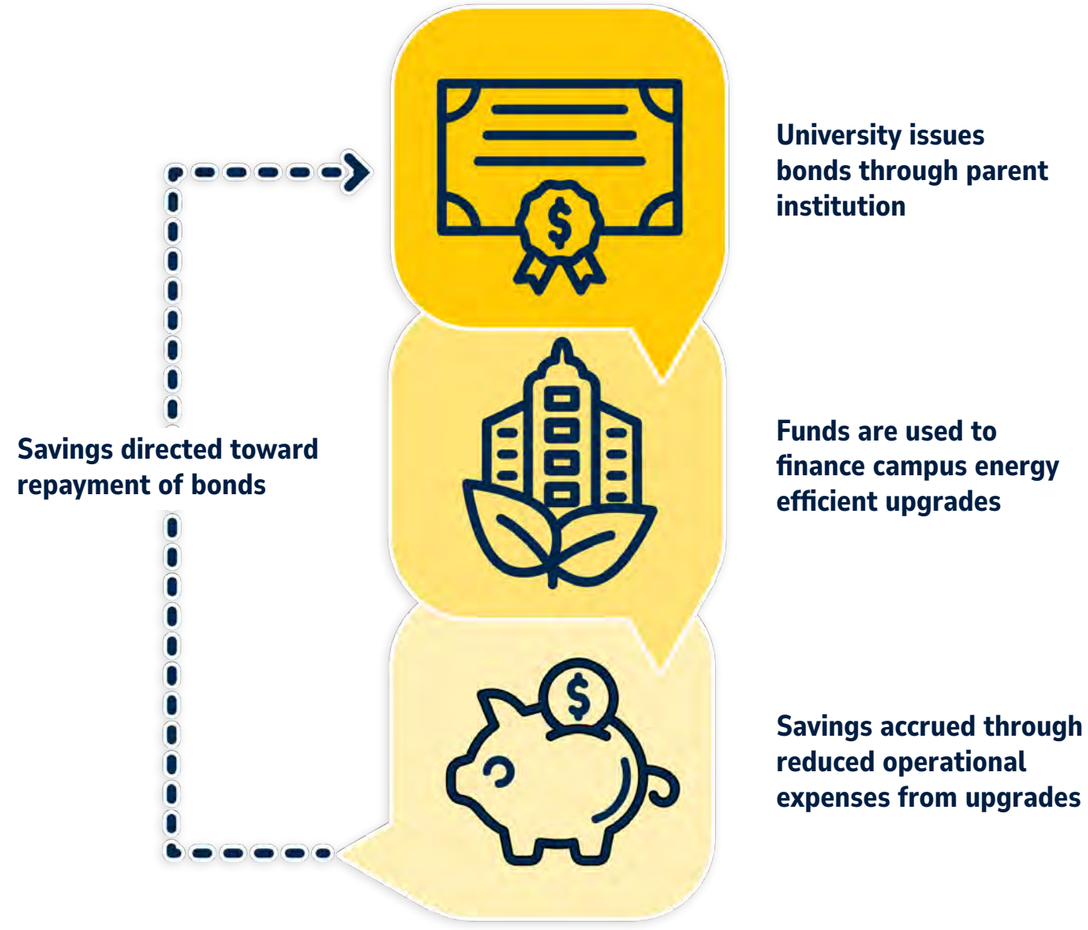
Throughout the bond issuance and project implementation process, the university establishes robust monitoring and reporting mechanisms. Regular updates are provided to investors and stakeholders, demonstrating the progress and impact of decarbonization initiatives funded by climate bonds. By leveraging climate bonds for infrastructure financing, UM-Dearborn can mobilize capital markets to support its sustainability efforts while minimizing the impact on students, showcasing leadership in sustainable finance and environmental stewardship.

## REPAYMENT WITH AN ENERGY FUND

When a university, through its parent institution, issues bonds, it essentially borrows money from investors in the bond market. These bonds represent a promise by the university to repay the investors the principal amount borrowed (the face value of the bonds) plus interest over a specified period. The university then uses the funds raised from the bond issuance to finance capital projects such as building construction, renovation, or infrastructure upgrades.

The repayment of this particular infrastructure and/or “decarbonization” bond, including both principal and interest, is typically made over the life of the bonds through periodic payments. This debt financing mechanism allows universities to access large sums of capital upfront (on big ticket items here like infrastructure replacement) while spreading out the repayment over time, making it a common and effective way to fund long-term infrastructure investments.

Establishing an energy savings fund at UM-Dearborn can play a pivotal role in repaying bonds issued by the University of Michigan for infrastructure projects. By implementing energy-efficient upgrades throughout the UM-Dearborn campus, the university can effectively reduce operational expenses, particularly utility bills. These accrued savings can then be directed towards the repayment of the bonds, providing a dedicated revenue stream that alleviates or reduces reliance on other budgetary allocations. Furthermore, investing in sustainable infrastructure aligns with the broader University of Michigan’s commitment to environmental stewardship and could potentially qualify for additional incentives or grants. This approach not only mitigates risks associated with fluctuating energy costs, but also enhances the University of Michigan’s reputation as a leader in sustainability, fostering increased support and financial backing for bond repayment. In summary, leveraging energy savings for bond repayment may offer a strategic and sustainable pathway for the University of Michigan Dearborn to fulfill its financial obligations while contributing to the overarching mission of the University of Michigan.



# DEVELOPING TECHNOLOGIES IN THE SUSTAINABILITY FIELD

In an effort to keep this decarbonization path as dynamic as possible, continual analysis should be conducted on emerging technologies that could prove to be useful. This pathway has been structured in such a way that there are many potential paths forward-each loop presents an opportunity for further innovation, given the unique characteristics of the buildings contained within.

The following technologies should be evaluated throughout the decarbonization process in order to determine value as the technologies develop:

+ High-approach water-source heat pumps
+ Net metering for micro-grids
+ Grid-interactive building controls

05

# Acknowledgments

# Acknowledgments

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- DOMENICO GRASSO- UM-DEARBORN CHANCELLOR
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- CAROL GLICK - EXECUTIVE DIRECTOR FOR FACILITIES OPERATIONS
- EMILY HAMILTON - DIRECTOR OF FACILITIES PLANNING & CONSTRUCTION
- SMITHGROUP, INC.
- KIRK ASSCOCIATES - ESTIMATING PARTNERS

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