# FACILITIES AND INFRASTRUCTURE REPORT

January 2012

MICHIGAN STATE UNIVERSITY

Office of the Vice President
for Finance & Operations

## Executive Summary

The infrastructure report is prepared annually to inform the Trustees of the state of the campus as it relates to new initiatives regarding the campus infrastructure and buildings, changes in construction or related planning processes, updated information on the Just-In-Time needs, required construction projects reporting, and finally the annual property report.
Additionally, as part of the infrastructure report, we attempt to highlight the challenges and successes that have occurred throughout the year. The report also contains annual construction statistics and some things that we are doing to line us up best for the future. Periodically we provide transportation and safety information, which is included in this year's report.

Over the last year we engaged in a new construction planning approach called Integrated Planning and Design. With the development of new ADA regulations, the report provides information on how regulations impact the campus and specifically infrastructure planning. A number of buildings have now completed the retro-commissioning process, and the savings yielded from this process is better than earlier projections.

The backlog of Just-In-Time maintenance needs has increased over the last few years. This is not surprising, given that investment income pays for the majority of Just-In-Time maintenance needs. At the lowest point in our maintenance backlog, we had reduced our estimated costs to $6 million to fund, an unparalleled accomplishment in a major university. We are managing to fund the higher risk needs, and we are beginning see some return of the stock market which should improve our maintenance position.

We have made improvements and refinements in many areas, such as meeting substantial completion dates of the capital projects, implementation of post occupancy reviews after major construction or renovation projects are completed, returning remaining funds in completed construction projects more quickly back to the funding units, and the excellent results of the retro-commissioning of the current set of completed buildings. We also have more work to do, for example, in the area of change orders that relate to document changes and how the data collected from these change orders can drive enhanced planning on the front end of projects and lowered costs, the post occupancy data to really drive planning changes, and also the continuance of the retro-commissioning process perhaps on a faster pace because of the excellent results we are gaining.

The infrastructure of MSU, while vast and complex, has historically been managed with a view towards the future. Our predecessors maximized opportunities for growth while minimizing the investment. This approach continues to serve us well. It is imperative that we have adequate infrastructure to support our academic programs.

F.L. Poston, Vice President for Finance and Operations and Treasurer

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# JUST-IN-TIME

## Summary

The Just-In-Time (JIT) facilities process is a comprehensive assessment of all campus infrastructure components.  The process assesses the condition of a particular component, estimates the failure date based on the assessment, and then develops a priority list and schedule of repair or replacement. The industry-predicted life-cycle of infrastructure systems (average number of years before a replacement is normally needed) is used as the starting point for projecting the timing of required work. The estimated replacement year is adjusted based on observations made in the field by preventative maintenance and repair crews. As a result of these observations, the time for replacement or repair of a particular piece of equipment or utility is adjusted so that funding resources can be used most efficiently and effectively and closest to a predicted failure. The JIT annual maintenance and replacement costs are then projected over a 20-year period.

Just-In-Time needs are broken down into three time frames: the next five years; six to ten years; and ten to twenty years. The JIT data provides opportunities to coordinate JIT projects with other construction and renovation projects. These opportunities diminish, however, when available funding falls short of what is needed.

## Analysis

Data for JIT needs are kept for both general fund supported and Residential and Hospitality Services (RHS) facilities.  The JIT needs for the next 20 fiscal years are shown by year in Figure 1.

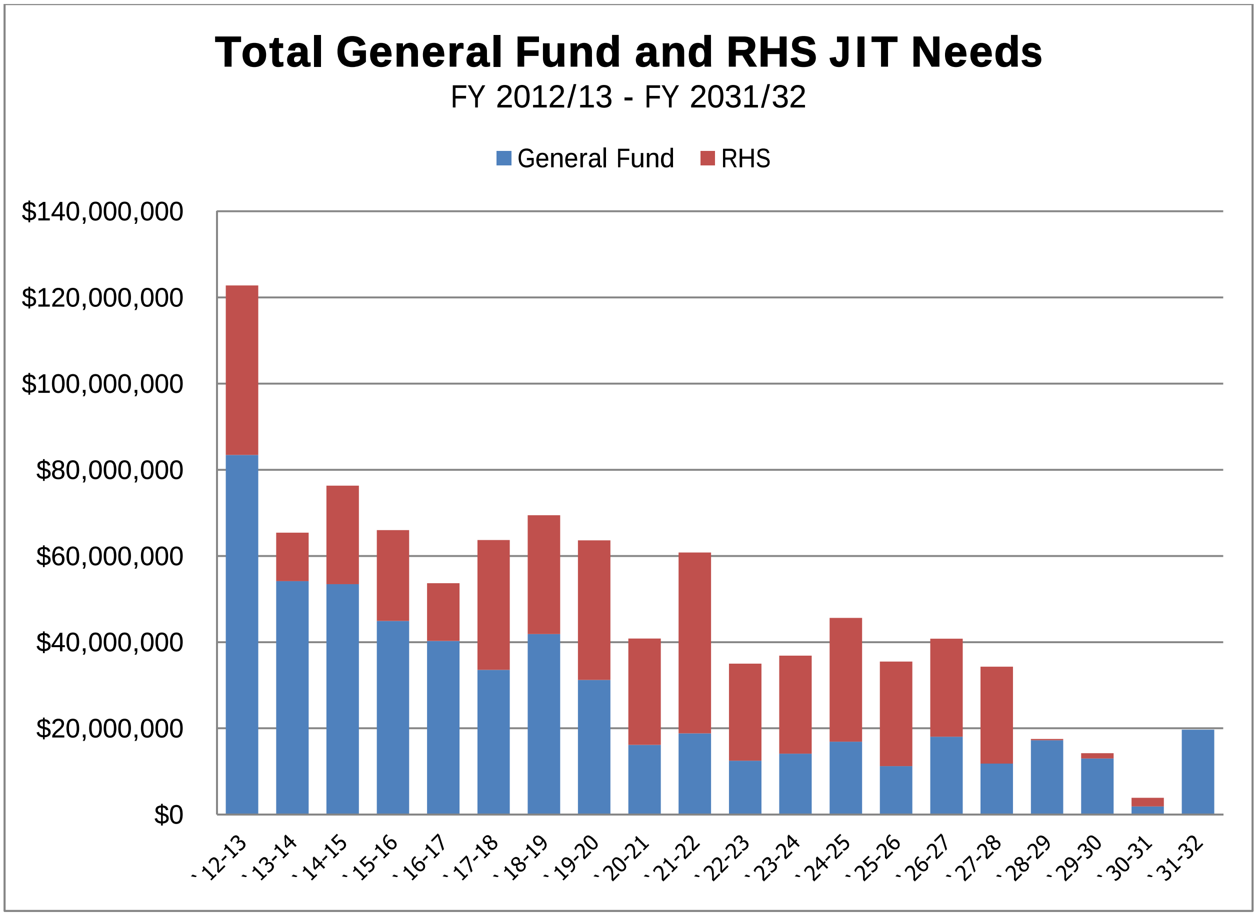



**Figure 1.** *Annual General Fund and RHS JIT Needs for Next 20 Fiscal Years*.

*General Fund*

The 20-year JIT forecast for the general fund identifies $554 million of work that must be performed in order to preserve the safety and reliability of the university's infrastructure. Figure 2 shows the JIT needs for the next 20 fiscal years.

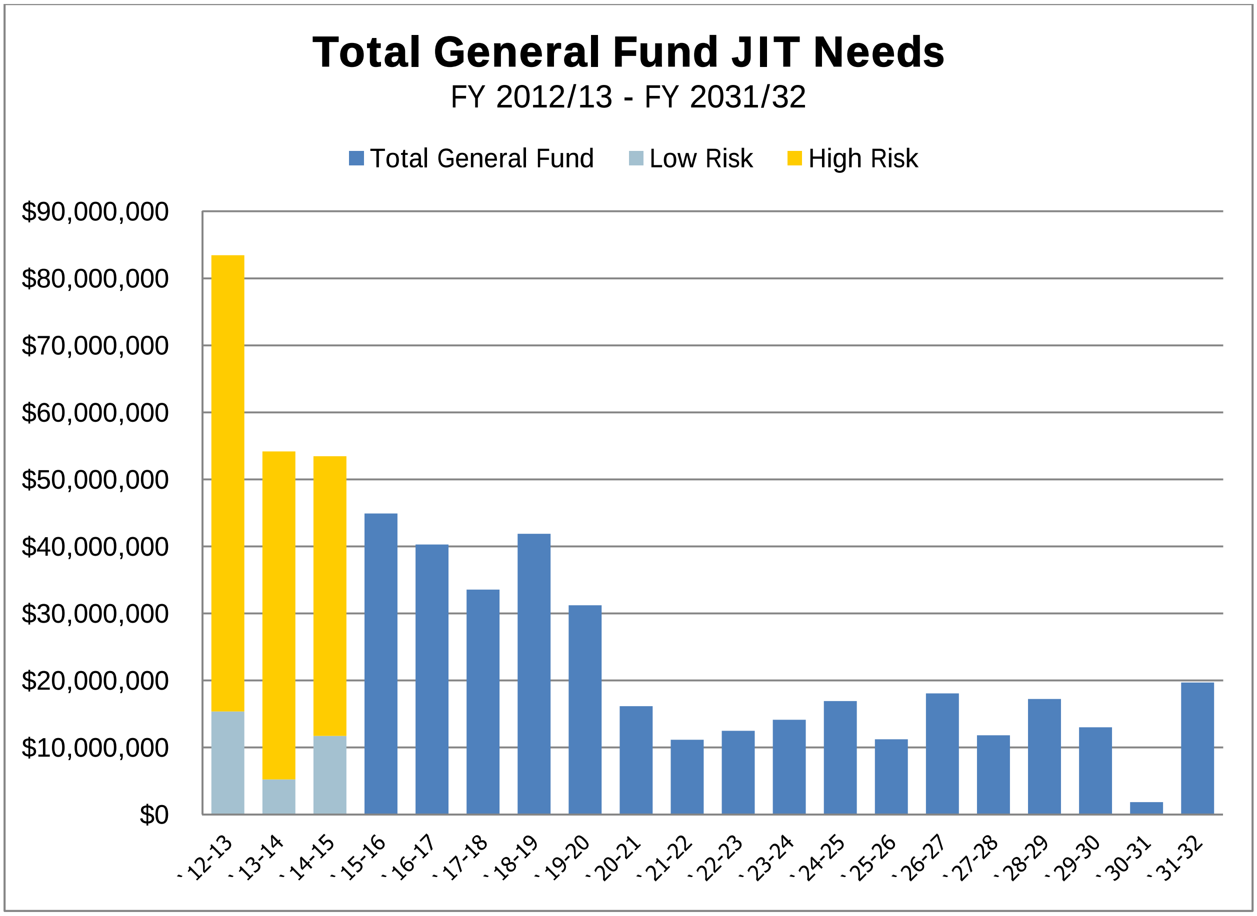



**Figure 2.** *Annual General Fund JIT Needs for Next 20 Fiscal Years*.

The projects which comprise the first three fiscal years of JIT needs are evaluated annually to determine which items present the highest risk to the institution, should a particular item fail. This "risk-based" approach for managing JIT reviews each item in light of the degree to which a failure would cause an interruption of normal university business and adversely impact the people and equipment that provide for the university's mission. For example, a steam tunnel failure would be deemed a higher risk than a window failure, because it could force the closure of one or more buildings.

Fiscal Year 2012-13 shows the largest amount of JIT needs in Figure 2. This is the result of unfunded JIT needs from previous years being included in the current year's projections. If JIT projects are not funded for a given fiscal year, those needs are then forwarded to the following fiscal year.

The JIT infrastructure needs for the general fund facilities are grouped into four categories: buildings, utility distribution systems, power and water systems, and roads.

Figure 3, which sorts the JIT information into those four categories, provides more detail of the JIT needs facing the general fund in the next 10 fiscal years.

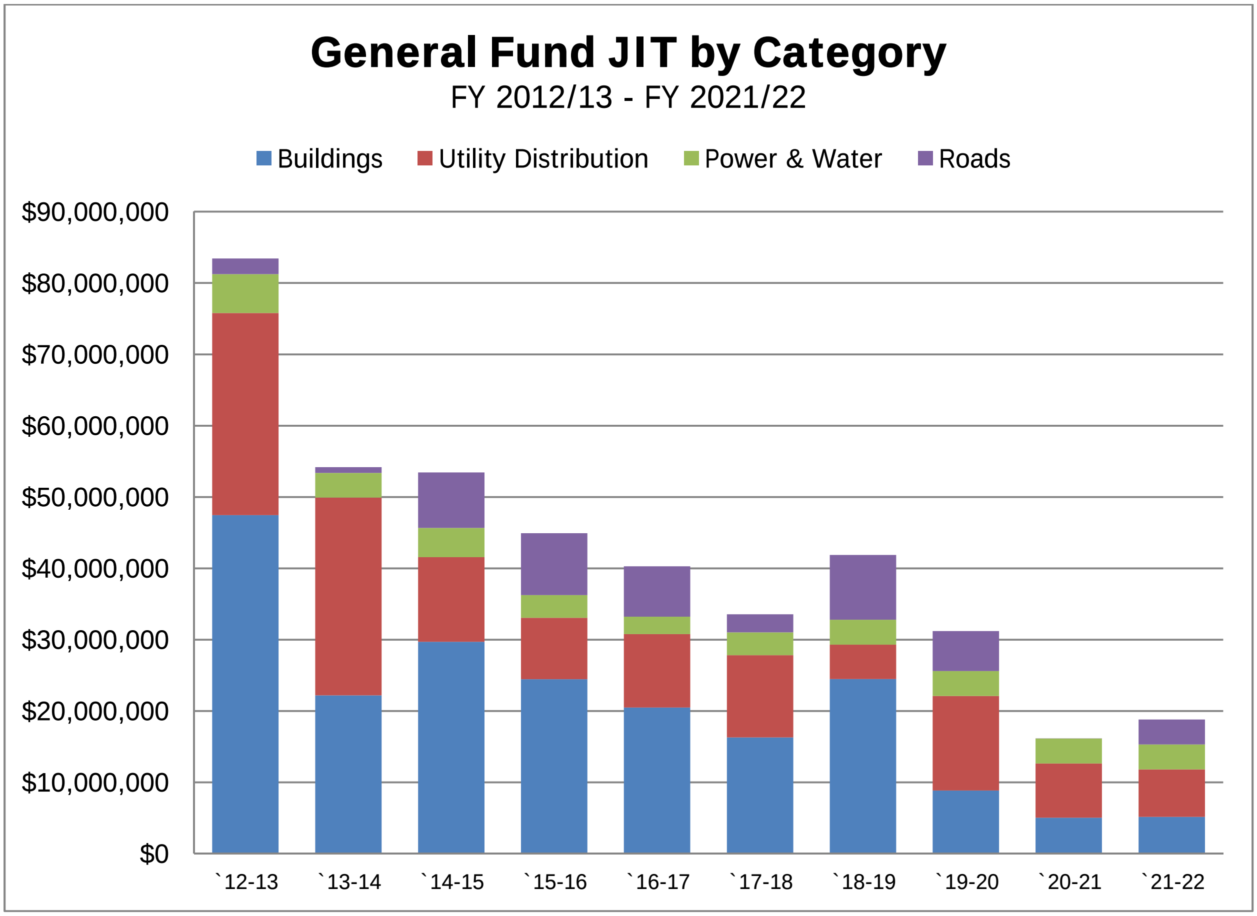



**Figure 3.** *Annual General Fund JIT Needs for 2012-13 through 2021-22 for Buildings, Utility Distribution, Power and Water, and Roads*.

The total ten year general fund JIT needs by category are as follows:

| | |
|---|---|
| Buildings: | $204,151,909 |
| Utility Distribution: | $130,657,722 |
| Power and Water: | $35,842,770 |
| Roads: | $47,246,825 |
| 10 year total | $425,409,226 |

Figure 4 shows the next ten years of JIT needs for general fund buildings, with the first three years reflecting needs sorted by high and low risk.

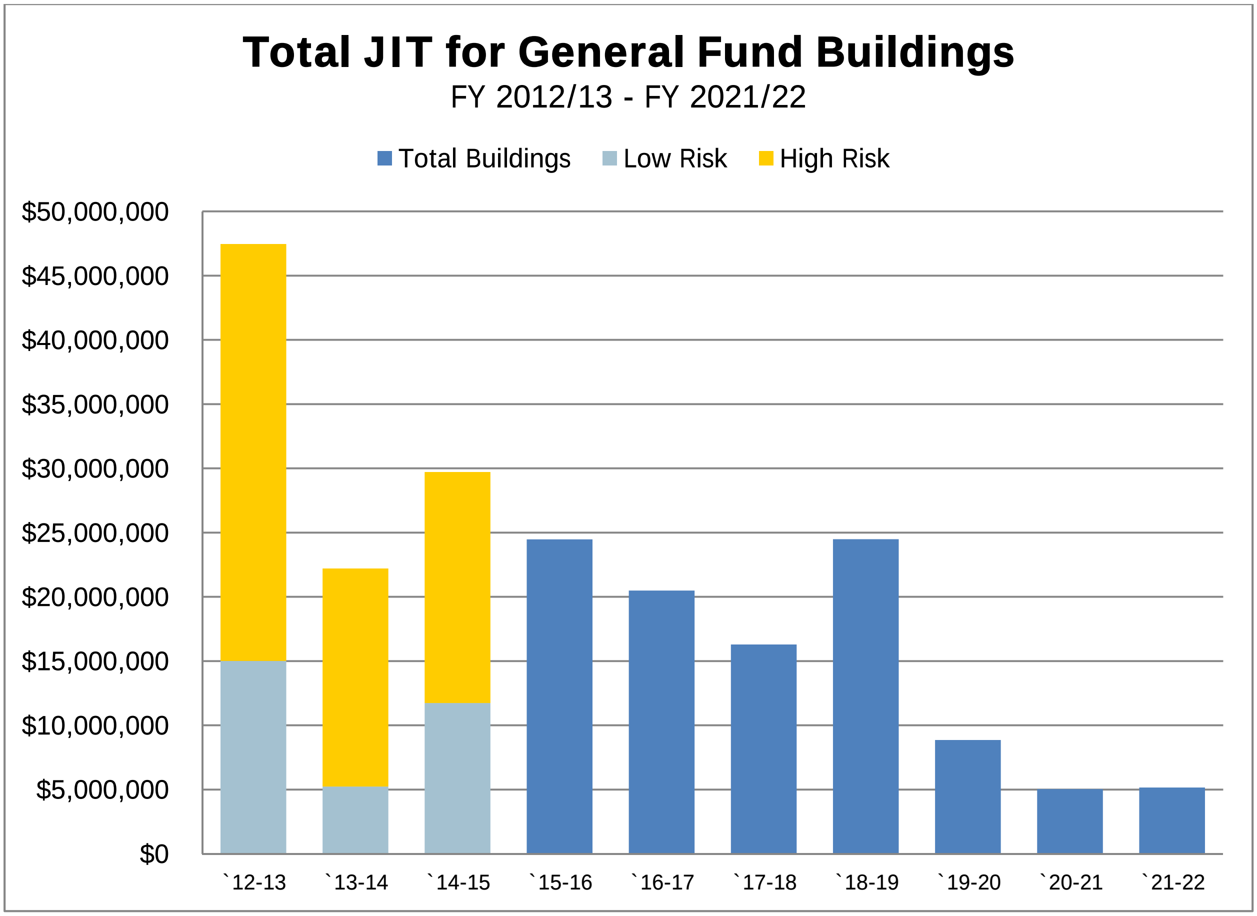



**Figure 4.** *Annual General Fund JIT Needs for 2012-13 through 2021-22 for General Fund Buildings with the First Three Years Sorted by High and Low Risk.*

The largest amount of JIT needs for the next 10 years is in the buildings category, which consists of three components: the building envelope, building interior, and building systems. Of those, the building systems component, which includes such things as heating, ventilation, and cooling systems (HVAC), chillers, elevators, and roofing, has the greatest funding requirement. Examples of large expenditures anticipated within the next ten fiscal years include replacement of the deteriorating metal exterior siding on the Clinical Center for $ 4 million in Fiscal Year 2013 and two chillers in the Engineering Building for $4 million in Fiscal Year 2015.

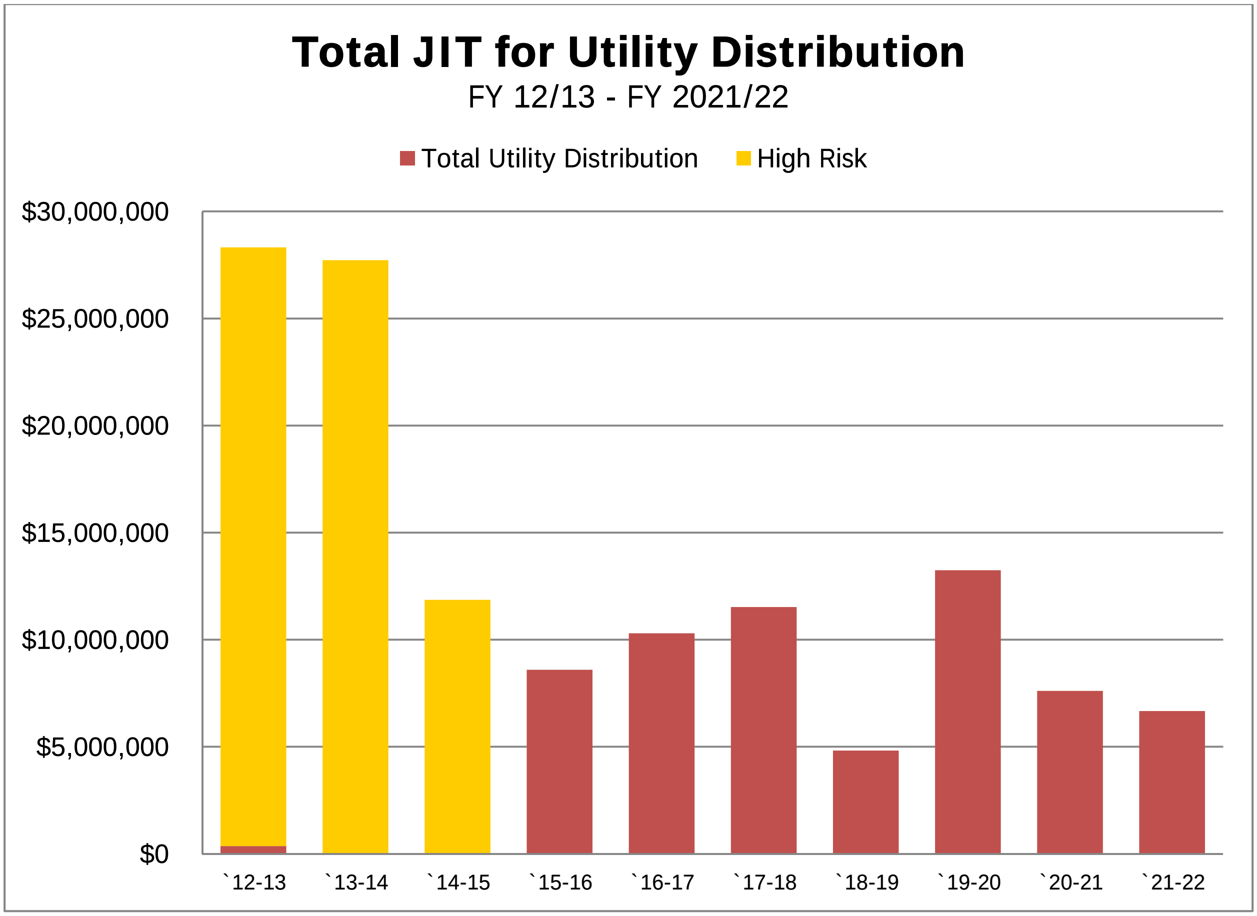



**Figure 5.** *Annual General Fund JIT Needs for 2012-13 through 2021-22 for Utility Distribution with the First Three Years Reflecting All High Risk Needs.*

The utility distribution category, which includes both steam and electrical distribution to the campus, has the next highest amount of funding requirements over the next ten fiscal years. As shown in figure 5, most of the JIT projects for the next three fiscal years are considered high risk needs. Many of the utility distribution needs occur from Fiscal Year 2012 through 2015, with much of the attention focused on campus steam tunnel and communication systems.

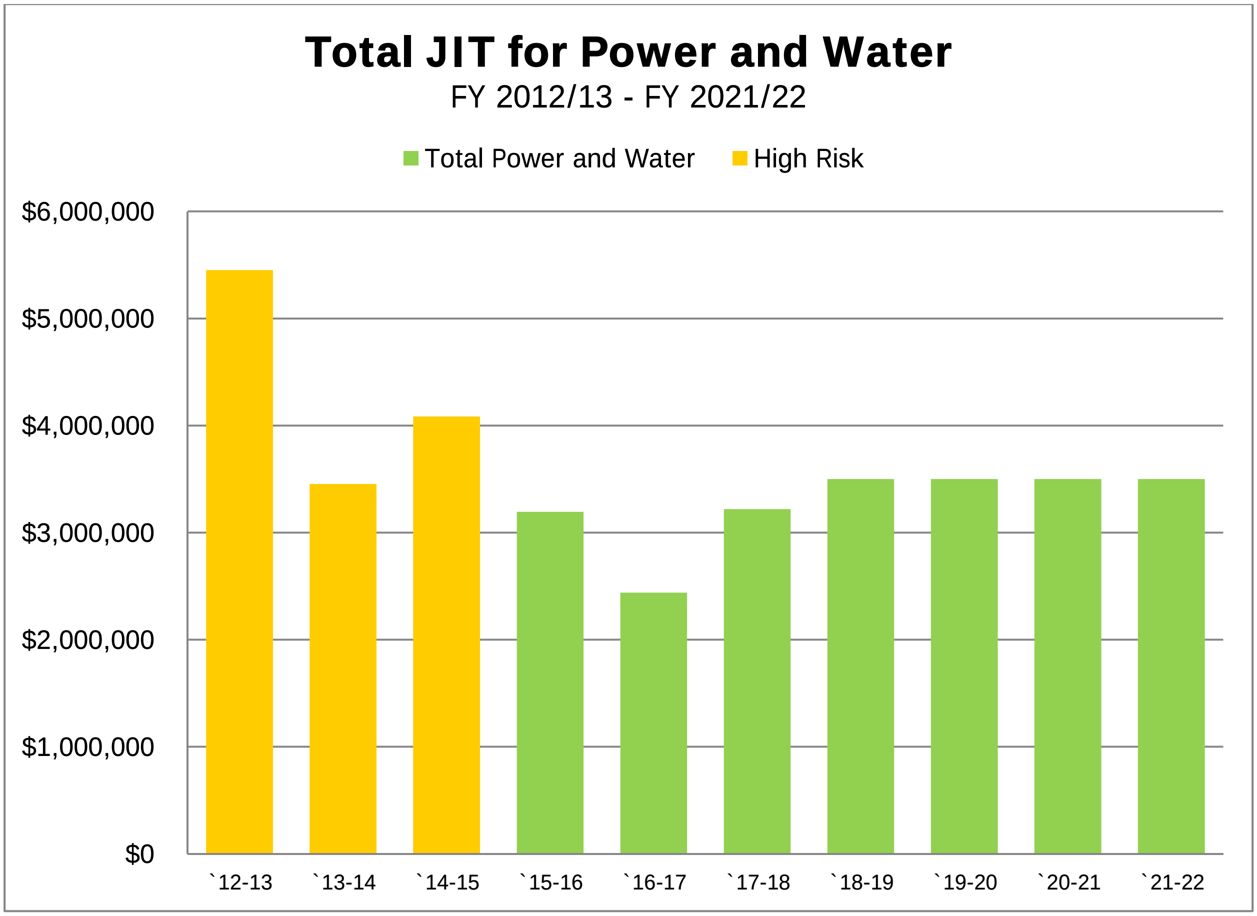



**Figure 6.** *Annual General Fund JIT Needs for 2012-13 through 2021-22 for Power and Water with the First Three Years Reflecting All High Risk Needs.*

The JIT power and water category remains relatively stable over the next ten years, averaging between $2 and $6 million per year. However, the JIT needs for the next three fiscal years are all considered high risk, as shown in figure 6.  Examples of power and water JIT projects include work on turbines, generators, and wells.

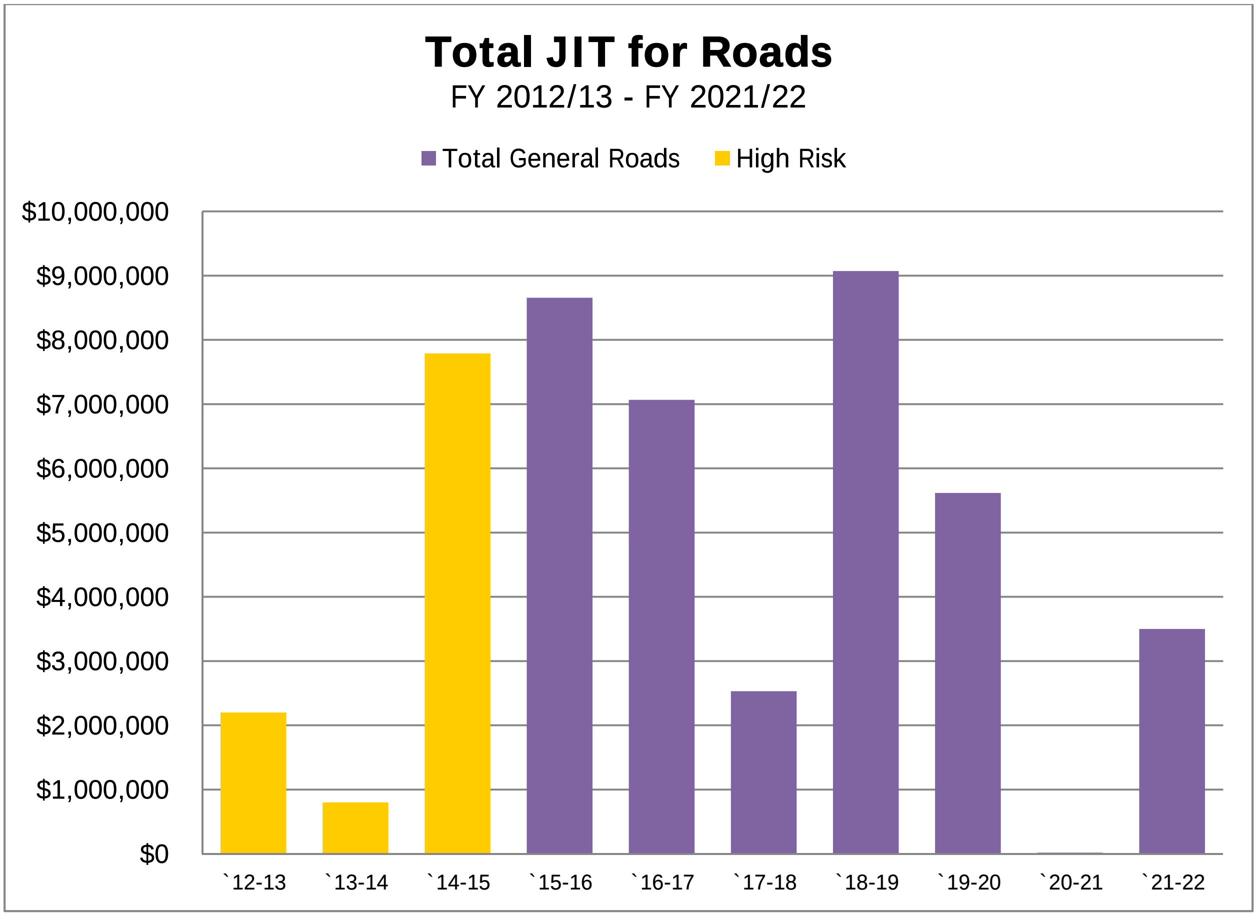



**Figure 7.** *Annual General Fund JIT Needs for 2012-13 through 2021-22 for Roads with the First Three Years Reflecting All High Risk needs.*

Figure 7 shows that all JIT projects in the roads category for the next three fiscal years are considered high risk, with a significant amount occurring in Fiscal Year 2015. Based on road condition assessments, Fiscal Years 2015 through 2017 are projected to be the years with the most in JIT needs. Decisions will have to be made as to whether to reconstruct some or all of these roads, which will reduce maintenance costs in the long run, or to mill and cap the existing road surface at a lower initial cost, but with a much shorter interval between maintenance cycles. Roads which have previously been reconstructed to current standards can usually be maintained at a much lower cost because they have been designed to support the traffic loads present today. As a result, the JIT need for campus roads will be less in the future as the road system is rebuilt, and the timing of maintenance can be more reliably estimated based on pavement life expectancy.

*JIT Funding*

A substantial effort has been made to address general fund JIT needs over the past five fiscal years. Figure 8 shows funding allocations by category.

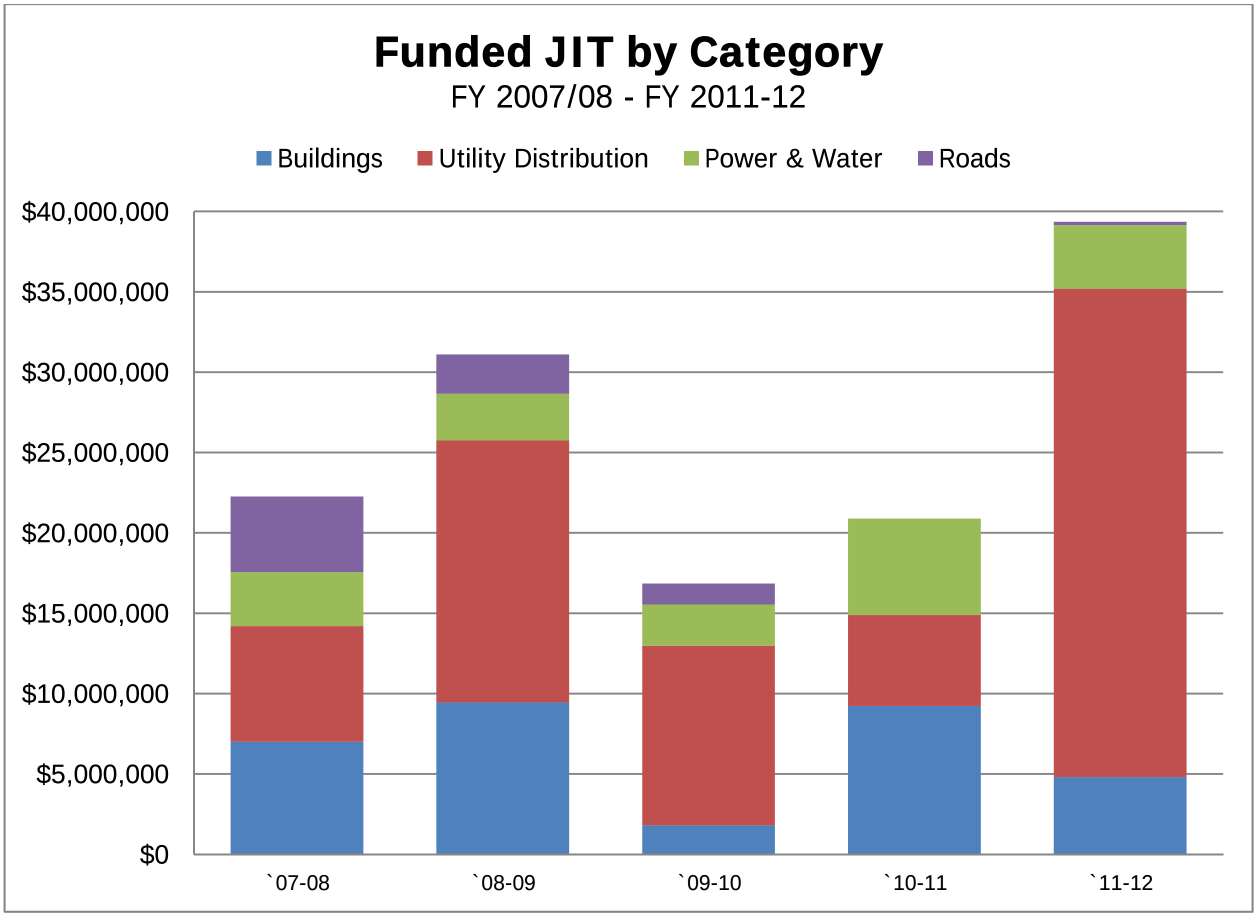



**Figure 8.** *Amount of Funding for JIT Projects Over the Past Five Fiscal Years by General Fund Category.*

As Figure 8 shows, funding for JIT projects over the last five fiscal years has been more than $130 million, but the amount per year has fluctuated. Fiscal Year 2012 had the largest amount funded of any of the years, with over $39 million. The Endowment Trusts are a funding source for the JIT needs. Over the past five years, the endowment performance of the trusts has impacted the available funds.

Utility distribution projects received the most funding over the past five fiscal years with a total of over $70 million. Much of that funding went to the campus steam tunnel projects which are still ongoing.

The buildings category also received a large amount of the funding for JIT projects over the past five fiscal years. The majority of this funding went to projects addressing mechanical systems needs.

The power and water category had over $18 million worth of projects funded while the roads category had over $8 million of funding.

*Residential and Hospitality Services*

Residential and Hospitality Services (RHS) also keeps data on the JIT needs of their infrastructure. While the same criteria and guidelines are used to project JIT needs for all infrastructure components, RHS buildings are also uniquely dependent on marketability as a factor in the assessment of their facilities. As a result, many furnishings, fixtures, and equipment appear as JIT items for RHS facilities that would not appear on the list for facilities supported by the general fund. In addition, the “risk based” approach has not been used to assess RHS JIT needs the way that it has with the general fund became because adequate funding has been available to address needs.

The 20-year JIT forecast for RHS facilities is $412 million. Figure 9 shows the RHS JIT needs for the next 20 fiscal years.

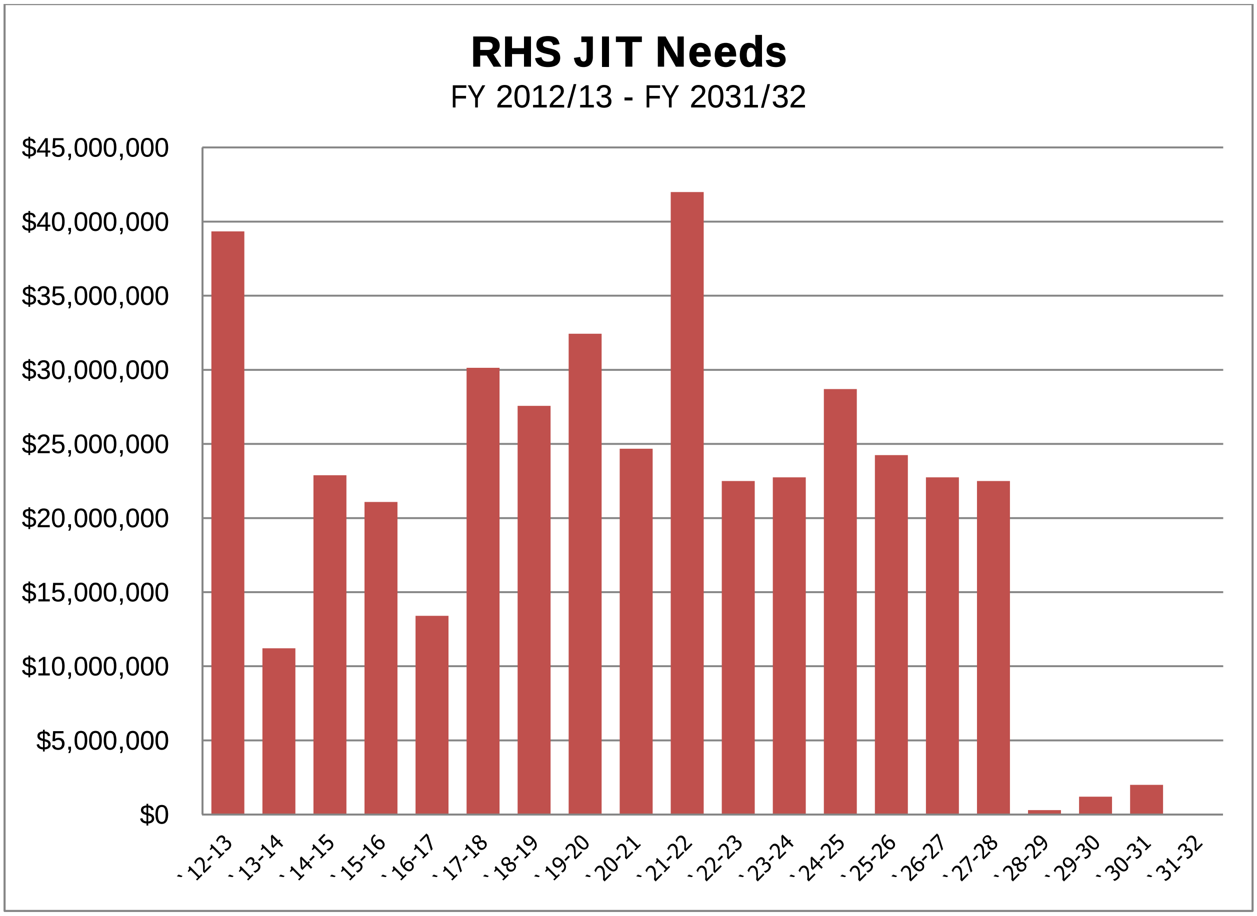



**Figure 9.** *Annual RHS JIT Needs for Next 20 Fiscal Years*.

Five categories make up JIT for RHS: architectural, mechanical, electrical, renovations, and fixtures. Figure 10 provides more detail of the issues facing RHS as the next 10 years of JIT needs are sorted by category.

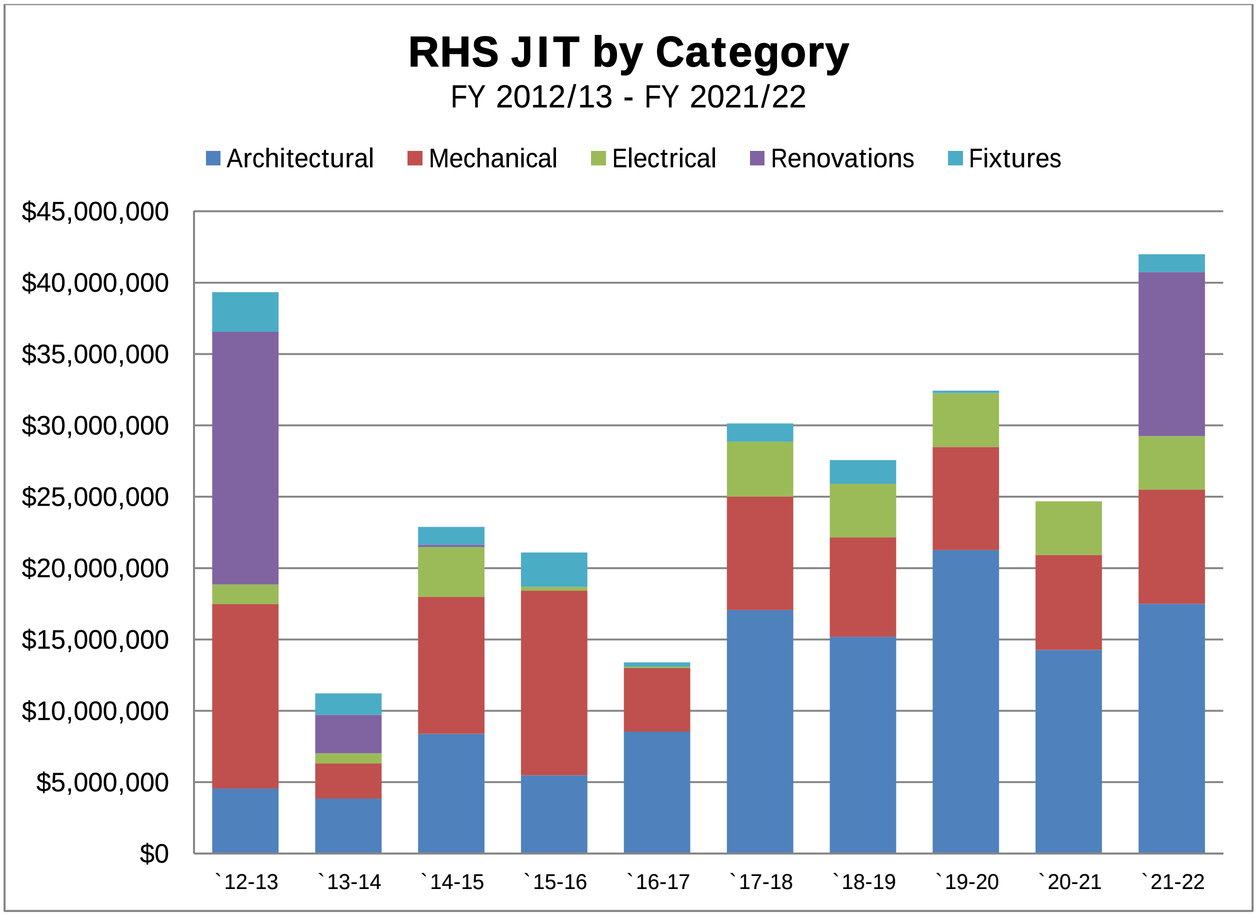



**Figure 10.** *Annual RHS JIT Needs for 2012-13 through 2021-22 for Architectural, Mechanical, Electrical, Renovations, and Fixtures*.

The majority of JIT needs for RHS over the next ten fiscal years are in the architectural category, although Fiscal Year 2013 shows a large amount of renovation projects. Timing RHS renovations projects to address JIT needs as they become a priority is essential to avoid major failures. If critical systems are projected to fail earlier than planned, then timely decisions to address those changing conditions must be made and funding sources identified.

**Future Directions**

Having data that reflects the JIT need for both 10 and 20 years into the future provides the opportunity to remedy various infrastructure issues before they become a liability to the campus. The ability to analyze the next ten fiscal years of JIT needs by category brings attention to some potential problems that must be addressed in the near future to ensure minimal disruption of the business operation of the campus.

The “risk based” approach to managing JIT has helped to identify the most critical of needs requiring attention; however, the lower risk JIT needs should not be ignored because they are shifted into future years when funding is not available. Eventually, some of these needs will become high risk projects and will have to be considered when making future funding decisions.

Significant attention must be given to building mechanical systems over the next 10 fiscal years, as these projects account for the greatest JIT funding requirement in the buildings category.

As work continues on the campus steam tunnel system over the next couple of years, exploring whether other JIT projects in the vicinity of the steam tunnel construction should be combined with the steam project to save money and reduce disruption to the campus will become important.

With a substantial number of JIT projects in the roads category for Fiscal Years 2015 through 2017 and again in 2019, decisions will need to be made as to whether a complete reconstruction of these roads is needed, with the possibility of disruptions to traffic on campus, or if milling and capping the road surfaces will suffice.

The summary of JIT requirements shows the financial challenges that must be met to preserve the university’s infrastructure framework. Although many infrastructure components may continue to operate, the likelihood of a disruptive failure grows yearly, due to their age and deteriorating condition. A critical need for JIT funding will occur over the next five fiscal years. During these years, the components of many buildings and systems constructed in the 1950s and 1960s will reach the end of their adjusted life cycle.

# CONSTRUCTION

## Summary

Adequate facilities are vital for Michigan State University (MSU) to perform its mission of education, research, and outreach. The university continues to invest heavily in design and construction projects. Approximately $109 million, or 6%, of the university's $1.85 billion expenditures in 2010-11 were for design or construction.

Michigan State University's construction performance and delivery of projects continues to improve in many areas. Ninety-three percent of projects met the planned substantial completion date during Fiscal Year 2010-11, and approximately 98% of all closed projects were within budget.

The annual Construction Report reviews completed projects as part of a required reporting process for MSU's Board of Trustees. This report is included in Appendix A and lists 41 major and minor capital projects, with a total value of nearly $85 million, which were closed in fiscal year 2010-11. These projects were completed 5.3% under budget, on average, resulting in the return of approximately $4.5 million to the original funding sources.

## Analysis

*Schedule Performance Analysis and Final Completion Trend*

Michigan State University emphasizes schedule requirements by setting substantial completion dates with MSU clients, specifying those requirements in the bid documents, and thus holding contractors to a high standard of compliance. Engineering and Architectural Services is using more demanding schedule specifications for most large projects and has emphasized schedule importance at contractor and consultant forums. Substantial completion requires that a project is usable for its intended purpose (e.g., a road intersection is open, classes or research can be conducted in a laboratory, or an elevator is permitted to carry passengers). Figure 1 shows that 38 of 41 projects (93%) met substantial completion on time or ahead of schedule compared to 90% and 86% in 2008-09 and 2009-10, respectively. While three projects did not meet substantial completion, university operations were not impacted.

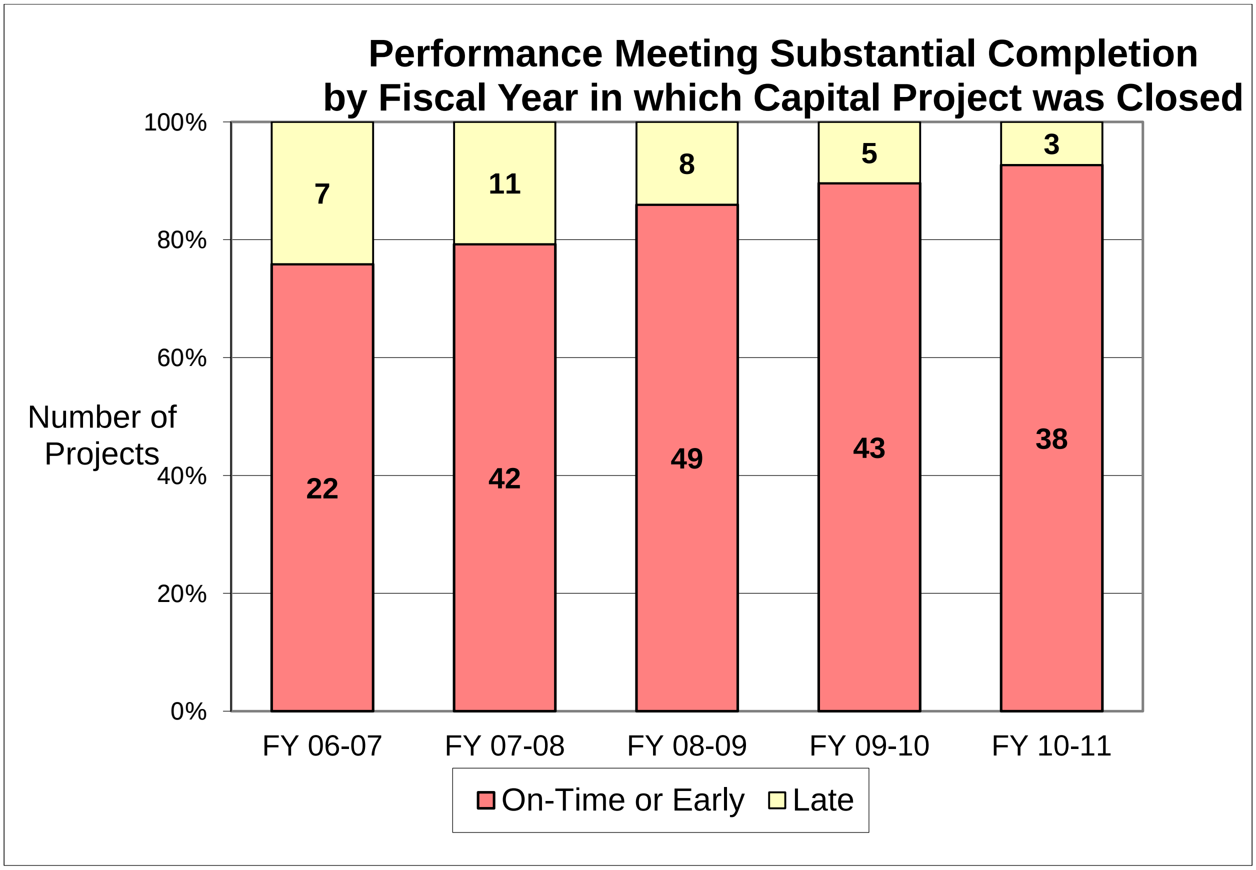



**Figure 1.** *Schedule Performance for Meeting Substantial Completion.*

Final completion is the task of closing out a project. It requires that all work be completed, no unpaid expenses remain, and any unused funds be returned. A number of factors can hinder timely final completion. The university performs many work functions on a construction project, including landscaping, procurement of furnishings and equipment, and computer and telecommunication networking. Because of the normal sequencing of construction, these functions tend to occur toward the end of a project. Many projects have not had realistic schedules for accomplishing these activities. While strides have been made in recent years to improve the accuracy of budgets for these activities, MSU is still refining the scheduling of these functions to deliver them efficiently to individual projects. In many ways, the closeout process is controlled by the inputs at the beginning of the project, including realistic schedules and budgets, along with a clear understanding of the entire scope of MSU-performed work.

In order to be successful in timely project completion, university- performed work must be fully integrated into the planning schedule. The university is putting forth greater efforts to accurately identify and perform MSU work on schedule. Planning is done in advance of construction activities and with consideration of MSU performed tasks, rather than waiting for the completion of all other field activities. Campus Planning and

Administration and EAS meet regularly to review the status of projects that are substantially complete and to communicate the status with customers and stakeholders.

Slightly more than half of the projects closed during Fiscal Year 2008-09 met final completion on schedule, a modest improvement from the prior year. In 2009-10, the number of projects that met final completion increased significantly. Nearly 80% of all projects met the required final completion date. While the trend has indicated continuous improvement in this area, the number of projects that met the planned final completion date decreased in 2010-11. By closing projects more quickly, funding can return to the original source in a timely manner and be used for other university needs. Figure 2 displays the results of the last five fiscal years. In 2010-2011, there were sixteen projects that did not meet the final completion date. Some of these projects were delayed in completion to ensure they were functioning as designed, which caused delays past planned final completion. It is important to set a realistic final completion date, and projects that continue beyond final completion are reviewed in an effort to minimize schedule risk and continuously improve schedule performance on future projects. There are five projects that continued beyond final completion that warrant further comment. The Engineering Research Complex had HVAC system problems caused by faulty contractor work, and the Spartan Stadium east upper stands repair project also missed the final completion due to contractor error. The Duffy Daugherty Football Complex had continuous construction scope additions that kept the project open past its planned final completion date, as did the Chemistry addition. The Wilson Road project missed the final completion date due to seasonal limitations for on-site work and landscaping being performed by MSU Landscape Services.

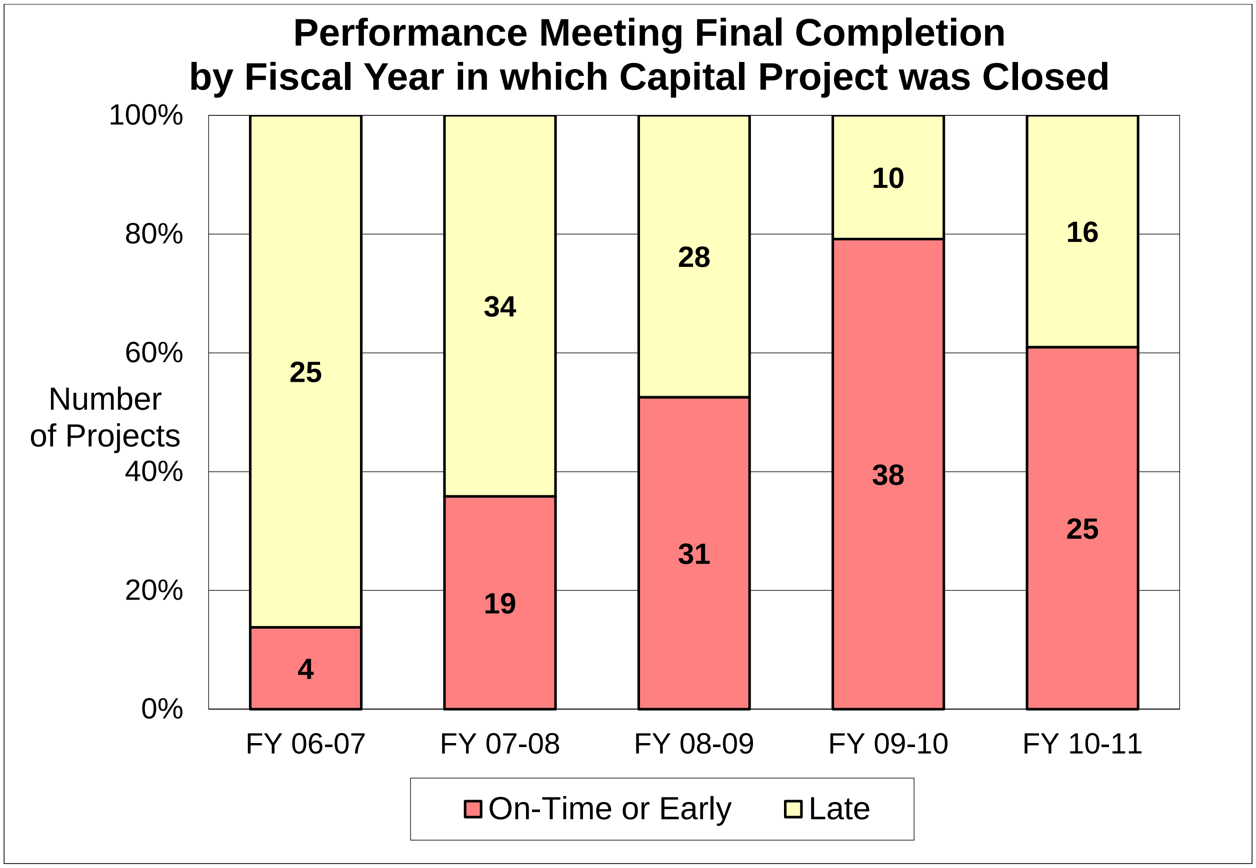



**Figure 2.** *Schedule Performance for Meeting Final Completion.*

In April 2008, the School of Planning, Design, and Construction (SPDC) completed a study evaluating the MSU project close-out process. Timelier project close-out was found to benefit all project stakeholders, including the MSU user, project implementation team, contractors, and designers. One recommendation was to track the project close-out process in two segments: 1) T1, which is the time period from substantial completion to final payment to the contractor, and 2) T2, which is the period from final payment to final closeout of the project. Figure 3 displays the average close-out duration for capital projects by the T1 and T2 categories, for the last five fiscal years. Close-out time significantly increased in Fiscal Year 2010-11. This is principally a product of the five projects listed in the prior section, which averaged 975 days to close. Two of these projects had performance issues with the contractor or building, and two had remained open to allow all external funds to be used. The final project was delayed completing site work. If these projects are excluded, the close-out duration would be 450 days on average, which is consistent with FY 2006-07 through FY 2008-09.

MSU categorizes capital projects by size, with those over $1 million in value or requiring a building footprint change categorized as major, and with those ranging from $250,000 to $1 million in value categorized as minor. The average for all major and minor projects represents a reasonable amount of time for a large scale project to be closed out. However, when analyzed by project size, the close-out times appear to be very different. A logical assumption is that most projects that are larger and more complicated would take more time to close out. The average time to close out a major project, those over $1 million in value, indeed took substantially more time than minor projects under $500,000 in value. The timeframe to bring projects to final payment (T1), and then to close out (T2) increased incrementally with the size of the project.  Figures 4-6 illustrate the timeframes to bring projects to closure when analyzed by project size.

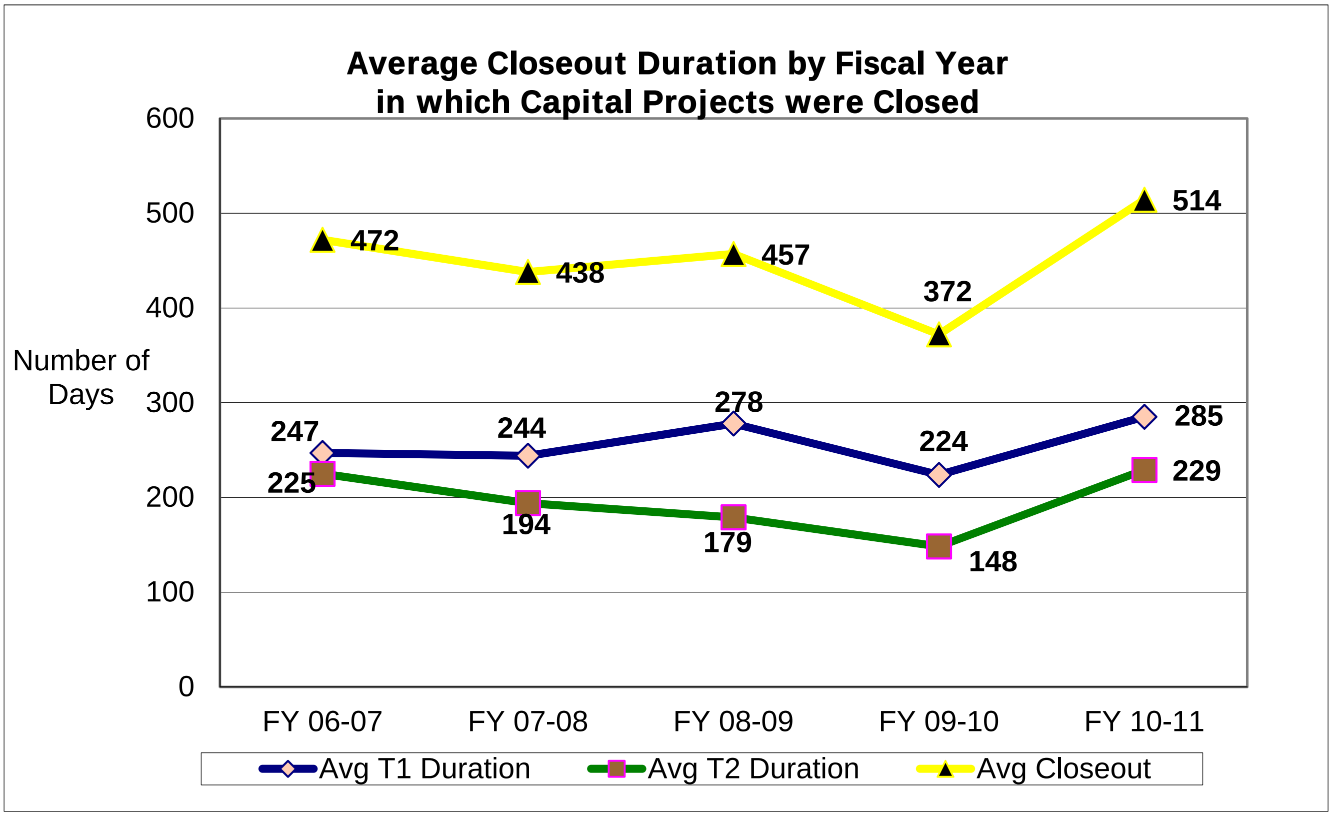



**Figure 3.** *Substantial and Final Completion Performance.*

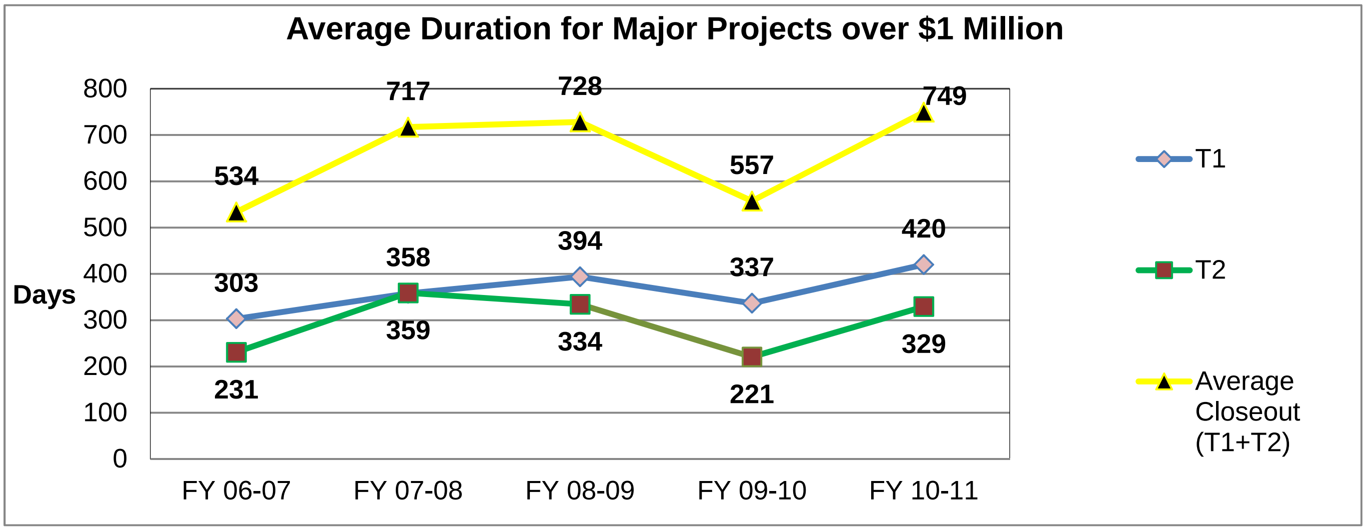



**Figure 4.** *Substantial and Final Completion Performance.*

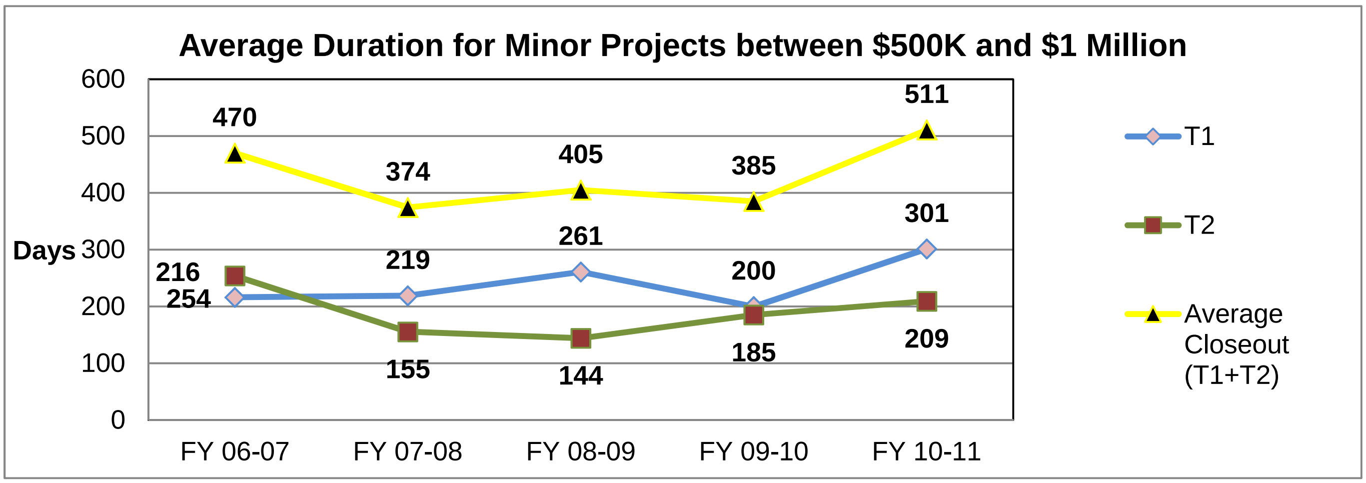



**Figure 5.** *Substantial and Final Completion Performance.*

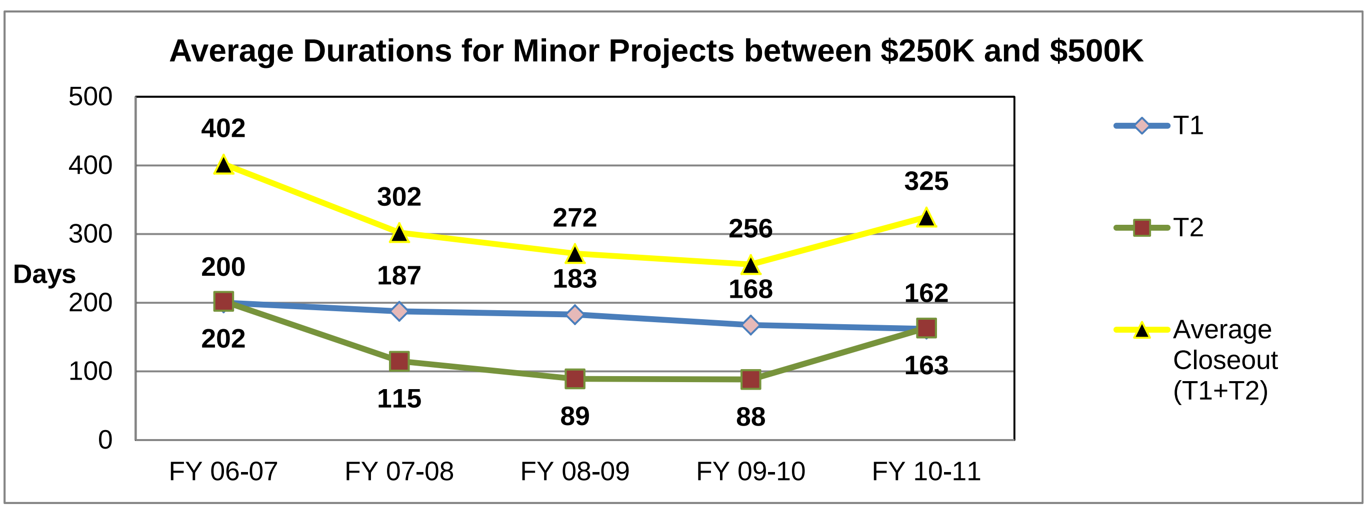



**Figure 6.** *Substantial and Final Completion Performance.*

The quality and cost of a project are of equal importance to schedule. The goal of measuring T1 or T2 is to close out all projects in as timely a manner as possible, without sacrificing quality or cost. The T1 duration should allow enough time for proper diligence to negotiate final costs of all change orders, complete all punch list work to the desired quality, and perform any required seasonal functional testing. The T2 duration should allow enough time for all seasonal work, functional testing, and evaluation to be performed as required. As Skire project management software continues to be implemented, MSU hopes that closeout requirements will be further automated, allowing more accurate project tracking and continued improvement with the end result of returning unused funds to MSU sources more quickly.

A direct correlation exists between budget performance and schedule performance on most projects. A well-managed project generally meets the project goals for both. Figure 10 shows aggregate schedule and cost information, by fiscal year, on a single graph. It assesses the overall project closeout performance. This result demonstrates that the final completion, while higher than in previous years, still has room for improvement. Over 97% of projects were completed within budget, and 93% met substantial completion. While final completion took a step backwards, meeting substantial completion continues to improve, and once again, 97% of projects were within budget. A number of factors could have resulted in the increased duration to reach final completion. They could include construction volume or workload of the project management staff, including the addition of the FRIB staffing requirements. One individual project closed over budget by a negligible amount ($31), having no impact on construction activity. Figure 7 illustrates the correlation between cost and schedule performance by fiscal year.

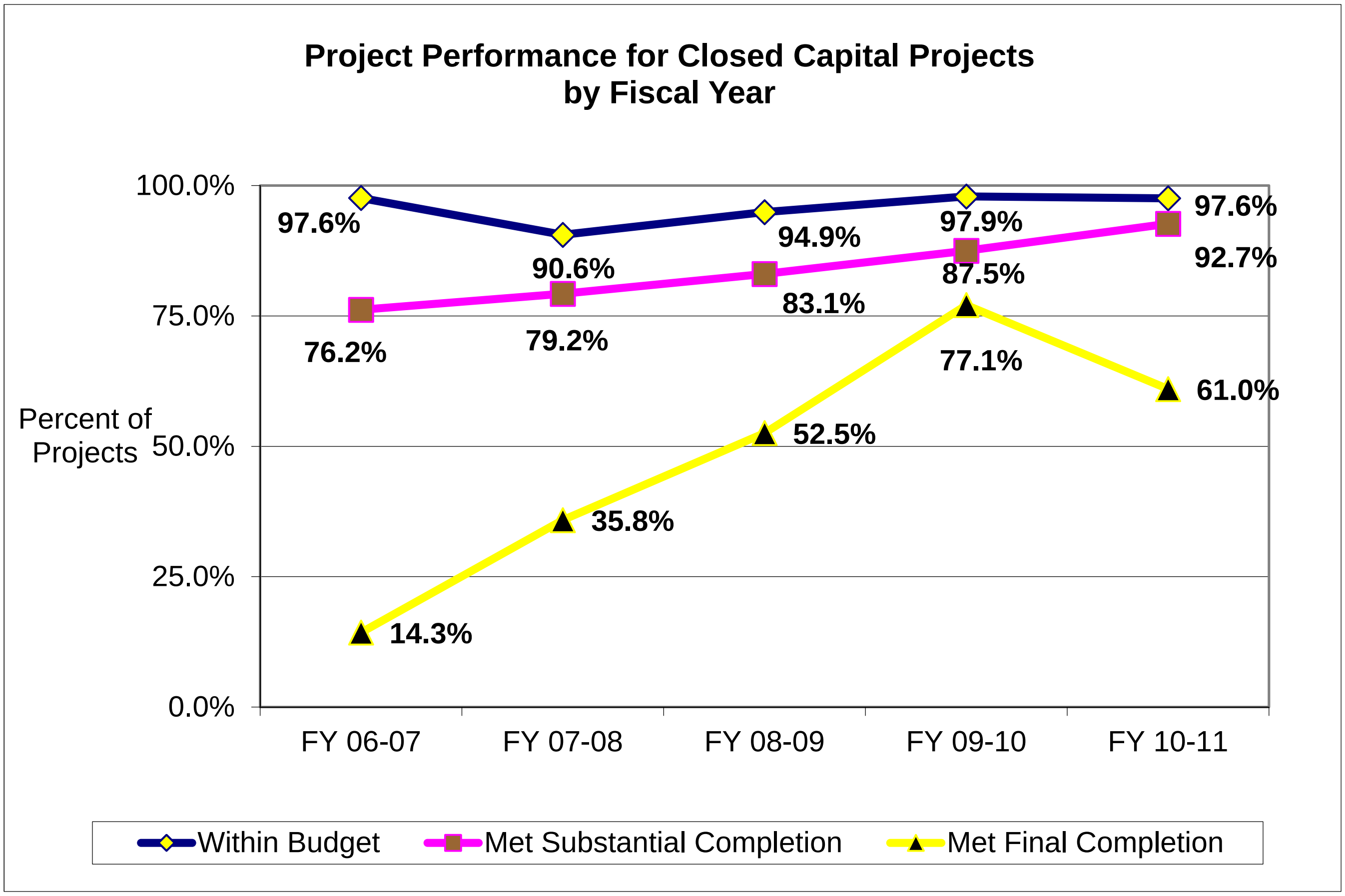



**Figure 7.** *Schedule and Cost Performance.*

*Completed Projects and Funds Returned*

Major capital improvement and construction projects are tracked through the Facilities Asset Management Information System (FAMIS) and Skire Unifier Project Management Software (PMS). This PMS provides timely and accurate project information, and creates a reporting mechanism for project performance as a whole. The data offers an opportunity to analyze strengths and weaknesses in the management and delivery areas of construction projects. This analysis can be used to evaluate means and methods and to improve upon processes. As the projects continue to increase in volume and complexity, MSU examines processes and implements improvements in the project management practice to engage designers, contractors, and the campus community.

Table 1 summarizes the projects which have been completed and referred to as closed. Fiscal Year 2010-11 has approximately 15% fewer projects compared to Fiscal Year 2009-10. In 2010-11, 5.3% of funding was returned to the source at project close, slightly higher than the 4.6% average over the prior four years.

**Table 1.** *Budget for Major and Minor Closed Capital Projects, by Fiscal Year.*

| Budget for Closed Projects | FY 06-07 | FY 07-08 | FY 08-09 | FY 09-10 | FY 10-11 |
|---|---|---|---|---|---|
| Authorized Budget: | $52,928,587 | $77,483,334 | $206,398,900 | $139,244,363 | $84,843,838 |
| Final Cost: | $50,353,767 | $75,836,038 | $198,930,659 | $132,931,212 | $80,362,824 |
| Returned: | $2,574,820 | $1,647,296 | $14,890,367 | $6,313,151 | $4,481,014 |
| % Returned: | 4.9% | 2.1% | 7.2% | 4.5% | 5.3% |
| Construction Contract: | $41,163,906 | $59,658,023 | $164,066,096 | $109,341,206 | $59,054,199 |
| **Number of Projects Closed** | **29** | **53** | **59** | **48** | **41** |

Table 2 illustrates the funding returned for projects when separated by project size. The chart represents three divisions, projects over $1 million, between $500,000 and $1 million, and from $250,000 to $500,000. The percentage of funds returned tends to be higher on the smaller projects. This reflects a need to carry a higher percentage of contingency when performing smaller jobs. A single change order or multiple change orders can have a much larger impact on a project that is small in size, depending on the magnitude of the change. In contrast, a single change order on larger projects tends to not commit contingency funding to a level that would require a budget adjustment to cover the costs of the changes.

**Table 2.** *Summary of Funds Returned for Projects Closed in Fiscal Year 09-10, by Project Size.*

| Budget for Closed Major Projects (Greater Than $1 Million) | FY 06-07 | FY 07-08 | FY 08-09 | FY 09-10 | FY 10-11 |
|---|---|---|---|---|---|
| Authorized Budget: | $42,594,087 | $53,557,235 | $186,600,978 | $121,962,000 | $69,550,000 |
| Final Cost: | $40,114,332 | $51,962,466 | $178,613,769 | $117,099,199 | $66,975,836 |
| Total Returned: | $2,479,755 | $1,594,769 | $7,987,209 | $4,862,801 | $2,574,164 |
| Total % Returned: | 5.8% | 3.0% | 4.3% | 4.0% | 3.7% |
| **Number of Major Projects Closed** | **11** | **13** | **21** | **13** | **11** |
| **Budget for Closed Minor Projects Between $500K and $1 Million** | **FY 06-07** | **FY 07-08** | **FY 08-09** | **FY 09-10** | **FY 10-11** |
| Authorized Budget: | $6,116,000 | $15,965,599 | $13,154,000 | $9,326,363 | $8,105,838 |
| Final Cost: | $5,594,299 | $14,581,544 | $12,427,400 | $8,743,434 | $7,630,527 |
| Total Returned: | $521,701 | $1,384,055 | $726,600 | $582,929 | $475,311 |
| Total % Returned: | 8.5% | 8.7% | 5.5% | 6.3% | 5.9% |
| **Number of Major Projects Closed** | **8** | **20** | **18** | **13** | **10** |
| **Budget for Closed Minor Projects Between $250K and $500K** | **FY 06-07** | **FY 07-08** | **FY 08-09** | **FY 09-10** | **FY 10-11** |
| Authorized Budget: | $4,218,500 | $7,960,500 | $7,559,079 | $7,956,000 | $7,188,000 |
| Final Cost: | $3,716,016 | $7,335,889 | $7,046,400 | $7,088,579 | $5,756,462 |
| Total Returned: | $502,484 | $624,611 | $512,679 | $867,421 | $1,431,538 |
| Total % Returned: | 11.9% | 7.8% | 6.8% | 10.9% | 19.9% |
| **Number of Major Projects Closed** | **10** | **20** | **20** | **22** | **20** |

Table 3 summarizes the contingency use for the 48 projects closed in Fiscal Year 2009-10.

As is typical, the construction contract, work by owner, and design costs have the largest impact on project contingency. As an aggregate, these projects returned over one half of the project contingency to the university. Having an effective, timely closeout process is important to release and return funds to be repurposed. An analysis of closeout times is reviewed later in this section.

**Table 3.** *Contingency Use Summary.*

| Description | *Authorized Budget* | *Total Cost* | *Dollars (Over) / Under Budget* | *Percent (Over) / Under Budget* | *Percent of Contingency Used* |
|---|---|---|---|---|---|
| CONTRACT | $53,635,581 | $59,054,199 | ($5,418,618) | (10.1%) | 64.2% |
| DESIGN | $7,430,913 | $7,448,129 | ($17,216) | (0.2%) | 0.2% |
| PROJECT ADMINISTRATION | $1,621,072 | $1,620,153 | $919 | 0.1% | 0.0% |
| PROJECT DEVELOPMENT COSTS | $376,749 | $445,136 | ($68,387) | (18.2%) | 0.8% |
| CONSTRUCTION BY OWNER | $9,067,109 | $7,792,052 | $1,275,057 | 14.1% | -15.1% |
| MOVEABLE FURNISHINGS AND EQUIPMENT | $4,272,344 | $4,003,155 | $269,189 | 6.3% | -3.2% |
| CONTINGENCY | $8,440,070 | | $3,959,056 | | |
| **Total Projects: 41** | **$84,843,838** | **$80,362,824** | **$4,481,014** | **5.3%** | **46.9%** |

Commonly, the contract category consumed the largest share of contingency. Contingency usage in this category was roughly proportionate with the contract share of the budget. While representing a small portion of project budgets, project development costs were over budget. Quite often, costs were apparently not budgeted or were applied to the wrong categories. Campus Planning and Administration and Engineering and Architectural Services continue to refine the budgeting process to provide better value and more reliability to the campus.

Table 4 provides a breakdown of the individual budget line items allocated for each major project. The intent is to focus on areas of concern and build more reliable budgets for projects during the planning stages.

**Table 4.** *Line Item Contingency Use Summary.*

| Budget Code | Description | *Authorized Budget* | *Total Cost* | *Money (Over)/Under Budget* | *Percent (Over)/ Under Budget* | *Percent of Contin-gency Used* | *# Projects Over for Line Item* | *Percent Over For Line Item* |
|---|---|---|---|---|---|---|---|---|
| 105 | CONTRACTS (CONSTRUCTION) | 26,122,055 | 28,538,026 | (2,415,971) | -9.2% | 28.6% | 27 | 65.9% |
| 110 | PREPURCHASED EQUIPMENT | 370,832 | 382,484 | (11,652) | -3.1% | 0.1% | 2 | 4.9% |
| 180 | CONSTRUCTION MANAGEMENT (AT RISK) | 25,556,017 | 28,237,047 | (2,681,030) | -10.5% | 31.8% | 5 | 12.2% |
| 185 | CONSTRUCTION MANAGEMENT (AGENCY) | 0 | 0 | 0 | N/A | 0.0% | 0 | 0.0% |
| 190 | DESIGN/BUILD | 1,409,347 | 1,512,852 | (103,505) | -7.3% | 1.2% | 1 | 2.4% |
| 195 | CONTRACT OTHER | 177,330 | 383,790 | (206,460) | -116.4% | 2.4% | 9 | 22.0% |
| 205 | DESIGN (CONSULTANT) | 5,220,998 | 5,181,640 | 39,358 | 0.8% | 0.0% | 11 | 26.8% |
| 210 | E + A SERVICES (DESIGN) | 1,814,344 | 1,840,647 | (26,303) | -1.4% | 0.3% | 7 | 17.1% |
| 215 | CP+P (DESIGN) | 0 | 5,795 | (5,795) | N/A | 0.1% | 1 | 2.4% |
| 220 | TELECOM (DESIGN) | 103 | 103 | 0 | 0.0% | 0.0% | 0 | 0.0% |
| 225 | HAZMAT (SURVEY + DESIGN) | 129,715 | 87,276 | 42,439 | 32.7% | 0.0% | 0 | 0.0% |
| 230 | INTERIOR DESIGN (DESIGN) | 3,500 | 0 | 3,500 | 100.0% | 0.0% | 0 | 0.0% |
| 295 | DESIGN OTHER | 262,253 | 332,668 | (70,415) | -26.9% | 0.8% | 6 | 14.6% |
| 305 | CGA | 455,594 | 455,594 | 0 | 0.0% | 0.0% | 0 | 0.0% |
| 310 | E + A SERVICES (INSPECTION) | 710,164 | 692,111 | 18,053 | 2.5% | 0.0% | 2 | 4.9% |
| 315 | CP+P (INSPECTION) | 0 | 0 | 0 | N/A | 0.0% | 0 | 0.0% |
| 325 | HAZMAT (AIR MONITORING) | 135,000 | 65,056 | 69,944 | 51.8% | 0.0% | 1 | 2.4% |
| 330 | COMMISSIONING | 319,314 | 407,392 | (88,078) | -27.6% | 1.0% | 15 | 36.6% |
| 335 | STATE DMB FEE | 0 | 0 | 0 | N/A | 0.0% | 0 | 0.0% |
| 395 | PROJECT ADMINISTRATION OTHER | 1,000 | 0 | 1,000 | 100.0% | 0.0% | 0 | 0.0% |
| 405 | PRINTING + ADVERTISING | 55,738 | 89,358 | (33,620) | -60.3% | 0.4% | 22 | 53.7% |
| 410 | SURVEYS (SITE, ENVIRONMENTAL, ETC.) | 90,240 | 58,740 | 31,500 | 34.9% | 0.0% | 1 | 2.4% |
| 415 | SOIL BORINGS | 1,845 | 0 | 1,845 | 100.0% | 0.0% | 0 | 0.0% |
| 420 | TESTING | 47,600 | 9,078 | 38,522 | 80.9% | 0.0% | 1 | 2.4% |
| 425 | MICHIGAN OFFICE OF FIRE SAFETY | 9,230 | 0 | 9,230 | 100.0% | 0.0% | 0 | 0.0% |
| 430 | PERMITS | 2,200 | 365 | 1,835 | 83.4% | 0.0% | 1 | 2.4% |
| 495 | PROJECT DEVELOPMENT COSTS OTHER | 169,896 | 287,595 | (117,699) | -69.3% | 1.4% | 10 | 24.4% |
| 505 | PHYSICAL PLANT SHOPS | 5,721,721 | 5,176,616 | 545,105 | 9.5% | 0.0% | 15 | 36.6% |
| 510 | CUSTODIAL (CLEANING, EQUIPMENT) | 24,260 | 3,518 | 20,742 | 85.5% | 0.0% | 5 | 12.2% |

| Budget Code | Description | Authorized Budget | Total Cost | Money (Over)/Under Budget | Percent (Over)/ Under Budget | Percent of Contin-gency Used | # Projects Over for Line Item | Percent Over For Line Item |
|---|---|---|---|---|---|---|---|---|
| 515 | SITE WORK - GROUNDS | 478,910 | 395,913 | 82,997 | 17.3% | 0.0% | 6 | 14.6% |
| 520 | TELECOM | 416,835 | 437,754 | (20,919) | -5.0% | 0.2% | 7 | 17.1% |
| 525 | COMPUTER LAB | 51,270 | 37,016 | 14,254 | 27.8% | 0.0% | 3 | 7.3% |
| 530 | INTERIOR DESIGN | 2,119,998 | 1,551,573 | 568,425 | 26.8% | 0.0% | 4 | 9.8% |
| 535 | RECYCLING AND WASTE MGT | 25,340 | 5,197 | 20,143 | 79.5% | 0.0% | 5 | 12.2% |
| 540 | IMC | 60,440 | 38,974 | 21,466 | 35.5% | 0.0% | 2 | 4.9% |
| 545 | DPPS | 18,553 | 3,240 | 15,313 | 82.5% | 0.0% | 2 | 4.9% |
| 550 | MOVING + SET UP | 46,082 | 25,873 | 20,209 | 43.9% | 0.0% | 4 | 9.8% |
| 595 | CONSTRUCTION BY OWNER OTHER | 103,700 | 116,378 | (12,678) | -12.2% | 0.2% | 5 | 12.2% |
| 605 | MOVEABLE FURNISHINGS + EQUIPMENT | 4,091,481 | 3,828,329 | 263,152 | 6.4% | 0.0% | 8 | 19.5% |
| 610 | ART ON CAMPUS | 180,863 | 174,826 | 6,037 | 3.3% | 0.0% | 0 | 19.5% |
| 705 | PROJECT CONTINGENCY | 8,440,070 | | | | | | |
| **Total Projects: 41** | | **84,843,838** | **80,362,824** | **4,481,014** | **5.3%** | **46.9%** | | |

*Project Change Order Analysis*

As Campus Planning and Administration (CPA) and Engineering and Architectural Services (EAS) strive to make improvements, one of the earliest focus areas has been reducing the number of construction change orders. Though often necessary, changes can lead to delays in construction and disputes with contractors. Often these disputes arise not from a single change, but from numerous small changes which may result in a contractor claiming that the volume of changes delayed the project or impacted their productivity, and therefore demanding substantial additional compensation. Change orders are a reality in the construction process for a number of reasons:

1) Undocumented field conditions, such as bad soils and concealed asbestos. Performing as much investigative research of the existing conditions as possible is important in order to minimize the impact of field conditions on a project.
2) Document discrepancies where the work specified either cannot be built or does not meet the intent of the project. Identifying and correcting recurring mistakes is important in order to reduce change orders and thereby limit university exposure.
3) Scope changes requiring additional work at the discretion of the university. Scope changes modify the function or capacity of a facility, and may include changes to the quality of finishes and furnishings, or change the size of the building or program to be included in the project. These are the most easily controlled sources of changes, but can also increase the value gained by the project.

Michigan State University tracks change order rates by calculating the dollar value of change orders divided by construction payments. The initial efforts of tracking change orders were good, with overall changes generally trending downward since 2003-04. While the overall trend has been downward, the change order rate increased significantly from the prior fiscal year. The scope-related change orders increased significantly, which attributed to the rise in overall change value. Figure 8 represents the change order rate by reason code as a percentage of total construction payments for active and closed projects, by fiscal year. Each percentage point of change order rate represents a $1 increase per $100 of the construction bid price. For example, for every $100,000 in construction paid during Fiscal Year 2009-10, the university identified $8,300 in change orders.

After a reduction in change orders in 2009-10, change orders increased in 2010-11. Most of the changes are attributable to four projects: the Plant Science Expansion, Eli and Edythe Broad Art Museum (BAM), Wells Hall, and Emmons Hall. Plant Science has proceeded very well, allowing some contingency to be directed to a fourth floor build-out. Emmons had significant mechanical and electrical deficiencies that were uncovered as the demolition phase of the project progressed. The existing conditions were not as anticipated, which necessitated a number of changes. The BAM has had a number of challenges, but given the nature of this project, a high change order rate isn't surprising. More than $900,000 of these changes are associated with finalizing the Guaranteed Maximum Price for Gartner Zaner's sophisticated, one-of-a-kind building envelope package. The Wells Hall project is very difficult, with a design that includes construction over an existing building. Some significant document clarifications have been identified, but because it was designed in Building Information Modeling (BIM), conflicts have been identified early, and 'pulled forward' in the construction process. While this raises some concerns initially, the changes have leveled off as the project proceeds.

Scope changes are much higher in 2010-11. More than 25% of these changes by value are attributed to BAM, which has had a number of challenges dealing with the signature architecture, including the building envelope, geometry of the walls, and uniquely finished concrete. Emmons Hall has also had $850,000 in scope changes, many of which are attributable to this being the first of the Brody Complex residence halls being renovated. As construction proceeded, RHS identified certain opportunities that made sense to pursue, such as flooring replacement, which attributed to a large percentage of the changes to date.

Field changes decreased significantly this year. They are the most difficult source of changes to control, and fluctuations are not surprising. Typically, field condition change orders have more of an impact on existing building renovation projects as opposed to new construction.

Document changes increased significantly, matching a four-year high as a percentage of construction. While this is significantly higher than the past two years, it is as low, or lower than, any of the previous five.  Possibly, this is a product of several projects being relatively early in construction, and conflicts being identified relatively early in the project. If this is the case, performance should improve in the coming fiscal year.

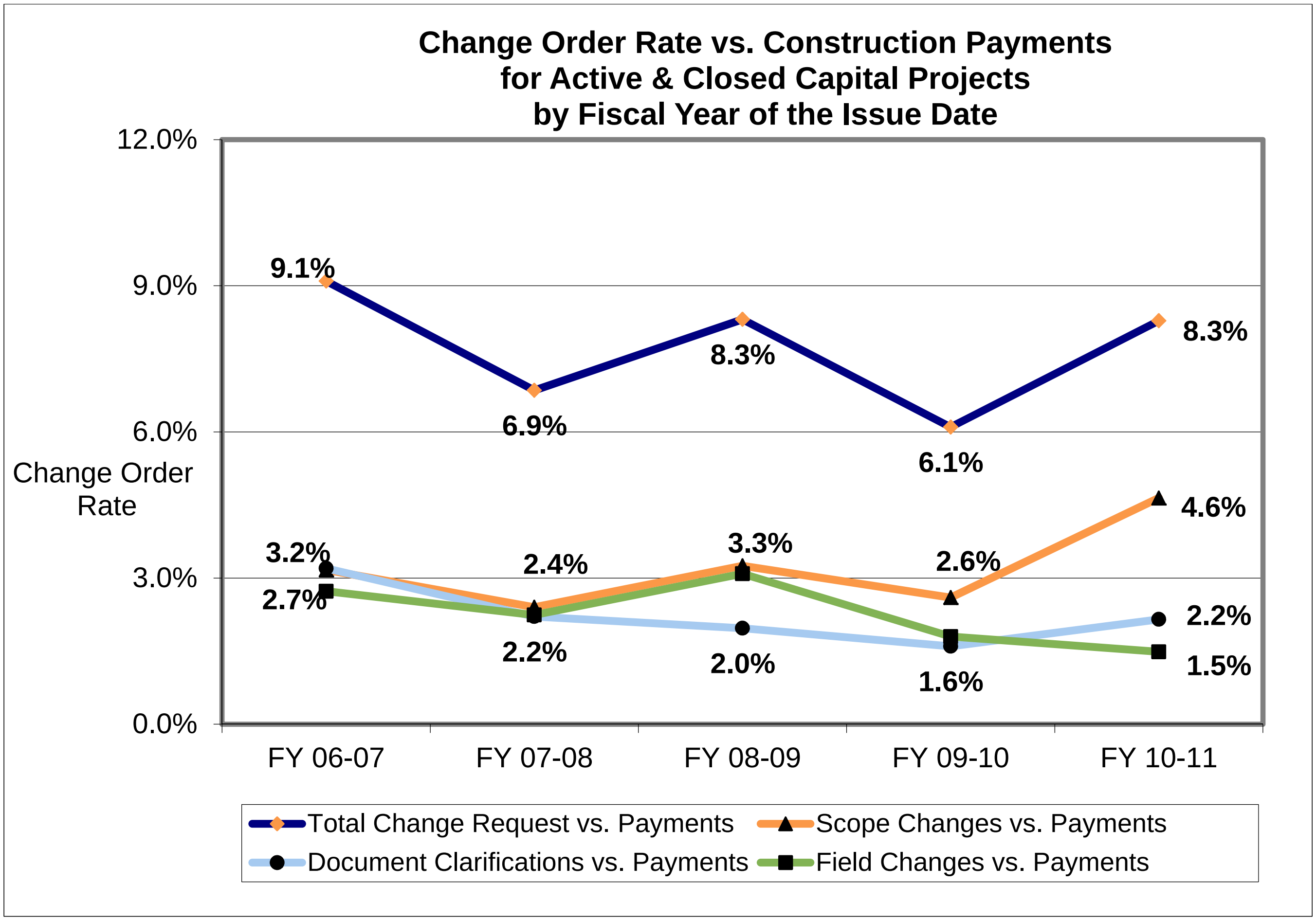



**Figure 8.** *Change Order Rates by Reason Code.*

Tables 5 and 6 sort change orders according to other characteristics, such as construction and work discipline (e.g., roads, mechanical, utilities, etc.). Projects closed within the last four fiscal years have been categorized as New Construction and Additions, Demolition, Renovation (such as reconstruction of existing space), and Infrastructure (such as roads, parking lots, and underground utilities). Table 5 shows that new construction generally has the smallest change order rate. This is due to a decrease in field condition change orders. Additions and renovations generally have a higher rate of field conditions and design errors due to unknown issues in an existing facility. Oftentimes, the coordination for additions and renovations cannot be fully completed until critical building components such as ceilings, walls, or foundations are exposed to entirely coordinate the design with the existing conditions. Table 6 shows the most significant areas of construction that require change orders, which are mechanical and electrical trades. Whether new construction, additions, renovations, or infrastructure work, mechanical and electrical (M&E) trade work is consistently the largest impact on project contingency. M&E work typically has a higher change order rate, due to the number of factors that can impact the function of the system. Many interferences and field conditions can cause re-routing of equipment mains from their designed locations. These interferences are sometimes not identified until walls or ceilings are opened up during the renovation or construction. Also, a start-up and debug process occurs for M&E work, requiring changes to the installed system in order for the system to function properly. The start-up and debug process does not impact other trades as substantially as it impacts the mechanical and electrical trades.

**Table 5.** *Change Orders by Project Type for Projects Closed in 10-11.*

| Value of Change Orders by Type of Construction | FY 06-07 | | FY 07-08 | | FY 08-09 | | FY 09-10 | | FY 10-11 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Change Order | % of Cont. | Change Order | % of Cont. | Change Order | % of Cont. | Change Order | % of Cont. | Change Order | % of Cont. |
| New Construction & Addition: | $183,113 | 0.4% | $624,525 | 1.0% | $1,989,805 | 1.2% | $9,690 | 0.0% | $2,196,069 | 3.7% |
| Demolition: | $0 | 0.0% | $0 | 0.0% | $62,032 | 0.0% | $152,275 | 0.1% | $0 | 0.0% |
| Renovation: | $412,321 | 1.0% | $1,415,243 | 2.4% | $5,538,121 | 3.4% | $5,669,473 | 5.2% | $3,346,326 | 5.7% |
| Infrastructure: | $3,001,218 | 7.3% | $3,751,347 | 6.3% | $2,332,813 | 1.4% | $2,867,398 | 2.6% | $388,644 | 0.7% |
| **Total:** | **$3,596,652** | **8.7%** | **$5,791,116** | **9.7%** | **$9,922,771** | **6.0%** | **$8,698,836** | **8.0%** | **$5,931,040** | **10.0%** |

**Table 6.** *Change Orders for Infrastructure and Maintenance Work for Projects Closed in 09-10.*

| Infrastructure Change Orders Breakdown by Project Type | FY 06-07 | | FY 07-08 | | FY 08-09 | | FY 09-10 | | FY 10-11 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Change Order | % of Cont. | Change Order | % of Cont. | Change Order | % of Cont. | Change Order | % of Cont. | Change Order | % of Cont. |
| Elevators: | $48,118 | 0.1% | $254,941 | 0.4% | $74,882 | 0.0% | $13,133 | 0.0% | $0 | 0.0% |
| Environmental: | $13,913 | 0.0% | $0 | 0.0% | $0 | 0.0% | $0 | 0.0% | $0 | 0.0% |
| Fire and Life Safety: | $20,511 | 0.0% | $75,002 | 0.1% | $80,989 | 0.0% | $201,765 | 0.2% | $0 | 0.0% |
| General Trades: | $0 | 0.0% | $299,087 | 0.5% | $189,790 | 0.1% | $198,535 | 0.2% | $214,599 | 0.4% |
| Laboratory: | $0 | 0.0% | $0 | 0.0% | $0 | 0.0% | $0 | 0.0% | $0 | 0.0% |
| Mechanical & Electrical: | $2,362,755 | 5.7% | $2,503,778 | 4.2% | $455,855 | 0.3% | $1,846,930 | 1.7% | $0 | 0.0% |
| Office: | $0 | 0.0% | $0 | 0.0% | $0 | 0.0% | $0 | 0.0% | $46,818 | 0.1% |
| Roads: | ($126,901 | (0.3 | $105,434 | 0.2% | $171,890 | 0.1% | $110,823 | 0.1% | $127,22 | 0.2% |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | ) | %) | | | | | | | 8 | |
| Roofing: | $72,164 | 0.2% | $244,126 | 0.4% | $23,222 | 0.0% | ($13,084) | (0.0%) | $0 | 0.0% |
| Site: | $0 | 0.0% | $0 | 0.0% | $0 | 0.0% | $0 | 0.0% | $0 | 0.0% |
| Steam & Underground: | $610,658 | 1.5% | $206,184 | 0.3% | $1,336,185 | 0.8% | $509,296 | 0.5% | $0 | 0.0% |
| Telecommunications: | $0 | 0.0% | $62,797 | 0.1% | $0 | 0.0% | $0 | 0.0% | $0 | 0.0% |
| Other: | $0 | 0.0% | $0 | 0.0% | $0 | 0.0% | $0 | 0.0% | $0 | 0.0% |
| **Total:** | **$3,001,218** | **7.3%** | **$3,751,347** | **6.3%** | **$2,332,813** | **1.4%** | **$2,867,398** | **2.6%** | **$388,644** | **0.7%** |

*Construction Authorizations and Spending.*

The number of Board actions for Authorization to Plan (step one) and Authorization to Proceed (step two) decreased compared to prior years, as fewer projects were identified to begin design with a reasonable funding plan for the needs. While the number of projects authorized to plan is just one less in the 2010-11 period from the previous year, the value of these projects authorized to plan is almost 30% lower. While certain large projects, including those precipitated by the Residential and Hospitality Services strategic plan, continue, the number of larger projects that have been Authorized to Plan continues to decline during the current fiscally constrained budget environment. The decline will most likely result in reductions in construction spending in the years 2012 through 2014. The reduction may be offset with the forecast of Just-In-Time (JIT) projects for the north campus steam tunnel restorations scheduled for Authorization to Plan in 2011-12, and also the high volume of projects that were previously authorized for planning in year 2009-10.

2010-11 saw a significant drop in the value of projects Authorized to Proceed, as fewer projects were ready to move forward with defined, scope, schedule, budget, and funding. The value of projects Authorized to Proceed is almost 25% below the average of the last five years ($147.5m), while the value of projects Authorized to Plan dropped almost 70% below the five year average ($131m). A correlation is present between the number and value of projects authorized to plan in a given year and authorized to construct (step three) in the following year. If this trend continues, spending on capital projects will begin to slightly decrease starting in the year 2012, pending activity on the Facility for Rare Isotope Beams (FRIB). Other known projects currently pending Board of Trustees approval but not included in the data for 2010-11 include the Wilson Hall renovation and Butterfield Hall renovation.

Figure 9 shows the number of Board of Trustees' authorizations by project step for the past four fiscal years. Figure 10 shows the total value of those authorizations.

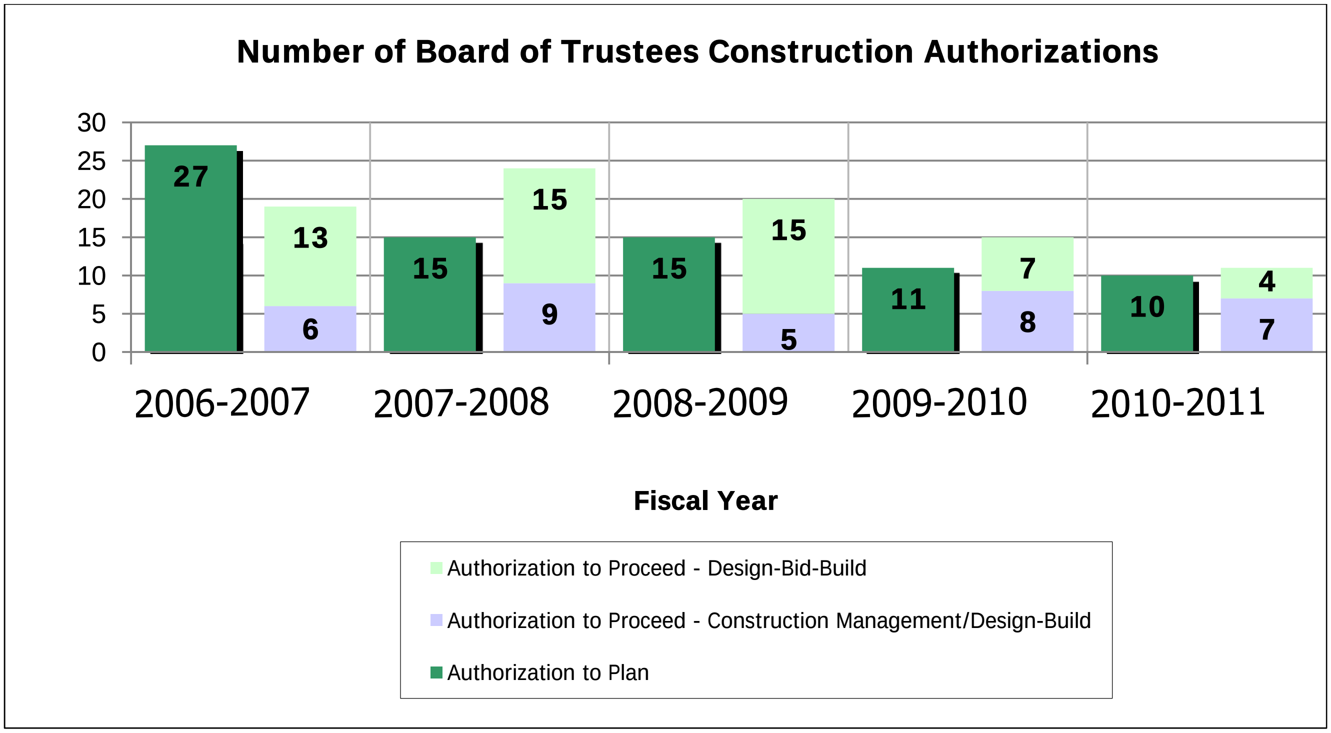



**Figure 9.** *Number of Board Authorizations.*

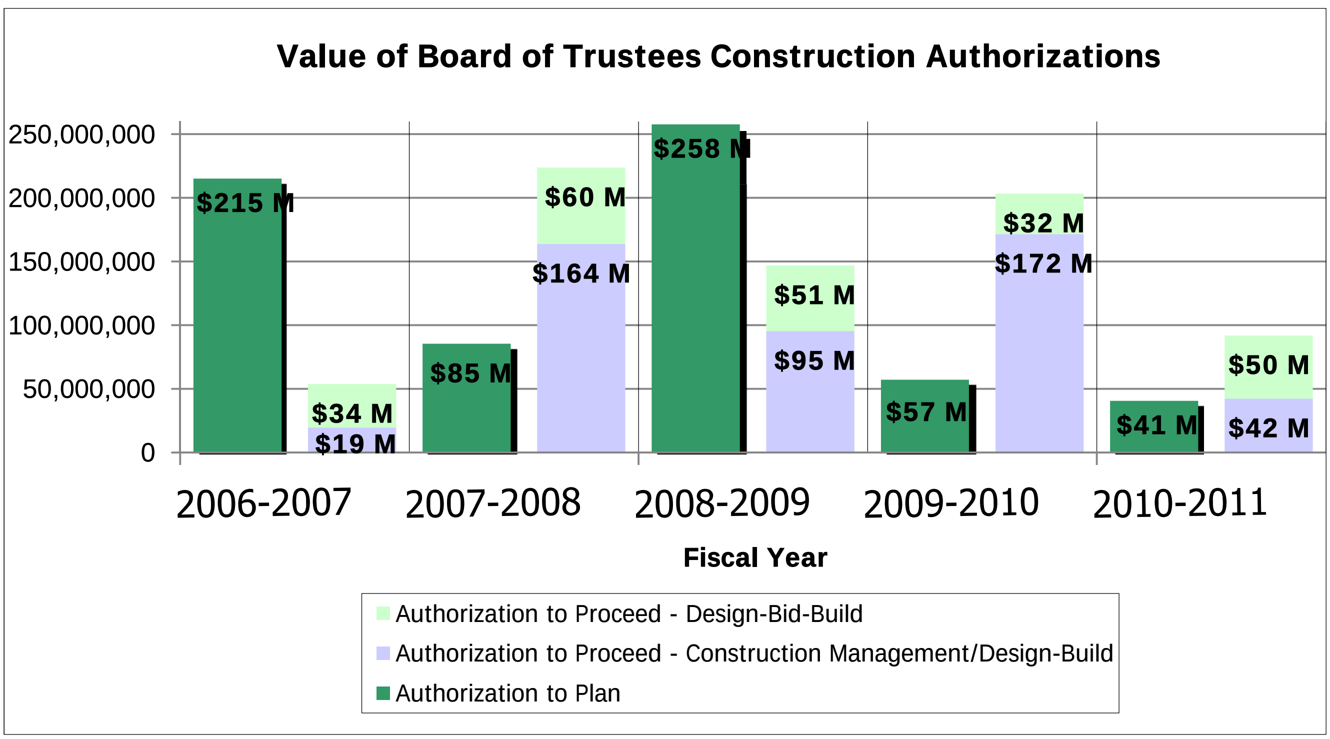



**Figure 10.** *Value of Board Authorizations.*

The university authorized less than 45% of the value of projects compared to the prior year, and less than 30% of the average value of construction projects approved over the last five years ($130m per year average). This is going to cause spending on construction to decrease in the near term. With relatively few large projects Authorized to Plan in 2010-11, a decrease in the value of projects that will be Authorized to Proceed in the year 2011-12 is likely. Nearly 50 percent of the funding in the Authorized to Plan category included only two projects: the Library Chiller Replacement, and the Fairchild Theatre and Music Building Auditorium Project. With relatively few projects Authorized to Plan, this lower spending volume may be offset by the north campus steam tunnel restoration projects and the FRIB.

Figure 11 illustrates the value of construction for the past 10 years.

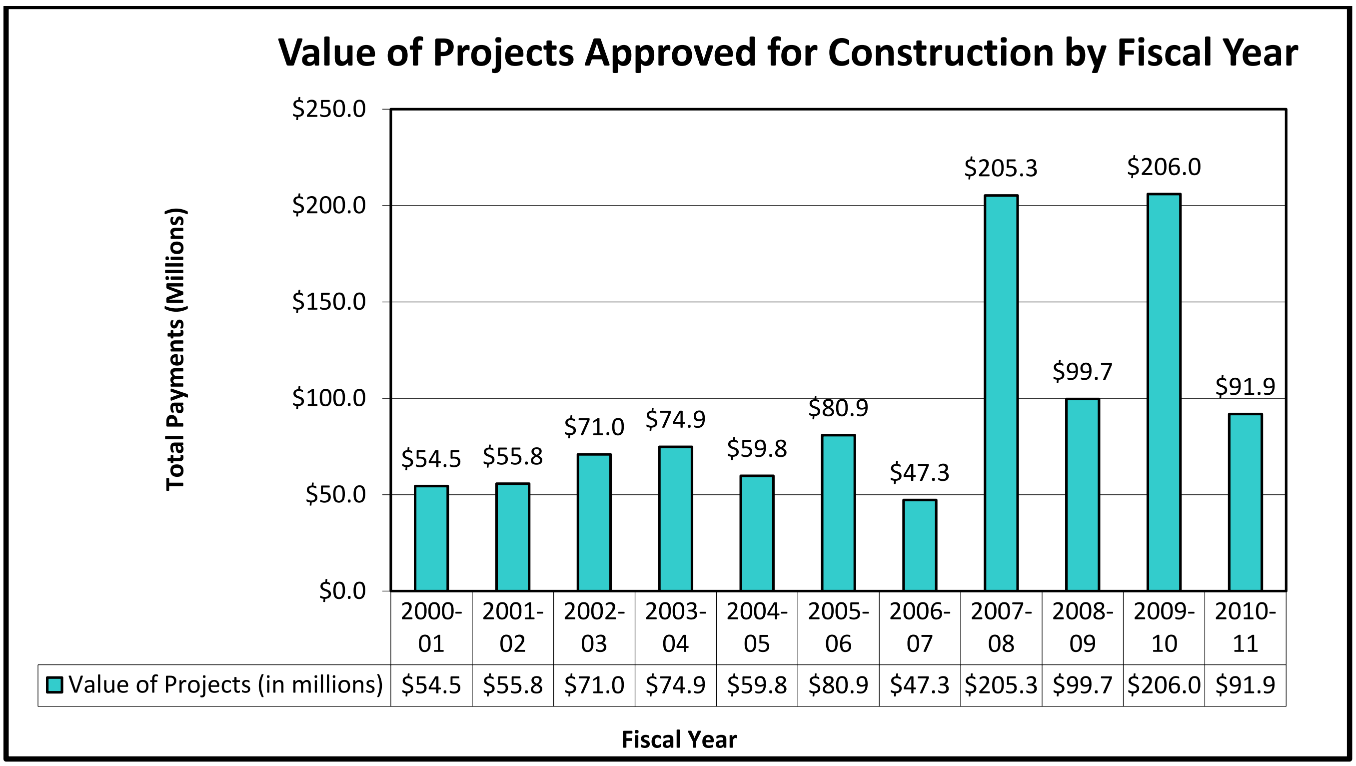



**Figure 11.** *Value of Projects.*

Design activity reached an extraordinary level in 2007-08 due to the size and number of projects approved for construction (which included the Secchia Center, Duffy Daugherty addition, Mary Mayo renovations, Cyclotron addition, Recycling Center, and Holden Hall renovations). In 2008-09 the number of projects Authorized to Plan increased, while projects Authorized to Proceed decreased. In 2009-10, construction and design payments were comparable to the prior year. A number of significant projects currently in the construction phase include the Wells Hall addition, Plant Sciences expansion, Broad Art Museum, Life Sciences addition, and Brody Complex Residence Hall renovations.

The value of projects that have been authorized to plan has decreased significantly in the past two fiscal years. As result, MSU is trending toward a modest downturn in construction spending. While the data indicates design payments for the upcoming years remaining stable or slightly increasing, the projects that have been approved for construction in the past three years will begin to come to completion. This forecast includes projects that will be Authorized to Plan in the near term, such as the Wilson Hall renovation, the Butterfield Hall renovation, and the north campus JIT steam tunnel work.

Figure 12 shows the total construction and design (non-FRIB) payments per fiscal year, as well as an estimate for design and construction payments for the upcoming two years.

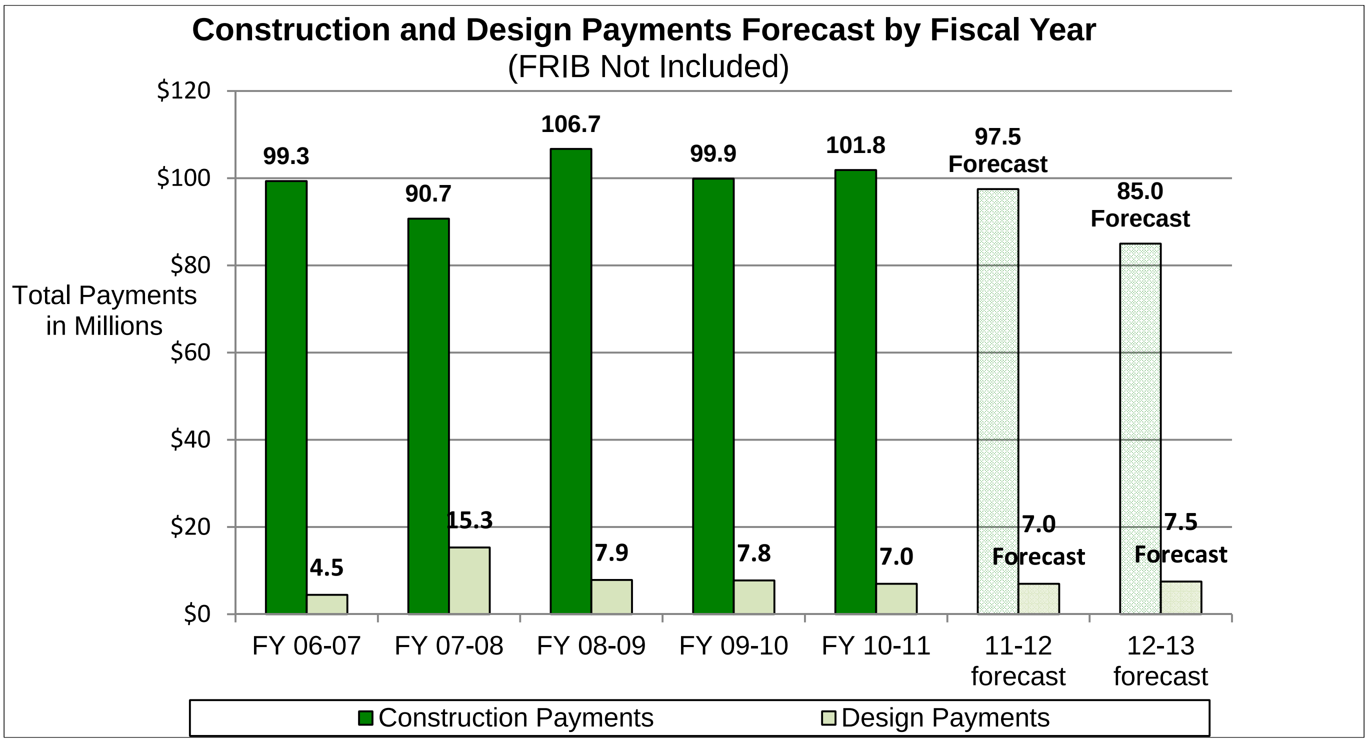



**Figure 12.** *Construction and Design Payments.*

*Project Delivery Methods*

MSU traditionally utilizes multiple types of delivery methods on projects. The four types of delivery methods most commonly used on campus are:

- **Design-Bid-Build (GC) -** The design-bid-build project delivery method is the traditional method of moving a project from conception to completion. The basis of this delivery method is that design is completed prior to bidding/pricing and construction.

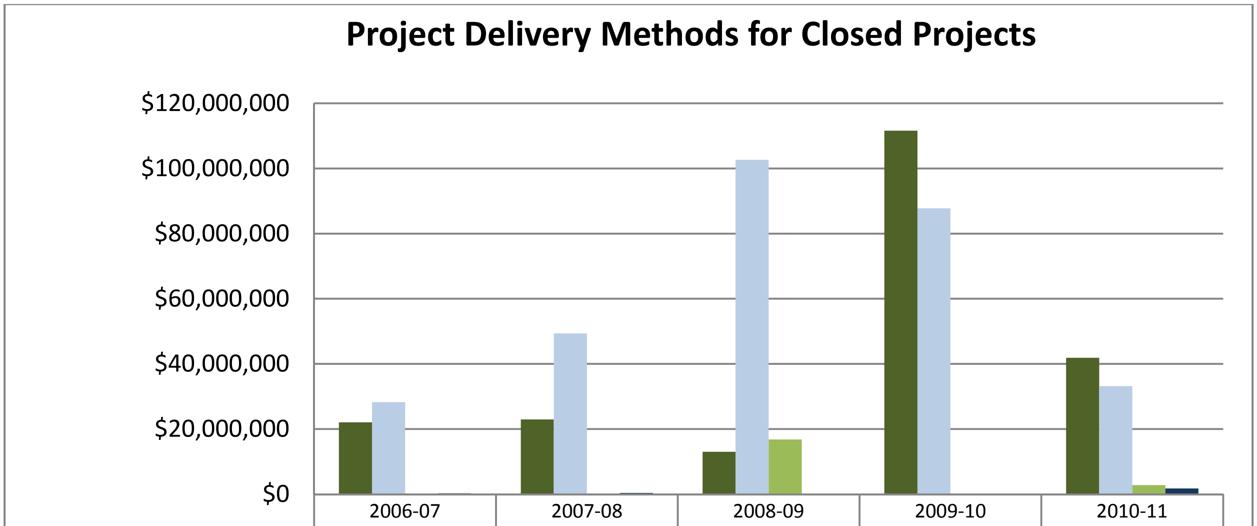
- **Construction Management (CM) -** Construction management is the process of professional management applied to a construction project from conception to completion for controlling project time, cost, and extent. A construction manager is an individual or entity hired by the owner to supplement the owner's role in the project.

- **Design-Build (DB) -** In the design-build delivery method, the owner contracts with a single entity for the complete design and construction of a project. Regardless of its composition, the design-builder provides complete design service and performs the construction under a single contract with the owner.

- **Owner-Build (OB)-** In owner-build, the owner is involved in aspects of contracting for every portion of a construction project. Because the owner acts similarly to a contractor, the construction contracts are between the owner and the specialty contractors (subcontractors).

Michigan State University has a long history of primarily using the traditional design-bid-build method of project delivery. However, within the last ten years, the construction management method has increasingly been utilized. Due to the fast-track nature of an increasing number of projects, this method can be employed to accelerate the project schedule and begin construction prior to having a completed design. The CM method has also been beneficial to supplant the MSU personnel during recent construction volume peaks, in which the current staffing levels would not be ideal for the situation.

The design-build method is used sparingly at Michigan State. Our projects typically require a high level of programmatic control; therefore design-build is not always appropriate. However, two projects within the last five years have utilized the design-build method of delivery: the University Village Apartments, and the KBS Dairy Facility. Design-build is the conventional method for simplistic designs such as these. The owner-build method is becoming more viable as a delivery option at Michigan State. While it has had limited use on major projects over the last five years, more projects have been approved using this method. The owner-build method is ideal as a potential cost savings alternative, as it eliminates the need for a Design-Build-Bid or a Construction Manager, while also giving MSU greater control over the schedule. Figure 13 illustrates the project delivery method utilization for the last 5 years.




| | 2006-07 | 2007-08 | 2008-09 | 2009-10 | 2010-11 |
|---|---|---|---|---|---|
| Construction Management | $22,049,519 | 22,933,271 | $12,997,937 | $111,585,162 | $41,861,832 |
| General Contract | $28,273,141 | $49,348,448 | $102,627,100 | $87,729,142 | $33,200,599 |
| Design Build | 0 | $0 | $16,816,246 | $0 | $2,792,177 |
| Owner Build | $299,097 | 401,069 | $0 | $0 | $1,771,412 |

**Figure 13.** *Project Delivery Methods for Closed Projects per Fiscal Year*

*Project Labor Agreements (PLA)*

In February 2008, the Board of Trustees (BOT) approved a responsible contractor policy. The policy outlines when a Project Labor Agreement (PLA) would be appropriate to implement in terms of advancing MSU's project-specific interests in cost savings, efficiency, timeliness, or quality, and would promote the institutional goals set forth in this policy. The policy directed the administration not to discourage a construction manager or general contractor from opting for a PLA independently.

In July 2011, the Governor signed Public Act 98 into law. The act prohibits universities from entering into construction contracts that require, discourage, or encourage contractors from using PLA's. While it is not clear that the act is consistent with the constitutional autonomy universities hold in Michigan, it is likely that requiring a PLA would lead a to a dispute that would delay construction and delivery of facilities to MSU. Accordingly, MSU has not found it advantageous to require a PLA since the act was passed.

Table 7 summarizes PLA usage on projects authorized for construction in FY 2010-11. The Board authorized PLAs on Bailey and Rather Hall renovations, and on Brody Complex Utilities Phase III in October 2009 as part of an action for all of the Brody Complex. No other PLAs were authorized. A list of the 11 projects authorized for construction is provided in Table 8.

**Table 7.** *BOT Approved Projects and PLA's.*

| PLA Status | Projects | | Project Value | |
|---|---|---|---|---|
| No PLA | 9 | 82% | 56,040,000 | 61% |
| PLA Authorized by BOT | 2 | 18% | 35,850,000 | 39% |
| Total: | 11 | | $ 91,890,000 | |

**Table 8.** *BOT Approved Projects and PLAs.*

| Project Number | Title | PLA Authorized? | Authorized Budget |
|---|---|---|---|
| CP08464 | Cherry Lane and Faculty Bricks Apartment Demolition | No | $5,300,000 |
| CP09108 | Brody Complex - Steam and Communications Master Pan Phase III | Yes | $2,350,000 |
| CP09070 | Bailey Hall and Rather Hall Renovations | Yes | $33,500,000 |
| CP10157 | Library - Chiller Replacement | No | $8,400,000 |
| CP10159 | Cyclotron Building - New High Bay Addition | No | $5,400,000 |
| CP07023 | The School of Hospitality Business - Culinary Management Education Laboratory Renovations | No | $2,600,000 |
| CP09284 | Case Hall - First Floor Renovations of Dining Hall Museum | No | $20,000,000 |
| CP07089 | Steam Distribution - Replace Deteriorated Steam Service to Spartan Stadium and Central Services | No | $3,600,000 |
| CP08355 | Spartan Stadium - Alterations to Rooms on Levels 200 and 300 | No | $2,200,000 |
| CP10066 | Kellogg Center - Meeting Room Renovations | No | $2,240,000 |
| CP09298 | Facility for Rare Isotope Beams - Utility Relocation - Phase II | No | $6,300,000 |

## Future Directions

*The MSU Way – Excellence in Campus Operations and Services (ECOS) Initiative*

A number of campus organizations are involved in construction projects at MSU. Several of those key organizations, such as the Physical Plant, Residential and Hospitality Services, Academic Technology Services, Recycling/Surplus/Waste Management, MSU Police, Land Management, Campus Planning and Administration, Facilities Planning and Space Management, Environmental Safety and Health, and MSU Purchasing, are partnering to develop and deploy an initiative that is presently called "The MSU Way: Excellence in Campus Operations and Services (ECOS)."

The focus of the effort is on all construction and maintenance operations or services that units provide to campus clients. "The MSU Way," is the method of delivery all partners would agree to follow to consistently and collaboratively exceed the campus customers' expectations while using MSU's resources as efficiently as possible.

Broadly defined, the goals of the MSU Way: ECOS project are as follows:

- Focus on investigating opportunities for improvement in how the Physical Plant interacts with divisions on campus;
- Identify and eliminate duplications in operations and service processes;
- Streamline existing operations and service processes and develop new ones if needed;
- Proactively look at MSU operations, and suggest improvements from within the organization.

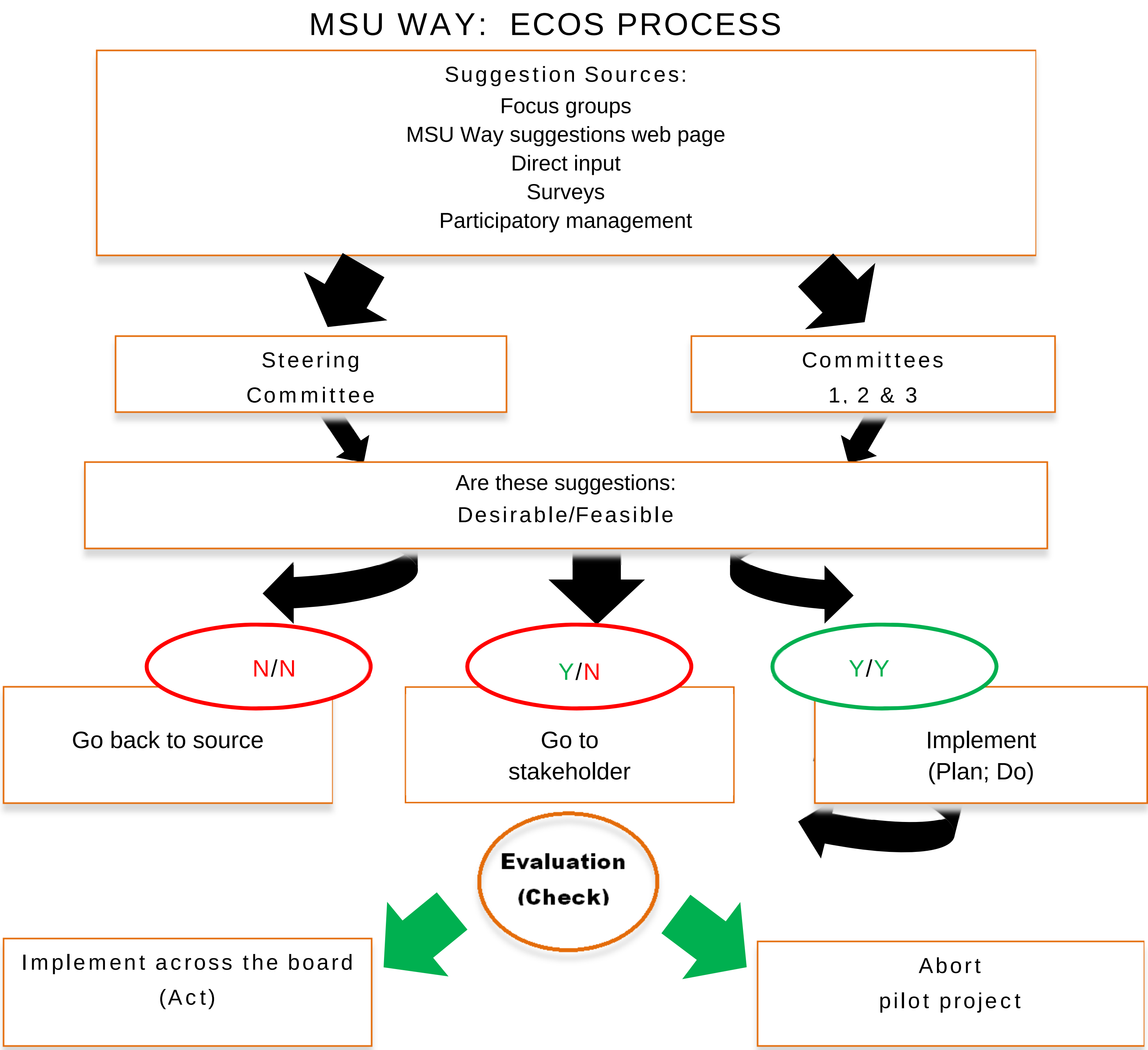
A steering committee leads the initiative, with three separate workgroups. Each individual workgroup is tasked with identifying and piloting opportunities for improvement in its focus topic. The focus topics are:

1. Major capital projects – Those projects that are $1 million and above or require Board of Trustees approval;
2. Minor projects from $250K to less than 1million;
3. All other service requests, maintenance operations, or shops or PO projects that are less than $250K or performed by the physical plant.

Numerous inputs can help identify areas of improvement. Workgroups focus on their own individual project areas, with a focus on identifying synergies that will produce the best results and provide the best value to MSU. The focus area inputs include:

- Suggestions made by the committee members;
- Survey of staff perceptions of process engagement levels;
- Focus group feedback from campus customers;
- Results from Post Occupancy Evaluations (POE);
- Process mapping and analysis;
- Feedback from participatory management meetings.

The ECOS initiative is designed to utilize the Plan, Do, Check, Act (PDCA) cycle, or Deming cycle, to guide the initiative. The PDCA cycle is a never-ending cycle, repeated again and again for continuous improvement. Given the multiple sources of data that the ECOS initiative will collect and accumulate, the following strategy is being used to process suggestions through the committee structure established for the initiative:




The process has three phases; the validation and cohesion phase, the scoping and development phase, and the implementation phase. The project is currently midway through the scoping and development phase. Incremental changes to the processes will be implemented over time. The focus of the effort will be to measure the effectiveness of that which has been modified, while also identifying new ways to improve the system.

## PROJECT DELIVERY – BUILDING AND INFRASTRUCTURE – PHYSICAL PLANT

### Standards for Construction Updates

**Summary**

The MSU Construction Standards have been compiled for architects and engineers retained to provide professional services for Michigan State University. They reflect the planning, construction, and maintenance experience of persons responsible for the university facilities. These standards have been prepared to achieve quality structures of maximum utility, minimum maintenance and operating expense, and prudent use of energy.

The standards undergo continual review update as experience or construction developments warrant. In particular, materials and equipment are reviewed to take advantage of the latest technology in the areas of energy and improved operational efficiency.

One recent technology improvement incorporated into a project at MSU is utilization of geothermal energy to provide heating and cooling.

Geothermal – The site location for the BOTT Building for Nursing Education and Research, at Bogue Street and Service Road, required an estimated $2,400,000 budget for the central steam and chilled water connections; hence, a geothermal design approach was advocated.  At an estimated cost of $750,000, this saved the project about $1,650,000 in infrastructure costs.

In addition to continually updating our standards to reflect the latest improvements for operational efficiency, the university also continues to explore more effective methods in delivering projects. Integrated Project Delivery is a relatively new delivery method that seeks better communication and collaboration through early involvement of building trades, shared profits, and early decision making.

The Shaw Hall dining center is the first capital project at MSU to use a construction delivery method called Integrative Project Delivery (IPD). The concepts of IPD and the behaviors of the project team are based on the five big ideas of lean construction as described in the analysis that follows.

## Analysis

*Standards for Construction Updates*

The most notable are nine updates in the area of sustainability, such as requirements for projects to exceed the updated AHSRAE/LEED standards, revisions in refrigerants used for air conditioning to reduce the impact on the environment, installation of outlets for electric hand dryers to reduce paper towel waste, and expansion of the selection of biodegradable transformer coolants, which increases competition and reduces impact on the environment.

Another significant update is the consistent application of a gas detection and emergency alarm system for prompt notification of emergency personnel. Prior to this update the systems, although code compliant, lacked the consistency necessary to assure timely and appropriate response from emergency personnel.

*Geothermal*

The geothermal system for the BOTT Building is designed as a ground-source horizontal closed loop system buried about ten feet under an adjacent intramural playing field, and will circulate non-toxic glycol to heat exchangers within the building mechanical room. In winter, the heat will be extracted from the 55 degree glycol, and large fan units will duct the warm and humidified air to the building zones. In summer, heat will be rejected to the ground-loop system to provide cooling and dehumidification for the building.

This horizontal ground-loop geothermal heat pump system has several other advantages. By itself, it will reduce annual energy costs for the building by 12.8% compared to a LEED-certified baseline building using MSU steam and chiller.

In combination with the other energy efficiency strategies, the BOTT Building will use 36.5% less energy than base building energy models utilizing conventional heating and cooling systems. The geothermal system will also provide heating and cooling at any time of the year. This provides the most flexibility in maintaining temperature comfort in all spaces.

This system will avoid using about 465,000 MBTU per year of capacity from the MSU power plant, saving 61 tons of coal per year and extending the capacity of the power plant.

**Figure 1.** *Geothermal Piping Installation at the Bott Building Project.*

**Figure 2.** *Header System for Geothermal Piping, Which Distributes Water to the Underground Heat Sink Loops.*

*Shaw Hall Dining Center*

*Collaborate, Really Collaborate*

An essential building block of Integrated Project Delivery (IPD) is the use of a multi-party contract among the owner, consultant, and contractor. All signers of the contract agree to a system of shared risks and rewards.

**Figure 3.** *Project Implementation Team at Early Design Work-Session in the Big Room at Shaw Hall.*

An IPD practice called Target Value Design is based on the idea that plan review, construction, maintenance, and operations inform the design rather than react to it. IPD emphasizes intensified early planning as opposed to the traditional methods of project delivery which commonly require re-working of the design based on input received too late. In IPD, review of building components and systems to maximize value begins conceptually and is continuous, rather than coming as an unwelcome surprise at the end of design. One of the tools used for evaluating the project as a whole is Building Information Modeling (BIM), with multiple team members creating and providing components of the design which are then coordinated together in a virtual format before anything is actually constructed. A tool used to disseminate the current progress of the project is one-page summary called an A3 (simply meaning all information is condensed on an 11x17 sheet; shown in Figure 4).

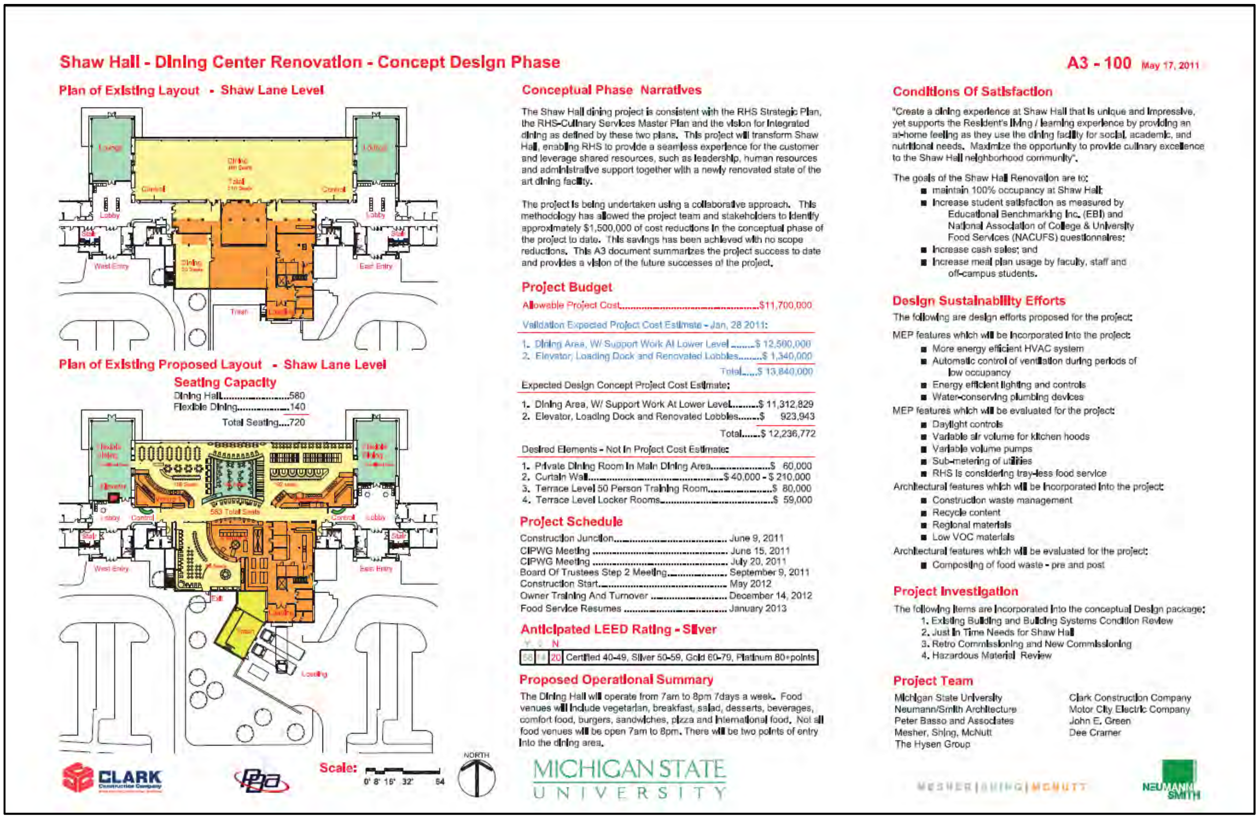



**Figure 4.** *Conceptual Design Phase Summary (A3).*

One tool used is the plus or delta portion of each weekly work-session. Team members offer suggestions on what worked well during the work-session and should be continued (plus), and what could be improved for future work-sessions (delta). Another tool is the periodic retrospective, where the team focuses on a recent issue and identifies what behaviors should be continued, stopped, or started, to ensure success of the project.

Project members participate in planning the work at all levels, self-organize their own approach to delivery, and voluntarily commit to the work they will perform. IPD depends on people making reliable promises and taking responsibility for their commitments. The initial source of the commitments at each phase of the project is an effort called pull planning, where the final result and all tasks leading to successful completion of the phase are identified. Team members promise to deliver their tasks when required to maintain the schedule. Commitments are added as needed during weekly work sessions. Efficiencies are gained when each team member only works on items that are on the commitment log. Each of the commitments become an item on a Promises Log which is maintained and updated during daily huddles – a short, efficiently run conference call.

This particular aspect of IPD on the Shaw dining project has been achieved due to open communication being encouraged and practiced. The experience of reaching, then maintaining, a high percentage of promises kept has created a sense that team members are reliable. The quantity and quality of interaction has produced relationships among the team members which are not typically formed during a capital project. The success of the construction phase of the project will be greatly enhanced by this early experience. IPD is expected to maximize value, reduce changes, and expedite completion of construction.

**Future Directions**

Construction, safety, sustainability, and energy savings methods and materials are continually reviewed for inclusion in the standards for construction. Moving forward, greater emphasis will be placed on implementation of new technologies to increase the operational effectiveness of facilities to support the university's mission while continuing to emphasize reduced energy usage and improved maintainability.

The Physical Plant is actively looking for other applications of geothermal technology for use in other areas of campus to reduce energy and to reduce the dependency on the Power Plant for steam. Use of the Campus Domestic Water System as a heat sink for future geothermal systems is being evaluated. Several regulatory hurdles will have to be overcome to apply this unique concept.

Upon final completion of the Shaw dining project, all aspects will be evaluated to determine if the Integrative Project Delivery method produced value on the current project, and whether IPD has value for use on future capital projects. The evaluation is expected to inform whether a certain type or size of project would be more successful using the IPD method. The project will be evaluated in terms of which of the IPD concepts should be used to attain the most value for the university, and how the concepts could best be implemented. In the meantime, the awareness and experience of the IPD concepts gained by the Shaw dining project team members has naturally led to efforts to share the concepts in a limited way with colleagues on other current capital projects.

# POST OCCUPANCY EVALUATIONS

## Summary

Post occupancy evaluation (POE) refers to the evaluation of a completed constructed facility during its occupancy. A POE process can answer several significant questions including: *Did the constructed building meet the program needs it was designed to address? Is the facility functioning as planned? If not, what corrective measures are necessary?* The main focus is to evaluate how building construction can be improved in the future to provide maximum value for the capital investment. Another objective is to document lessons learned from the review of completed projects to ensure that best practices are applied to future projects. Campus Planning and Administration, in conjunction with the Construction Industry Research and Education Center (CIREC) at MSU, is currently developing a model in which all major capital projects will have some level of post occupancy evaluation. This is being done in partnership with the other campus organizations involved in project delivery.

In addition to the project performance metrics found in this report, such as change order and schedule data, a POE explores the functional performance and design quality of the building. Many methods can be used to evaluate a building's performance. They include occupant and project team interviews, direct observation, surveys, and design efficiency data as examples. Three in-depth pilot POEs have been completed to date, in addition to two other projects that have been evaluated through a POE survey. Table 5 shows the projects that have been evaluated.

**Table 5.** *Completed Project Post Occupancy Evaluations*

| Project | Year Bldg. Comp. | POE Type |
|---|---|---|
| The Wharton Center | 2009 | In-depth |
| Owen Hall Renovation | 2009 | In-depth |
| The Surplus Store and Recycling Center | 2010 | In-depth |
| Spartan Stadium Expansion | 2008 | Survey only |
| The School of Planning, Design, and Construction Renovation | 2008 | Survey only |

## Analysis

The focus of post occupancy evaluations can be divided into two main categories: functional performance, and indoor environment. Figure 14 is a consolidated summary of the functional performance results of the five POEs to date. The results of the surveys have indicated that privacy is the leading cause of dissatisfaction among building occupants after move-in. The United States Green Building Council LEED standard suggests that any categories with a satisfaction rating of less than 80% be addressed. The 80% threshold equates to achieving a rating of at least neutral or better. While the categories of space, ease of interaction, office interiors, and accessibility all achieved over 80%, the privacy category only achieved a 75% rating. Privacy rankings are not expected to improve in the short-term, because of the changing philosophies of the design of office environments in the higher education sector, which emphasize opportunities for interaction and collaboration. People coming from a traditional office environment typically need a period of adjustment to adapt to the new approach. The Wells Hall and Plant Sciences additions are examples of environments that feature an open office design not traditionally seen at MSU. As occupants move into these new buildings, they will have a learning phase with a higher level of dissatisfaction in regards to privacy, until the building occupants adapt to these new environments.

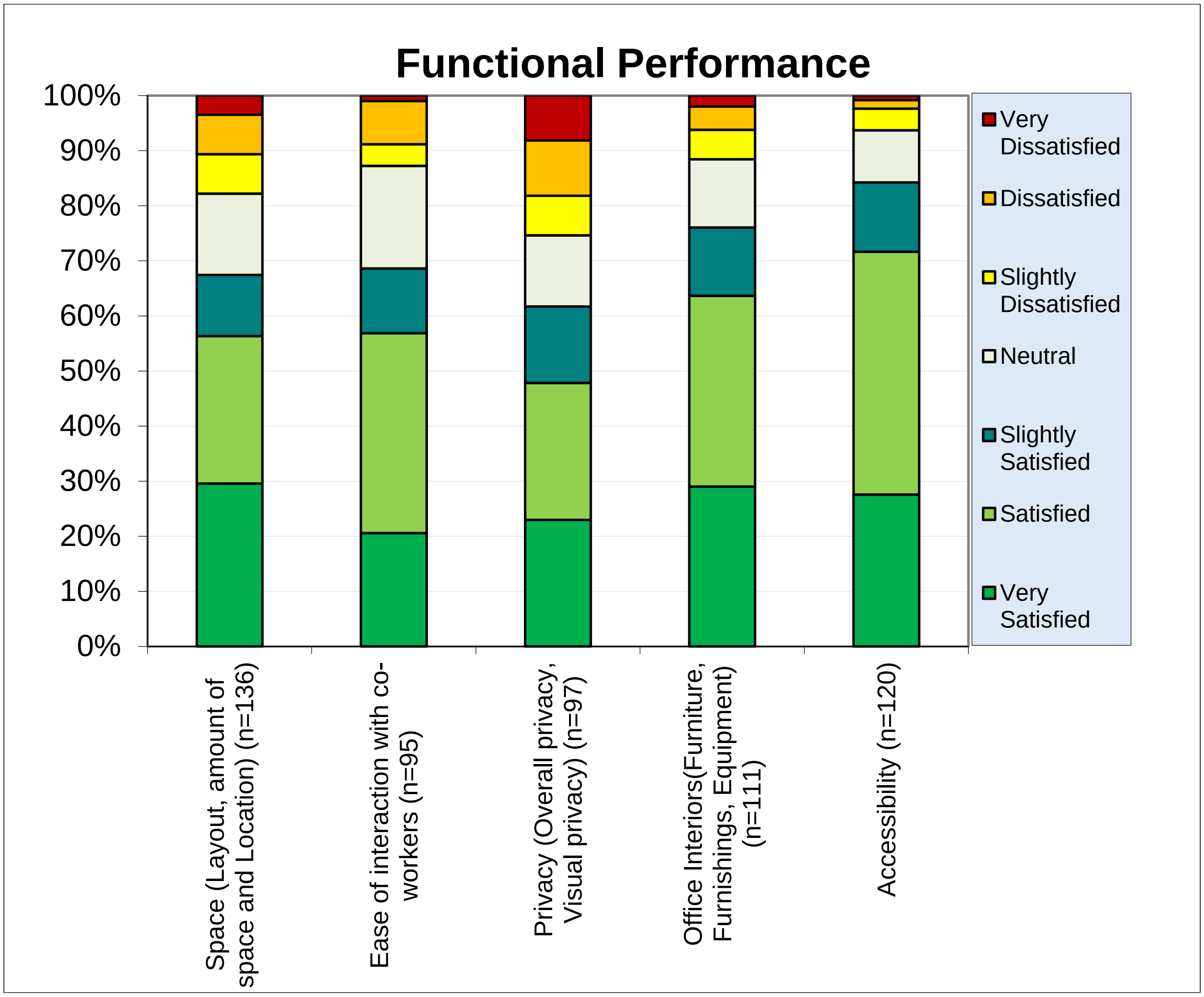



**Figure 14.** *Functional Performance Results for Five Completed POEs*

Figure 15 is a consolidated summary of the indoor environment results of the five POEs conducted to date. The results indicate that thermal comfort, personal control, and acoustics are the leading cause of dissatisfaction among building occupants after move-in. As mentioned, the United States Green Building Council LEED standard suggests that all categories with a satisfaction rating of less than 80% be addressed. All three of the categories are below the 80% satisfaction rating. The acoustics category may be the result of the increased level of open office environments being constructed today, as referenced in the functional performance analysis.

The university standard for thermal comfort is 76° F during summer and 70° F during winter. The standard has been created in balance with the intended energy savings or building operations costs for new projects on campus. Building occupants may have multiple causes for the higher level of dissatisfaction. The issue may be the standard thermal settings, or the facility may not be operating as designed.

The personal control standard is to provide an individual thermostat for every three individual spaces or in every common area. While the level of satisfaction may be increased by increasing the level of personal control, building maintenance costs, operating costs, and construction costs would most likely be increased too. The building also may not be performing as intended or designed. Both thermal comfort and personal control can be addressed through good commissioning and communication flow with the occupants during move-in and the first year of operation of the new facility.

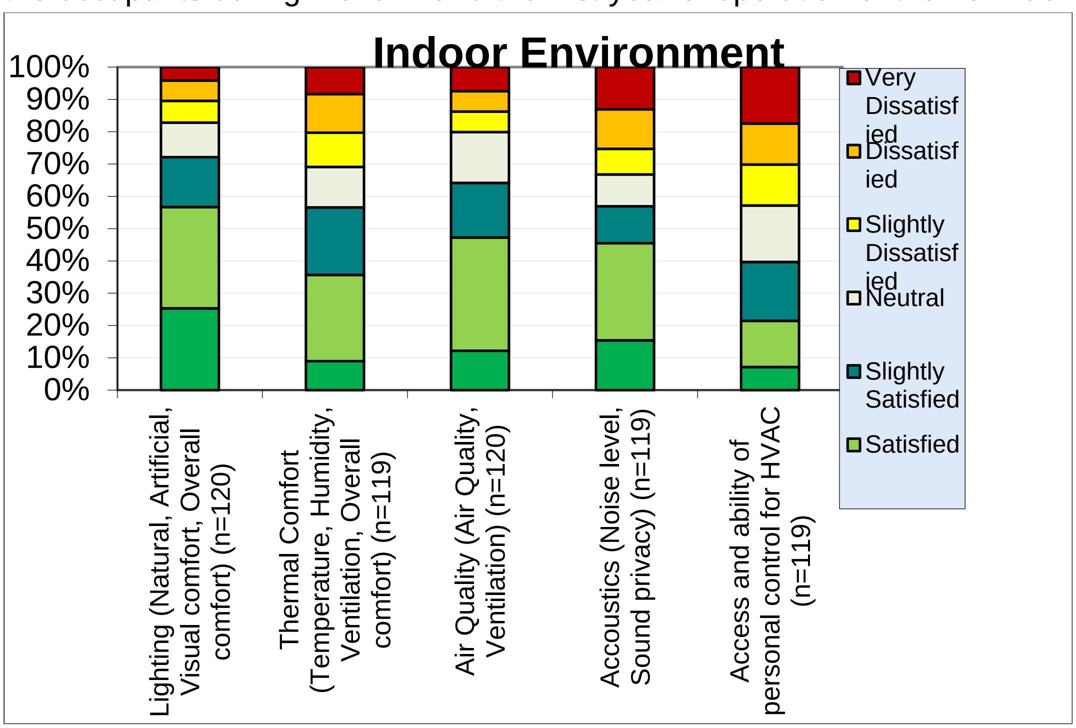



**Figure 15.** *Functional Performance Results for Five Completed POE's*

**Future Directions**

The POE is intended to be a quality control and value analysis tool used to continuously improve the delivery of projects. While the POE is used primarily for evaluating the constructed facility, it also serves to reveal process issues that may be improved to increase value and provide more reliable project performance. A number of process improvements have been implemented to date, such as earlier investigation of infrastructure requirements in design, earlier investigation of maintenance requirements of an existing building, and development of a standard protocol for document archiving.

Many process improvement initiatives are currently under consideration by the MSU Excellence in Operations and Services (ECOS) Committee formed to improve the delivery of projects on campus. The following are examples of the more critical areas that are currently being evaluated:

- Implementing a more in-depth programming standard;
- Creating a published operational guideline for building occupants and construction users;
- Creating a more formal building commissioning document earlier in the design process;
- Creating a measurement and verification protocol to evaluate the impact of new construction on the existing campus infrastructure;
- Measuring the return on investment of sustainability features incorporated into each project;
- Requiring energy models on all projects.

All of the above mentioned initiatives are intended to provide better quality, cost reliability, and value for projects at MSU.

# MEASURING AND MONITORING

## Summary

*Energy Management*

Measurement, monitoring, analysis, and continuous improvement are keys to successful energy management programs, as well as to developing a culture of energy conservation in the campus community. Michigan State University has taken a number of steps towards continuous improvement in the area of energy management, including implementing a building commissioning program in over 16 million square feet of existing university facilities with a goal of 20% reduction in energy consumption at completion of the program. The building commissioning program is scheduled in general fund buildings over the next five years and in Residential and Hospitality Services over the next 10 years to accommodate the renovation schedule in those facilities. Additional efforts to improve measurement, monitoring, and analysis of energy use on campus include:

- Installation of smart real time meters for all utilities in all major buildings;
- Implementation of an energy dashboard display to engage students and make energy consumption visible to the campus;
- Daily monitoring of building heating ventilating and air conditioning systems through central control energy management software;
- Implementation of a continuous building commissioning program that will allow for course correction when systems begin to go out of alignment; and
- Development of a mechanism for real time utility invoicing including a comprehensive rate design.

All of these steps are designed to:

- Reduce increases in energy costs;
- Improve operations and energy efficiency;
- Improve the environment by reducing greenhouse gas emissions;
- Delay the need for additional energy generation capacity;
- Maintain reliability.

## Future Directions

### *Energy Management*

The campus community provides a great opportunity to partner with researchers that are on the forefront of technologies that will provide solutions to some of the problems currently facing operations, such as greenhouse gas emission reductions and renewable energy goals. Seeking out those opportunities to partner with research in demonstration projects on campus is a high priority and will continue to be as new technologies develop. Areas such as the T.B. Simon Power Plant, Transportation Services, Engineering and Architectural Services, and Landscape Services provide support to the research function not only in day to day operations by providing reliable and properly equipped facilities to perform research, but also as partners in demonstrating and moving new technologies to commercialization.

Future energy management challenges include:

- Regulations requiring capital investment to comply;
- Price of fuel;
- Retirement of generation capacity;
- Development of a culture of energy conservation;
- Aggressive energy conservation projects;
- Changes in preventative maintenance;
- Identification of opportunities for space consolidations;
- Focus on research labs and energy efficiencies;
- Current knowledge of technology options.

The future will be challenging, and energy managers keeping current with technologies, piloting projects with research, and developing a culture of energy conservation are vital to achieving energy efficiency for campus.

## Summary

### *Utility Billing*

As a result of increased attention on energy efficiency, sustainability, and method of energy supply to Michigan State University, an increasing need to improve the tracking and reporting of utility usage has appeared. Mechanisms already in place collect and report utility usage through the campus Geographical Information System (GIS), but data comes from a variety of sources that require significant handling and repackaging of the data before reporting. Because of these complexities, delays take place in communicating utility usage information. Further, utility costs are budgeted and expensed at the central campus level. As such, individual campus units are not fully aware of their actual consumption, nor do they have an incentive to monitor these expenses. Timely delivery of this information and alignment of the university with the ability to report and bill at the unit level in the future will contribute to changing behavior and creating a culture of energy conservation.

**Analysis**

*Utility Billing*

For Fiscal Year 2010/2011, total MSU utility expenses exceeded $80 million. Most of these costs are associated with the production of electricity and steam. Sixteen percent of the utility production costs are recovered through an abatement process (Figure 1).

The abatement process disconnects actual usage from the financial impact. The yearly "true-up" required by the abatement process further disconnects the financial impact by separating increased usage patterns from the increased financial responsibility by more than a full year.

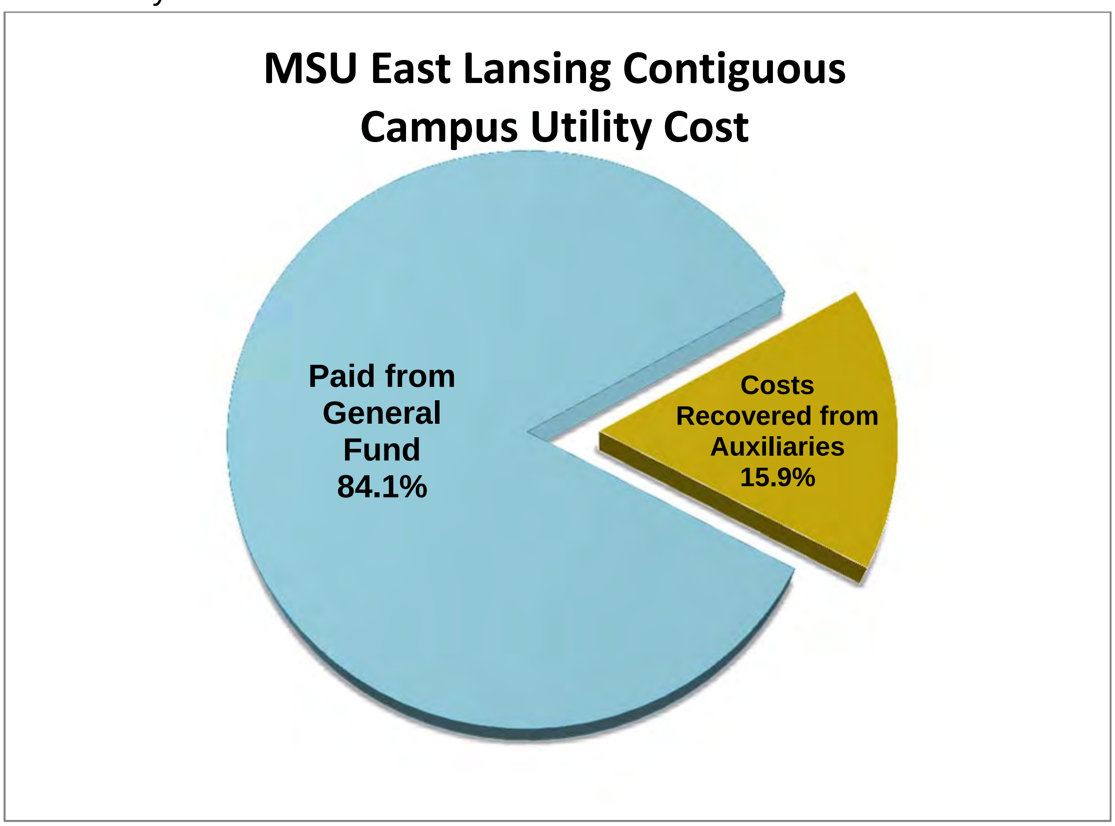



**Figure 1.** *Campus Utility Costs.*

A utility billing system will more tightly couple the utility usage data with the financial costs of the utility services. The implementation of a new software system will allow for a more fully functional and timely invoicing of utilities on a monthly basis according to actual usage. This software is expected to be active beginning July 1, 2012. This allows this system to be piloted with auxiliaries to provide a fuller transparency and breakdown of the costs. The system will provide a framework for handling financial charges with respect to all campus utilities, both generated and purchased.

**Future Directions**

*Utility Billing*

After implementation of a utility billing system for Fiscal Year 2012/2013 and completion of the pilot, discussion will continue to explore how the system can be extended to other units and leveraged to communicate utility usage data and costs to the entire campus community. In addition to educating the campus population about the cost of utilities, the billing system will lay the ground work for connecting operational costs related to utilities, space, maintenance, and other services to the units that use them.

**Summary**

*Commissioning – Improving Building Efficiency*

The commissioning team was formed in Fiscal Year 2008/2009 with the intention of tuning up heating, ventilating, and air conditioning (HVAC) systems in existing campus buildings; identifying energy conservation measures with associated return on investment; and verifying that new construction projects are delivered with HVAC equipment operating as efficiently as possible while meeting the requirements of the building occupants. Over a five year period, commissioning will be carried out in 10,500,000 square feet of academic and athletic buildings. Over a ten year period, existing building commissioning will be done in 5,800,000 square feet of Residential and Hospitality Services buildings, covering a total of nearly 16.4 million square feet (Figure 2).

Commissioning is a systematic approach to inspection of existing mechanical systems, including measuring air flows, hot water and chilled water flow, balancing the entire HVAC systems and HVAC controls adjustments to improve operation, comfort, and energy conservation. The commissioning process includes testing steam traps, replacing failed steam traps, validating sequence of operations and programming of HVAC systems for optimization and comfort, and analyzing vibration of rotating equipment. Program completion will save an estimated 25 to 30% in annual energy consumption for campus. The commissioning program will help delay the need for additional generation capacity, improve efficiency, reduce the impact to the environment, and avoid increasing utility costs.

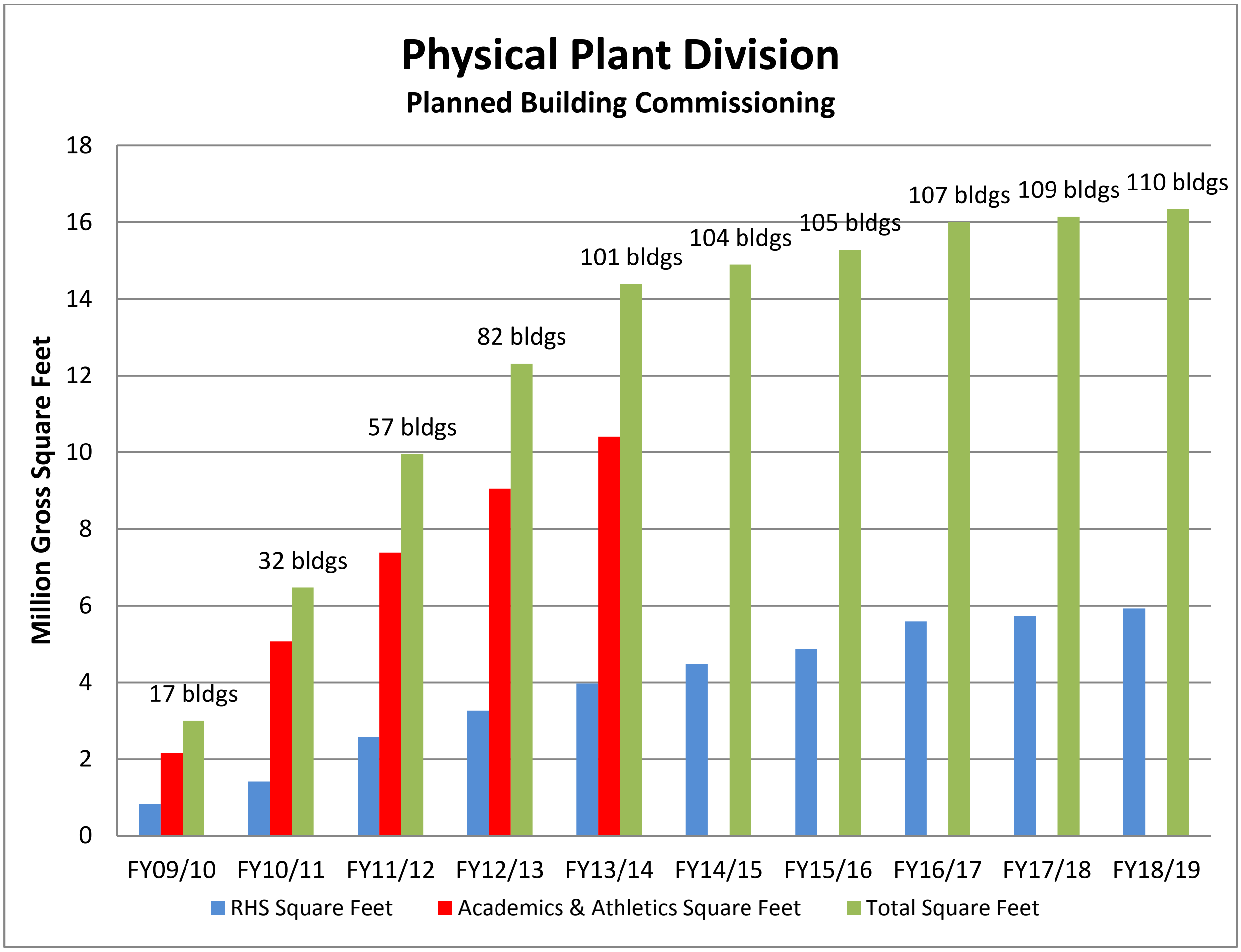



**Figure 2.** *Commissioning Timeline (Cumulative Progress).*

### Analysis

*Commissioning – Improving Building Efficiency*

To date thirteen buildings have completed the first phase of the commissioning process. The thirteen buildings are; Erickson Hall; Radiology; Food Safety & Toxicology; Malcom G. Trout Food Science; Manly Miles; Duffy Daugherty Football Building; BioChemistry; Plant & Soil Science; Plant Biology; Cyclotron; Holden Hall; Owen Hall; and International Center. In seven of the thirteen buildings, the maintenance and repair work is around 80% complete. All thirteen buildings are in the process of implementing the additional energy conservation measures identified by the commissioning process.

- The first phase of building commissioning is estimated to yield an annual savings in utility cost of approximately 5%.

- During the second phase of the commissioning process, maintenance and repair opportunities identified by the team are implemented and further avoid energy costs on average of 5% annually.

- The third phase of commissioning requires implementation of the energy conservation measures identified which require capital investment. Energy conservations measures with a return on investment of 7 years or less are funded and will yield an average avoided energy consumption of an additional 10% when completed.

The measured energy savings to date in ten of the existing buildings that have been through the first phase of the commissioning process is 6.37% of the baseline. See (Figure 3a).

When the energy conservation measures have been fully implemented, the estimated avoided energy in the first ten buildings is 22.76% of the baseline, with value of over $1.85 million. See (Figure 3b).

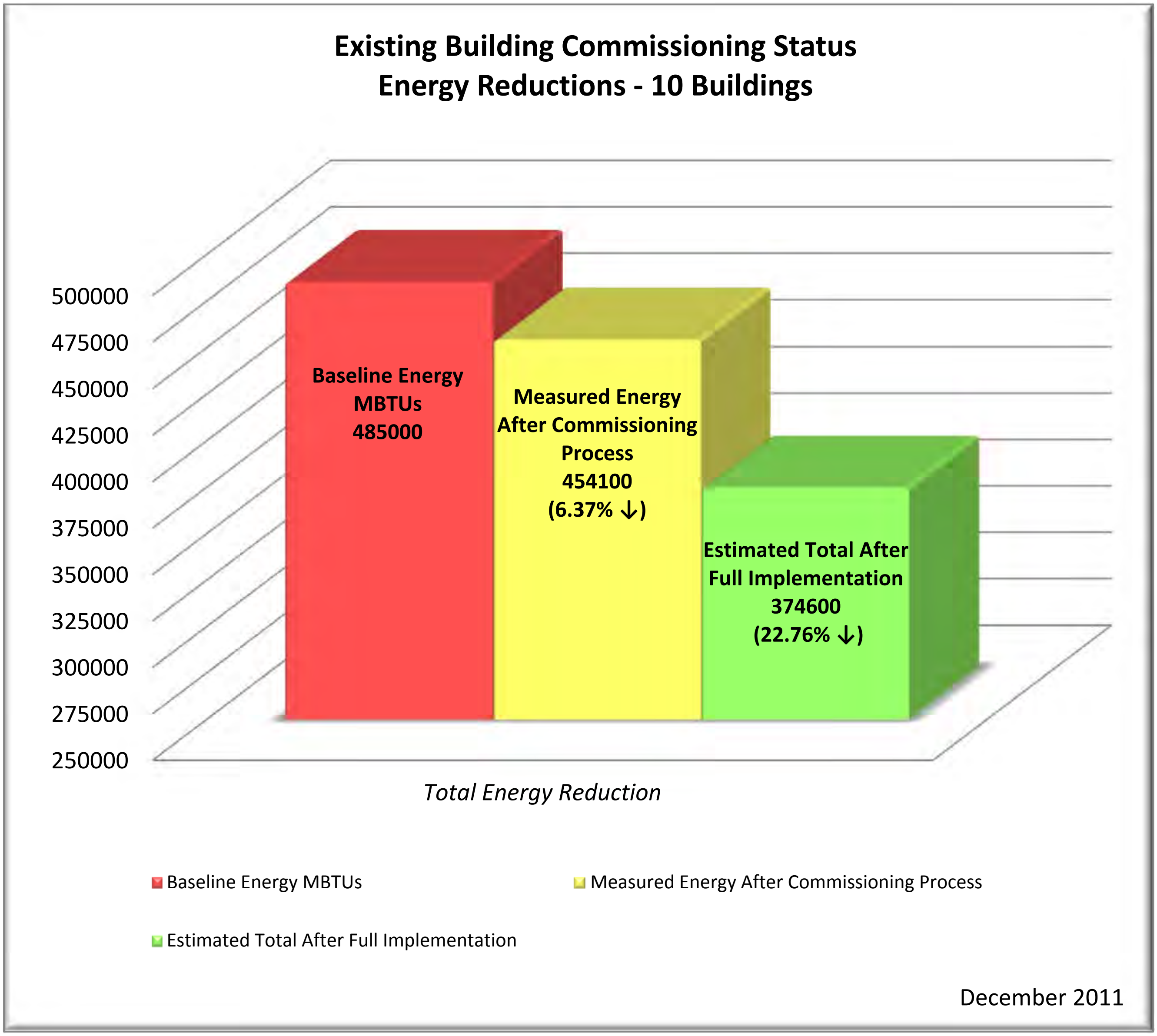



**Figure 3a.** *Commissioning Forecast, Energy.*

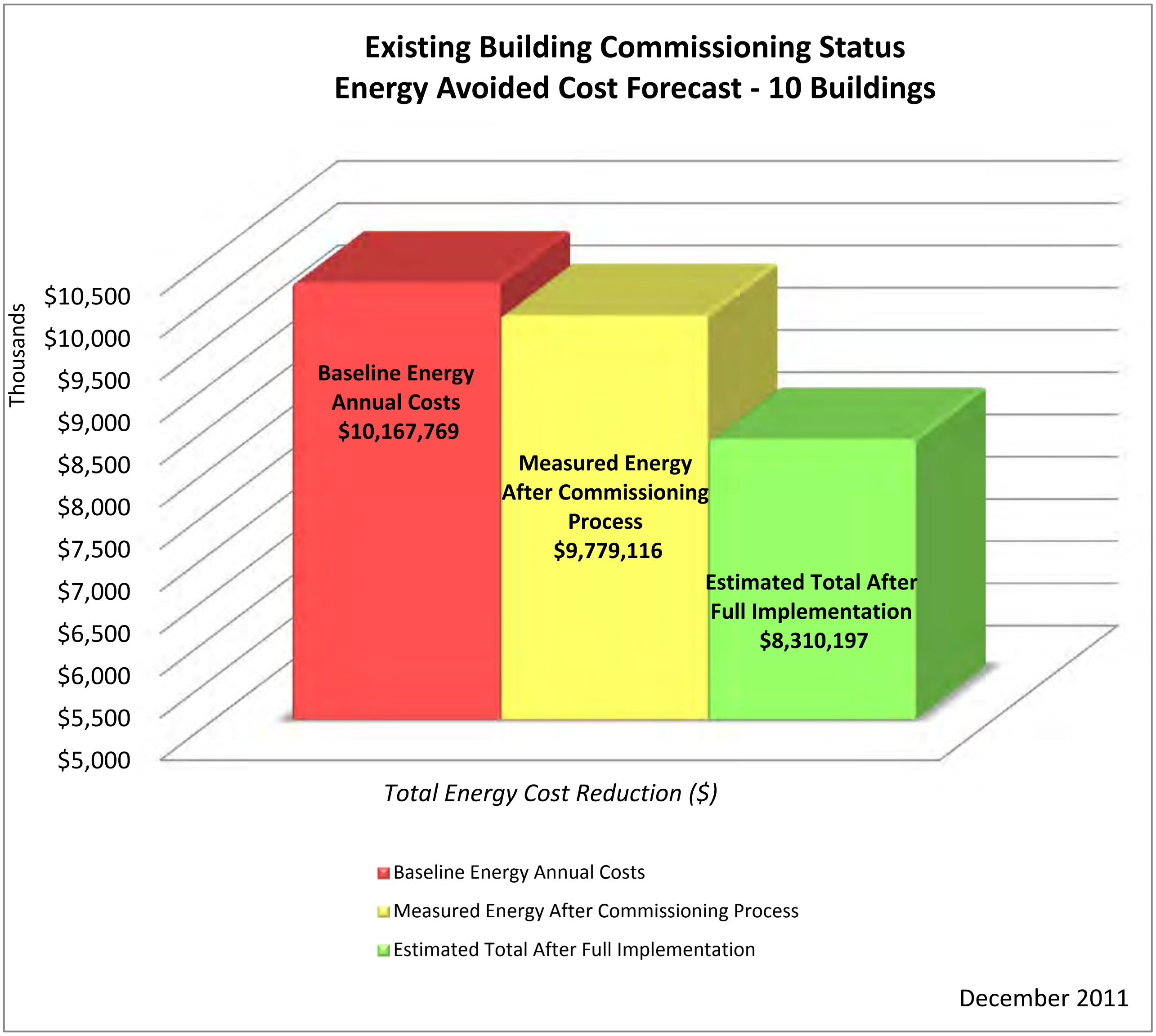



**Figure 3b.** *Commissioning Forecast, Energy Costs.*

Erickson Hall was the first building to undergo the commissioning process and has subsequently experienced an impressive 32% reduction in energy consumption. Revisions to heating, ventilating, and air conditioning operational hours saved close to 5% in energy costs for the building. The Just-In-Time maintenance window replacement project in Erickson Hall yielded additional energy savings, but with a greater than 50 year returns on investment due to the high capital cost. The participation of the College of Education as good environmental stewards of energy provided additional savings (Figure 4).

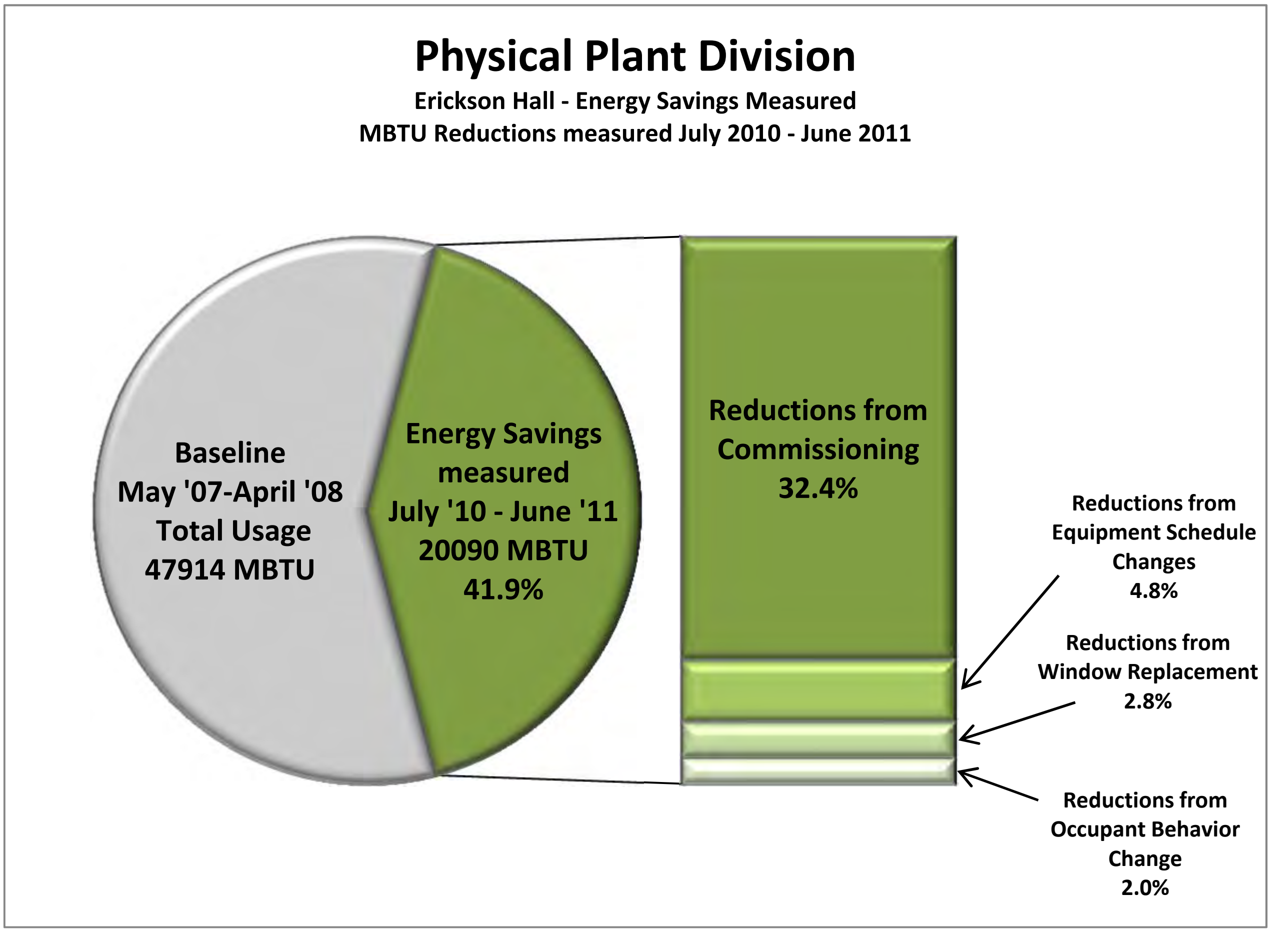



**Figure 4.** *Erickson Hall Energy Savings Measured.*

### Future Directions

*Commissioning – Improving Building Efficiency*

When the existing building commissioning program has been implemented for all 110 major buildings, the estimated avoided energy costs will be $7 million annually for campus. The seven million in avoided energy costs will be shared between general fund facilities at $5.25 million annually and auxiliaries at $1.75 million annually. The program is expected to reduce energy consumption by an average 20% across over 16 million square feet of existing building space.

### Summary

*Real Time Utility Meters*

The first phase of the smart real time meter upgrade project focused on electrical meters and provided the data to track the progress of reduction of energy used in buildings such as Erickson Hall, as noted in figure 4. Close to 300 smart real time electrical meters were installed in university buildings as part of a three year program, and the data is publically available at http://meters.msu.edu. This data is used by the campus GIS system (http://www.gis.msu.edu) to report the monthly consumption of energy by building and send electronic reports on electrical energy use to over 600 environmental stewards across campus. Real time live meters provide opportunities to identify buildings that consume above normal amounts of energy and make corrections to building systems to reduce the consumption.

## Analysis

*Real Time Utility Meters*

Displaying real time energy feedback to students, faculty and staff through the http://energydashboard.msu.edu provides the opportunity for engagement such as energy reduction competitions between residence halls and raises awareness on the amount of energy consumed on campus (Figure 5). Continuous feedback to the campus community in a transparent way helps to develop a culture of energy conservation. Further, measurement, monitoring, and analysis of the energy used on campus provides opportunities for improvement in conservation, validates technologies installed to reduce energy use, brings insight into new areas as potential targets for reductions, and provides validation of the commissioning efforts, similar to Figure 4 for Erickson Hall.

Currently 298 electric meters of those 290 are real time smart meters reporting live data to the web. The power plant also manages 414 steam/condensate meters and 103 water meters. Of those, 18 are real time steam meters, and 32 are real time water meters. Natural gas delivered to individual buildings is metered by the local utility, Consumers Energy. The campus has over 100 natural gas meter accounts. The long range plan is to continue to upgrade to real time smart steam and water meters. Installation of real time smart meters will improve accuracy of the utility data, provide real time information to determine if buildings are consuming above normal amounts of energy, and provide transparency via the web to the campus community on consumption of energy.

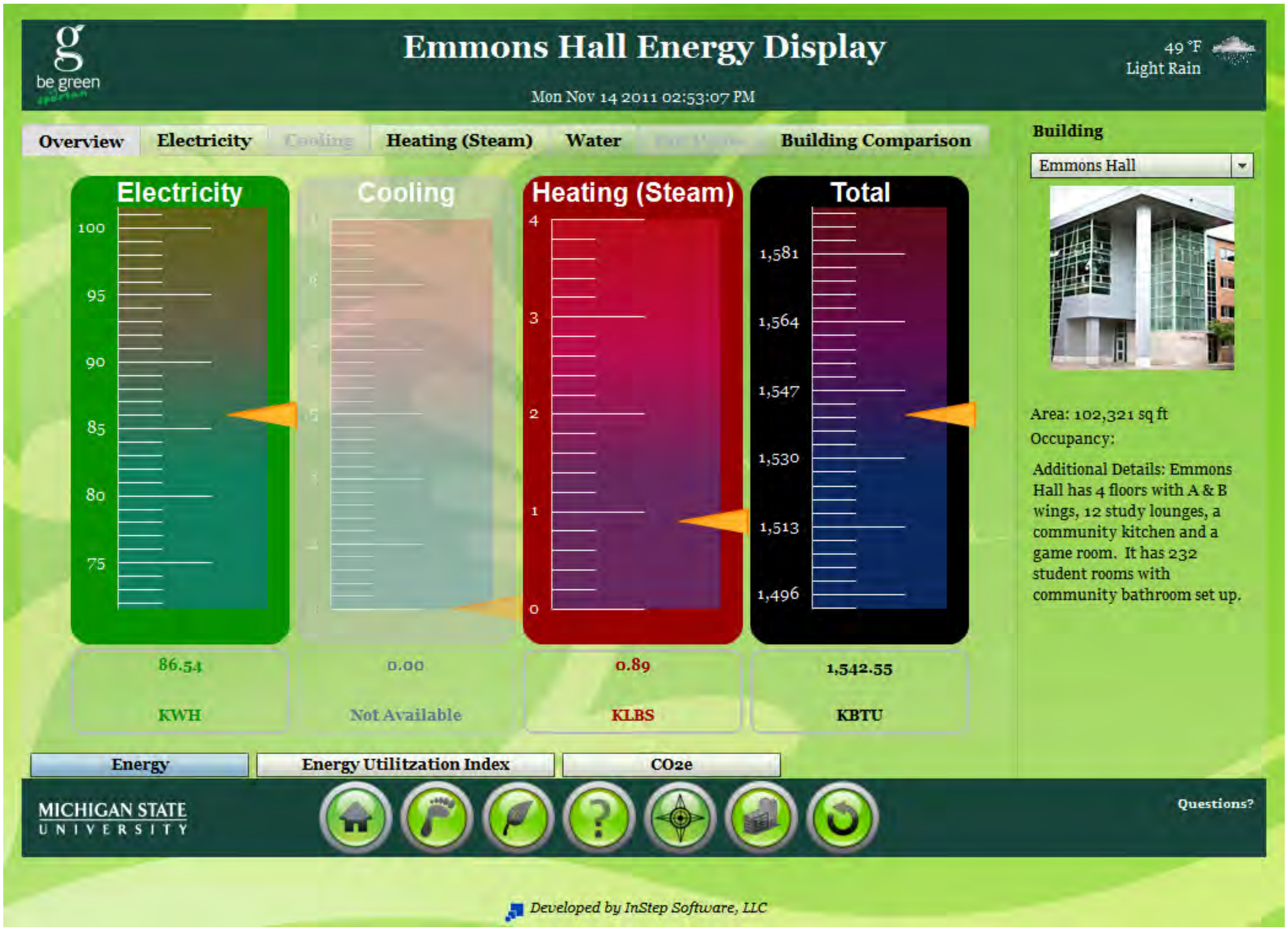



**Figure 5.** *Emmons Hall Energy Dashboard.*

## Future Directions

### *Real Time Utility Meters*

Measuring the energy used on campus includes not only electrical use, but also steam, water, and natural gas. In the past, steam use has been measured by the condensate leaving a building. This method of metering has a low initial cost, but lacks the ability to detect losses within the building, such as steam traps leaking, or condensate going to drain. That method therefore does not provide consistent data and could potentially lead to energy waste. MSU has a 10 year plan for upgrading to real time steam meters in all major facilities on campus. This plan will allow measurement of the steam entering the building and comparison to the condensate leaving the building, which will determine losses within the building. Upgrading to real time smart steam meters will provide a comprehensive picture of energy used within a building when coupled with smart electrical meter data. Potable water meters have been upgraded in essentially all Residential and Hospitality Services facilities to smart real time meters. Long range planning for water conservation and water meter upgrades is in progress.

## Summary

*Central Computerized Control of Building Systems*

Central Computerized Control of energy consuming systems was first installed on campus in the early 1970's as an answer to the “energy crisis” and high energy costs at the time. Installation of Central Computerized Control, also known as a centralized building energy management system, and implementation of energy conservation strategies is a standard for all new construction to maintain Michigan State University.

## Analysis

*Central Computerized Control of Building Systems*

Installation of Central Computerized Control of energy consuming systems in a building offers an average five year payback on the investment from the energy conserved. One recent example is the Manly Miles building. When the building energy management system was installed, Manly Miles saw a 25% reduction in both electrical and natural gas use over the course of a year. The amount of energy saved due to installation of Central Computerized Control building energy management depends on the type and number of pieces of heating, ventilating, and air conditioning (HVAC) equipment in a building. Longer return on investments can be expected for facilities that are not air conditioned.

Central Computerized Control manages the HVAC systems in over 16 million square feet of campus through high speed network and servers. The central computer system programs start and stop times of HVAC equipment, adjust equipment operations based on weather, manage communications between buildings, alarm technicians when equipment is out of operational range, and integrate algorithms to operate equipment efficiently while maintaining occupant comfort. HVAC controls and new technologies are continuously being implemented on campus and include:

- Demand ventilation, in which carbon dioxide sensors in lecture halls control ventilation based on occupancy;
- Laboratory air quality sensors which control the number of air changes per hour based on air quality;
- Occupant override which enables override buttons based on occupant request in the building, in lieu of scheduling extended hours of operation of HVAC systems;
- Weather data which is utilized to optimize outdoor air control and maximize “free cooling” when conditions are right;

- Night time setbacks which keep buildings at minimum temperature levels during unoccupied hours, reducing energy consumption;
- Classroom occupancy sensors which not only turn off lighting during unoccupied hours, but also minimize ventilation rates to reduce energy consumption even further;
- Heat recovery systems which utilize thermal recovery loops to capture energy in the exhaust air from buildings and use the heat to pre-heat incoming outdoor air.

These and other technologies and control strategies help to keep campus consumption to a minimum.

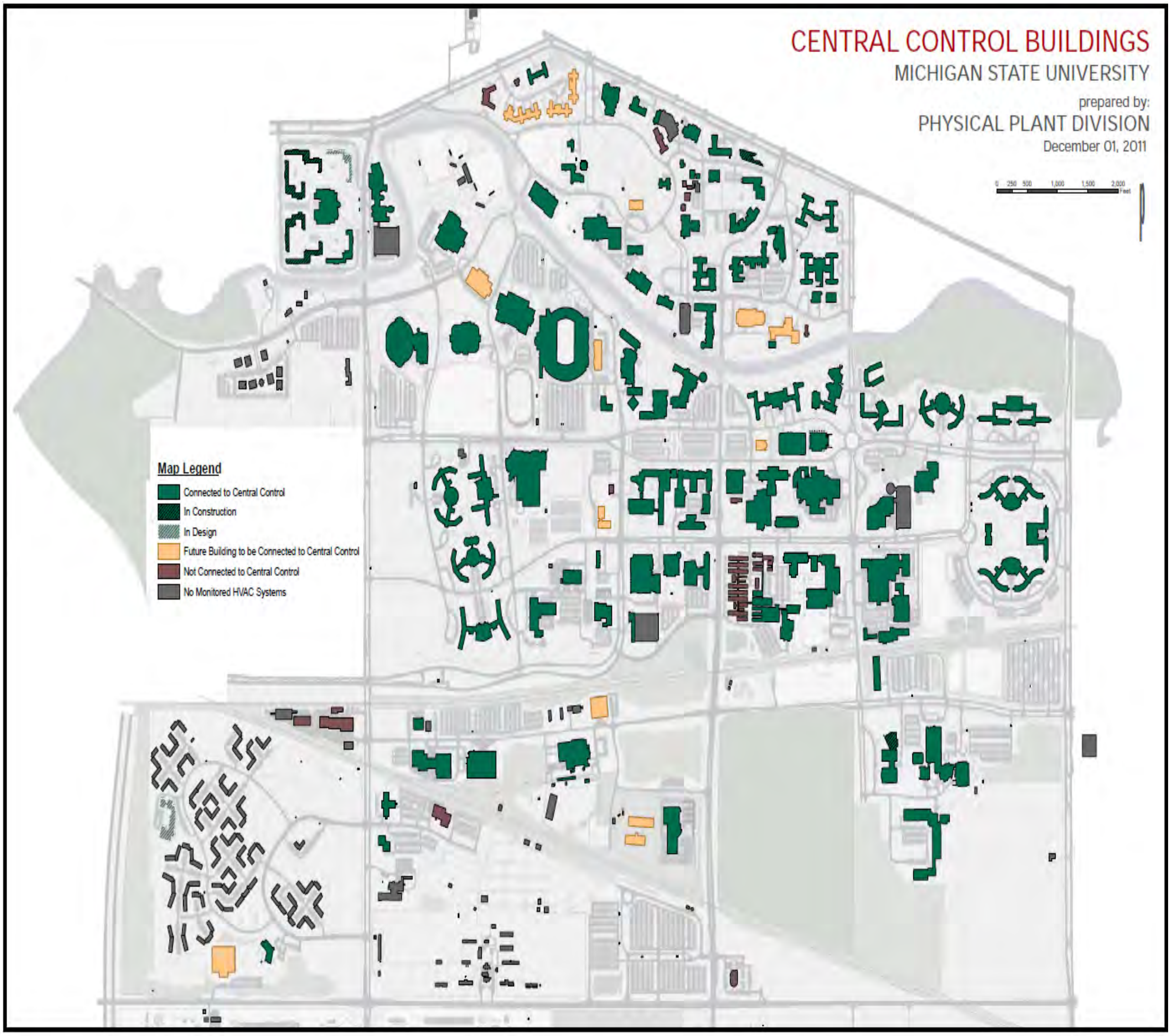



**Figure 6.** *Central Control Buildings.*

## Future Directions

*Central Computerized Control of Building Systems*

Installation of Central Computerized Control in the remaining facilities shown in Figure 6 and highlighted in yellow will be completed as funding becomes available. Central Computerized Control is working with the commissioning team to develop a continuous automated commissioning process. With the power of the computers controlling equipment on campus and the amount of data available on how those systems are operating, setting up a mechanism for continuous evaluation and improvement of HVAC systems seems natural. Once a building has completed the commissioning process and is finely tuned to be as energy efficient as possible, monitoring those systems to determine when the building begins to drift off course, and making quick corrections will ensure that energy savings continue to accumulate for years to come. A pilot project is underway utilizing two different software approaches to model building HVAC systems and send automated alarms when the systems begin to drift off course. Continuous building commissioning will leverage the investment in the existing building energy management hardware and software to ensure energy conservation measures are maintained in the future.

## INFRASTRUCTURE AND DATA DEVELOPMENT

### Summary

*Environmental Data Repository*

Over the past year and a half, an effort has been underway to create a university-wide Environmental Data Repository which will provide a central source for all data relating to campus environmental sustainability. Having such a repository will enable Michigan State University to track how well it is doing in terms of becoming a more sustainable campus community by providing a single source of information that can be accessed for detailed reporting on environmental performance. This database will house information ranging from the amount of coal used and the recycled content of products and purchases, to the quantity of paper recycled and fluorescent bulbs.

Information will be publically available so that it can be used as the central data source for reporting MSU sustainability to both university administrators and outside entities (*e.g.,* the Association for the Advancement of Sustainability in Higher Education and the Environmental Protection Agency, etc.).

Although the repository itself is not designed to interpret the contents of the database, it will provide key indicators and information to those who use data for forecasting, reporting, and modeling.

### Background

The process for developing and implementing the environmental data repository began a year and a half ago at the request of the Office of the Vice President for Finance and Operations and Treasurer. A work group was formed which included representatives from each campus unit that would be providing data to the repository. The units represented for the initial phase included the Geographic Information Systems Office (GIS), Physical Plant, Surplus and Recycling, Residential and Hospitality Services, Purchasing, and Office of Radiation, Chemical, and Biological Safety (ORCBS).

The initial meetings of the work group were used to define what function the data repository would serve, which campus operations should have data collected, and which of those operations would be included in the first phase of implementation. A contact person representing each of these areas, were assigned the responsibility for providing the data specific to their portion of the repository.

Two graduate students assisted the process by meeting with each representative individually and developing a template for data collection. Below in Figure 1 is an example of the template for Transportation Services.

| | |
|---|---|
| **Name of the Responsible Person:** | Brian Watts |
| **Position:** | Assistant Director |
| **Department:** | Transportation Services |

| S. No. | Parameter | Collcetion Frequency Calender | Source Contact Department | Source Contact Person | Direct Input Value | Extract Output Value | Additional Info. | Backtrack Data | Data Definition | Calculation Parameters |
|---|---|---|---|---|---|---|---|---|---|---|
| **Transporataion** | | | | | | | Backtrack Data - how far back the data o | | | Bus Btu per mile |
| 1 | Bus Energy Consumption (Btu) | CY | Transportation Services | Brian Watts | | 0 | Input Value: Total bus mileage | | | Fleet Btu per mile |
| 2 | Fleet Vehicle Energy Consumption ( | CY | Transportation Services | Brian Watts | | 0 | Input Value: Total fleet mileage | | | |
| 3 | Renewable Percentage for Transport | CY | Transportation Services | Brian Watts | | 0 | | | | |
| 4 | Number vehicles | CY | Transportation Services | Brian Watts | | 0 | | | | |
| 5 | Gallons unleaded gas Total FLEET | CY | Transportation Services | Brian Watts | | 0 | | | | |
| 6 | Gallons E85 Purchased | CY | Transportation Services | Brian Watts | | 0 | | | | |
| 7 | Gallons E85 Fleet | CY | Transportation Services | Brian Watts | | 0 | | | | |
| 8 | Gallons unleaded gas Fleet | CY | Transportation Services | Brian Watts | | 0 | | | | |
| 9 | Hybrid | CY | Transportation Services | Brian Watts | | 0 | | | | |
| 10 | E85 fueled vehicles | CY | Transportation Services | Brian Watts | | 0 | | | | |
| 11 | unleaded gas cars | CY | Transportation Services | Brian Watts | | 0 | | | | |
| 12 | unleaded gas trucks | CY | Transportation Services | Brian Watts | | 0 | | | | |
| 13 | biodiesel bus | CY | Transportation Services | Brian Watts | | 0 | | | | |
| 14 | biodiesel trucks | CY | Transportation Services | Brian Watts | | 0 | | | | |
| **STARS Transportation** | | | | | | | | | | |
| 15 | Institution Gas Hybrid Vehicles | CY | Transportation Services | Brian Watts | | 0 | | | | |
| 16 | Institution diesel Hybrid Vehicles | CY | Transportation Services | Brian Watts | | 0 | | | | |
| 17 | Institution plug in Hybrid Vehicles | CY | Transportation Services | Brian Watts | | 0 | | | | |
| 18 | Institution Electric Vehicles | CY | Transportation Services | Brian Watts | | 0 | | | | |
| 19 | Institution Hydrogen Vehicles | CY | Transportation Services | Brian Watts | | 0 | | | | |
| 20 | Institution Bio Vehicles | CY | Transportation Services | Brian Watts | | 0 | | | | |
| 21 | Institution Ethanol Vehicles | CY | Transportation Services | Brian Watts | | 0 | | | | |
| 22 | Total Institution Vehicles | CY | Transportation Services | Brian Watts | | 0 | | | | |
| **Waste** | | | | | | | | | | |
| 23 | Regulated Recycling- Coolants (gall | CY | Transportation Services | Brian Watts | | 0 | | | | |
| 24 | Regulated Recycling- Transportation | CY | Transportation Services | Brian Watts | | 0 | | | | |
| **Additional Parameters** | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

**Figure 1.** *Example of Template Used to Collect Data for Transportation Services.*

The work group decided that all data should be tabulated and submitted on an annual basis, at the close of the fiscal year, to maintain as much consistency in data collection and reporting as possible across the various units. Data for FY 2011 has already been collected and incorporated into the GIS interface. A listing of all the data elements included in the initial release of the data repository, sorted by unit and category, is presented at the end of this section.

The Environmental Data Repository will be available to the public through the university's Geographic Information Systems (GIS) website at www.gis.msu.edu. The GIS office will house the Environmental Data Repository and will be responsible for maintaining the database elements contained within it. Below in Figure 2 is a graphic of the preliminary interface for the environmental data repository.

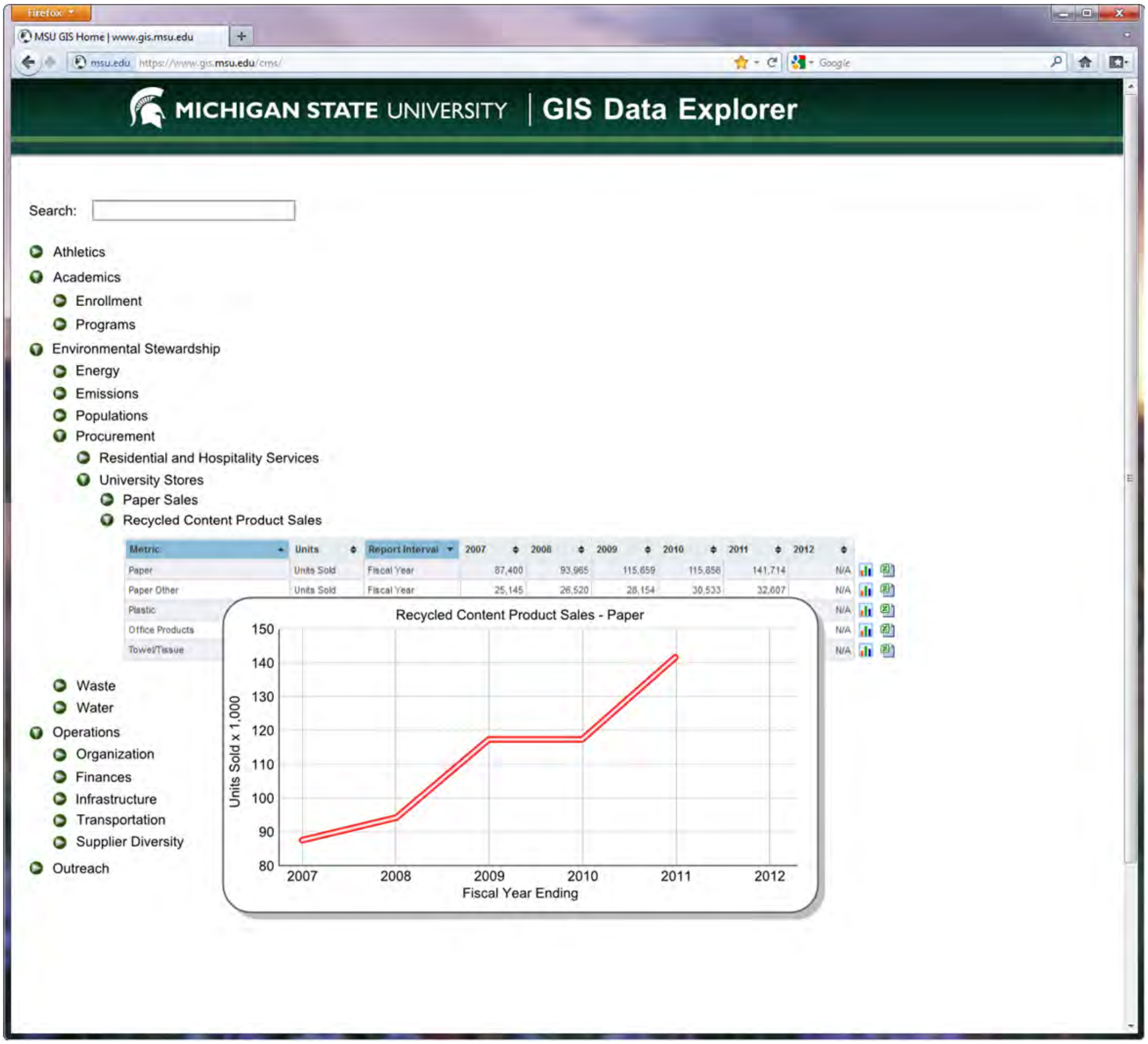



**Figure 2.** *Example of the Environmental Data Repository's Interface.*

The initial interface of the Environmental Data Repository will feature a set of graphic "buttons" that will represent a category of data elements. For example, a click on one of the buttons will lead to information regarding how much recycled content paper has been sold on campus over the past five fiscal years. Information representing the data elements, (in this example, recycled content paper sales on campus) can be presented either in a report form or graphically as in a graph or chart format. An example of each is shown in figure 3 and 4.

| Paper Sold By Stores | FY 2005-2006 Reams Sold | FY 2006-2007 Reams Sold | FY 2007-2008 Reams Sold | FY 2008-2009 Reams Sold | FY 2009-2010 Reams Sold | FY 2010-2011 Reams Sold |
|---|---|---|---|---|---|---|
| 100% Recycled Content | 19,533 | 23,175 | 25,547 | 30,558 | 33,056 | 28,912 |
| 30% Recycled Content | 59,944 | 71,224 | 72,688 | 97,684 | 93,758 | 73,717 |
| Virgin | 177,696 | 198,018 | 189,569 | 134,529 | 111,789 | 112,953 |
| TOTAL Paper Use | 257,173 | 292,417 | 287,804 | 262,771 | 238,603 | 215,582 |

| Paper Sold By Stores | FY 2005-2006 $ | FY 2006-2007 $ | FY 2007-2008 $ | FY 2008-2009 $ | FY 2009-2010 $ | FY 2010-2011 $ |
|---|---|---|---|---|---|---|
| 100% Recycled Content | $63,487.49 | $77,465.00 | $87,375.85 | $118,413.56 | $131,976.51 | $122,849.23 |
| 30% Recycled Content | $169,694.21 | $220,357.14 | $250,908.42 | $338,214.82 | $346,477.87 | $283,149.56 |
| Virgin | $432,795.58 | $571,391.17 | $596,986.01 | $443,507.65 | $378,778.08 | $398,319.42 |
| TOTAL Paper Use | $665,977.28 | $869,213.31 | $935,270.28 | $900,136.03 | $857,232.46 | $804,318.20 |

| Paper Sold By Stores | FY 2005-2006 Reams Sold | FY 2006-2007 Reams Sold | FY 2007-2008 Reams Sold | FY 2008-2009 Reams Sold | FY 2009-2010 Reams Sold | FY 2010-2011 Reams Sold |
|---|---|---|---|---|---|---|
| Recycled Content | 79,477 | 94,399 | 98,235 | 128,242 | 126,814 | 102,629 |
| Virgin | 177,696 | 198,018 | 189,569 | 134,529 | 111,789 | 112,953 |
| Total | 257,173 | 292,417 | 287,804 | 262,771 | 238,603 | 215,582 |

| Paper Sold By Stores | FY 2005-2006 $ | FY 2006-2007 $ | FY 2007-2008 $ | FY 2008-2009 $ | FY 2009-2010 $ | FY 2010-2011 $ |
|---|---|---|---|---|---|---|
| Recycled Content | $233,181.70 | $297,822.14 | $338,284.27 | $456,628.38 | $478,454.38 | $405,998.79 |
| Virgin | $432,795.58 | $571,391.17 | $596,986.01 | $443,507.65 | $378,778.08 | $398,319.42 |
| Total | $665,977.28 | $869,213.31 | $935,270.28 | $900,136.03 | $857,232.46 | $804,318.20 |

**Figure 3.** *Example of a Report Showing Purchasing Data.*

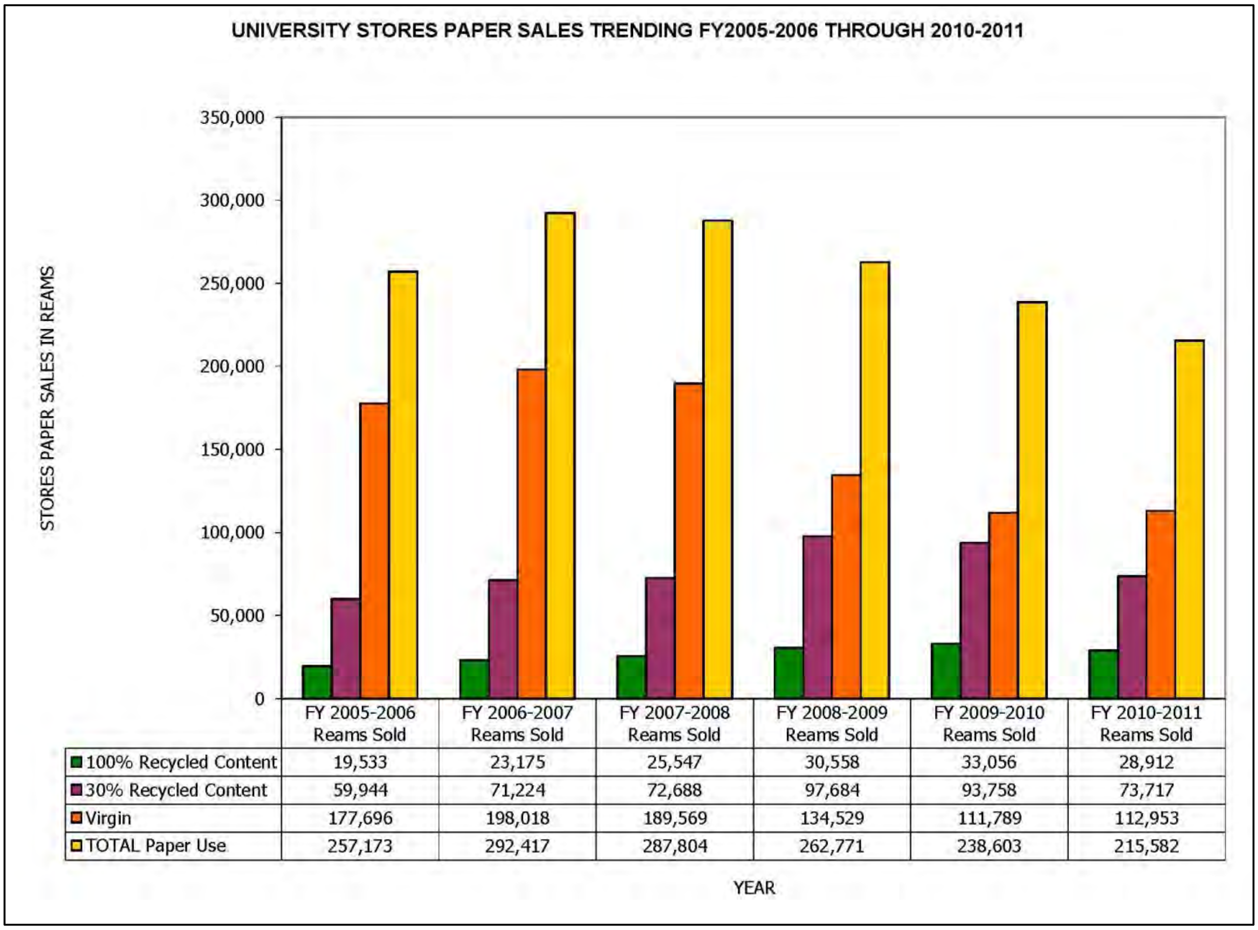



**Figure 4.** *Example of a Chart Showing Data within the Environmental Data Repository.*

Some elements have up to five years of historical data that is available in the repository for use in conducting analysis, while other elements have as few as one year of data collected. As the data from future years is added, benchmarking analysis and future trend predictions of MSU's sustainability progress will become more precise.

**Future Directions**

Work on the development and refinement of the Environmental Data Repository is ongoing. Some of the challenges include ensuring that the data received for the repository is consistent and accurate, which is critical to the value and usability of the information provided by the data repository. In addition, before collecting new data, the data need must outweigh the work effort required to collect the data.

Future phases of the project involve identifying, defining, and collecting data elements related to environmental sustainability from additional campus units such as Land Management, University Services, and Athletics, reviewing and possibly adding new data elements from the campus units involved in the initial phase of development, and implementing web interface upgrades based on feedback from test users.

The following is a complete listing of data elements that have been collected for the data repository so far.

Physical Plant

Amount of $CO_2$ in metric tons used by University Automotive by calendar year
Amount of natural gas used by building in a calendar year
Amount of natural gas used by Power Plant minus best in class by calendar year
Amount of coal used by Power Plant in a calendar year
Amount of coal burned in tons by calendar year
Amount of gas burned by calendar year
Amount of cornstarch burned by tons in a calendar year
Amount of wood burned by tons in a calendar year
Amount of switch grass burned by tons in a calendar year
Amount of fuel heating-BTU
Electric use in megawatt hours
Steam generated by thousands of pounds
Steam send out by thousands of pounds
Performance of load factors on campus
Performance of apparent boiler efficiencies
Evaporation rate
Emission control- limestone
Emission control- UREA

Emission control- sand
Number of responses to snow or ice events
Total snow fall in inches
Number of times salt trucks responded
Number of times ERT responded
Number of times snow removal contractor responded
Number of times sidewalk crews responded outside normal working hours
Quantity of road salt ordered in tons
Cost of road salt ordered
Quantity of mag chloride ordered in bags
Cost of mag chloride
Quantity of bagged rock salt
Cost of bagged rock salt
Quantity of Sno N Ice ordered in bags
Cost of Sno N Ice
Quantity of Beat-Heet ordered in Gallons
Cost of Beat-Heat
Quantity of brine produced in gallons
Quantity of road salt used for brine in tons
Landscape Services labor hours spent on snow and ice responses
Landscape Services labor costs for snow and ice responses
Labor costs for turf grass staff and farms staff responses to snow and ice
Snow contractor costs
oil in gallons

Total landscape services equipment rental hours
Total landscape services equipment rental costs
Bus energy consumption by BTU
Fleet vehicle energy consumption by BTU
Renewable percentage for transportation energy
Number of vehicles
Total gallons of unleaded gas used by university fleet only
Total gallons of E85 purchased
Total gallons of E85 used by university fleet
Number of E85 fueled vehicles
Number of unleaded gas cars
Number of unleaded gas trucks
Number of biodiesel buses
Number of biodiesel trucks
Number of institution gas hybrid vehicles
Number of institution diesel hybrid vehicles
Number of institution plug in hybrid vehicles
Number of institution electric vehicles
Number of institution bio vehicles
Number of institution ethanol vehicles
Total number of institution vehicles
Regulated recycling of coolants in gallons
Regulated recycling of transportation

Office of Radiation, Chemical, and Biological Safety (ORCBS)

Recycled 4’ fluorescent bulbs
Recycled 8’ fluorescent bulbs
Recycled incandescent/CFL bulbs
Recycled ballasts per pound for calendar year
Recycled electronics per pound by calendar year
Recycled nickel cadmium batteries per pound by calendar year
Recycled lithium ion batteries per pound by calendar year
Recycled nickel metal hydride batteries per pound by calendar year
Recycled small sealed lead acid batteries per pound by calendar year
Volume of oil removed from MSU Waste Storage Facility and MSU Power Plant

Recycling

Total recycling in tons
Total solid waste in tons
Total waste from campus in tons per person
Amount of paper recycled in tons
Amount of paper recycled in percentage of total waste
Amount of glass containers recycled in tons
Amount of plastic containers recycled in tons
Amount of metal containers recycled in tons
Total amount of compost in tons
Total MSU campus trash in tons
Internal paper recycled

Purchasing

Sales of white office paper
Sales of watermark office paper
Sales of color copy paper
Sales of other paper products which includes bags, pads, and wrap
Sale of plastic materials
Sale towels and tissue
Paper sales using 100% recycled content in reams
Paper sales using 30% recycled content in reams
Paper sales using no recycled content (virgin) in reams

Residential and Hospitality Services

- Food purchased both locally and regional in dollar amount
- Napkins purchased in dollar amount
- Quantity of food supplies (excluding napkins) in dollar amount
- Number of tray less dinning units
- Number of vegetarian and vegan dinning in units
- Trans fats in dollar amount
- Pre-consumer food waste composting in pounds
- Post-consumer food waste composting in pounds
- Food donations in pounds
- Recycled content napkins in dollar amount
- Number of reusable mug discounts
- Number of reusable mugs sold through concessions
- Number of refills by mugs
- Recycled grease in pounds
- Fry oil purchased in dollar amount

Parking

- Number of bicycles registered
- Number of student vehicles registered
- Number of carpool permits and number of people in those carpools
- Percentage of employees not driving in carpools
- Number of parking spaces on campus
- Number of deck parking spots on campus
- Percentage of parking spaces that are parking decks on campus

## TRANSPORTATION AND SAFETY

*10 Year Trend for Employee Vehicle Registration*

### Summary

By action of the Board of Trustees in 1983, the parking system at MSU must be self-supporting. The largest source of revenue to that system is the sale of parking permits to employees, students, and visitors, and the most significant part of those revenues comes from permits sold to employees. Sales indicated in Figure 1 reflect the two year cycle on which the permits are sold. Sales are always greater in the first year of the two year cycle.

### Analysis

Currently, the large majority of employee permits are sold on-line and paid for through payroll deduction. The number of employee parking permits sold year-over-year remains remarkably stable as does the revenue stream. However, due to the rising cost of operating a motor vehicle, a number of MSU employees may begin to seek other options. Low cost permits are available that allow an employee to use their no-cost on-campus CATA bus pass with a commuter lot permit. Car pool permits have been available for years but are finding increased use with more than a dozen in existence. Two MichiVan groups now park on campus. MichiVan is a commuter vanpool program, sponsored by the Michigan Department of Transportation, that allows riders to pay a monthly fee and share an MDOT supplied van along an established route.

### Future Directions

As part of the Campus Master Plan Principles, an effort is being made to move pieces of the parking infrastructure to the perimeter of campus. However, if the trend toward lower cost perimeter parking and carpooling accelerates, and the use of mass transit grows, close monitoring of the balance of low cost parking options and the resulting revenue for the self-supporting parking system must be monitored.


**Figure 1.** *Number of Faculty/Staff Vehicle Registrations Compared to the Number of Faculty/Staff Employees*.

*Commuter Parking Registrations*

**Summary**

Commuter parking permits are sold to students living off campus. In addition to the low first cost, the permits can be used to receive half price parking at selected campus core lots or combined with a bus pass to achieve a range of parking options that can be customized to meet various needs.

**Analysis**

In recent years the number of off-campus students purchasing commuter lot permits has declined. In 2008, Farm Lane from Red Cedar Rd to Mt. Hope Rd was rebuilt to allow movement of traffic without delay from the 60 plus trains daily passing through campus. Access to the commuter lot and access to main campus was severely impacted during construction. Utilization of the Mt. Hope commuter lot has never recovered to its pre-construction level. Additionally, while students previously bought commuter lot permits for the entire year, many wait to purchase pro-rated (less expensive) permits after the weather turns cold, reflecting increased concern with the cost of motor vehicle operation.

**Future Directions**

The potential to develop a more northerly commuter lot that would also help with the traffic management for special events has been a long-held goal. The return of the Michigan State Police compound site may allow this to be realized. Migrating core campus parking, especially for north campus residents and employees, will become more acceptable if such a facility can be constructed. Bus service there will complement the bus service to the south commuter lot and make the low cost perimeter parking more attractive for the entire campus.

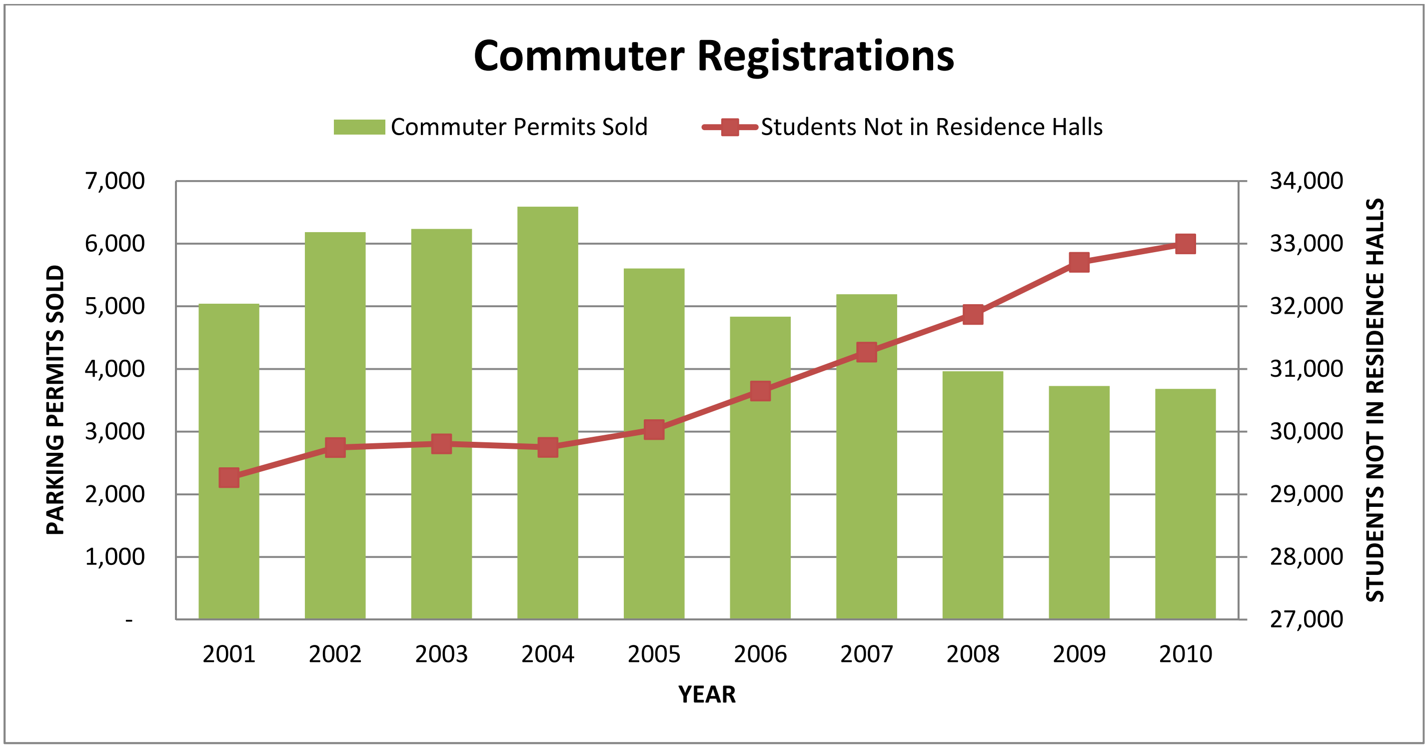



**Figure 2.** *Number of Commuter Vehicle Registrations Compared to the Number of Students.*

*Student Vehicle Registrations*

**Summary**

Students living in residence halls are permitted to park in four on-campus storage lots which are available according to the assigned residence hall. The four lots have a combined capacity of more than 4,400 spaces. Only sophomores and upper class students are permitted to have vehicles on campus full time. Students living off campus have the option of purchasing commuter permits, parking at meters or in pay lots, or applying for special parking privileges based upon need.

**Analysis**

The average number of storage lot parking permits purchased by students living on-campus closely tracks the number of students reflected in the residence hall house count numbers. The reductions in the number of vehicles registered can be attributed to the Residence Hall system taking successive buildings off-line for refurbishing resulting in a drop in house count. While overall costs to the parking system for the management of the parking infrastructure could be significantly reduced by the elimination of the student storage lots, the position of the Residence Hall management has long been that the four student storage lots are a necessary part of keeping the residence hall system attractive.

**Future Directions**

Absent a significant change in the ability of students to bring vehicles to campus while they live in residence halls, or a change in the size of the residence hall system, the number of permits sold to this group will likely continue to reflect the size of the student on-campus population.

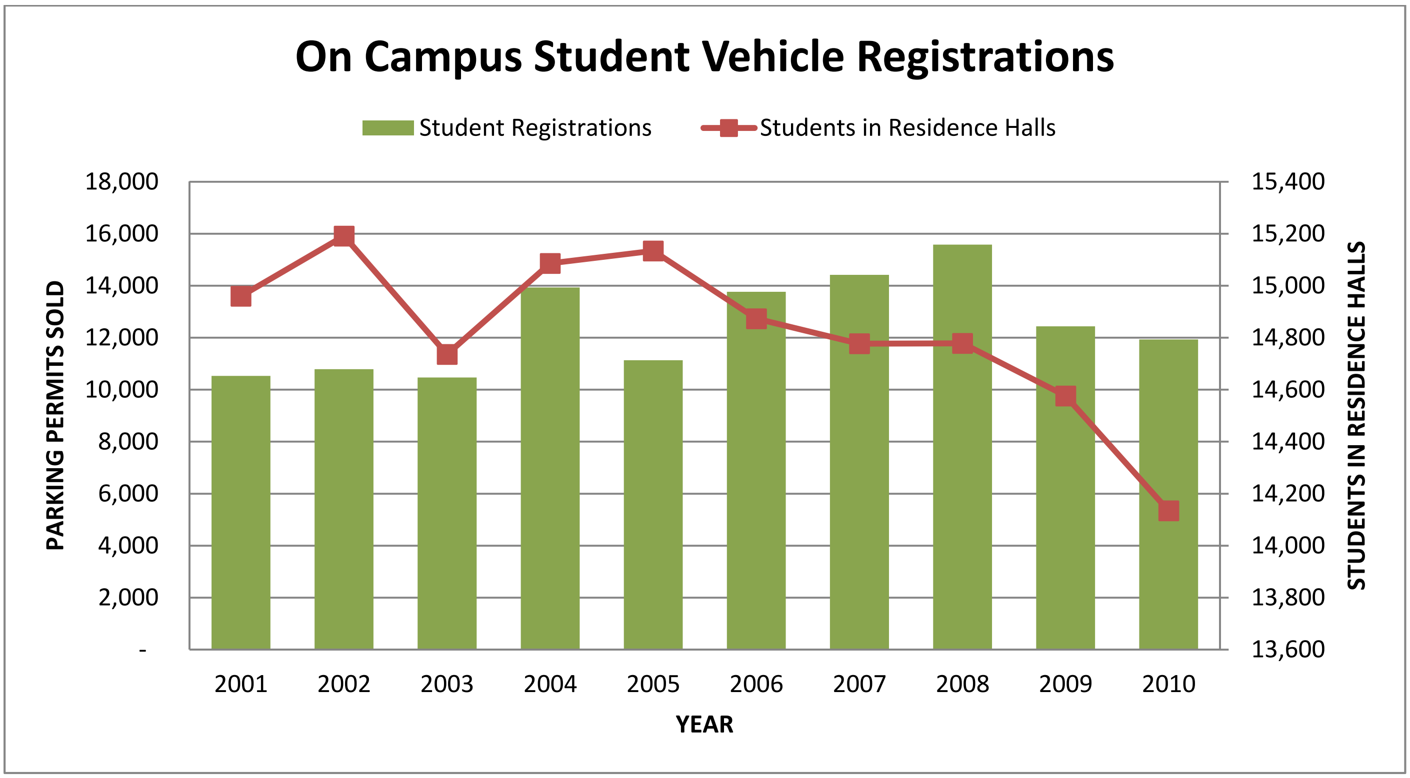



**Figure 3.** *Number of Student Vehicle Registrations Compared to the Number of Students.*

*Violations*

**Summary**

Parking enforcement remains an unfortunate but necessary part of the control of MSU's parking infrastructure, which contains more than 24,400 parking spaces. In recent years, the annual total of parking violations issued has held above 120,000 in spite of efforts to reduce it. All parking violations are written by student employees.

**Analysis**

The number of parking violations issued each year depends upon a number of variables including the date of the onset of winter weather, number and experience level of parking enforcement students available, and campus construction projects. The majority of parking violations are issued either for expired meters or for parking in a reserved area, such as a lot reserved for employees. Net of operational costs and revenues are used for safety-related activities in the community, such as upgrading traffic signals, maintaining the green light emergency phone system, and implementing traffic engineering studies.

**Future Directions**

While the number of citations issued could be reduced by the installation of more access card controlled gates, the cost of such gate equipment along with the added construction and maintenance costs makes the effort cost prohibitive in smaller lots. Gating all of our lots to reduce parking violations not only would be cost prohibitive but would interfere with our primary method of accommodating visitors. Visitors to academic departments and residence halls can purchase hourly or daily temporary permits which allow parking in employee parking lots. This would not be possible if all of the employee lots were gated.  Unfortunately, the cost of our parking citation fines, currently capped at $25.00 by university ordinance, presents little deterrent for some habitual violators. Indeed, some students receive more than fifty parking tickets a year. Consideration should be given to increasing parking fines, perhaps on a graduated scale, to increase compliance.


**Figure 4.** *Number of Violations Issued.*

*Accidents*

**Summary**

As illustrated in Figure 5, the benefits of our aggressive accident reduction program, begun in 1995, have been realized. The key components of that effort included the re-design and re-construction of high accident intersections, the relocation of parking, and a vigorous targeted enforcement program. The drastically reduced traffic accident profile for the university has leveled off and will serve as the baseline for measuring the next round of accident reduction efforts.

**Analysis**

Accident reduction efforts that involve reconstruction of intersections and removal of on-street parking bays are capital intensive and are often done in conjunction with Just-In-Time (JIT) infrastructure projects or other construction. Accident locations on campus are continually monitored in an attempt to identify emerging concentrations so that those that could benefit from redesign and reconstruction are identified for the capital planning process. The removal of street parking bays on East Circle Drive and Red Cedar Road, accomplished in the summer of 2011, was done in conjunction with the construction of the Broad Museum and the Morrill Hall addition to Wells Hall.

**Future Directions**

At some point most accident concentrations will be mitigated through this process. Accident reduction thereafter can best be achieved through relocation of parking areas and the redirection of traffic. The University Master Plan principle supporting perimeter parking will reduce the number of vehicles moving toward the core of campus, the area of highest vehicle-pedestrian conflicts. Emphasis on mass transit utilization and improvement of the bicycle infrastructure will further reduce the number of vehicles moving to the campus core.

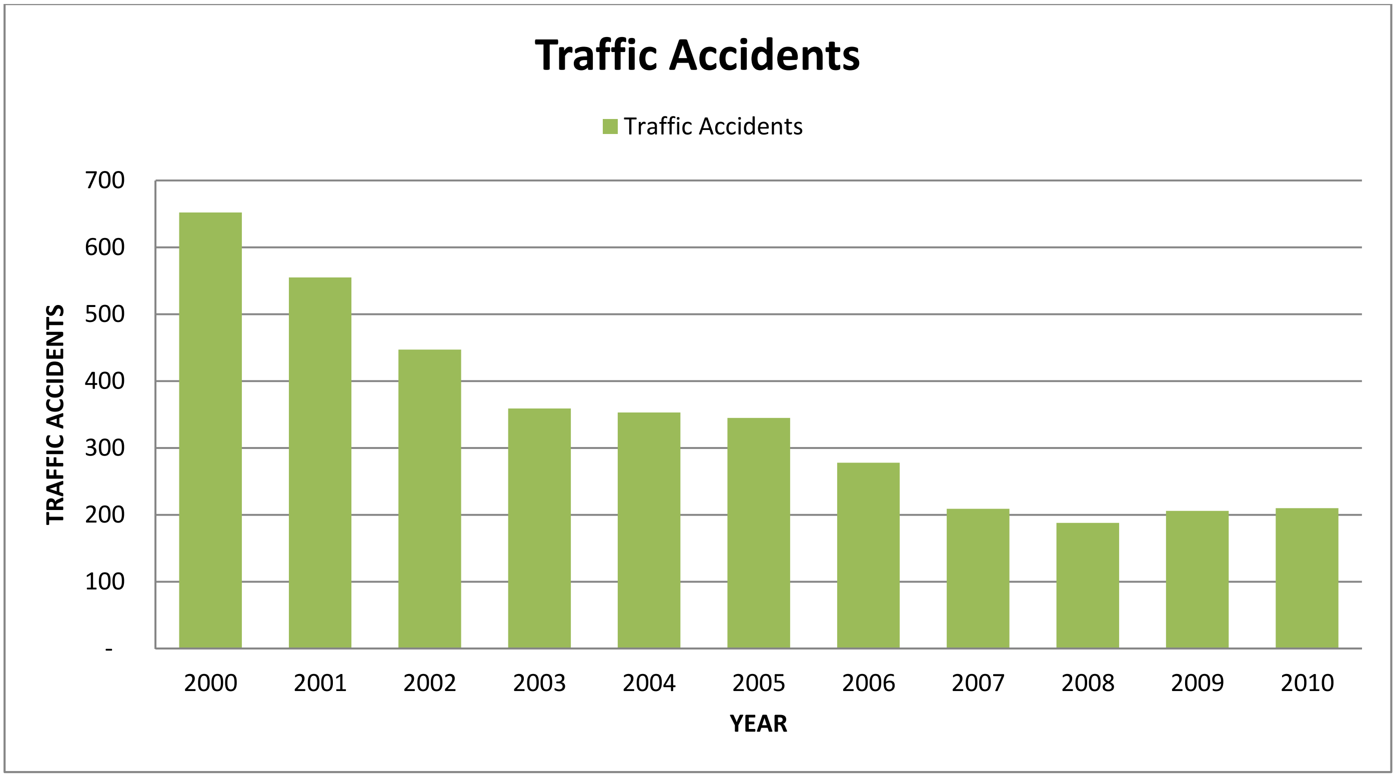



**Figure 5.** *Number of Traffic Accidents.*

*Electronic Card Access System Growth*

**Summary**

Since its inception in 2006, the electronic card access system has provided a network of building and parking lot access control for the university. The system monitors, alarms, and controls both external and internal access in more than 165 buildings. Within the last two years, the university residence halls have joined the access control system, increasing the security of on-campus living facilities but also increasing the number of access card users to more than 16,000. When all of the residence halls go active in the system, the number of access card users will exceed 24,000. Currently, the system grants access more than 19,700 times per day or an average of about 7.2 million times per year.

**Analysis**

Though departmental customers supplement the budget of the system with monthly maintenance fees, the brunt of the construction of the system has been paid for with central funding. The maintenance costs of the installed base are modest, though certain to rise as the components of the system age.  A portion of the monthly maintenance fees are being used to build a reserve for the replacement of the current system.  Thus a potential remains for the need for additional funding of the system in the future.

Alarms received by the system must currently be interpreted for appropriate action by personnel at the MSU Police Desk who also perform other duties. As the size of the access control system continues to increase, the need for a separate dedicated control center within the Police Department to moderate the load on the Police Desk personnel becomes more certain.

**Future Directions**

The challenge of maintaining a comprehensive access control system on the campus will grow.  The chart above depicts the relationship between the card readers installed and the “points” or electronic sources for potential actionable events connected to that card reader.  A point could be a glass break sensor, a motion sensor, a hazardous atmosphere sensor, or the like.  Each actionable event from a point requires a response of some sort.  Thus while the growth of the access control system is a strong positive for the campus, its growth requires more skilled technicians for maintenance, more police officers for response, and more staff to monitor and interpret the alarms and decide the appropriate action. The access control system is not self-supporting and must be supplemented by funding from other university sources. The challenge becomes balancing the size and complexity of the system with the funding available to support it.

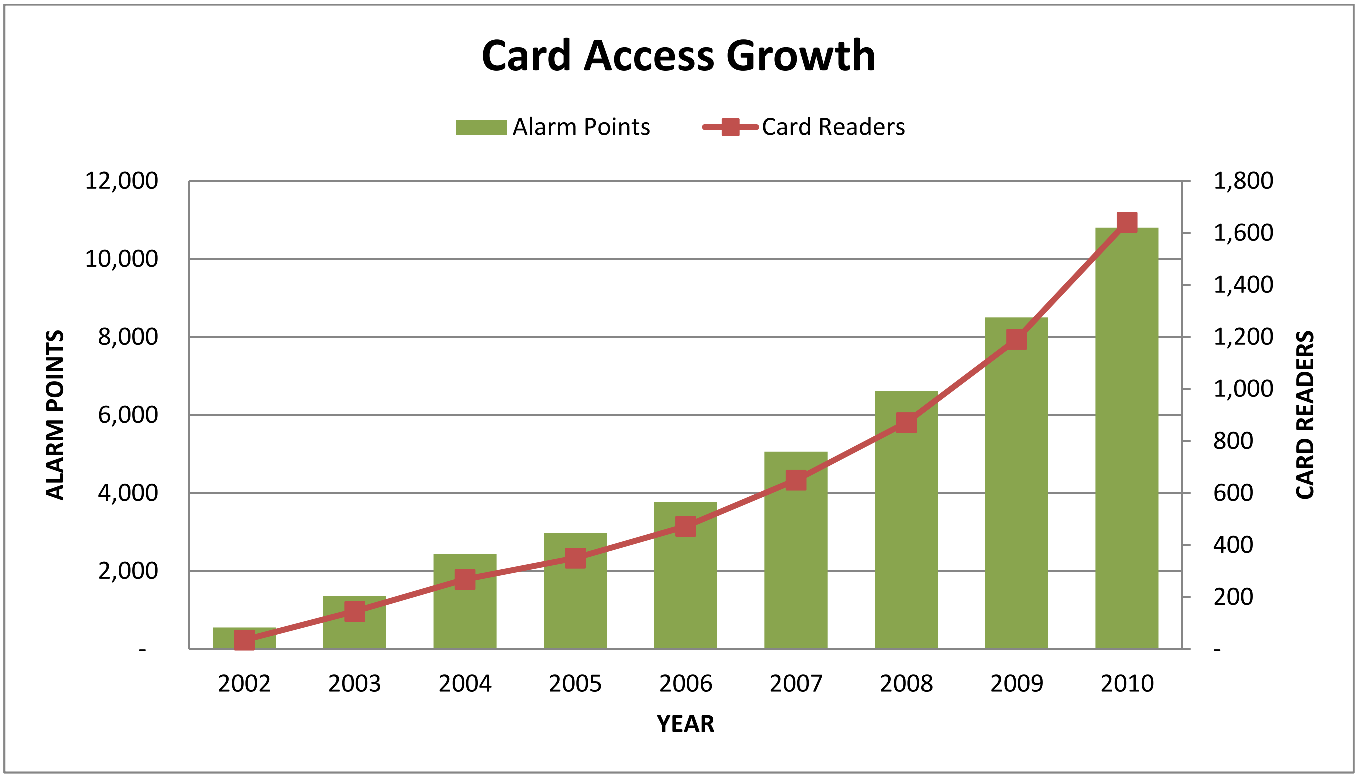



**Figure 6.** *Trend of Card Access Growth Depicting Number of Alarm Points and Installed Card Readers.*

## CAPITAL AREA TRANSPORTATION AUTHORITY- MSU SERVICE

### Summary

The Capital Area Transportation Authority (CATA) has been providing bus service on the MSU campus since Fiscal Year 1999. Ridership quickly grew from 829,000 rides that first year to more than three million rides by FY 2005. Aside from a spike to 3.5 million in FY2007, the number of campus rides has held relatively steady to within 7% of the three million rides per year plateau (see Figure 1 below).

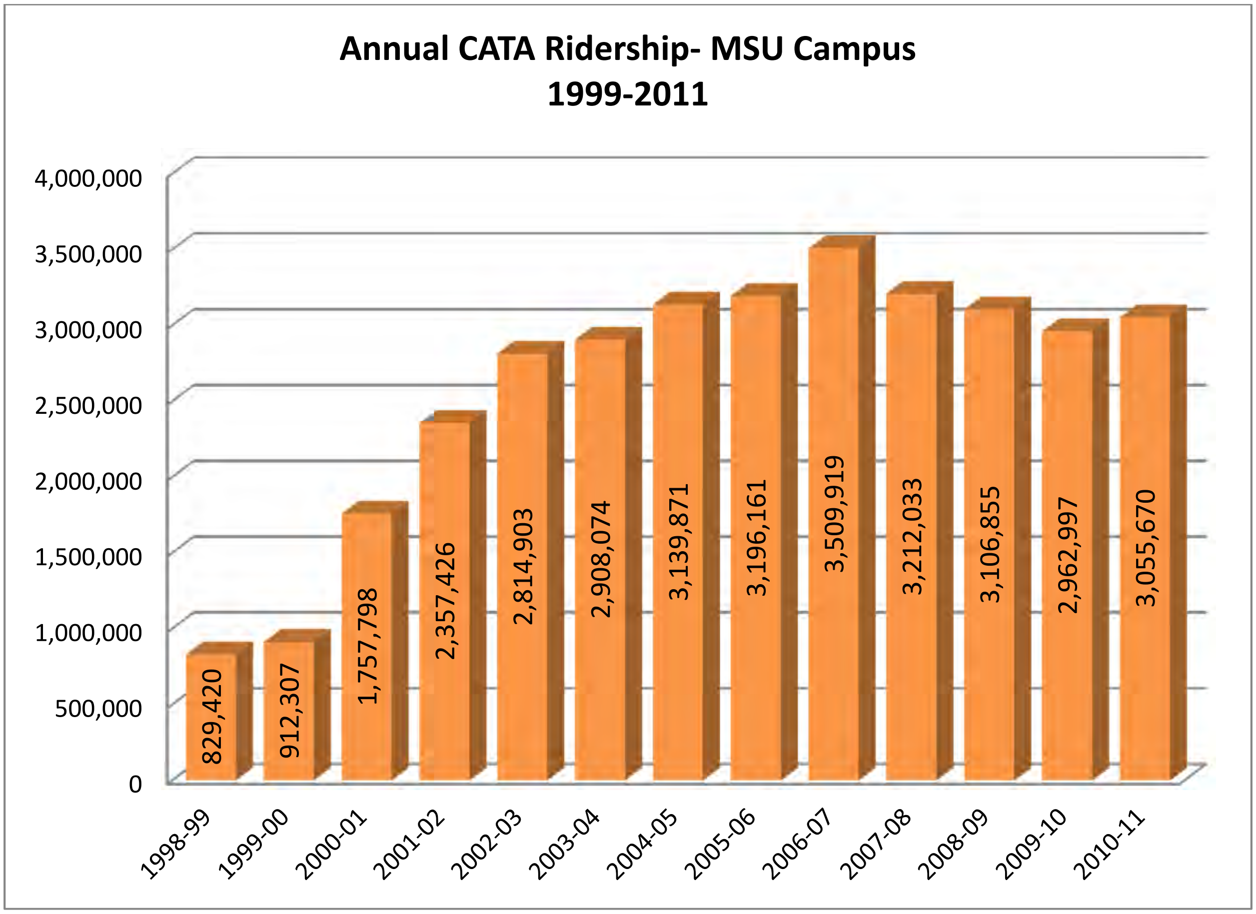



**Figure 1.** *Annual CATA Ridership by Fiscal Year.*

MSU continues to work with CATA to find ways to improve efficiency and enhance the transit service on campus, while at the same time containing the cost of the operation. Input from the campus community and information supplied from CATA have been used effectively to adjust the system annually to better meet the needs of bus riders. One example, implemented this year, was the consolidation of five bus stops in the Fee-Akers-Hubbard complex into one major boarding center on Wilson Road near the west side of Akers Hall. This change significantly reduced boarding times within the complex, moved students more quickly to their destinations on campus, and resulted in considerable savings for the university.

Operational data from CATA is the key to exploring opportunities for service improvement and cost savings.  In response to urging from MSU and in accordance with requirements outlined in the latest CATA/MSU Transportation Services Agreement which began in July of this year, CATA has begun the process of implementing an Automatic Vehicle Locater (AVL) system on all of its buses. In addition to providing real-time information about bus locations, the system includes Automatic Passenger Counters (APCs) which track the number of riders boarding or exiting a bus, by route, location, and time of day. The robustness of this data will greatly enhance the ability to assess the performance of existing bus service and explore new opportunities for improvement.

Another area of technological focus is the student bus pass. The goal is to be able to activate a CATA student pass on the MSU identification card. Despite a number of technical hurdles to achieving the goal, MSU and CATA have been working with the vendors that supply the pass reading fare box equipment on CATA buses to find a workable solution. CATA has a contract requirement to have this system operational by May 1, 2013.

## Construction Project Data Summary

The Annual Construction Report, as requested by the Board of Trustees, includes construction projects which have been completed and project accounts which have been closed.

Major capital projects are those that are $1 million or greater and require Board approval. Minor capital projects are greater than $250,000 and less than $1 million. The Board requests a listing of these projects on an annual basis. In addition to the annual report, the Board receives quarterly construction reports reflecting current construction projects.

The Closed Major Capital Projects Report highlights three areas for the 15 major capital projects that were closed during Fiscal Year 2010-11. These areas include authorized budget, final cost of the project, contingency use, schedule adherence, and change order management. The reports are utilized to provide timely and accurate project information, and to report on project performance in the aggregate, analyze strengths and weaknesses, and improve processes.

The Closed Minor Capital Projects Report highlights final cost for the 29 minor capital projects that were closed during the fiscal year. Of the 41 closed projects, 12 are major capital projects and 29 are minor capital projects. The approved budgets for the projects totaled $84,843,838. The final cost of these projects was $80,362,824, a difference of $4,481,014 (5.3%), which was returned to the appropriate unit.

## CP03422 - ENGINEERING RESEARCH COMPLEX - ADDITION NO. 2 - ENERGY & AUTOMOTIVE RESEARCH FACILITY

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 8,640,000 | **Final Cost:** | 8,567,995 | **Classification:** | Office |
| **Construction:** | 6,118,000 | **Returned:** | 72,005 | **Delivery Method:** | Design Bid Build |
| **Professional Services:** | 1,071,251 | | | **Contractor:** | WEILAND DAVCO CORPORATION |
| **Owner Work and Material:** | 765,408 | | | **A/E (Consultant):** | ALBERT KAHN ASSOCIATES |
| **Contingency:** | 685,341 | | | **Funds returned to:** | Dean of Engineering |

| Change Orders | | % of Contract | % of Contingency |
|---|---|---|---|
| **Scope:** | 0 | 0.0% | 0.0% |
| **Document:** | 381,357 | 6.2% | 55.6% |
| **Field:** | 7,638 | 0.1% | 1.1% |
| **Total:** | 388,995 | 6.4% | 56.8% |

| Schedule | Planned | Actual | Days (Under)/Over |
|---|---|---|---|
| **Substantial Completion:** | 11/14/2006 | 11/14/2006 | 0 |
| **Close Out:** | 11/28/2010 | 8/25/2010 | (95) |

## CP05241 - DUFFY DAUGHERTY FOOTBALL BUILDING - ADDITION NO. 4

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 18,170,000 | **Final Cost:** | 18,165,523 | **Classification:** | Office |
| **Construction:** | 13,543,117 | **Returned:** | 4,477 | **Delivery Method:** | Construction Manager |
| **Professional Services:** | 1,841,350 | | | **Contractor:** | BARTON MALOW COMPANY |
| **Owner Work and Material:** | 1,262,220 | | | **A/E (Consultant):** | INTEGRATED DESIGN SOLUTIONS |
| **Contingency:** | 1,523,313 | | | **Funds returned to:** | Athletics |

| Change Orders | | % of Contract | % of Contingency |
|---|---|---|---|
| **Scope:** | 513,165 | 3.8% | 33.7% |
| **Document:** | 336,348 | 2.5% | 22.1% |
| **Field:** | 665,009 | 4.9% | 43.7% |
| **Total:** | 1,514,523 | 11.2% | 99.4% |

| Schedule | Planned | Actual | Days (Under)/Over |
|---|---|---|---|
| **Substantial Completion:** | 10/31/2008 | 10/31/2008 | 0 |
| **Close Out:** | 6/28/2011 | 5/31/2011 | (28) |

## CP06047 - GILTNER HALL - ROOF REPAIRS

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 1,740,000 | **Final Cost:** | 1,599,958 | **Classification:** | General Trades |
| **Construction:** | 999,760 | **Returned:** | 140,042 | **Delivery Method:** | Design Bid Build |
| **Professional Services:** | 404,210 | | | **Contractor:** | CEI, INC. |
| **Owner Work and Material:** | 44,999 | | | **A/E (Consultant):** | ROOFING TECHNOLOGIES ASSOCIATE |
| **Contingency:** | 291,031 | | | **Funds returned to:** | JIT |

| Change Orders | | % of Contract | % of Contingency |
|---|---|---|---|
| **Scope:** | -4,512 | -0.5% | -1.6% |
| **Document:** | 0 | 0.0% | 0.0% |
| **Field:** | 213,165 | 21.3% | 73.2% |
| **Total:** | 208,653 | 20.9% | 71.7% |

| Schedule | Planned | Actual | Days (Under)/Over |
|---|---|---|---|
| **Substantial Completion:** | 9/11/2010 | 4/9/2010 | (155) |
| **Close Out:** | 10/9/2010 | 8/25/2010 | (45) |

## CP06233 - MARY MAYO HALL - RENOVATIONS

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 12,750,000 | **Final Cost:** | 12,199,374 | **Classification:** | Residential Facility |
| **Construction:** | 8,756,000 | **Returned:** | 550,626 | **Delivery Method:** | Design Bid Build |
| **Professional Services:** | 1,355,660 | | | **Contractor:** | KARES CONSTRUCTION CO., INC. |
| **Owner Work and Material:** | 1,483,621 | | | **A/E (Consultant):** | SMITHGROUP |
| **Contingency:** | 1,154,719 | | | **Funds returned to:** | RHS |

| Change Orders | | % of Contract | % of Contingency |
|---|---|---|---|
| **Scope:** | -112,714 | -1.3% | -9.8% |
| **Document:** | 706,497 | 8.1% | 61.2% |
| **Field:** | 366,353 | 4.2% | 31.7% |
| **Total:** | 960,136 | 11.0% | 83.1% |

| Schedule | Planned | Actual | Days (Under)/Over |
|---|---|---|---|
| **Substantial Completion:** | 6/19/2009 | 6/19/2009 | 0 |
| **Close Out:** | 6/25/2011 | 4/25/2011 | (61) |

### CP06353 - NATURAL SCIENCE - WINDOW REPLACEMENT

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 1,550,000 | **Final Cost:** | 1,489,929 | **Classification:** | General Trades |
| **Construction:** | 1,268,500 | **Returned:** | 60,071 | **Delivery Method:** | Design Bid Build |
| **Professional Services:** | 127,465 | | | **Contractor:** | GRAHAM CONSTRUCTION |
| **Owner Work and Material:** | 18,171 | | | **A/E (Consultant):** | KINGSCOTT |
| **Contingency:** | 135,864 | | | **Funds returned to:** | JIT |

| Change Orders | | % of Contract | % of Contingency |
|---|---|---|---|
| **Scope:** | 0 | 0.0% | 0.0% |
| **Document:** | 0 | 0.0% | 0.0% |
| **Field:** | 41,818 | 3.3% | 30.8% |
| **Total:** | 41,818 | 3.3% | 30.8% |

| Schedule | Planned | Actual | Days (Under)/Over |
|---|---|---|---|
| **Substantial Completion:** | 7/31/2009 | 7/31/2009 | 0 |
| **Close Out:** | 6/15/2011 | 5/6/2011 | (40) |

### CP06429 - CHEMISTRY BUILDING - ALTERATIONS TO ROOMS 407, 408 & 412

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 1,300,000 | **Final Cost:** | 1,202,933 | **Classification:** | Office |
| **Construction:** | 860,800 | **Returned:** | 97,067 | **Delivery Method:** | Construction Manager |
| **Professional Services:** | 169,773 | | | **Contractor:** | GRANGER CONSTRUCTION CO |
| **Owner Work and Material:** | 99,396 | | | **A/E (Consultant):** | FTCH |
| **Contingency:** | 170,031 | | | **Funds returned to:** | Facilities Reserve |

| Change Orders | | % of Contract | % of Contingency |
|---|---|---|---|
| **Scope:** | 0 | 0.0% | 0.0% |
| **Document:** | 18,210 | 2.1% | 10.7% |
| **Field:** | 8,830 | 1.0% | 5.2% |
| **Total:** | 27,039 | 3.1% | 15.9% |

| Schedule | Planned | Actual | Days (Under)/Over |
|---|---|---|---|
| **Substantial Completion:** | 4/30/2009 | 4/30/2009 | 0 |
| **Close Out:** | 4/20/2011 | 6/9/2011 | 50 |

### CP07021 - SPARTAN STADIUM - REPAIR EAST UPPER STANDS

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 2,000,000 | **Final Cost:** | 1,645,171 | **Classification:** | General Trades |
| **Construction:** | 1,062,998 | **Returned:** | 354,829 | **Delivery Method:** | Design Bid Build |
| **Professional Services:** | 209,590 | | | **Contractor:** | E & L CONSTRUCTION, INC |
| **Owner Work and Material:** | 40,000 | | | **A/E (Consultant):** | VEC ENGINEERING |
| **Contingency:** | 687,412 | | | **Funds returned to:** | Athletics |

| Change Orders | | % of Contract | % of Contingency |
|---|---|---|---|
| **Scope:** | -3,082 | -0.3% | -0.4% |
| **Document:** | 33,626 | 3.2% | 4.9% |
| **Field:** | 180,846 | 17.0% | 26.3% |
| **Total:** | 211,390 | 19.9% | 30.8% |

| Schedule | Planned | Actual | Days (Under)/Over |
|---|---|---|---|
| **Substantial Completion:** | 7/18/2008 | 8/15/2008 | 28 |
| **Close Out:** | 11/30/2010 | 6/2/2011 | 184 |

### CP07120 - AUDITORIUM - REPLACE ELECTRICAL SUBSTATION

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 1,150,000 | **Final Cost:** | 1,002,342 | **Classification:** | Mechanical & Electrical |
| **Construction:** | 0 | **Returned:** | 147,658 | **Delivery Method:** | Construction Manager |
| **Professional Services:** | 147,000 | | | **Contractor:** | PP - PROJECT SERVICES |
| **Owner Work and Material:** | 1,003,000 | | | **A/E (Consultant):** | ORION |
| **Contingency:** | 0 | | | **Funds returned to:** | JIT |

| Change Orders | | % of Contract | % of Contingency |
|---|---|---|---|
| **Scope:** | 0 | N/A | N/A |
| **Document:** | 0 | N/A | N/A |
| **Field:** | 0 | N/A | N/A |
| **Total:** | 0 | N/A | N/A |

| Schedule | Planned | Actual | Days (Under)/Over |
|---|---|---|---|
| **Substantial Completion:** | 12/31/2009 | 12/30/2009 | (1) |
| **Close Out:** | 12/31/2010 | 4/12/2011 | 102 |

### CP07478 - HOLDEN HALL - PUBLIC AREA RENOVATIONS

| | | | | | |
|---|---|---|---|---|---|
| Authorized Budget: | 9,450,000 | Final Cost: | 9,355,924 | Classification: | Residential Facility |
| Construction: | 5,144,900 | Returned: | 94,076 | Delivery Method: | Construction Manager |
| Professional Services: | 674,566 | | | Contractor: | GRANGER CONSTRUCTION |
| Owner Work and Material: | 2,900,028 | | | A/E (Consultant): | IDS |
| Contingency: | 730,506 | | | Funds returned to: | RHS and FPSM |

| Change Orders | | % of Contract | % of Contingency |
|---|---|---|---|
| Scope: | 2,283 | 0.0% | 0.3% |
| Document: | 122,718 | 2.4% | 16.8% |
| Field: | 452,318 | 8.8% | 61.9% |
| Total: | 577,320 | 11.2% | 79.0% |

| Schedule | Planned | Actual | Days (Under)/Over |
|---|---|---|---|
| Substantial Completion: | 12/1/2008 | 11/26/2008 | (5) |
| Close Out: | 12/17/2010 | 10/29/2010 | (49) |

### CP08155 - OWEN HALL - REFURBISHMENT

| | | | | | |
|---|---|---|---|---|---|
| Authorized Budget: | 10,000,000 | Final Cost: | 8,954,509 | Classification: | Residential Facility |
| Construction: | 6,000,000 | Returned: | 1,045,491 | Delivery Method: | Construction Manager |
| Professional Services: | 1,347,935 | | | Contractor: | TRIANGLE ASSOCIATES, INC. |
| Owner Work and Material: | 1,715,250 | | | A/E (Consultant): | SMITHGROUP |
| Contingency: | 936,815 | | | Funds returned to: | RHS |

| Change Orders | | % of Contract | % of Contingency |
|---|---|---|---|
| Scope: | 688,527 | 11.5% | 73.5% |
| Document: | 213,599 | 3.6% | 22.8% |
| Field: | 341,854 | 5.7% | 36.5% |
| Total: | 1,243,980 | 20.7% | 132.8% |

| Schedule | Planned | Actual | Days (Under)/Over |
|---|---|---|---|
| Substantial Completion: | 7/31/2009 | 7/31/2009 | 0 |
| Close Out: | 12/15/2010 | 11/16/2010 | (29) |

## CP08902 - KELLOGG BIOLOGICAL STATION - CONSTRUCT PASTURE-BASED DAIRY FACILITY

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 2,800,000 | **Final Cost:** | 2,792,177 | **Classification:** | Animal Facilities |
| **Construction:** | 2,349,267 | **Returned:** | 7,823 | **Delivery Method:** | Design Build |
| **Professional Services:** | 231,210 | | | **Contractor:** | WEDEVEN BROTHERS |
| **Owner Work and Material:** | 63,700 | | | **A/E (Consultant):** | CURRY-WILLE |
| **Contingency:** | 155,823 | | | **Funds returned to:** | Kellogg Biological Station |

| **Change Orders** | | **% of Contract** | **% of Contingency** |
|---|---|---|---|
| **Scope:** | 50,194 | 2.1% | 32.2% |
| **Document:** | 29,218 | 1.2% | 18.8% |
| **Field:** | 43,533 | 1.9% | 27.9% |
| **Total:** | 122,945 | 5.2% | 78.9% |

| **Schedule** | **Planned** | **Actual** | **Days (Under)/Over** |
|---|---|---|---|
| **Substantial Completion:** | 6/1/2009 | 5/1/2009 | (31) |
| **Close Out:** | 9/30/2009 | 8/24/2010 | 328 |

## CP09145 - OLD COLLEGE FIELD RENOVATIONS - PHASE IV - RESTROOM BLDG ADD 1

| | | | | | |
|---|---|---|---|---|---|
| **Authorized Budget:** | 850,000 | **Final Cost:** | 840,254 | **Classification:** | Athletic/Physical Education |
| **Construction:** | 569,809 | **Returned:** | 9,746 | **Delivery Method:** | Construction Manager |
| **Professional Services:** | 195,454 | | | **Contractor:** | KINCAID HENRY BUILDING GROUP |
| **Owner Work and Material:** | 24,953 | | | **A/E (Consultant):** | HAMILTON ANDERSON |
| **Contingency:** | 59,784 | | | **Funds returned to:** | Athletics |

| **Change Orders** | | **% of Contract** | **% of Contingency** |
|---|---|---|---|
| **Scope:** | -7,032 | -1.2% | -11.8% |
| **Document:** | 16,610 | 2.9% | 27.8% |
| **Field:** | 14,617 | 2.6% | 24.5% |
| **Total:** | 24,195 | 4.2% | 40.5% |

| **Schedule** | **Planned** | **Actual** | **Days (Under)/Over** |
|---|---|---|---|
| **Substantial Completion:** | 9/18/2009 | 9/18/2009 | 0 |
| **Close Out:** | 7/18/2011 | 6/10/2011 | (38) |

## Closed Minor Capital Projects for Fiscal Year 2010 – 2011

| CP Number | Project Description | Budget | Final Costs | Returned |
|---|---|---|---|---|
| CP06192 | VETERINARY MEDICAL CENTER - A142 RENOVATION (MRI) | $997,000 | $945,657 | $51,343 |
| CP06294 | FEE HALL - DOOR REPLACEMENT | $250,000 | $222,776 | $27,224 |
| CP06301 | AUDITORIUM - MASONRY RESTORATION | $270,000 | $243,969 | $26,031 |
| CP06302 | DEMONSTRATION HALL - ROOF REPLACEMENT | $600,000 | $554,395 | $45,605 |
| CP06310 | FEE HALL - CEILING REPLACEMENT | $266,000 | $264,465 | $1,535 |
| CP06380 | OLDS HALL - WINDOW REPLACEMENT | $700,000 | $657,900 | $42,100 |
| CP06433 | FOREST AKERS GOLF COURSE - EAST - DRIVING RANGE ENCLOSURE - CONSTRUCT ORIGINAL BUILDING | $765,000 | $736,805 | $28,195 |
| CP06491 | PARKING - LOTS MODIFICATIONS TO OPERATE ON LINEPARKING | $500,000 | $298,959 | $201,041 |
| CP07015 | STUDENT SERVICES BUILDING - REPLACE CHILLERS NO. 1 AND 2 | $370,000 | $345,907 | $24,093 |
| CP07024 | ABRAMS PLANETARIUM - DOME REPLACEMENT | $500,000 | $432,546 | $67,454 |
| CP07186 | ENGINEERING RESEARCH COMPLEX - ALTERATIONS TO ROOM A10 | $750,000 | $720,616 | $29,384 |
| CP07272 | KEDZIE HALL - ELEVATOR REPLACEMENT | $287,000 | $266,798 | $20,202 |
| CP07352 | CENTRAL SERVICES  - ELEVATOR REPLACEMENT | $460,000 | $392,162 | $67,838 |
| CP07366 | ENGINEERING BUILDING - AIR CONDITION ROOM 3300 | $835,000 | $751,506 | $83,494 |
| CP07405 | ROADS - WILSON ROAD RECONSTRUCTION 2008 - EAST WILSON HALL LOOP TO STADIUM DRIVE% | $960,000 | $785,129 | $174,871 |

| | | | | |
|---|---|---|---|---|
| CP07543 | VET MED CNTR / MCPHAIL EQUINE / PEGASUS - NEW ACCESS CONTROL SYSTEM | 775,000 | 764,555 | 10,445 |

| CP Number | Project Description | Budget | Final Costs | Returned |
|---|---|---|---|---|
| CP09032 | MCDONEL HALL - NEW CARD READERS ON INTERIOR, EXTERIOR AND MECH ROOM DOORS | $300,000 | $224,906 | $75,094 |
| CP09033 | HUBBARD HALL - NEW CARD READERS ON INTERIOR, EXTERIOR, AND MECH ROOM DOORS | $350,000 | $274,890 | $75,110 |
| CP09035 | AKERS HALL - NEW CARD READERS ON INTERIOR, EXTERIOR, AND MECH ROOM DOORS | $300,000 | $279,200 | $20,800 |
| CP09060 | ENGINEERING RESEARCH COMPLEX - RELOCATE GLASS COLUMN TO MBI BUILDING | $255,000 | $252,724 | $2,276 |
| CP09079 | PARKING RAMP NO. 1 (SHAW LANE) – RESTORATION AND MAINTENANCE | $375,000 | $327,385 | $47,615 |
| CP09130 | PARKING RAMP NO. 3 (WHARTON CENTER) - RESTORATION AND MAINTENANCE | $265,000 | $244,883 | $20,117 |
| CP09230 | OLD COLLEGE FIELD - CONCESSIONS BUILD - OUT PAVILION ROOM 100 | $350,000 | $303,493 | $46,507 |
| CP09279 | PHYSICAL PLANT - RELOCATE COMPUTER ROOM | $415,000 | $414,999 | $1 |
| CP09288 | PHYSICAL PLANT - REPLACE CHILLER | $250,000 | $250,031 | $-31 |
| CP09299 | ELECTRICAL AND TELECOMMUNICATION DIST BETWEEN STUDENT SERVICES AND BERKEY HALL | $650,000 | $426,587 | $223,413 |
| CP09300 | ENGINEERING BUILDING - REVISIONS TO ROOM 3532 | $460,000 | $53,671 | $406,329 |
| **Total Projects: 29** | | $**14,443,838** | $**12,546,735** | $**1,897,103** |

# Real Property Holdings

## MICHIGAN STATE UNIVERSITY

As of July 1, 2011

Saginaw Valley Research and Extension Center

**Prepared by:**

**Land Management Office**

# Real Property Holdings - Table of Contents

## MICHIGAN STATE UNIVERSITY

As of July 1, 2011

# Real Property Holdings - Real Estate Facts

## MICHIGAN STATE UNIVERSITY

As of July 1, 2011

**Summary of Acres**

- Michigan State University (MSU) lands comprise 25,479.800 acres.
- Main campus lands (North of Mt. Hope) comprise 2,045.617 acres.
- Research, education, and outreach lands (South of Mt. Hope) comprise 2,737.492 acres.
- The golf course is 325 acres.
- Campus lands leased to others include 87.116 acres.
- Off-campus properties include 20,284.575 acres.
- Property for sale comprise 7.831 acres (included in off-campus total).

**Acreage Changes**

- Appoximately 1.48 acres of the Saginaw Valley Research and Extension Center, identified as a non-research grain storage site, were sold.
- MSU purchased approximately 62 acres of research land for the Saginaw Valley Research and Extension Center.

**Long-Term Leases**

- Leases of a term of ten years or greater require Board of Trustee approval. A long-term lease was entered into with the Michigan State University Federal Credit Union, with MSU as Landlord.

**State Building Authority Projects**

- MSU has four State Building Authority bond-financed projects. The project site is deeded to the State Building Authority and leased back to MSU. Current projects are: Anthony Hall Dairy Plant and Meat Lab (to be repaid 2032); Biomedical and Physical Sciences Building (to be repaid 2037); Diagnostic Center for Population and Animal Health (to be repaid 2040); and the Chemistry Building renovation project (to be repaid 2043). State Building Authority bonds are typically issued for 35 years but the State may retire them before their maturity date.

**Agreement to Restore Title**

- A 50-year lease between MSU and the State of Michigan was entered into February 1956 for approximately six acres on Harrison Road. The Department of Agriculture constructed a lab on the parcel known as the Geagley Laboratory. In 2002, the parcel was deeded to the State of Michigan in order for the State to convey the property to the State Building Authority to obtain bond financing for needed improvements. An "Agreement to Restore Title" requires the State to deed the parcel to MSU at the time the property is conveyed back to the State from the State Building Authority. At that time, a lease will be entered into between MSU (landlord) and the State (tenant) in order for the State to continue occupancy at the Geagley Laboratory. The "Agreement to Restore Title" is on file in the MSU Office of General Counsel and the Land Management Office.

# Real Property Holdings - Summary

## MICHIGAN STATE UNIVERSITY

As of July 1, 2011

| PROPERTY | | ACRES |
|---|---|---|
| East Lansing Campus | | |
| North of Mt. Hope | | 2,045.617 |
| Golf Course | | 325.000 |
| Research, Education, and Outreach south of Mt. Hope | | 2,737.492 |
| Campus Property Leased to Others | | 87.116 |
| | **Total Campus Acres** | **5,195.225** |
| Off-Campus | | 20,284.575 |
| | **Total Deeded Acres** | **25,479.800** |
| Property Leased to MSU Long-Term | | 264.000 |
| | **Total Leased and Deeded Acres** | **25,743.800** |

# Real Property Holdings - Acquisitions and Properties Sold

MICHIGAN STATE UNIVERSITY

July 1, 2010 - June 30, 2011

| **ACQUISITIONS** | | **ACRES** |
|---|---|---|
| Property: | Human Medicine, College of<br>Condominium Unit #29 (Parking Spots)<br>21 NE Michigan<br>Grand Rapids, Michigan<br>Kent County | - |
| Acquisition Date: | 12/8/2010 | |
| Purchase Price: | $2,690,000.00 | |
| How Acquired: | Purchase | |
| Property: | Huber Property<br>3908 South Van Buren Road<br>Frankenmuth, Michigan<br>Tuscola County | 62.000 |
| Acquisition Date: | 8/11/2010 | |
| Purchase Price: | $285,000.00 | |
| How Acquired: | Purchase | |

| **PROPERTY SOLD** | | |
|---|---|---|
| Property: | Saginaw Valley Research and Extension Center<br>3775 S. Reese Road<br>Frankenmuth, Michigan<br>Tuscola County | 1.480 |
| Sale Date: | | |
| Sale Price: | | |

| **PROPERTY FOR SALE** | | **ACRES** |
|---|---|---|
| Property: | Hulett Road Engineering | 5.691 |
| Property: | Gantos Property | 2.140 |

# Real Property Holdings - Active Mineral Leases

## MICHIGAN STATE UNIVERSITY

As of July 1, 2011

MSU owns the Martin Property, MacCready Reserve, Rogers Reserve, the Management Education Center, and Hidden Lake Gardens. The Mancelona Property and Homer Nowlin Property were sold; MSU retained the mineral rights on both properties.

| PROPERTY | ACRES |
| --- | --- |
| Mancelona Property (MSU owns mineral rights)<br>Section 16, Mancelona Township, Antrim County<br>Leased to Mercury Exploration Co.<br>Lease is continued with producing well | 31.400 |
| Martin Property (Rose-Dell Seed Orchard, MSU owns surface and mineral rights)<br>Sections 23 and 24, Albion Township, Calhoun County<br>Leased to West Bay Exploration<br>Three-year lease (commenced December 2007) | 160.000 |
| Homer Nowlin Property (MSU owns mineral rights)<br>Sections 28 and 23, Rich Township, Lapeer County<br>Leased to Total Petroleum, Inc.<br>Lease is continued with producing well | 313.000 |
| Management Education Center<br>(MSU owns surface and mineral rights)<br>Section 9, Troy Township, Oakland County<br>Leased to West Bay Exploration Company<br>Lease is continued with producing well | 24.320 |
| Hidden Lake Gardens (MSU owns 750.265 surface acres and 712.655 mineral acres)<br>Sections 17, 18, 19, and 20, Liberty Township, Lenawee County<br>Leased to West Bay Exploration Company<br>Three-year lease (commenced August 2009) | 712.256 |
| Merillat Property (MSU owns mineral rights)<br>Section 29, Adrian Township, Lenawee County<br>Leased to Savoy Energy, L.P.<br>Three-year lease (commenced August 2010) | 80.000 |
| **Total Acres Under Mineral Leases** | **1,240.976** |

# Real Property Holdings - Mineral Rights Reserved on Sold Properties

## MICHIGAN STATE UNIVERSITY

As of July 1, 2011

| PROPERTY | ACRES |
|---|---|
| Allegan County | |
| Section 21, Saugatuck Township | 53.275 |
| | |
| Antrim County | |
| Section 16, Mancelona Township | 29.900 |
| | |
| Clinton County | |
| Section 22, Eagle Township | 24.000 |
| Sections 22 & 27, Eagle Township | 61.300 |
| | |
| Ingham County | 20.369 |
| Section 1, Delhi Township | |
| | |
| Lapeer County | |
| Section 28, Rich Township | 10.000 |
| Section 33, Rich Township | 303.000 |
| | |
| Lenawee County | |
| Section 29, Adrian Township | 80.000 |
| | |
| Monroe County | |
| Section 21, Milan Township | 80.000 |
| | |
| Oakland County | |
| Sections 2, 11, 12, Avon Township | 234.434 |
| Section 32, Bloomfield Township | 5.000 |
| | |
| Ontonagon County | |
| Section 6, Bohemia Township; Section 12, Greenland Township | 78.000 |
| Section 23, Bohemia Township | 40.000 |
| | |
| VanBuren County | |
| Section 6, Geneva Township | 29.000 |
| Section 23, South Haven Township | 53.230 |
| | |
| **Total Mineral Acres Reserved:** | **1,101.508** |

# Real Property Holdings - Gas and Oil Royalty Income

## MICHIGAN STATE UNIVERSITY

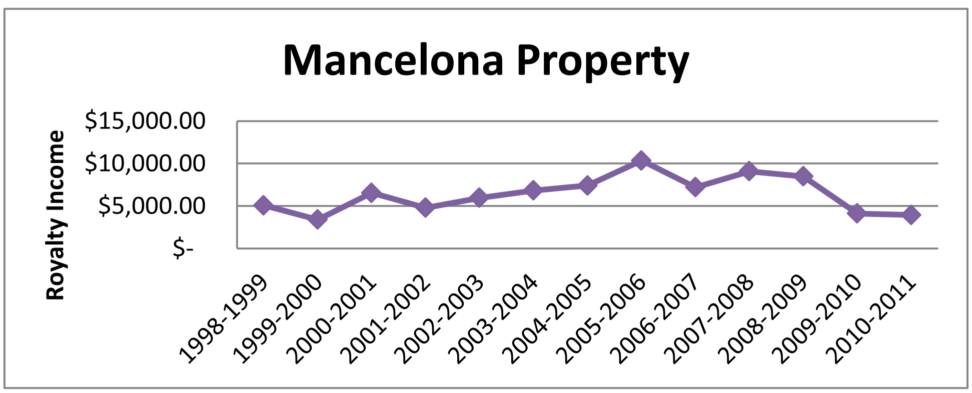
As of July 1, 2011

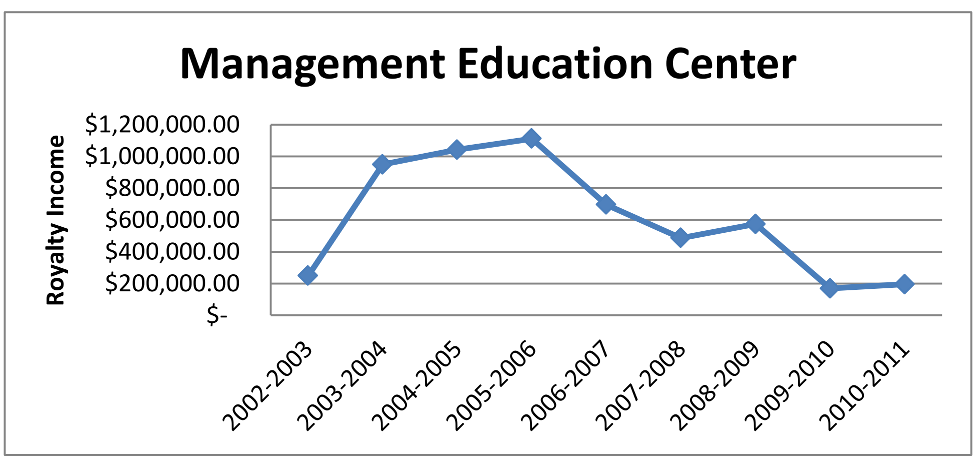
**Mancelona Property**
(Income funds the Land Fund Account)

| | |
|---|---|
| 1998-1999 | $ 5,068.62 |
| 1999-2000 | $ 3,390.42 |
| 2000-2001 | $ 6,547.95 |
| 2001-2002 | $ 4,789.45 |
| 2002-2003 | $ 5,958.69 |
| 2003-2004 | $ 6,833.60 |
| 2004-2005 | $ 7,415.27 |
| 2005-2006 | $ 10,337.62 |
| 2006-2007 | $ 7,192.83 |
| 2007-2008 | $ 9,082.79 |
| 2008-2009 | $ 8,484.09 |
| 2009-2010 | $ 4,114.23 |
| 2010-2011 | $ 3,941.64 |

**Management Education Center**
(Income funds Eli Broad College of Business Programs)

| | |
|---|---|
| 2002-2003 | $ 248,679.62 |
| 2003-2004 | $ 949,191.09 |
| 2004-2005 | $ 1,041,242.41 |
| 2005-2006 | $ 1,111,581.83 |
| 2006-2007 | $ 695,627.95 |
| 2007-2008 | $ 486,734.28 |
| 2008-2009 | $ 573,939.94 |
| 2009-2010 | $ 169,303.36 |
| 2010-2011 | $ 195,046.47 |



# Real Property Holdings - Gas and Oil Royalty Income

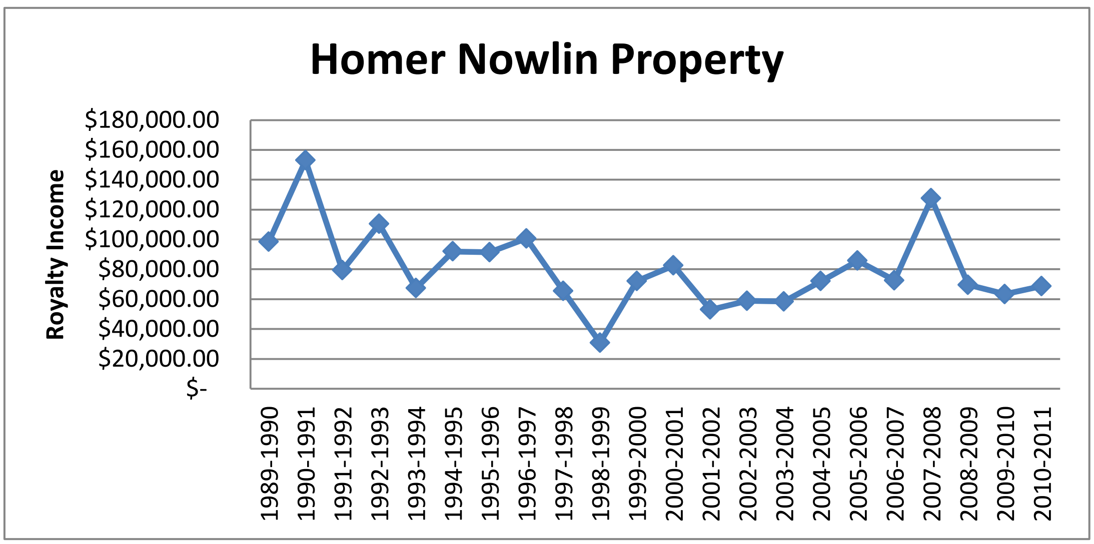
MICHIGAN STATE UNIVERSITY

As of July 1, 2011

**Homer Nowlin Property**

(Income funds endowed chair in the College of Agriculture and Natural Resources)

| | |
|---|---|
| 1989-1990 | $ 98,404.78 |
| 1990-1991 | $ 153,008.72 |
| 1991-1992 | $ 79,323.99 |
| 1992-1993 | $ 110,311.26 |
| 1993-1994 | $ 67,355.68 |
| 1994-1995 | $ 91,965.81 |
| 1995-1996 | $ 91,421.59 |
| 1996-1997 | $ 100,641.83 |
| 1997-1998 | $ 65,468.04 |
| 1998-1999 | $ 30,788.53 |
| 1999-2000 | $ 72,118.88 |
| 2000-2001 | $ 82,535.99 |
| 2001-2002 | $ 53,000.00 |
| 2002-2003 | $ 58,819.50 |
| 2003-2004 | $ 58,386.86 |
| 2004-2005 | $ 71,997.24 |
| 2005-2006 | $ 85,676.23 |
| 2006-2007 | $ 72,534.18 |
| 2007-2008 | $ 127,494.63 |
| 2008-2009 | $ 69,521.30 |
| 2009-2010 | $ 63,304.32 |
| 2010-2011 | $ 68,704.58 |



# Real Property Holdings - Leased/Licensed Properties

## MICHIGAN STATE UNIVERSITY

As of July 1, 2011

Leases of 10 years or longer require MSU Board of Trustee approval. The following leases meet that criteria. Only real property leases are included in the Real Property Holdings annual report.

| **MSU as TENANT** | **ACRES** |
|---|---|
| Trevor Nichols Research Center (Kalamazoo Orchard site)<br>Administrative Unit: College of Agriculture and Natural Resources<br>Department of Entomology | 45.000 |
| Northwest Michigan Horticultural Research Center<br>Administrative Unit: College of Agriculture and Natural Resources<br>Department of Horticulture<br>MSU Extension | 100.000 |
| Tollgate Education Center<br>Administrative Unit: College of Agriculture and Natural Resources<br>Land Management Office<br>MSU Extension | 100.000 |
| MSU Forest Biomass Innovation Center<br>Administrative Unit: College of Agriculture and Natural Resources<br>Department of Forestry | 9.000 |
| MSU Forest Biomass Innovation Center<br>Administrative Unit: College of Agriculture and Natural Resources<br>Department of Forestry | 10.000 |
| **Total Leased Acres:** | **264.000** |

# Real Property Holdings - Leased/Licensed Properties

## MICHIGAN STATE UNIVERSITY

As of July 10, 2011

Leases of 10 years or longer require MSU Board of Trustee approval. The following leases meet that criteria. Only real property leases are included in the Real Property Holdings annual report.

| TENANT | MSU PROPERTY | ACRES |
| --- | --- | --- |
| Prairieville Township | Lux Arbor Reserve | 0.800 |
| Berrien County Extension Service | Southwest Michigan Research & Extension Center | 1.380 |
| Cass County Historical Commission | Russ Forest | 1.800 |
| Cass County Park & Recreation Commission | Russ Forest | 14.000 |
| Marcellus Community School | Russ Forest | 21.450 |
| Department of Natural Resources | Dunbar Forest | 9.400 |
| Michigan State Police Headquarters | Campus | 13.000 |
| MSU Federal Credit Union | Campus | 4.711 |
| MSU Federal Credit Union | Campus | 3.960 |
| Sewage Plant | Campus | 16.500 |
| Consumers Energy | Campus | 0.100 |
| Northstar Cooperative, Inc. | Campus | 9.710 |
| University Rehabilitation Alliance | Campus | 35.000 |
| Candlewood/Vista I, LLC | Campus | 3.235 |
| LBWL/METC | Campus | 0.900 |
| Gull Lake Bible Conference | Kellogg Biological Station | 10.000 |
| Sheridan Lake YMCA (License) | Brook Lodge | 415.000 |
| Sheridan Lake YMCA (Lease) | Brook Lodge | 40.000 |
| Leland Township | Leland Property | 0.700 |
| Avon Players | VanHoosen Jones | 1.793 |
| Pete Clark | Morris Property | 1,385.000 |
| | **Total Acres Leased/Licensed to Others:** | **1,988.439** |

Credit Union

# Real Property Holdings - Inventory

## MICHIGAN STATE UNIVERSITY

As of July 1, 2011

### BioEconomy Research and Development Center
### Holland, Ottawa County

| Purpose | Status | Acres |
|---|---|---|
| Research | Active | 6.300 |
| | Land use or resource use restrictions | |

| Administrator | Comment |
|---|---|
| Vice President for Research and Graduate Studies | None |

### Brook Lodge
### Augusta, Kalamazoo County

| Purpose | Status | Acres |
|---|---|---|
| Conference center, teaching, research, and outreach | Inactive | 633.240 |

| Administrator | Comment |
|---|---|
| Kellogg Center<br>Land Management Office | Long term lease on 40 acres to Sherman Lake YMCA |

### Clarksville Research Center
### Clarksville, Ionia County

| Purpose | Status | Acres |
|---|---|---|
| Horticulture research on small fruit and tree fruit | Active | 440.000 |

| Administrator | Comment |
|---|---|
| Department of Horticulture<br>Land Management Office | AgBioResearch Field Research Center<br>Coordinator: Dr. Doug Buhler & Charles Reid<br>Farm Manager: Gerald Skeltis |

### Dobie Road
### Okemos, Ingham County

| Purpose | Status | Acres |
|---|---|---|
| WKAR Broadcasting Site | Active | 114.431 |

| Administrator | Comment |
|---|---|
| Land Management Office | Location of WKAR tower<br>T-Mobile tower |

# Real Property Holdings - Inventory

MICHIGAN STATE UNIVERSITY

As of July 1, 2011

## Dunbar Forest
## Sault Ste. Marie, Chippewa County

| Purpose | Status | Acres |
|---|---|---|
| Forest research and demonstration | Active | 5,759.815 |
| | Title restricted on 4,668.84 acres | |
| | Land reverts to State if not used | |
| | solely for forestry purposes | |

| Administrator | Comment |
|---|---|
| **Department of Forestry** | AgBioResearch Field Research Center |
| Land Management Office | |

## Forest Biomass Innovation Center
## Escanaba, Delta County

| Purpose | Status | Acres |
|---|---|---|
| Research and demonstration in | Active | 1,737.260 |
| forestry and crops | | |

| Administrator | Comment |
|---|---|
| | AgBioResearch Field Research Center |
| Department of Forestry | Coordinator: Dr. David McFarlane |
| Land Management Office | Resident Forester: Dr. Ray Miller |

## Gantos Property
## City of Kentwood, Kent County

| Purpose | Status | Acres |
|---|---|---|
| Donation for resale | Property is for sale | 2.140 |

| Administrator | Comment |
|---|---|
| Land Management Office | None |

## Hidden Lake Gardens
## Tipton, Lenawee County

| Purpose | Status | Acres |
|---|---|---|
| Arboretum and plant conservatory | Active | 756.618 |

| Administrator | Comment |
|---|---|
| Land Management Office | Manager: Steven Courtney |

# Real Property Holdings - Inventory

## MICHIGAN STATE UNIVERSITY

As of July 1, 2011

### Hulett Road Engineering
### Okemos, Ingham County

| Purpose | Status | Acres |
|---|---|---|
| Former facilities and site for | Property is for sale | 5.691 |
| College of Engineering research | Building vacant | |

| Administrator | Comment |
|---|---|
| Land Management Office | None |

### Human Medicine, College of
### Grand Rapids, Kent County

| Purpose | Status | Acres |
|---|---|---|
| Medical School | Active | 1.735 |

| Administrator | Comment |
|---|---|
| College of Human Medicine | Includes Condominium #5 |
| | Includes Condominium #29 (Parking Spots) |
| | .005 acres sold to MDOT |

### Jolly Road Engineering
### Okemos, Ingham County

| Purpose | Status | Acres |
|---|---|---|
| Facilities and site for | Active | 3.260 |
| College of Engineering research | | |

| Administrator | Comment |
|---|---|
| College of Engineering | None |
| Land Management Office | |

# Real Property Holdings - Inventory

## MICHIGAN STATE UNIVERSITY

As of July 1, 2011

### Kellogg, W.K. Biological Station
### (Including Farm and Bird Sanctuary)
### Hickory Corners, Kalamazoo County

| Purpose | Status | Acres |
|---|---|---|
| Teaching, research, and extension activities in the environmental sciences focusing on the interdependence of natural and managed landscapes. The programs treat integrated study of biology, wildlife, and production agriculture, including animal input. | Active<br>Title on original gift restricted. Property needs to be maintained and operated for educational purposes. | 1,690.850 |

| Administrator | Comment |
|---|---|
| Director, Biological Station<br>College of Agriculture & Natural Resources<br>College of Natural Science<br>Land Management Office | AgBioResearch Field Research Center<br>Director: Dr. Katherine Gross<br>Farm Manager: Jim Bronson<br>Bird Sanctuary Coordinator: Tracey Kast<br>Farm Acreage: 944.674<br>Bird Sanctuary Acreage: 746.176<br>4.92 acres acquired in 2009 |

### Kellogg, W.K. Biological Station
### Lux Arbor Reserve
### Delton, Barry County

| Purpose | Status | Acres |
|---|---|---|
| Research and education in the agricultural, biological, botanical, and horticulture sciences | Active | 1,323.000 |

| Administrator | Comment |
|---|---|
| Same as Kellogg Biological Station | Included with Kellogg Biological Station as an Agricultural Research Station<br>Farm Manager: Steve Norris |

### Kellogg, W.K. Experimental Forest
### Augusta, Kalamazoo County

| Purpose | Status | Acres |
|---|---|---|
| Forestry research, teaching, demonstration, and public use | Active<br>Title restricted on 280 acres.<br>To be used for reforestation, education, and experimental purposes | 715.995 |

| Administrator | Comment |
|---|---|
| Department of Forestry<br>Land Management Office | AgBioResearch Field Research Center<br>Coordinator: Dr. David McFarlane<br>Resident Forester: Greg Kowalewski |

# Real Property Holdings - Inventory

MICHIGAN STATE UNIVERSITY

As of July 1, 2011

## Lake City Research Center
## Lake City, Missaukee County

| Purpose | Status | Acres |
|---|---|---|
| Research in beef cattle, forages, and potatoes | Active | 810.010 |

| Administrator | Comment |
|---|---|
| Department of Animal Science<br>Land Management Office | AgBioResearch Field Research Center<br>Coordinator: Dr. Jason Rountree<br>Farm Manager: Doug Carmichael |

## Leland Property
## Leland, Leelanau County

| Purpose | Status | Acres |
|---|---|---|
| Long-term lease to Leland Township | Active | 0.700 |

| Administrator | Comment |
|---|---|
| Land Management Office | None |

## MacCready Forest and Wildlife Reserve
## Clark Lake, Jackson County

| Purpose | Status | Acres |
|---|---|---|
| Wildlife and forestry demonstration | Active | 408.000 |

| Administrator | Comment |
|---|---|
| Department of Forestry<br>Department of Fisheries & Wildlife<br>Land Management Office | None |

## Management Education Center
## Troy, Oakland County

| Purpose | Status | Acres |
|---|---|---|
| Advanced management training center | Active | 24.327 |

| Administrator | Comment |
|---|---|
| College of Business | Manager: Tom Freed |

## Martin Property (Rose-Dell Seed Orchard)
## Calhoun County

| Purpose | Status | Acres |
|---|---|---|
| Tree seed orchard and demonstration site | Active<br>Proceeds from leases and timber sales to be used for farm maintenance and scholarships | 160.000 |

| Administrator | Comment |
|---|---|
| Department of Forestry<br>Land Management Office | None |

# Real Property Holdings - Inventory

MICHIGAN STATE UNIVERSITY

As of July 1, 2011

## Mason Research Farm
## Mason, Ingham County

| Purpose | Status | Acres |
|---|---|---|
| Cereal grains and soybean research | Active | 117.000 |

| Administrator | Comment |
|---|---|
| Department of Crop & Soil Sciences<br>Land Management Office | None |

## Michigan State University Campus
## East Lansing, Ingham County

| Purpose | Status | Acres |
|---|---|---|
| Research, education, and outreach | Active | 5,195.225 |

## Montcalm Research Center
## Lakeview, Montcalm County

| Purpose | Status | Acres |
|---|---|---|
| Potato production research and cash crops | Active | 57.250 |

| Administrator | Comment |
|---|---|
| Department of Crop & Soil Sciences<br>Land Management Office | AgBioResearch Field Research Center<br>Coordinator: Dr. Dave Douches<br>Farm Manager: Bruce Sackett |

## Morris Property
## Grand Ledge, Clinton and Eaton Counties

| Purpose | Status | Acres |
|---|---|---|
| Income generating property to fund endowments established by David and Betty Morris | Active | 1,531.000 |

| Administrator | Comment |
|---|---|
| Land Management Office | Long-term crop lease restricts near-term sale of property; includes eight residential leased properties, cell tower lease, research crop lease, billboard lease, and option to the Grand Ledge School District |

## MSU Sailing Club
## Haslett, Ingham County

| Purpose | Status | Acres |
|---|---|---|
| Sailing and wind surfing lessons | Active | 0.760 |

| Administrator | Comment |
|---|---|
| Intramural Sports and Recreative Services | None |

# Real Property Holdings - Inventory

## MICHIGAN STATE UNIVERSITY

As of July 1, 2011

### Muck Soils Research Center
### Laingsburg, Clinton County

| Purpose | Status | Acres |
|---|---|---|
| Organic soil vegetable and crops research | Active | 447.048 |

| Administrator | Comment |
|---|---|
| Department of Crop & Soil Sciences | AgBioResearch Field Research Center |
| Land Management Office | Coordinator: Dr. Doug Buhler |
| | Farm Manager: Mitch Fabis |

### River Terrace Property
### East Lansing, Ingham County

| Purpose | Status | Acres |
|---|---|---|
| Investment | Active | 1.210 |

| Administrator | Comment |
|---|---|
| Land Management Office | None |

### Rogers Reserve
### Jackson, Jackson County

| Purpose | Status | Acres |
|---|---|---|
| Botantical and horticultural sciences research and teaching | Active | 115.850 |

| Administrator | Comment |
|---|---|
| Department of Plant Pathology | Coordinator: Dr. Dennis Fulbright |
| Land Management Office | |

### Russ (Fred) Forest
### Decatur, Cass County

| Purpose | Status | Acres |
|---|---|---|
| Forestry plantings and genetics research | Active | 938.750 |
| Demonstration and public use | Title restricted on 269 acres | |
| | Land to be used for educational purposes | |

| Administrator | Comment |
|---|---|
| Department of Forestry | AgBioResearch Field Research Center |
| Land Management Office | Coordinator: Dr. David MacFarlane |
| | Non-Resident Forester: Greg Kowalewski |

# Real Property Holdings - Inventory

MICHIGAN STATE UNIVERSITY

As of July 1, 2011

## Saginaw Valley Research and Extension Center
### Frankenmuth, Saginaw and Tuscola Counties

| Purpose | Status | Acres |
|---|---|---|
| Dry bean, sugar beet, and crop research | Active | 310.040 |
| Research, outreach, and teaching | | |

| Administrator | Comment |
|---|---|
| Department of Crop & Soil Sciences | AgBioResearch Field Research Center |
| Land Management Office | Coordinator: Dr. James Kelly |
| | Farm Manager: Paul Horny |

## Southwest Michigan Research and Extension Center
### Benton Harbor, Berrien County

| Purpose | Status | Acres |
|---|---|---|
| Horticultural research and extension center | Active | 350.000 |

| Administrator | Comment |
|---|---|
| Department of Horticulture | AgBioResearch Field Research Center |
| Cooperative Extension Service | Coordinator: Dr. Thomas Zabadal |
| Land Management Office | Farm Manager: Dave Francis |

## Stranahan-Bell (WaWaSum)
### Grayling, Crawford County

| Purpose | Status | Acres |
|---|---|---|
| Inland stream and reforestation research | Active | 251.000 |
| Small conference center | | |

| Administrator | Comment |
|---|---|
| Land Management Office | None |

## Stuckman Property
### St. Johns, Clinton County

| Purpose | Status | Acres |
|---|---|---|
| Educational and/or research | Active | 40.000 |

| Administrator | Comment |
|---|---|
| Land Management Office | MOU on file in Land Management Office |

# Real Property Holdings - Inventory

## MICHIGAN STATE UNIVERSITY

As of July 1, 2011

### Sycamore Creek
### Holt, Ingham County

| Purpose | Status | Acres |
|---|---|---|
| Support campus water management plan; controlled access to Sycamore Creek flood plain | Active<br>Title restricted on 52 acres<br>Deed covenants restrict use | 54.500 |

| Administrator | Comment |
|---|---|
| Land Management Office | None |

### Tollgate Education Center
### Novi, Oakland County

| Purpose | Status | Acres |
|---|---|---|
| Agricultural and environmental education and leadership training | Active | 56.675 |

| Administrator | Comment |
|---|---|
| Cooperative Extension Service<br>Land Management Office | Farm Manager: Roy Prentice |

### Trevor Nichols Research Center
### Fennville, Allegan County

| Purpose | Status | Acres |
|---|---|---|
| Fruit pest research | Active | 156.100 |

| Administrator | Comment |
|---|---|
| Department of Entomology<br>Land Management Office | AgBioResearch Field Research Center<br>Coordinator: Dr. John Wise<br>Farm Manager: Jason Seward |

### Upper Peninsula Research Center
### Chatham, Alger County

| Purpose | Status | Acres |
|---|---|---|
| Dairy, forestry, and crops research | Active | 1,262.227 |

| Administrator | Comment |
|---|---|
| Department of Animal Science<br>Land Management Office | AgBioResearch Field Research Center<br>Coordinator: Dr. Dan Buskirk<br>Farm Manager: Paul Naasz |

### VanHoosen Property
### Rochester, Oakland County

| Purpose | Status | Acres |
|---|---|---|
| Long-term lease to Avon Players | Active | 1.793 |

| Administrator | Comment |
|---|---|
| Vice President for Finance and Operations<br>Land Management Office | Remaining land of Sarah<br>Van Hoosen gift acquired in 1956 |

**Total Acres: 25,479.800**

# Real Property Holdings - AgBioResearch Centers

MICHIGAN STATE UNIVERSITY

As of July 1, 2011

**AgBioResearch Centers owned by MSU**

Clarksville Research Center
9302 Portland Road
Clarksville, MI 48815

MSU Forest Bomass Innovation Center
6005 J. Road
Escanaba, MI 49829

Kellogg, W.K. Experimental Forest
7060 N. 42nd Street
Augusta, MI 49012

Montcalm Research Center
4747 McBride Road
Lakeview, MI 48850

Fred Russ Forest
20673 Marcellus Highway
Decatur, MI 49045

Southwest Michigan Research and
Extension Center
1781 Hillandale Road
Benton Harbor, MI 49022

Upper Peninsula Research Center
E3774 University Drive
P.O. Box 168
Chatham, MI 49816

Dunbar Forest
12839 S. Scenic Drive
Sault Ste. Marie, MI 49783

Kellogg, W.K. Biological Station
3700 E. Gull Lake Drive
Hickory Corners, MI 49060

Lake City Research Center
5401 W. Jennings Road
Lake City, MI 49651

Muck Soils Research Center
Route 3
9370 E. Herbison Road
Laingsburg, MI 48848

Saginaw Valley Research and
Extension Center
9923 Krueger Road
Frankenmuth, MI 48734

Trevor Nichols Research Center
6237 124th Avenue
Fennville, MI 49408

**AgBioResearch Centers leased by MSU**

Northwest Michigan Horticultural
Research Center
6686 S. Center Highway
Traverse City, MI 49684

# Real Property Holdings - Land Acquisition by Decade

MICHIGAN STATE UNIVERSITY

As of July 1, 2011

| | Acres | |
|---|---|---|
| | **Campus** | **Off-Campus** |
| Prior to 1920 | 1,026.380 | 1,060.327 |
| 1920's ………………………………………………………… | 564.350 | 2,007.112 |
| 1930's ………………………………………………………… | 284.614 | 795.026 |
| 1940's ………………………………………………………… | 1,605.236 | 6,281.322 |
| 1950's ………………………………………………………… | 1,266.862 | 862.190 |
| 1960's ………………………………………………………… | 767.850 | 2,417.390 |
| 1970's ………………………………………………………… | 188.747 | 861.049 |
| 1980's ………………………………………………………… | 13.943 | 3,265.245 |
| 1990's ………………………………………………………… | 66.338 | 1,775.765 |
| 2000's ………………………………………………………… | 1.069 | 1,566.310 |
| 2010's ………………………………………………………… | 0.000 | 1,635.140 |

# Real Property Holdings - Land Available for Agricultural and Natural Resources Research

MICHIGAN STATE UNIVERSITY

As of July 1, 2011

| **Off-Campus** | **Acres** |
|---|---|
| 13 Outlying Stations (owned) | 15,998.345 |
| 1 Outlying Station (leased) | 100.000 |
| Dobie Road Property, Okemos | 114.431 |
| Off-Campus owned land used for agricultural research (Not designated as a research station) | 1,146.350 |
| Off-Campus leased land used for agricultural research | 264.000 |
| **Campus** | |
| Land used for agricultural research - south of Mt. Hope | 2,733.249 |
| **Total Acres:** | **20,356.375** |

# Real Property Holdings - Warranty Deeds to State Building Authority

## MICHIGAN STATE UNIVERSITY

As of July 1, 2011

The following parcels have been or will be deeded to and leased back from the State Building Authority, for financing pursuant to earlier Board of Trustees approval.

- Anthony Hall Dairy Plant and Meats Lab
- Biomedical and Physical Sciences Building
- Diagnostic Center for Population and Animal Health
- Chemistry Building Renovation Project

The following parcels have been deeded to the State of Michigan, pursuant to Board of Trustees approval, in connection with a State of Michigan financing of improvements. A written agreement obligates the State to deed the property back to MSU at a later date.

- The Geagley Laboratory

# Real Property Holdings - Maps

MICHIGAN STATE UNIVERSITY

As of July 1, 2011

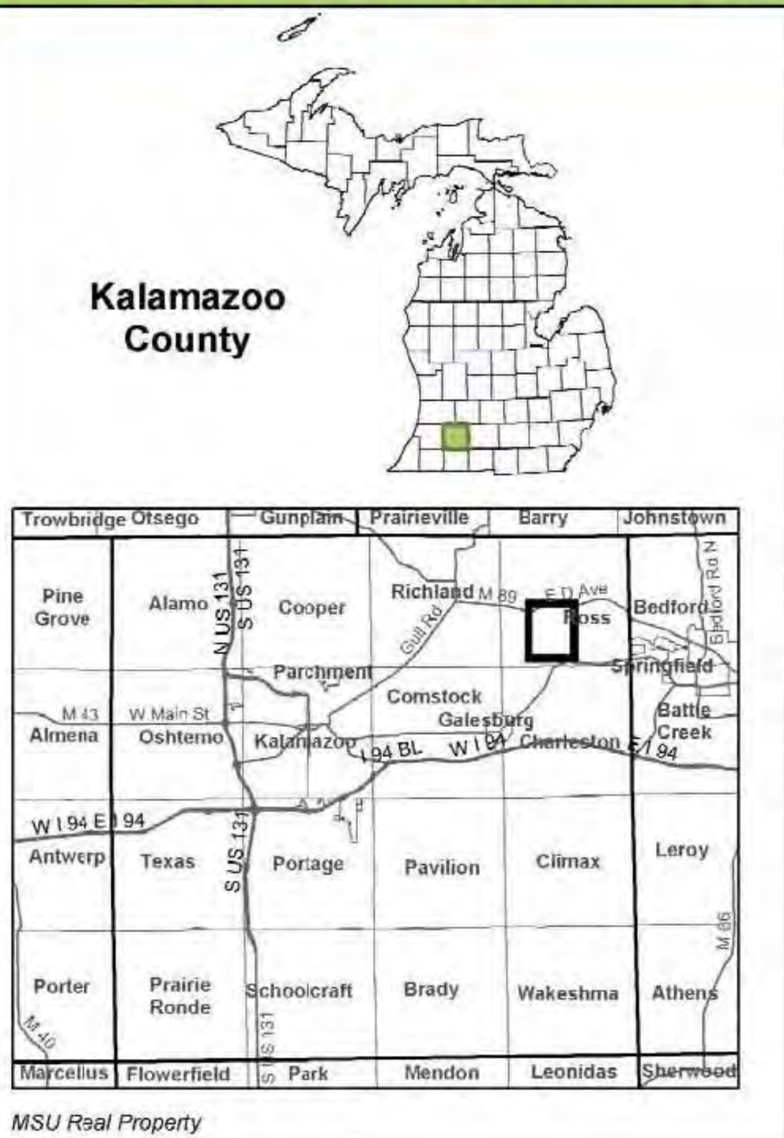
# Location Maps
# of
# Michigan State University Properties
# Alphabetical by County

# BioEconomy Research and Development Center

## Holland Township, Section 19

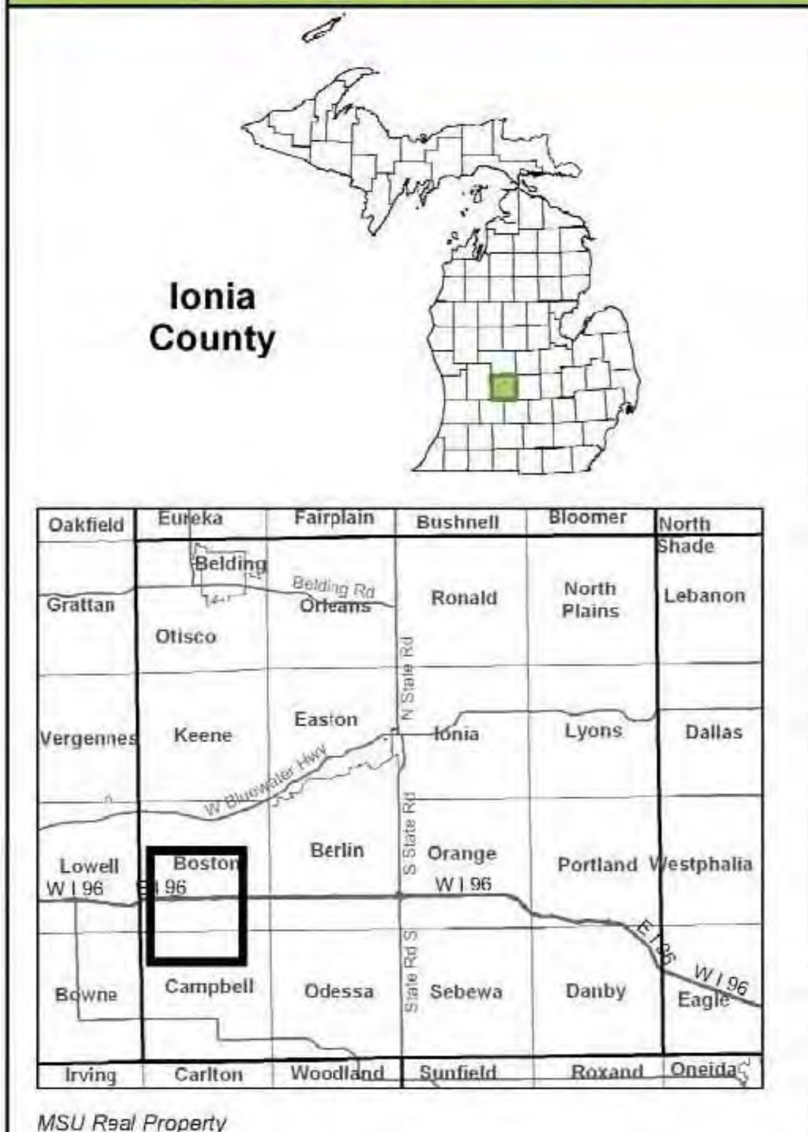
# Brook Lodge

## Ross Township, Section 21, 27, 28, and 29



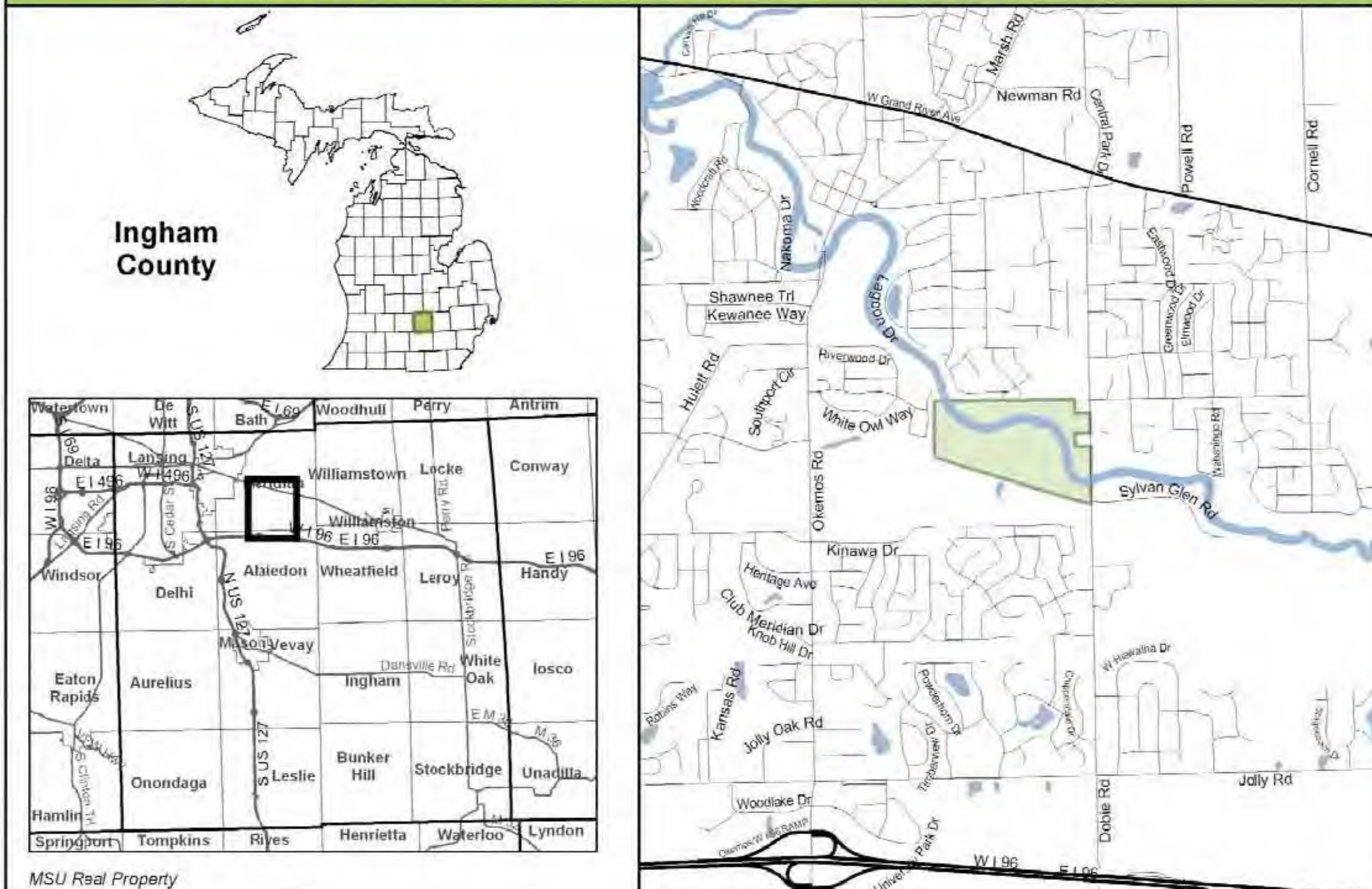

# Clarksville Horticultural Experiment Station

## Boston Township, Sections 27, 28, and 33



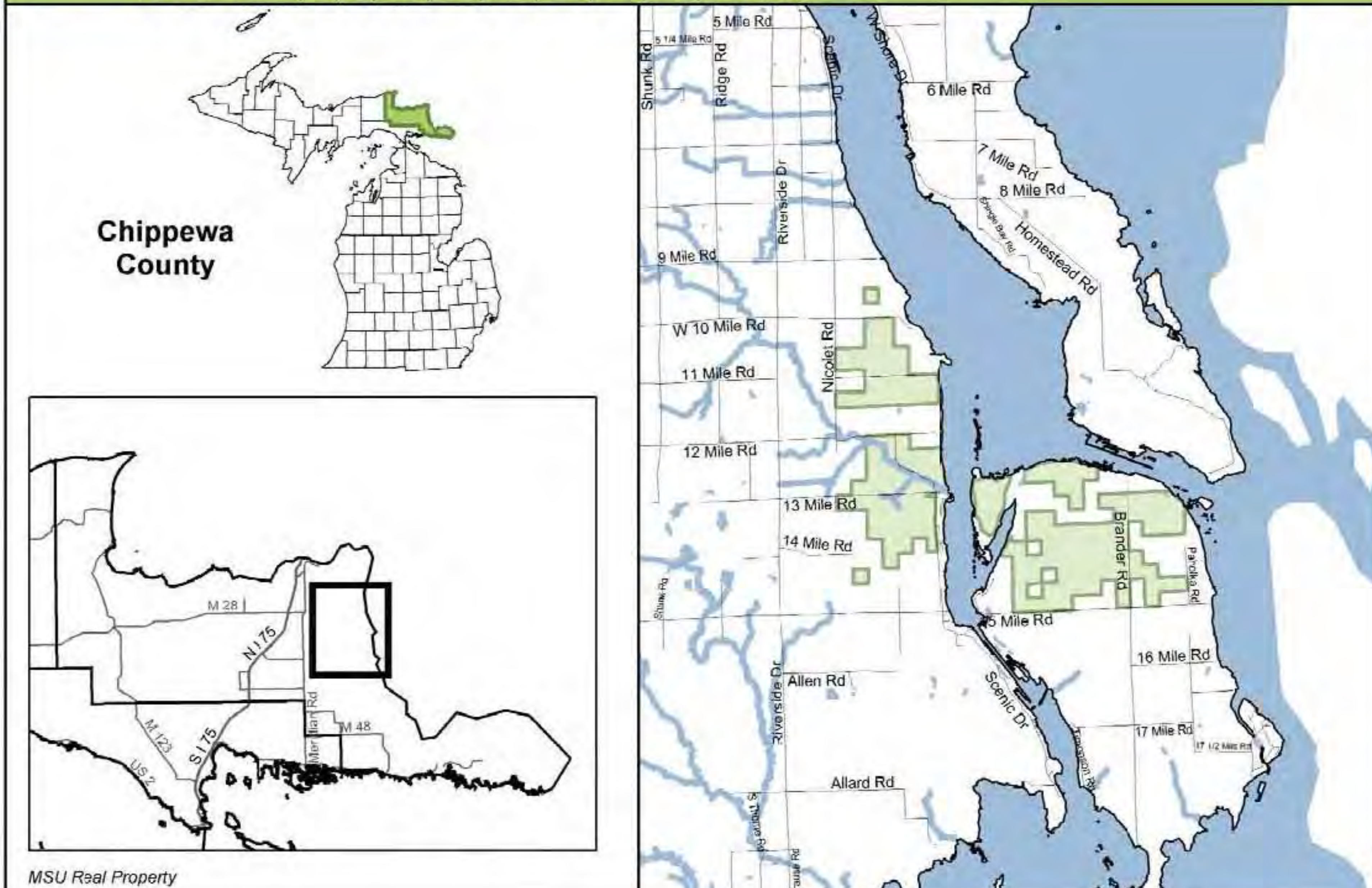

# Dobie Road Property

## Meridian Township, Section 27



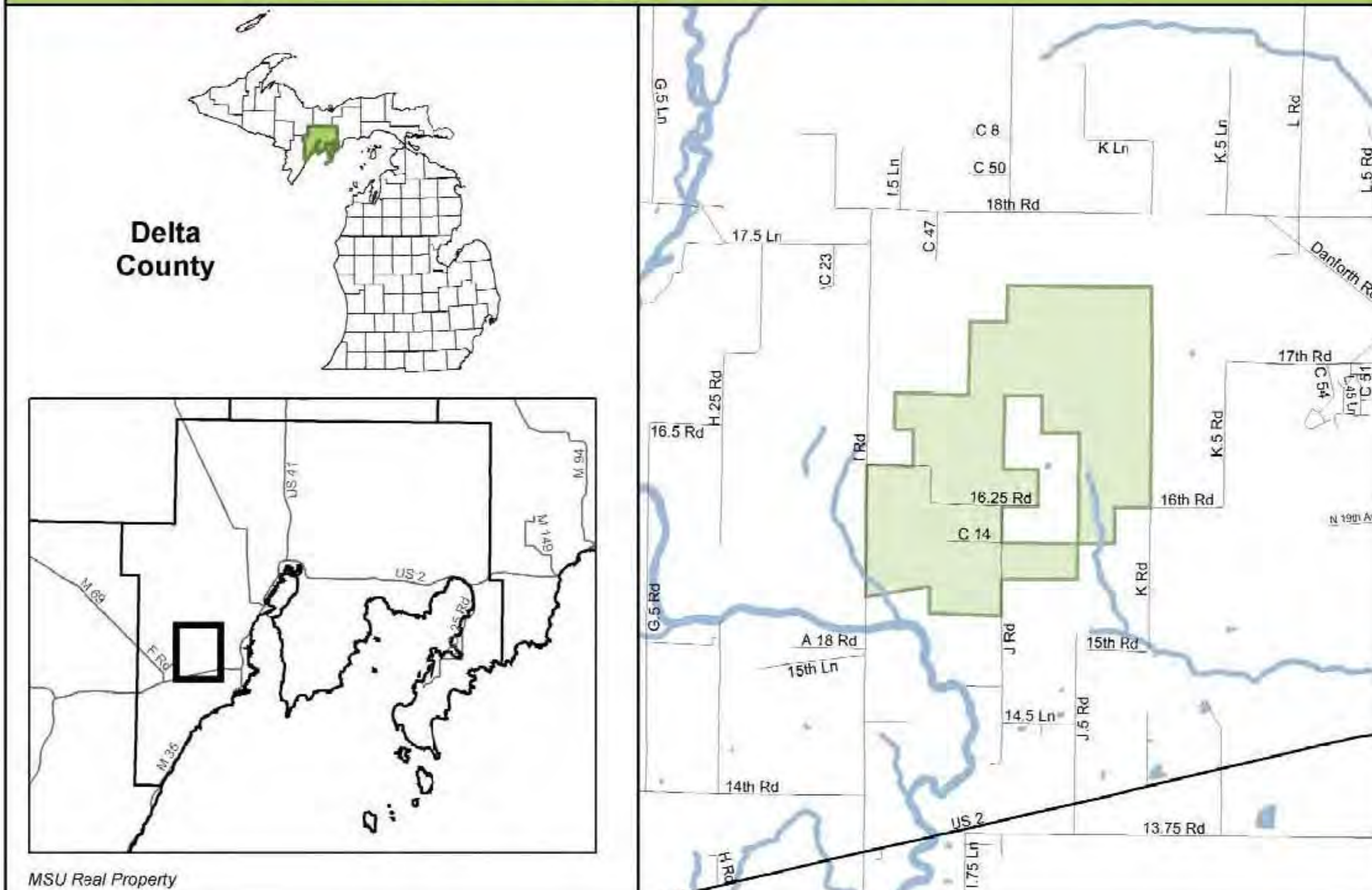
# Dunbar Forest Experiment Station

## Soo Township, Sections 3, 4, 5, 8, 9, 10, 11, 14, 15, and 16; Bruce Township, Sections 1, 6, 7, 12, 13, 24, 25, 30, 31, and 36



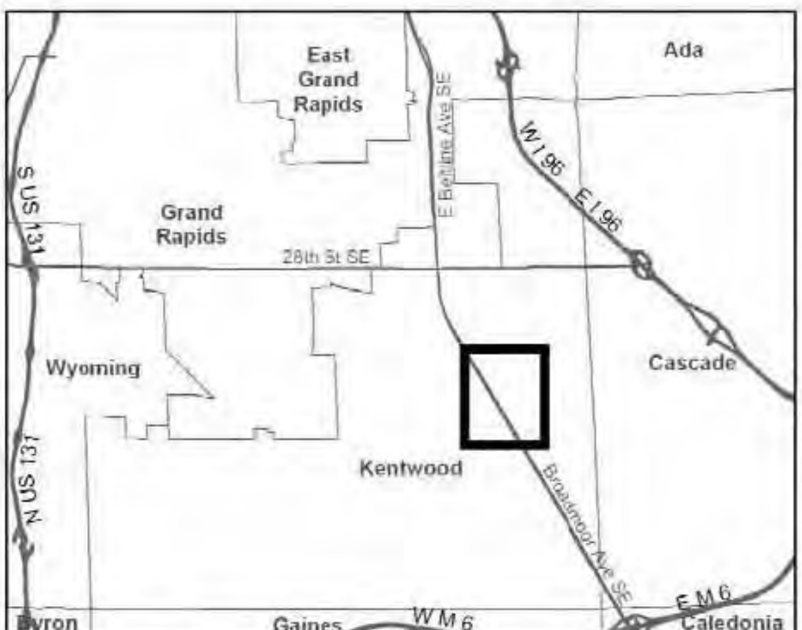
# Forest Biomass Innovation Center

## Wells Township, Sections 8, 17, 18, 19, and 20



# Gantos Property

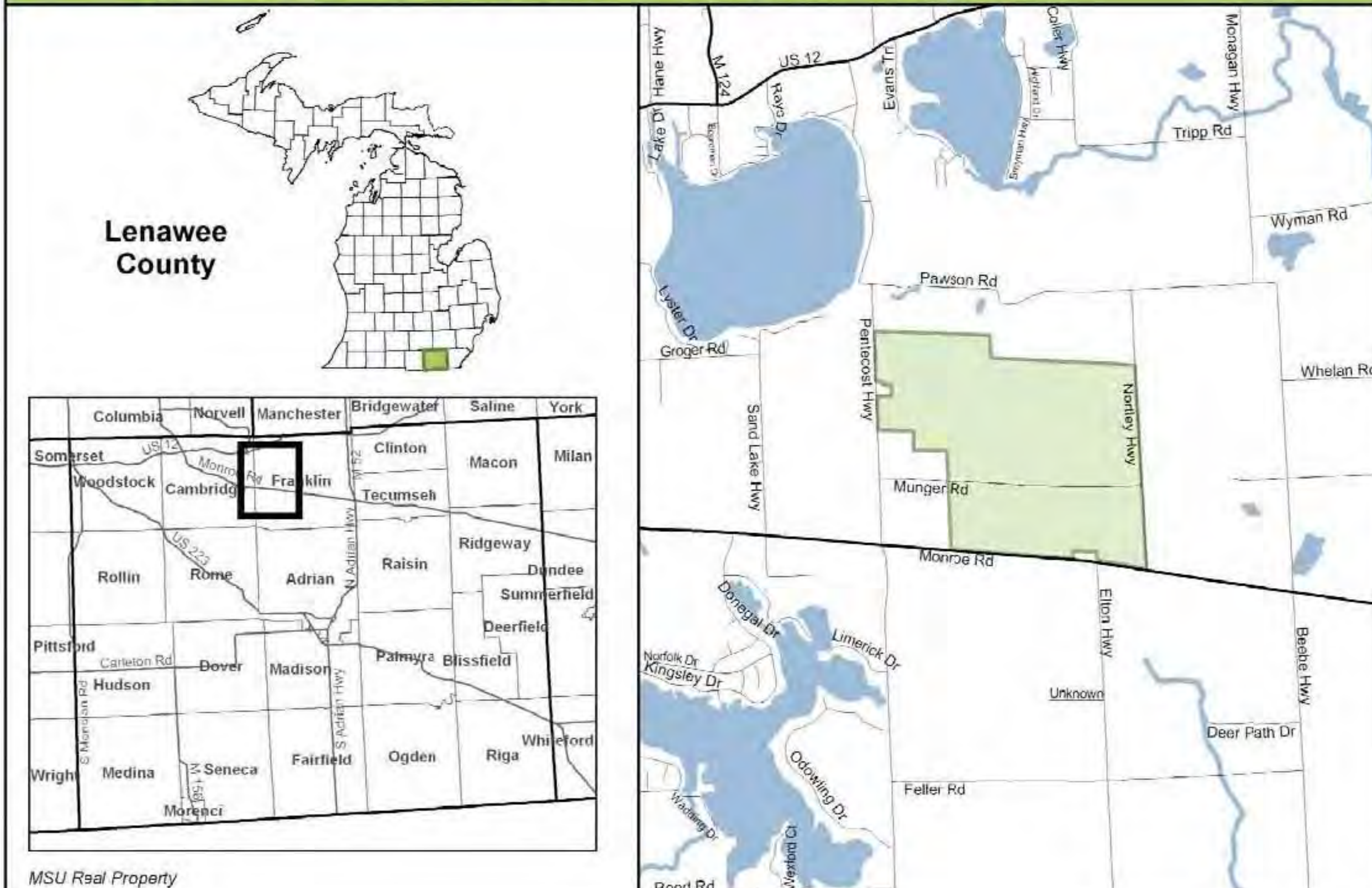
## Kentwood Township, Section 23


MSU Real Property

# Hidden Lake Gardens

## Franklin Township, Sections 17, 18, 19, and 20

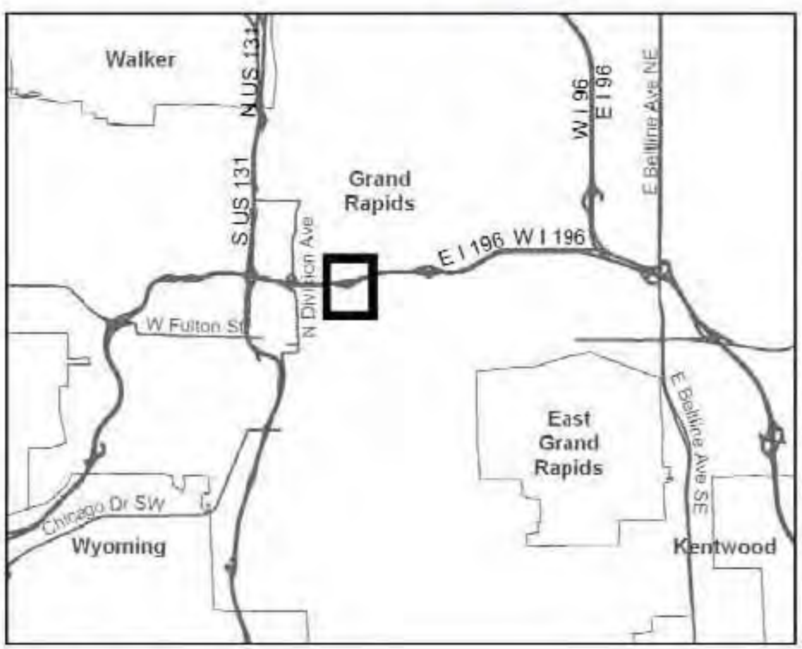


# Hulett Road Engineering

## Alaiedon Township, Section 5

# College of Human Medicine

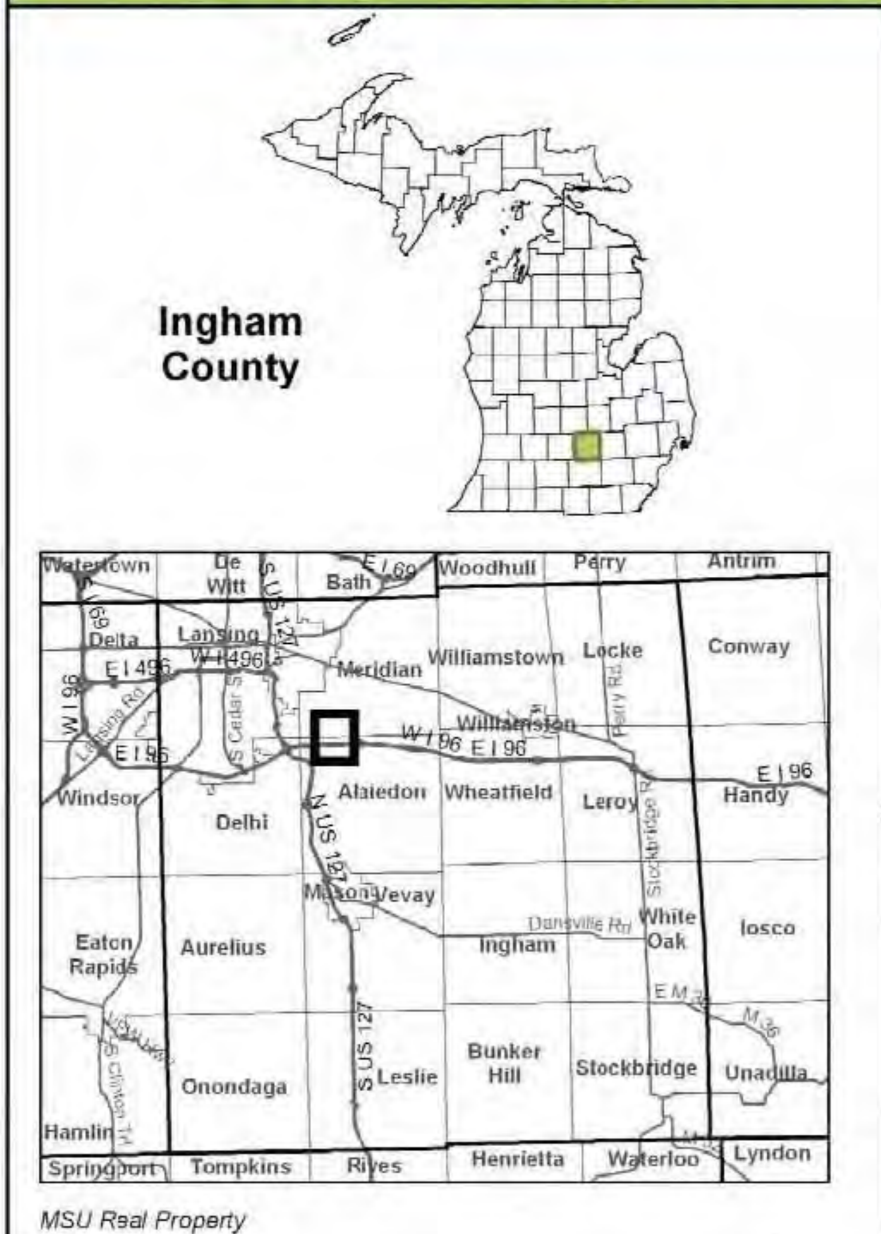
## Grand Rapids Township, Section 19


MSU Real Property

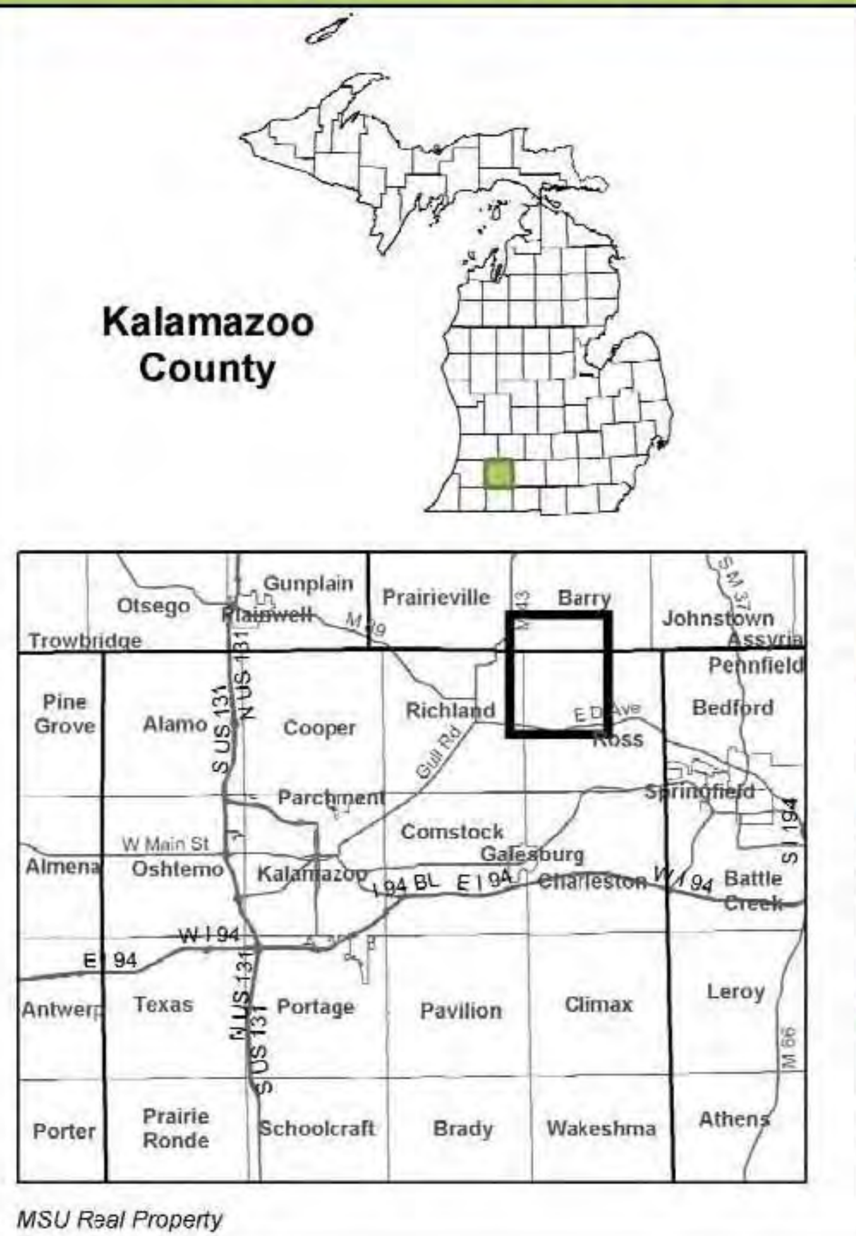
# Jolly Road Engineering and Civil Infrastructure Lab

## Alaiedon Township, Section 5



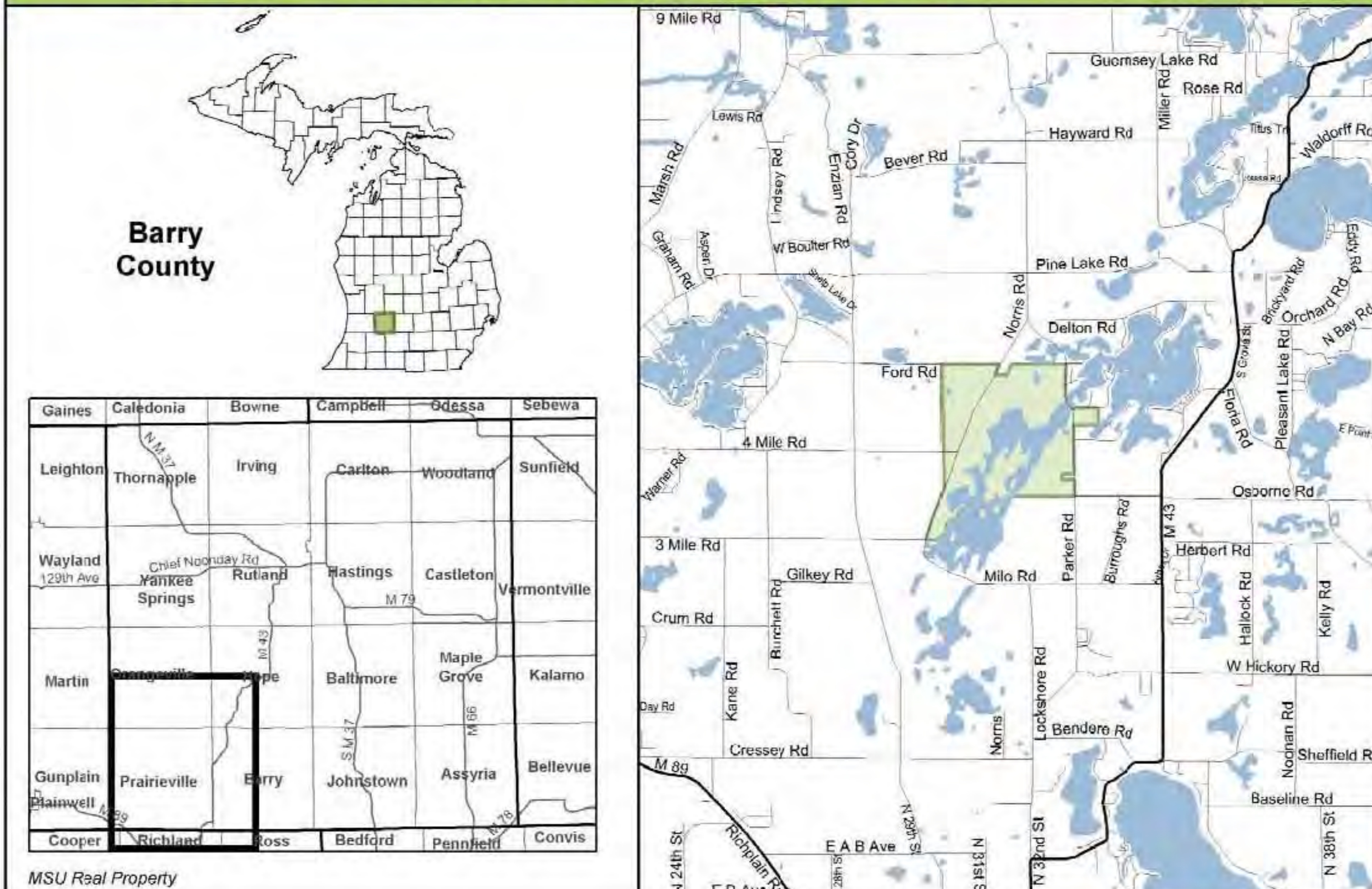

# W.K. Kellogg Biological Station, Bird Sanctuary, and Farm

## City of South Gull Lake and Ross Township, Sections 4, 5, 6, 8, and 9



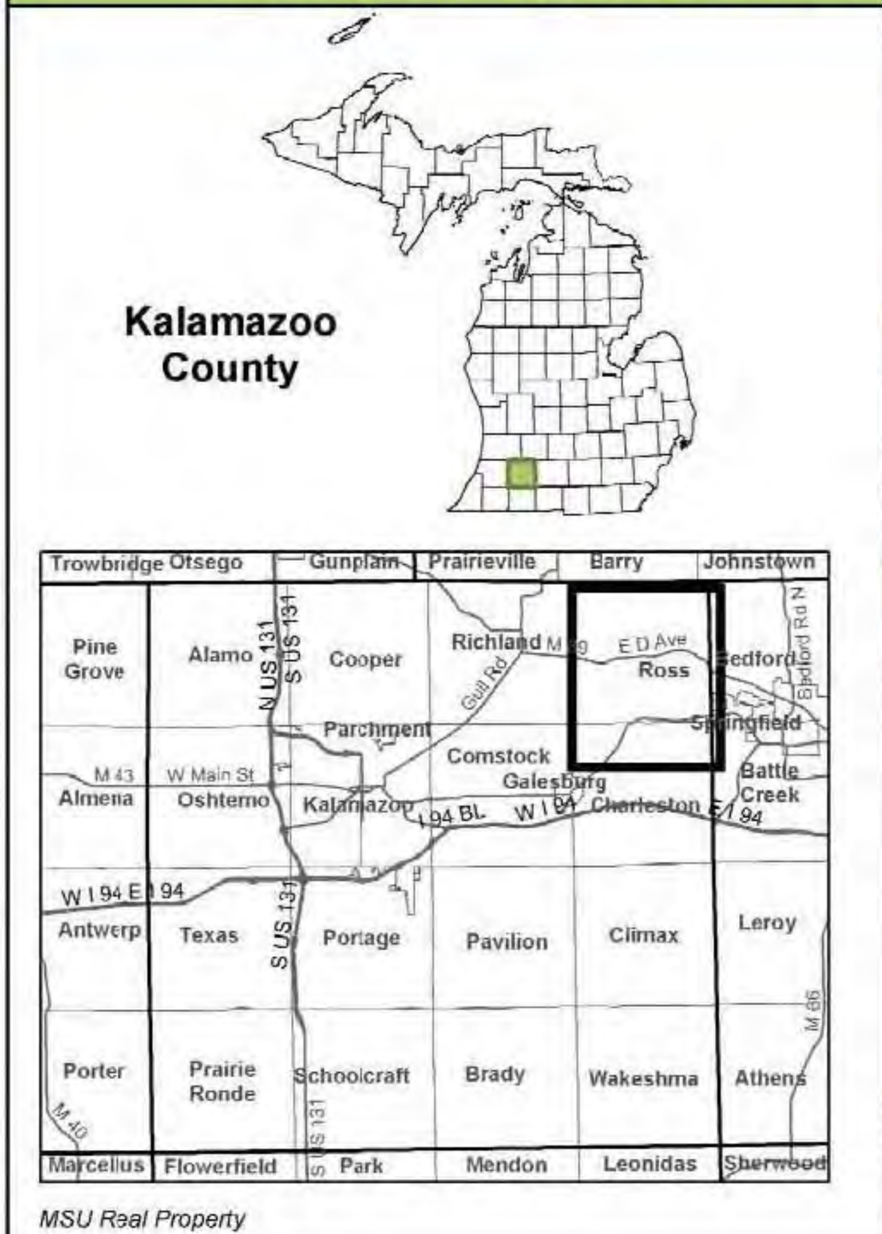

# W.K. Kellogg Biological Station (Lux Arbor Reserve)

## Prairieville Township, Sections 10, 11, 14, and 15



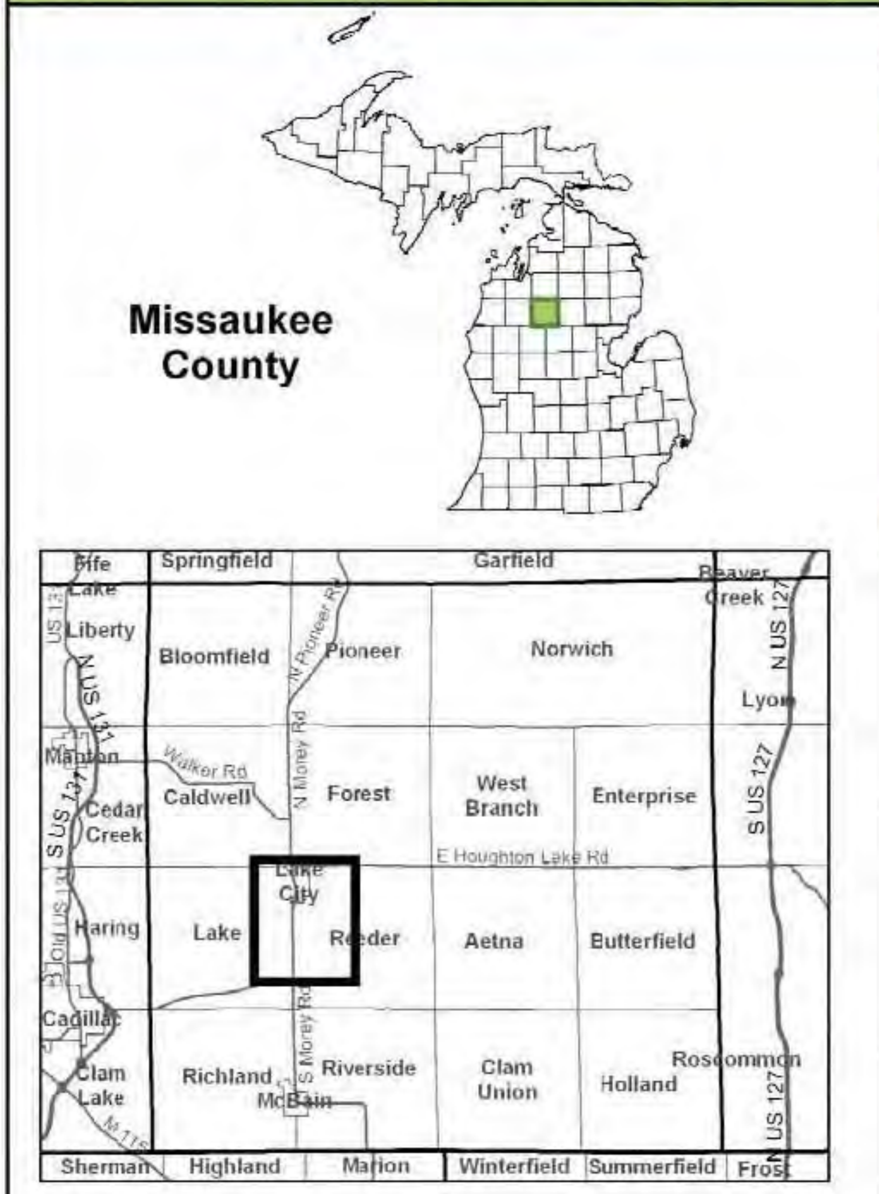
# W.K. Kellogg Experimental Forest

## Ross Township, Sections 21, 22, 27, and 28




# Lake City Experiment Station

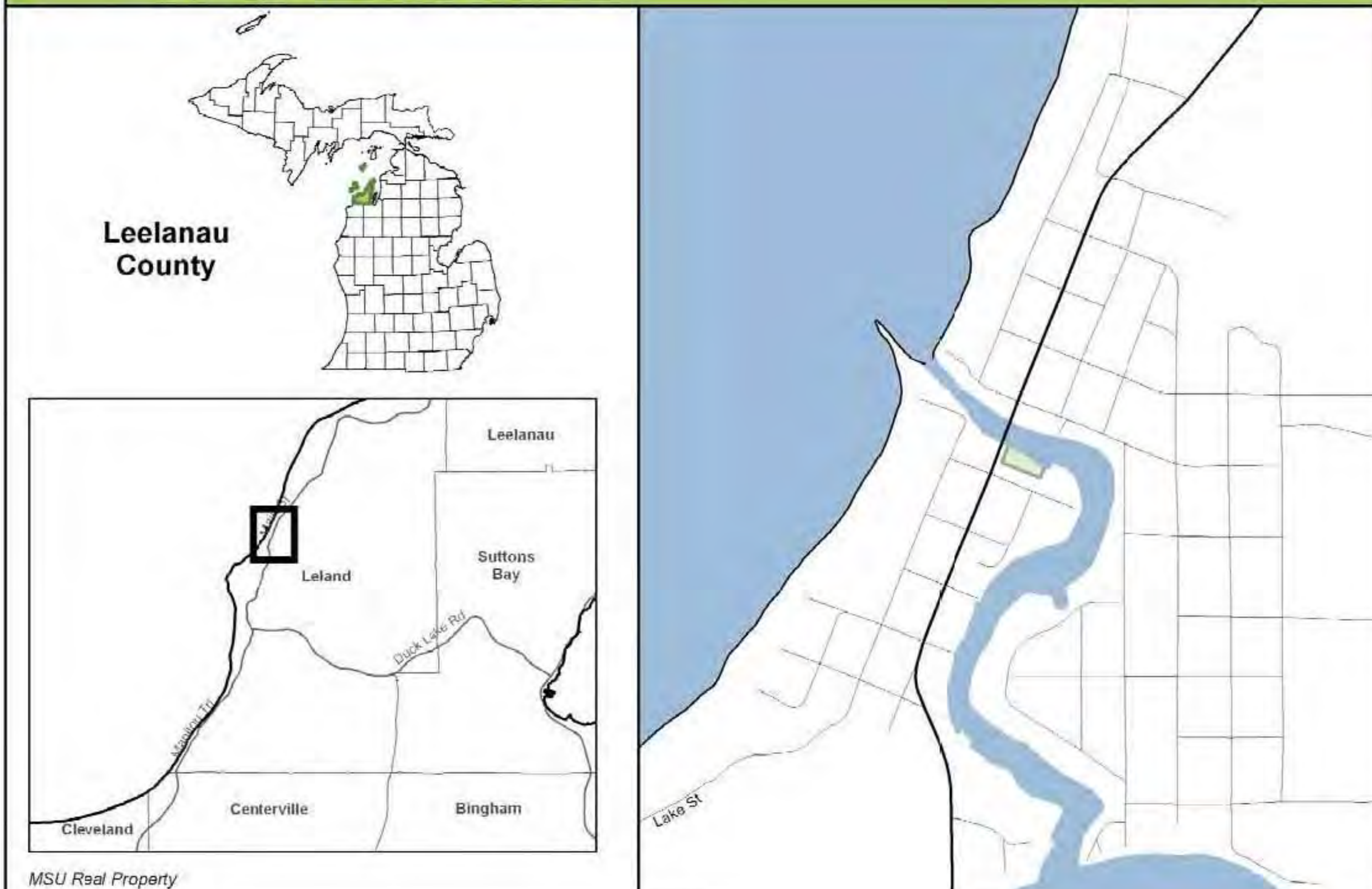
## Reeder Township, Sections 7 and 18




MSU Real Property

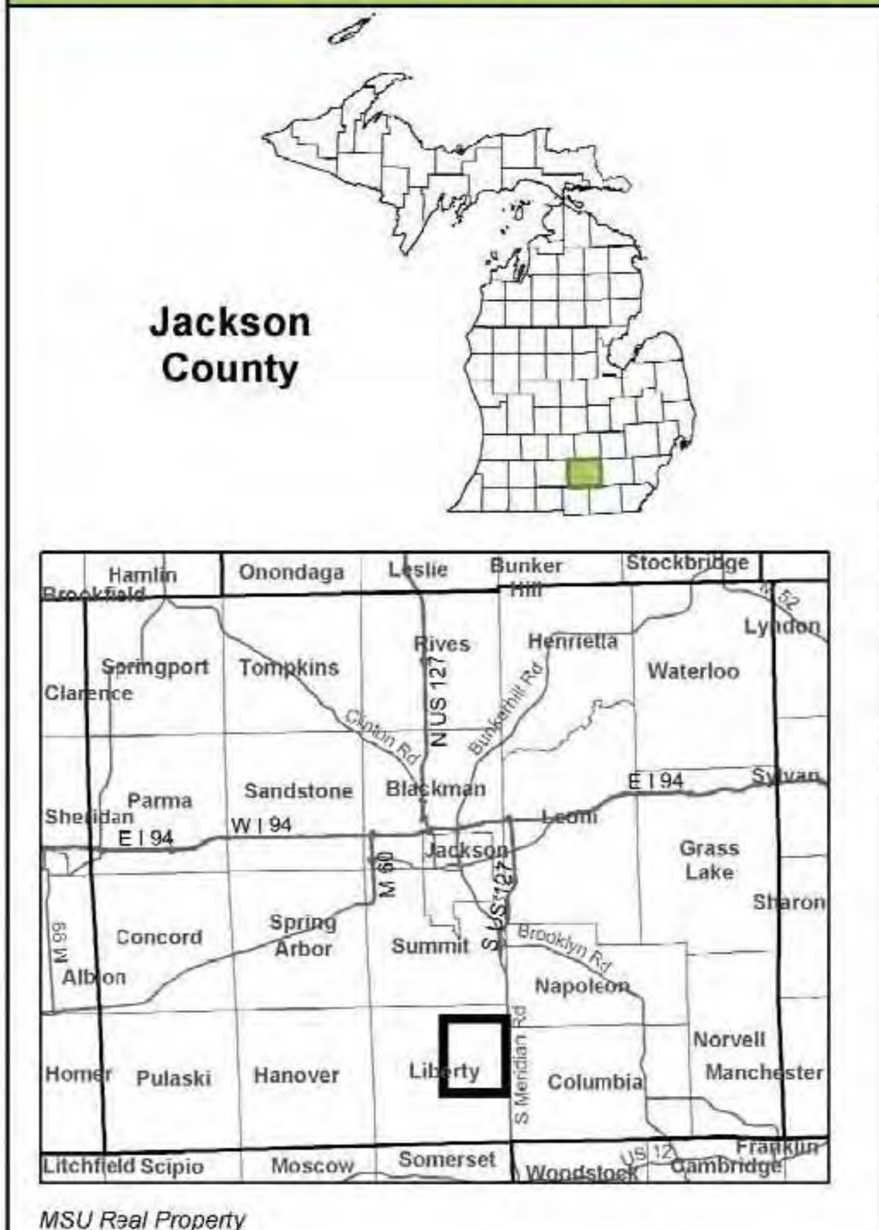
# Leland Property

## Leland Township, Section 9



# MacCready Forest and Wildlife Reserve

## Liberty Township, Sections 11 and 14

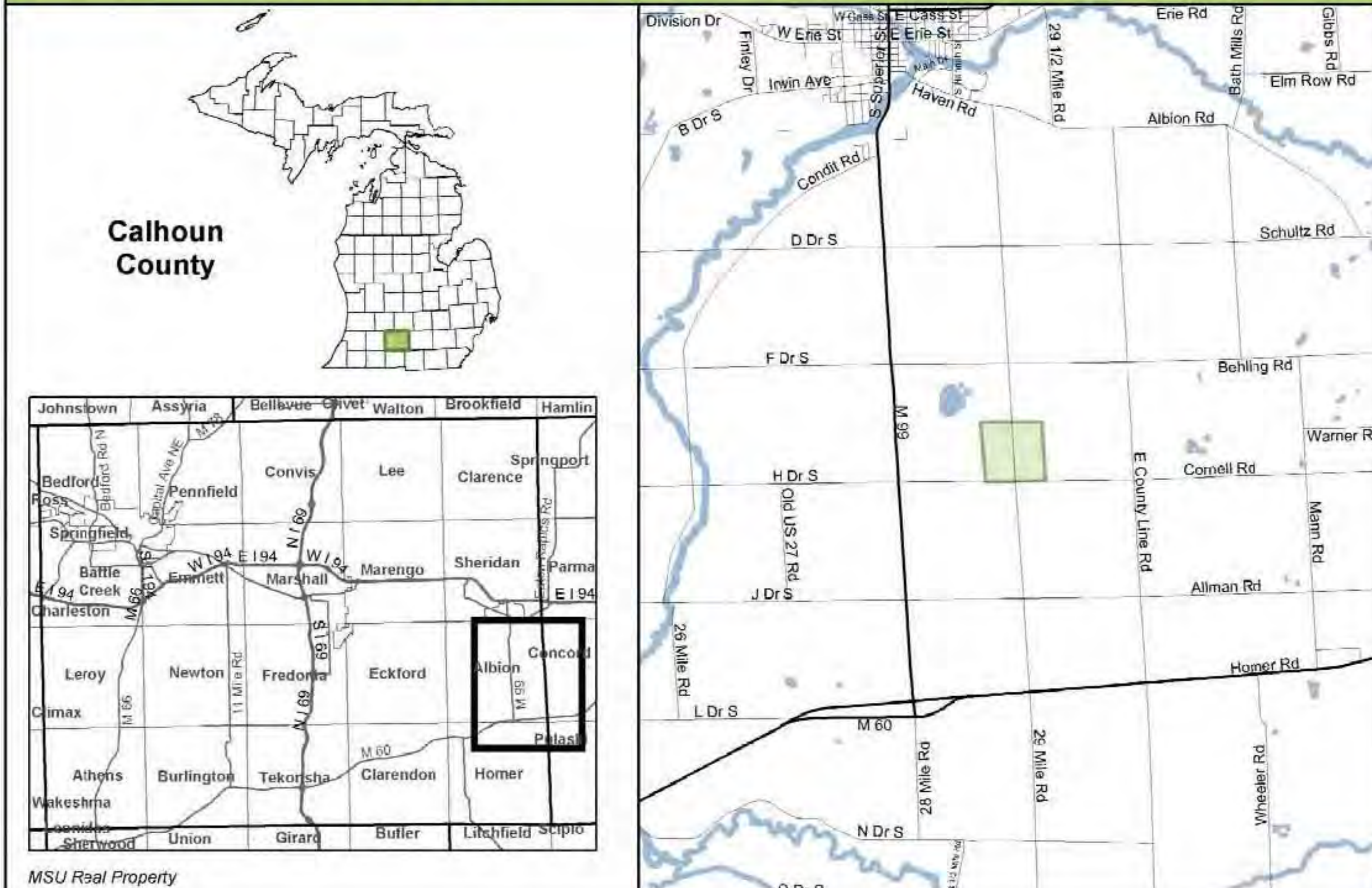



# Management Education Center, Troy

## City of Troy, Section 9

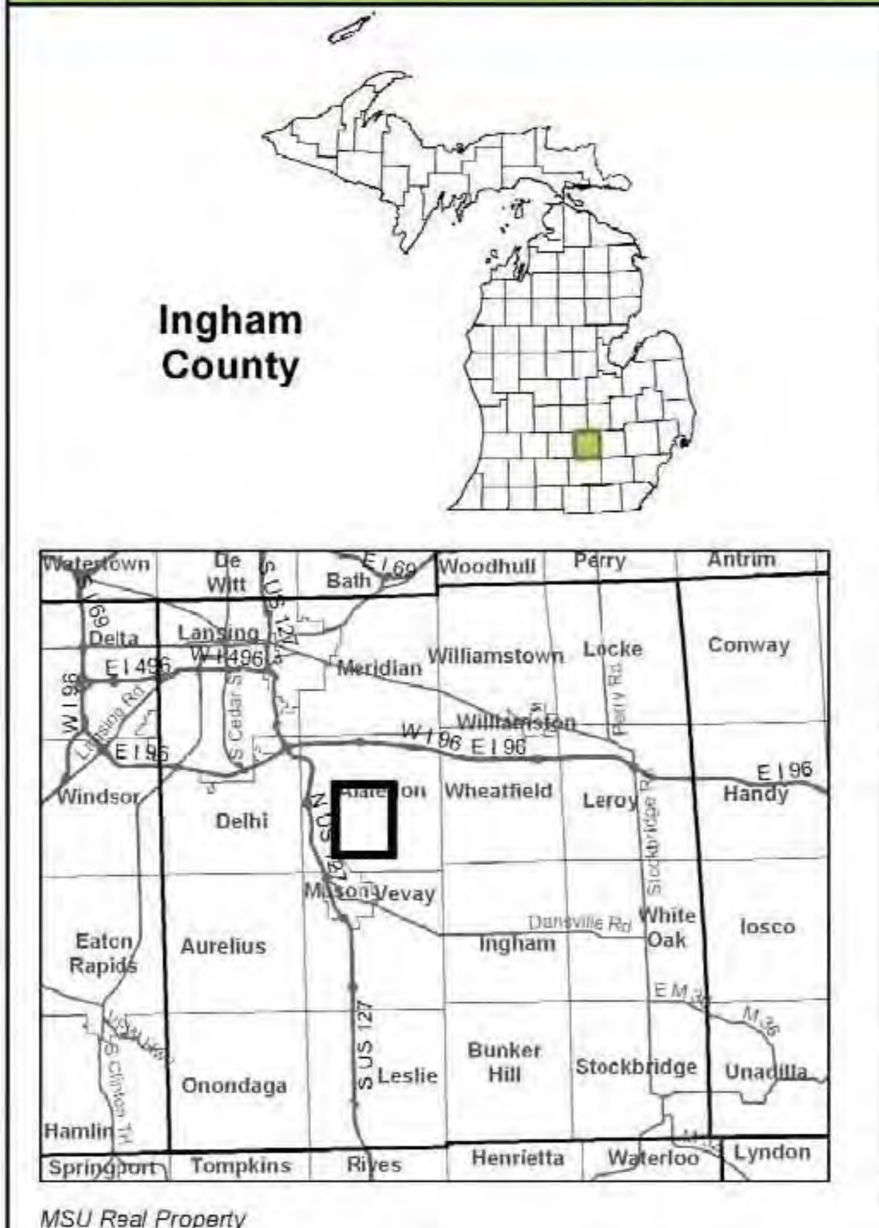

# Martin Property (Rose-Dell Seed Orchard)

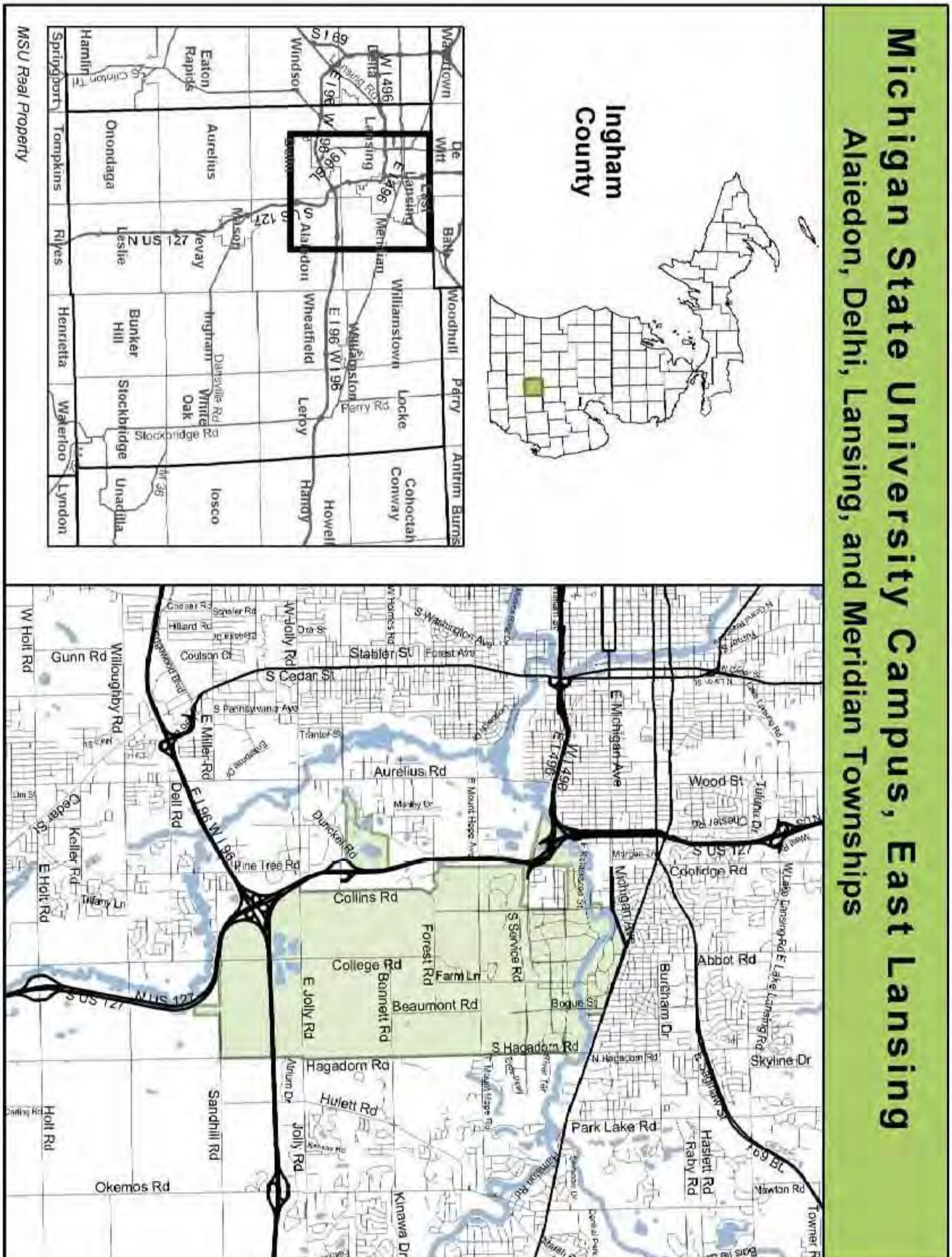
## Albion Township, Sections 23 and 24



# Mason Research Farm

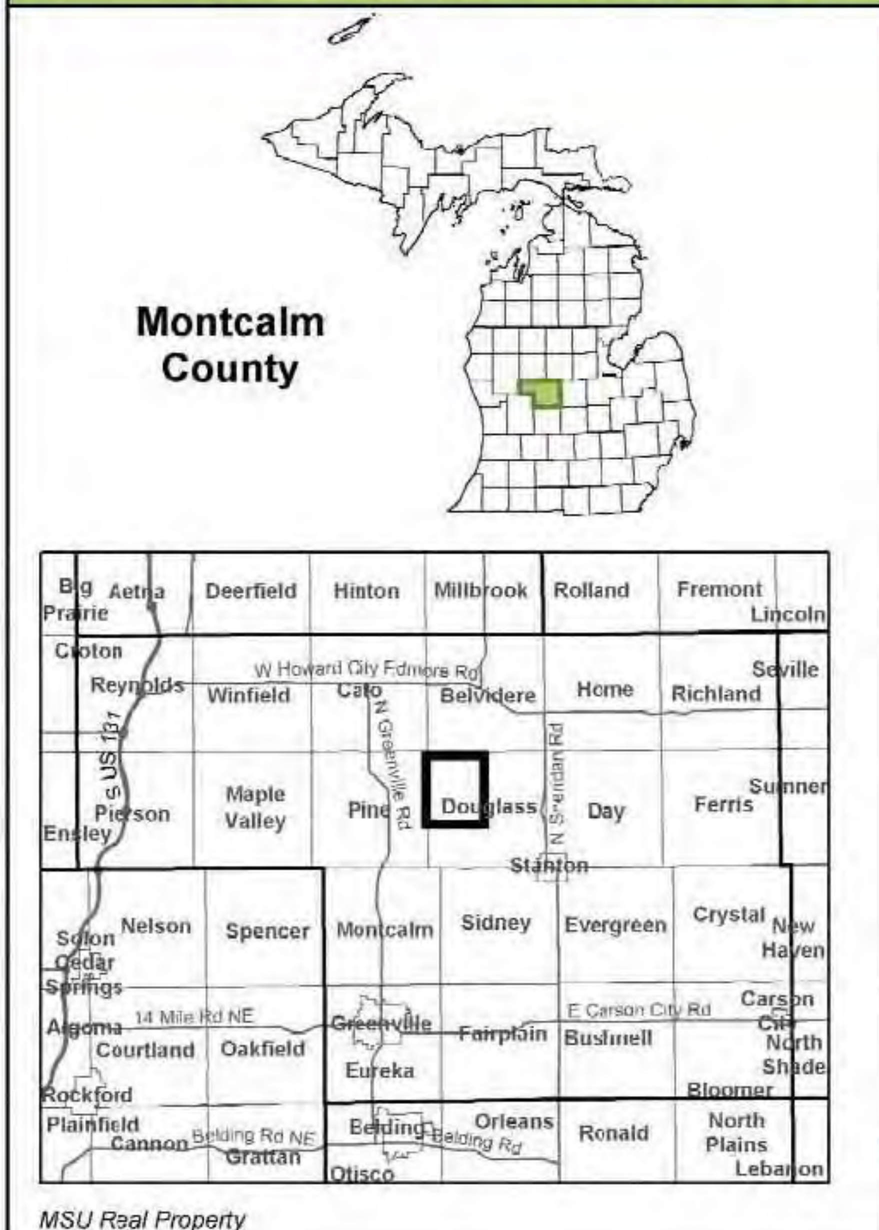
## Alaiedon Township, Section 21





Michigan State University Campus, East Lansing
Alaiedon, Delhi, Lansing, and Meridian Townships
Ingham County
MSU Real Property
Collins Rd
College Rd
Beaumont Rd
Farm Ln
Forest Rd
Bennett Rd
E Jolly Rd
Hagadorn Rd
S Hagadorn Rd
Bogue St
S Service Rd
Aurelius Rd
S Cedar St
E Michigan Ave
Wood St
Coolidge Rd
Abbot Rd
Burcham Dr
Park Lake Rd
Haslett Rd
Raby Rd
Skyline Dr
Towner Rd
Hulett Rd
Jolly Rd
Kinawa Dr
Okemos Rd
Holt Rd
Sandhill Rd
Dell Rd
E Miller Rd
Willoughby Rd
Gunn Rd
W Holt Rd
E Holt Rd
Keller Rd
Pine Tree Rd
Stabler St
W Jolly Rd

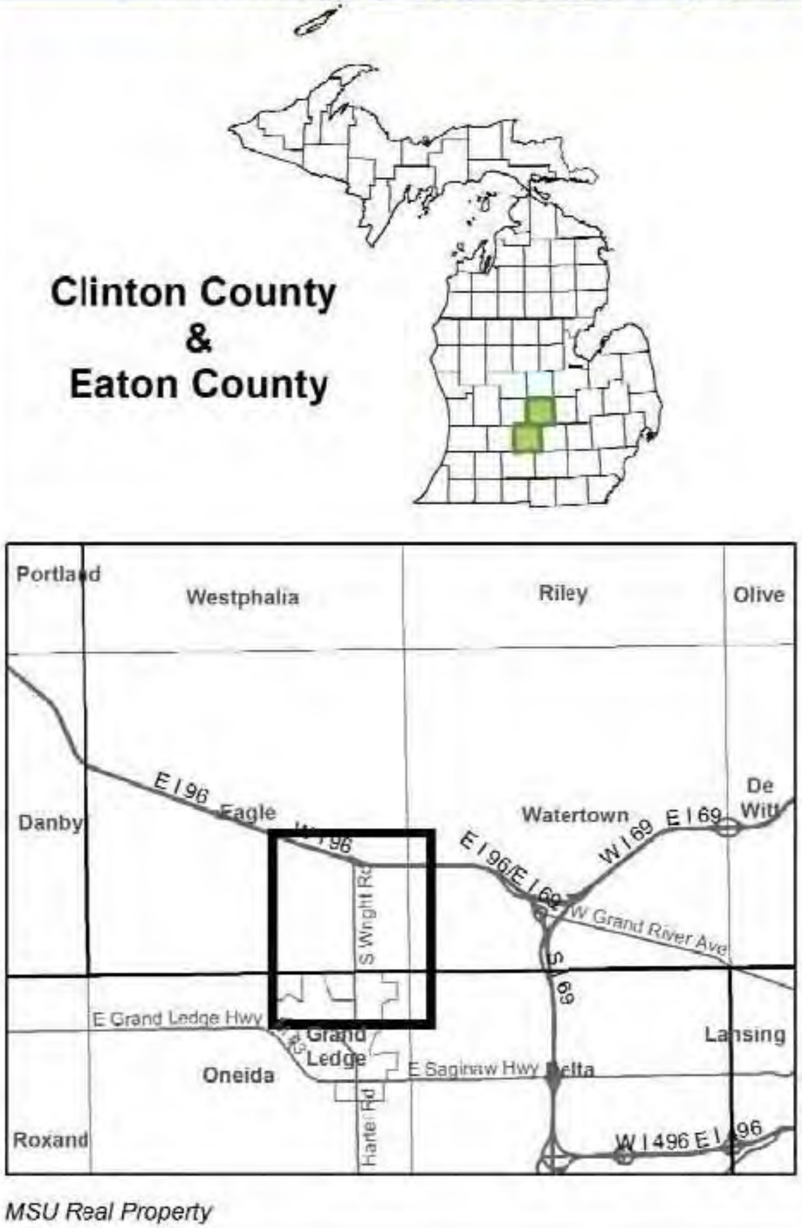
# Montcalm Experimental Farm

## Douglass Township, Sections 8 and 17



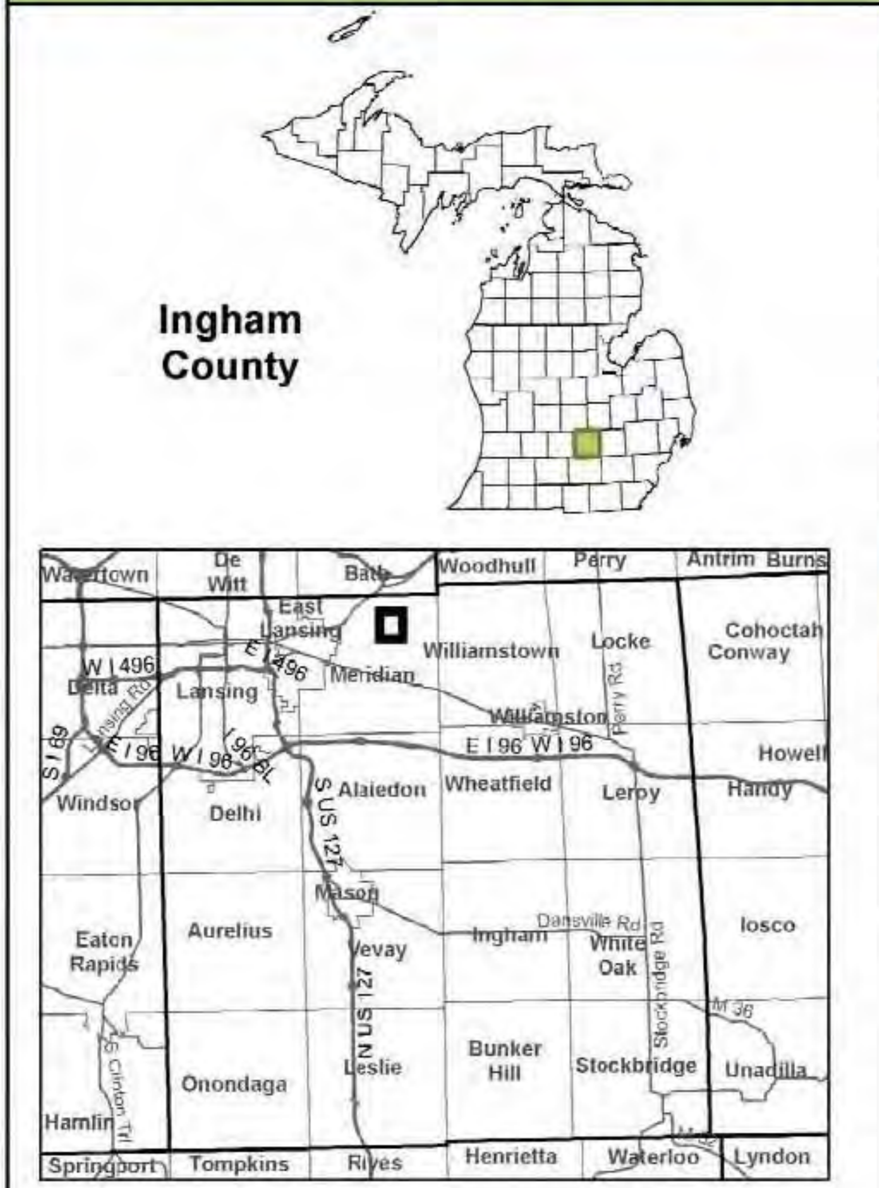

# Morris Property

## Oneida Twp, Sections 1 and 2; Delta Twp, Section 6; Eagle Twp, Sections 23, 25, 26, 27, 34, 35; and Watertown Twp, Section 30




# MSU Sailing Club

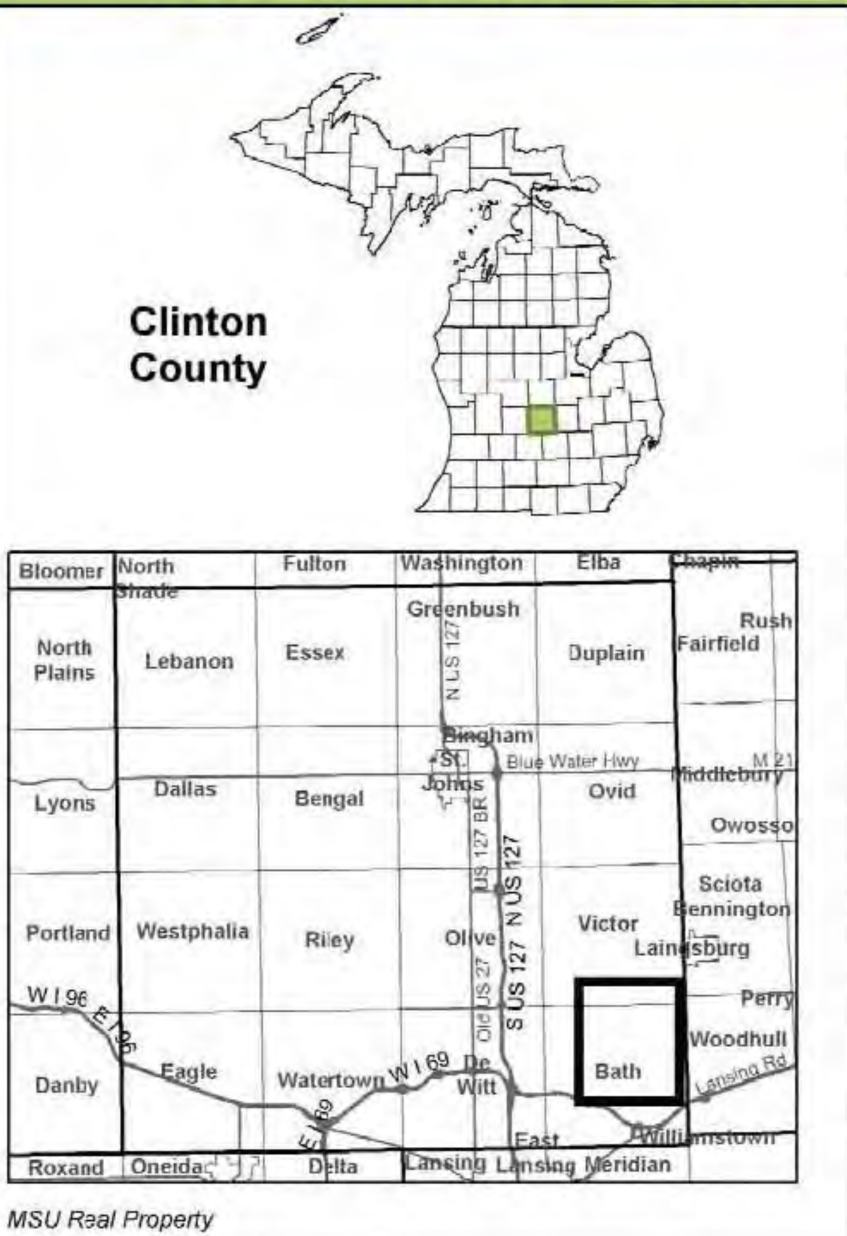
## Meridian Township, Section 11




MSU Real Property

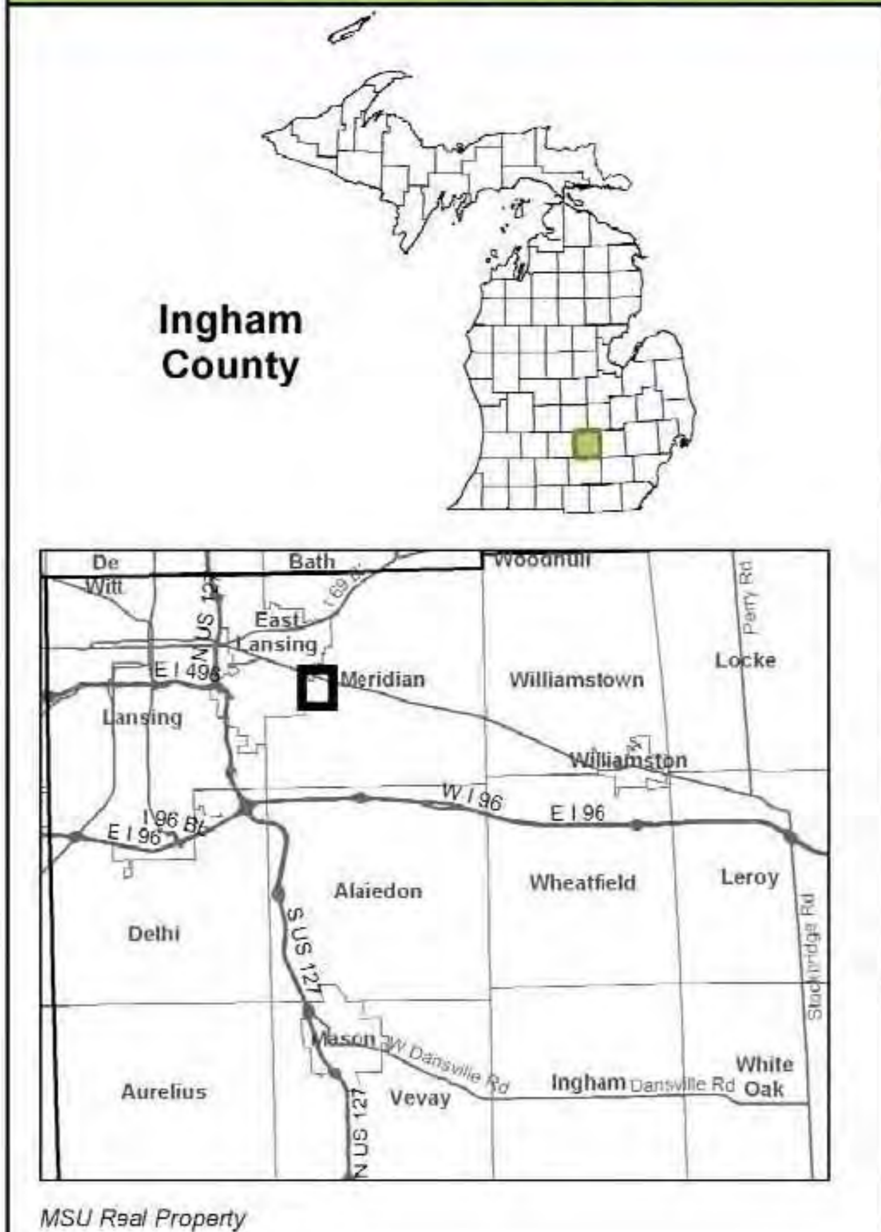
# Muck Soils Research Farm

## Bath Township, Sections 4, 5, 11, 12, 13, and 14



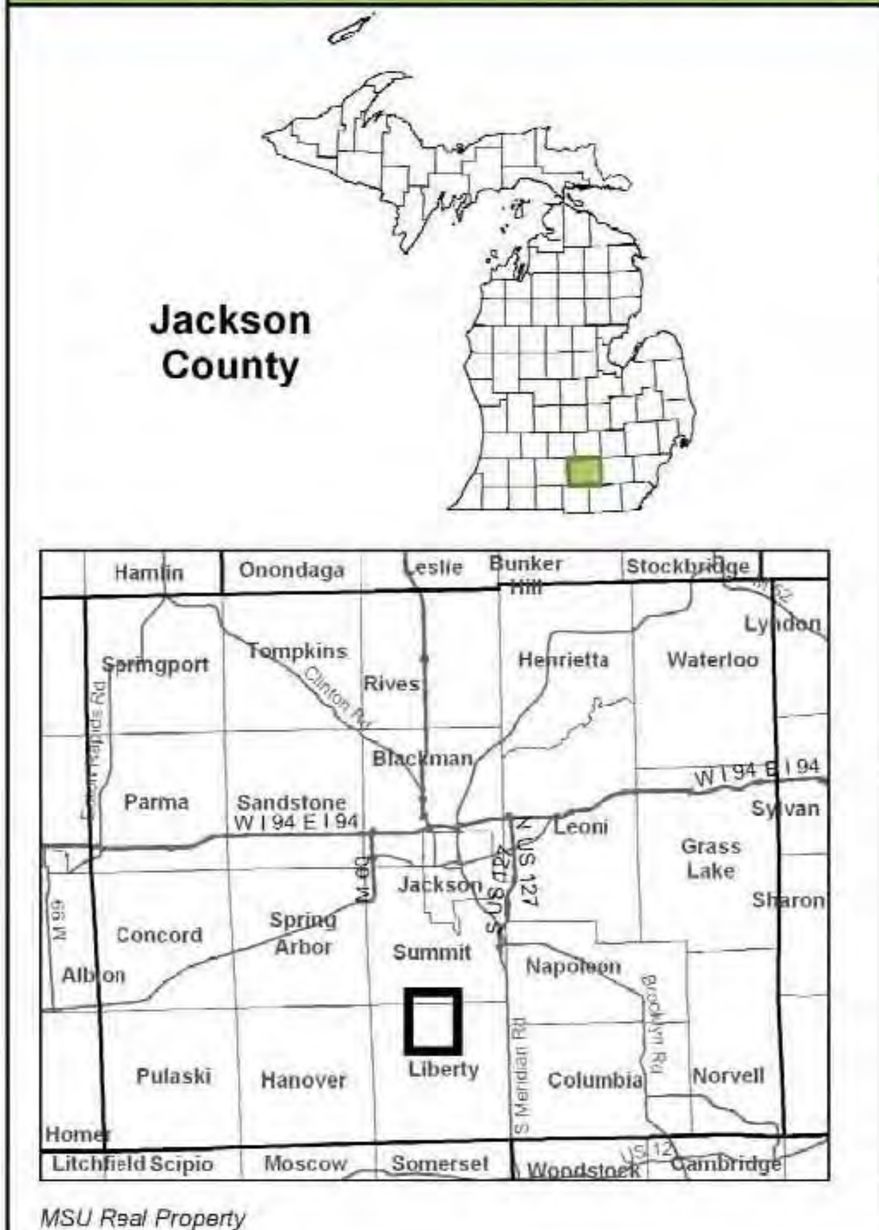

# River Terrace Property

## Meridian Township, Section 20



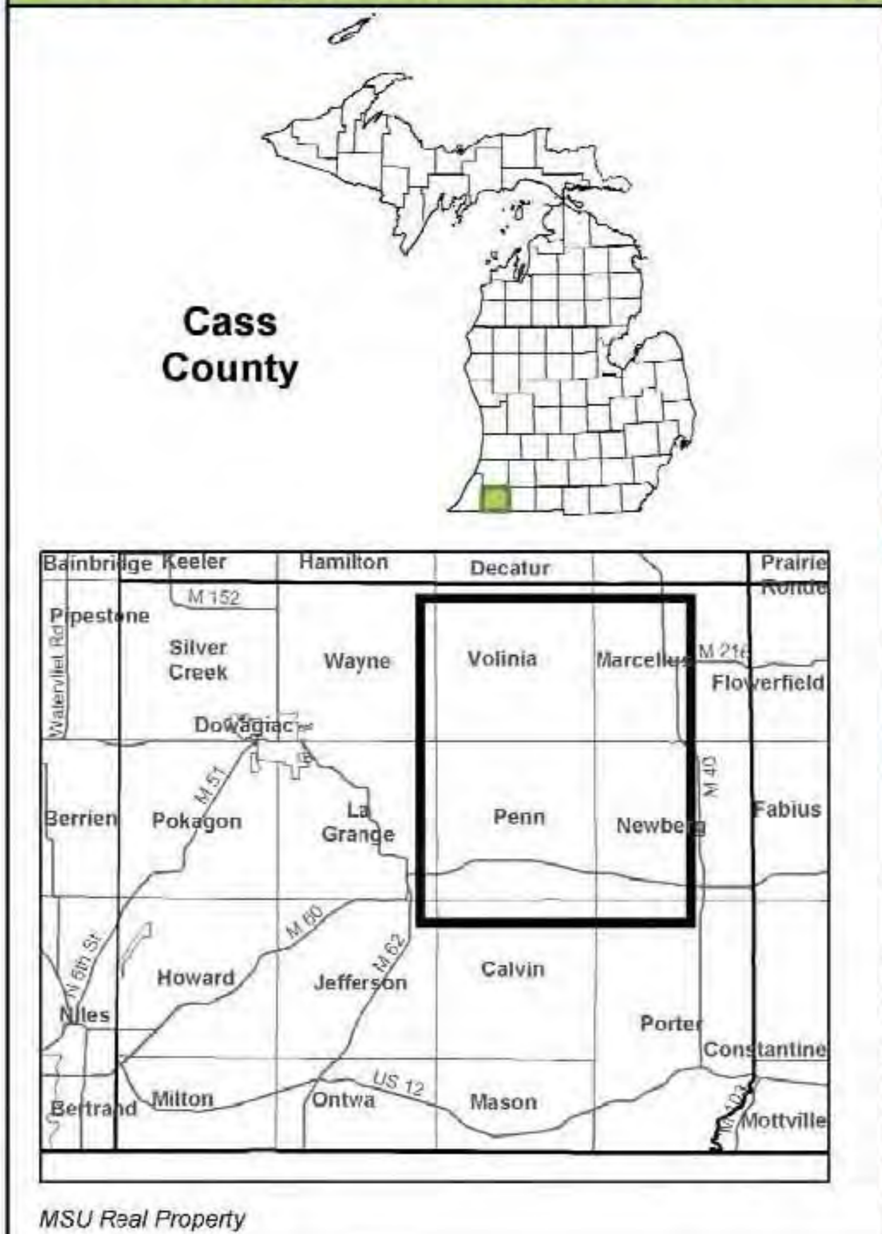

# Rogers Reserve

## Liberty Township, Section 4



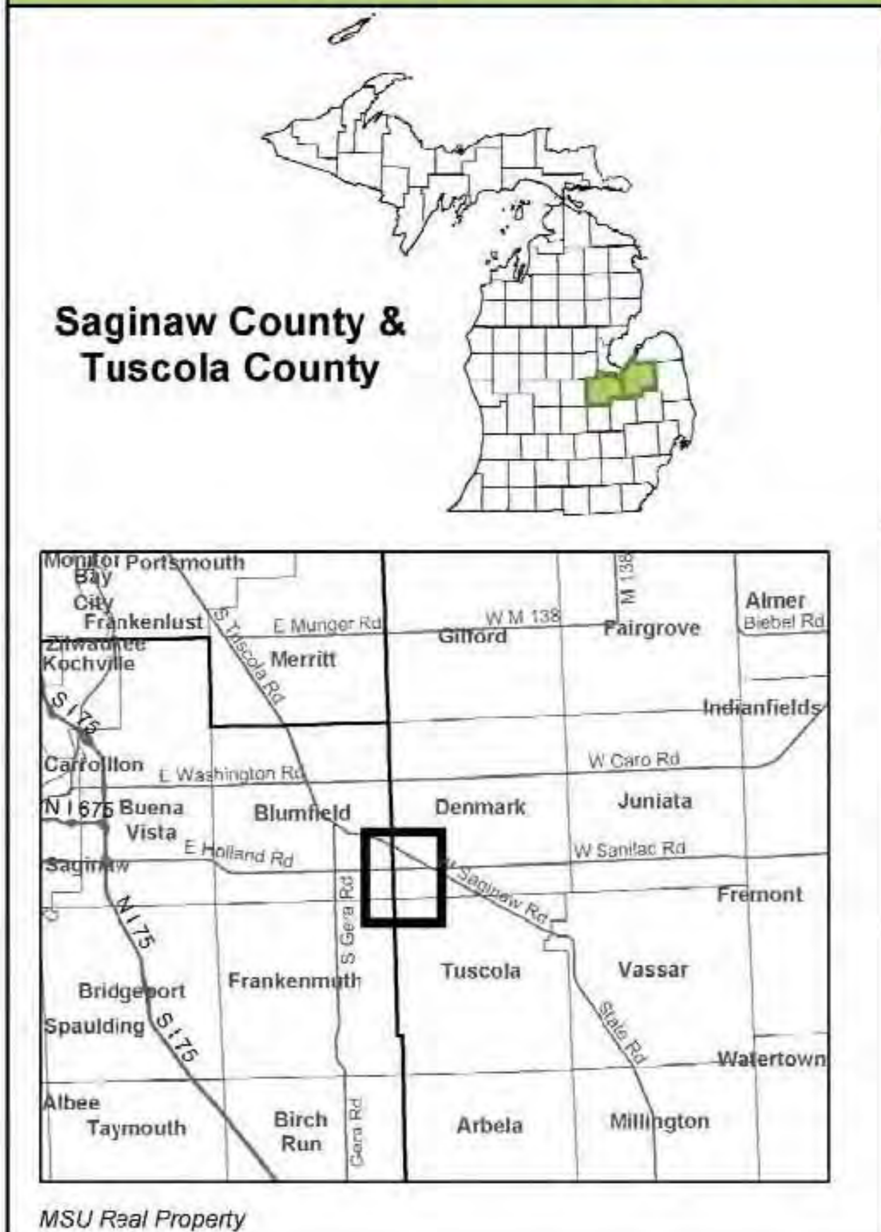

# Russ Forest Experiment Station

## Cass County, Volinia Township, Sections 20, 29 and 30; Newberg Township, Sections 16, 17, and 21



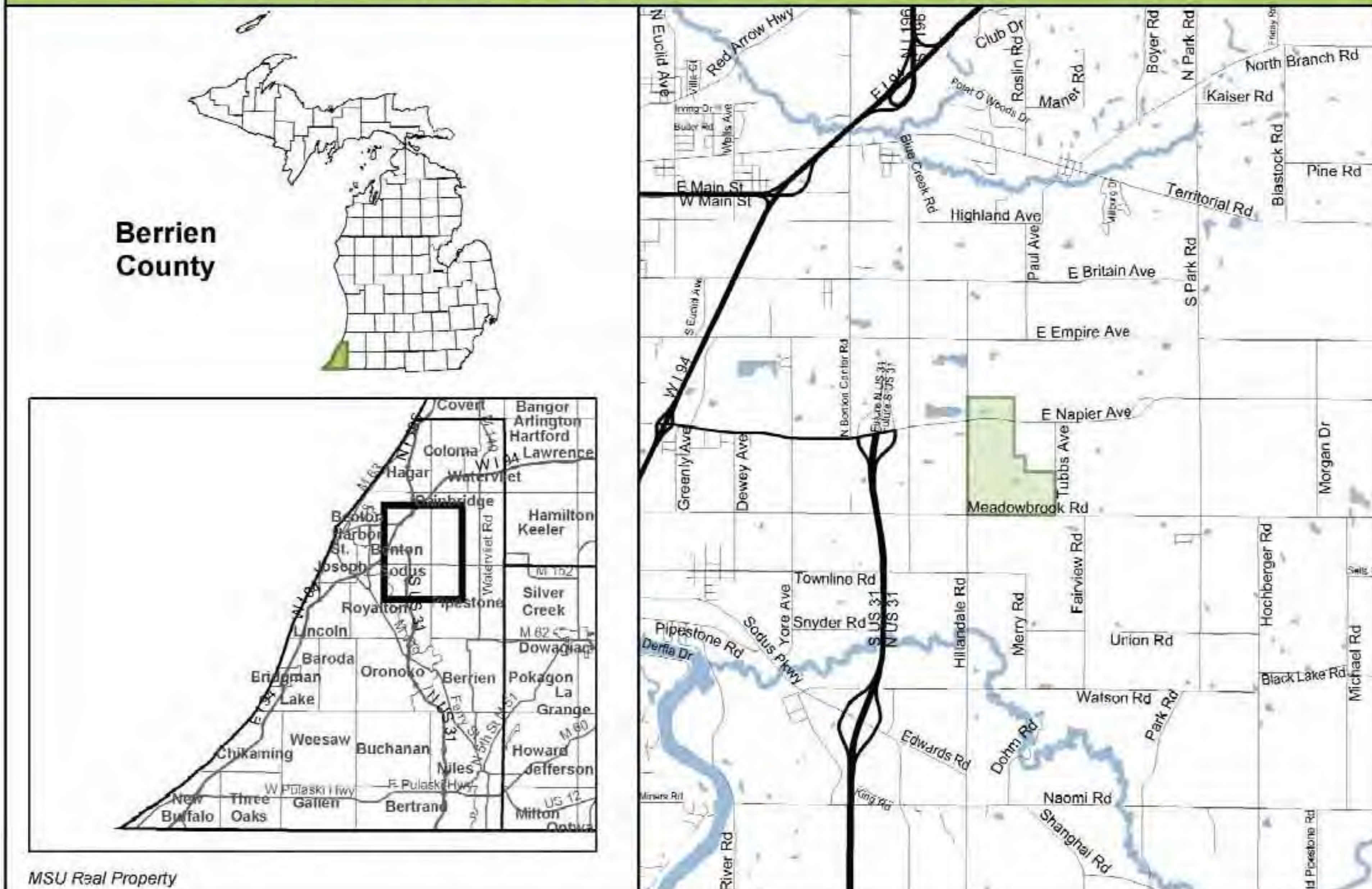

## Saginaw Valley Research and Extension Center

### Blumfield Township, Section 25; Denmark Township, Section 31



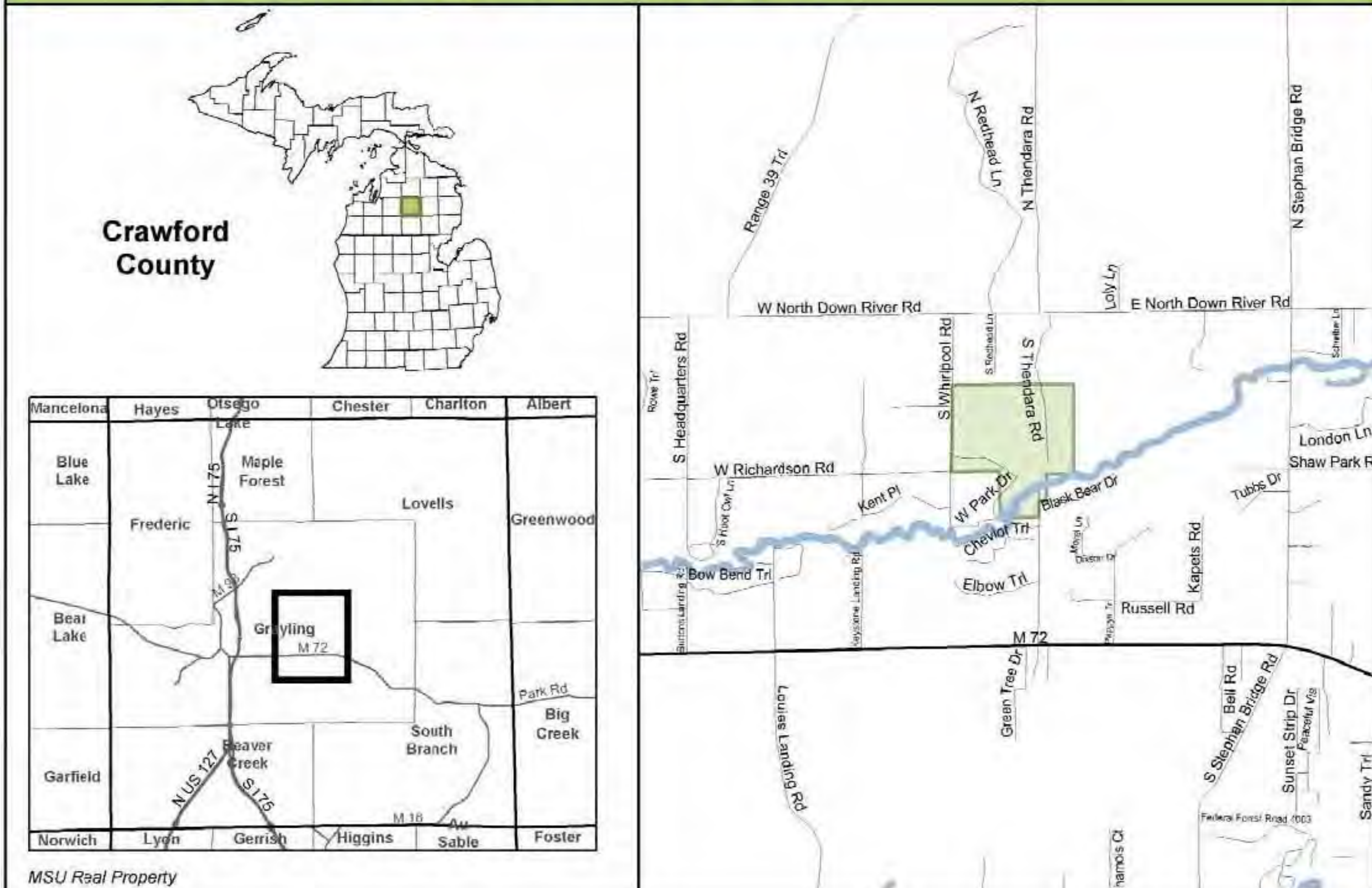

# Southwest Michigan Research and Extension Center

## Benton Township, Sections 25 and 36



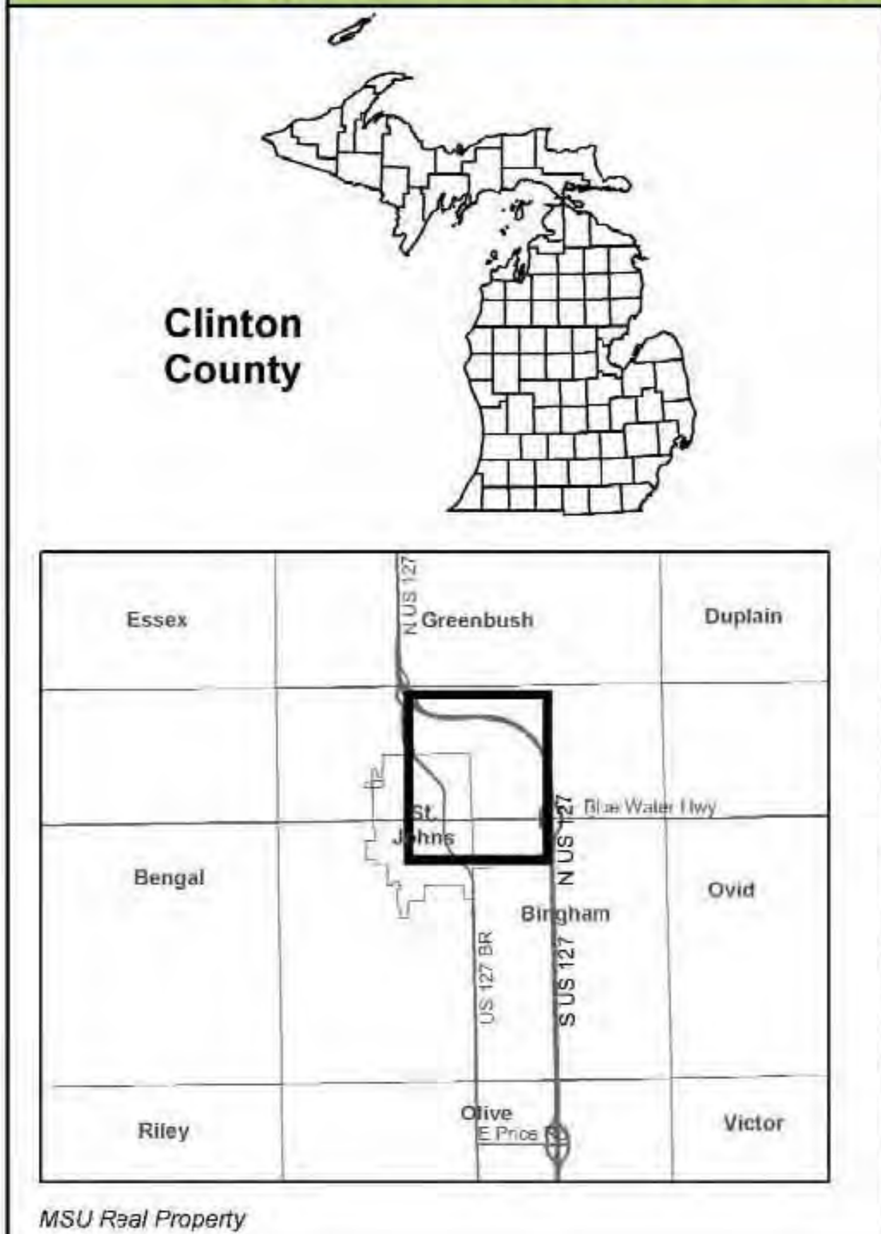
# Stranahan-Bell Property (Wa Wa Sum)

## Grayling Township, Sections 1, 6, and 12

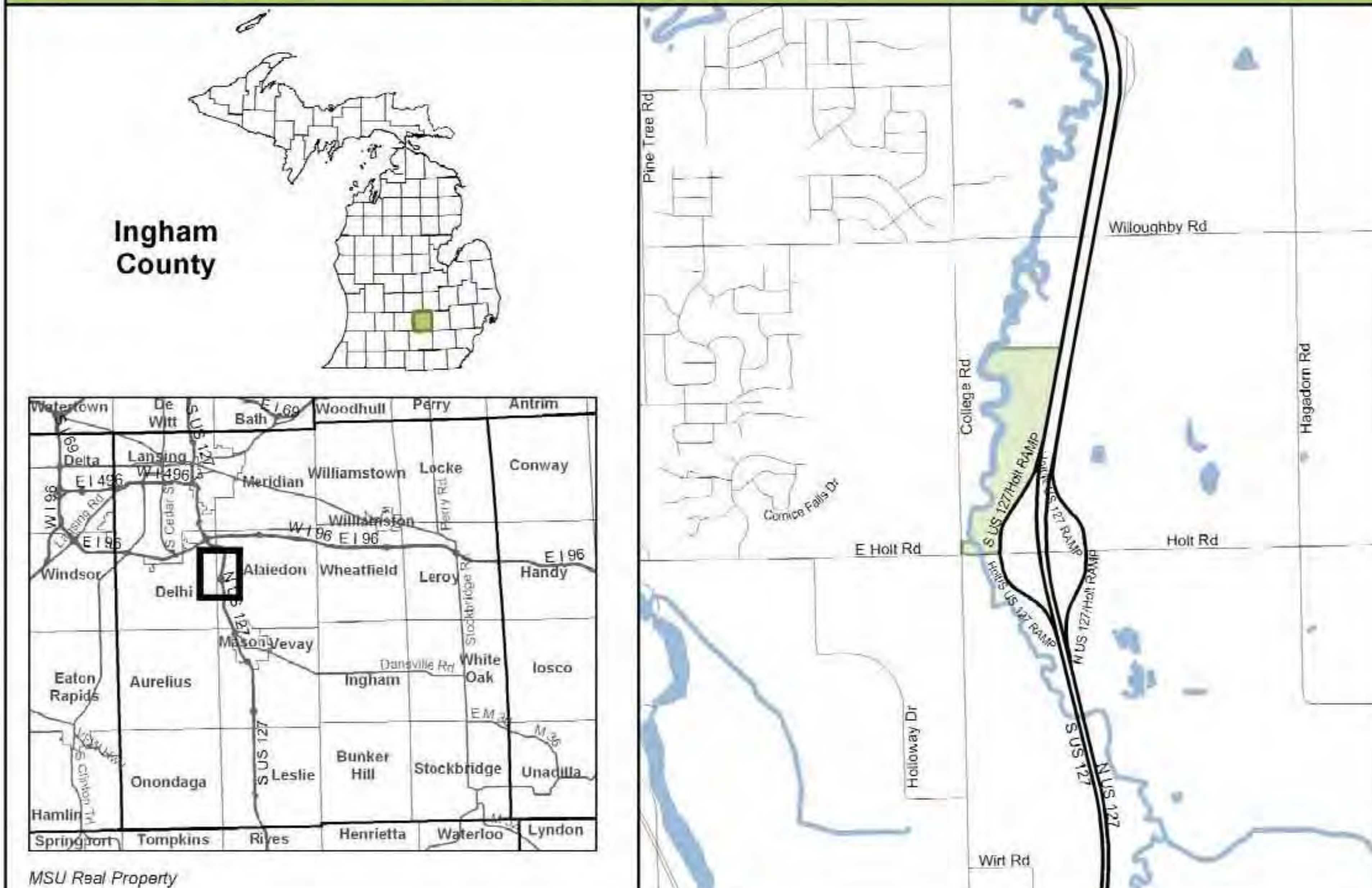


# Stuckman Property

## Bingham Township, Section 10




# Sycamore Creek Property
## Alaiedon Township, Section 18

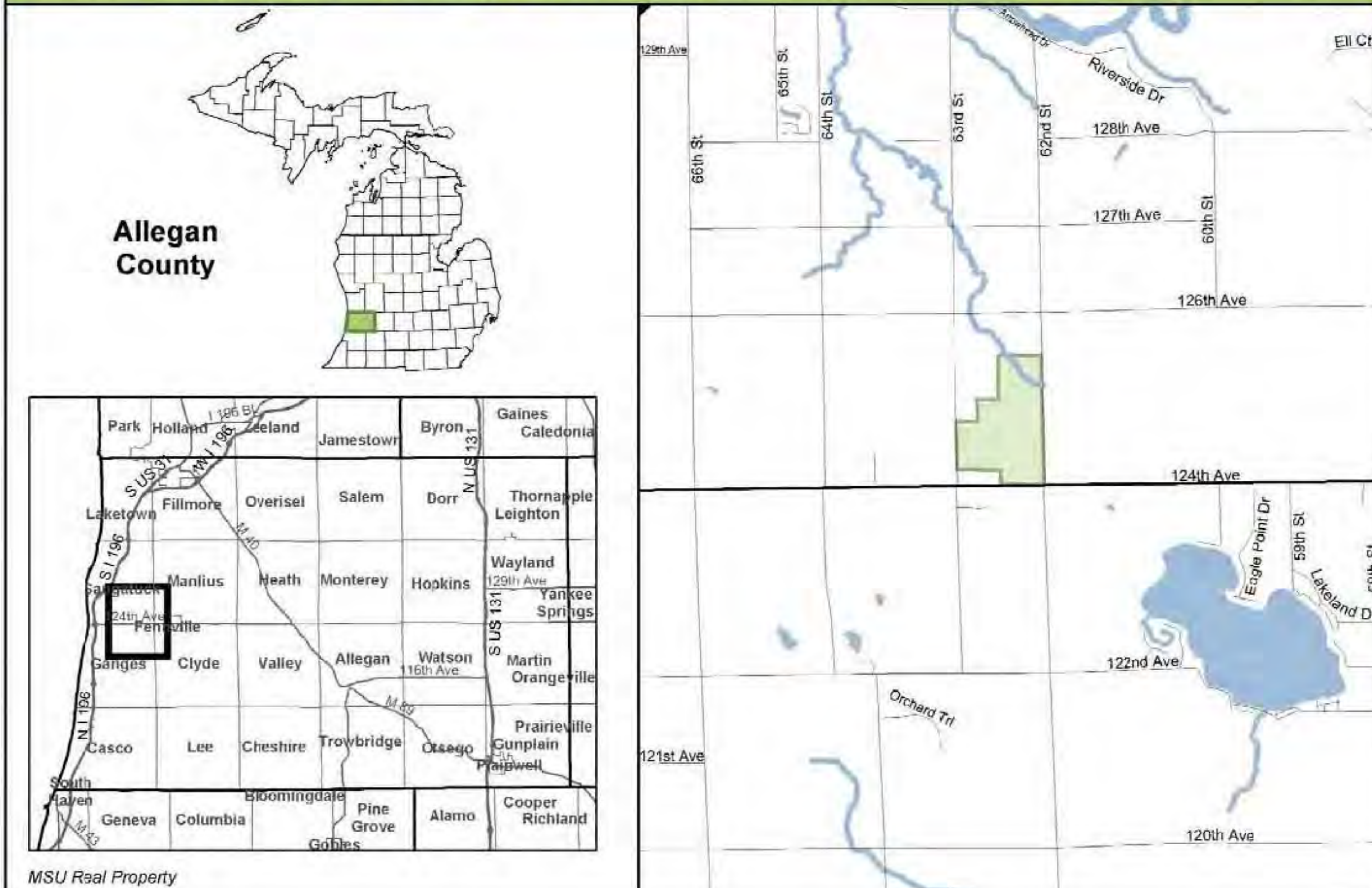


# Tollgate Education Center and Americana Foundation Property

## City of Novi, Section 11

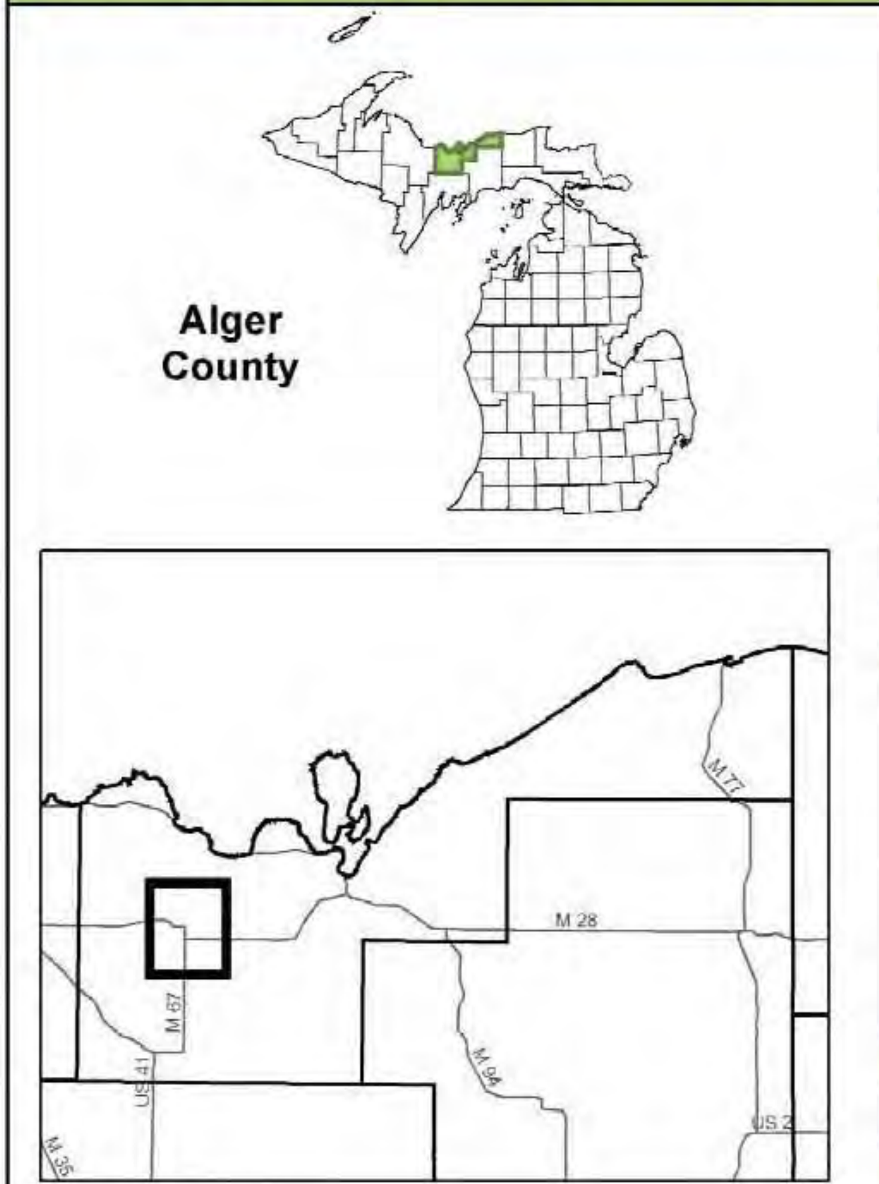

# Trevor Nichols Research Complex

## Saugatuck Township, Section 35



# Upper Peninsula Experiment Station

## City of Chatham and Rock River Township, Sections 24, 25, 27, 28, and 34





MSU Real Property

# Van Hoosen Property

## Avon Township, Section 1

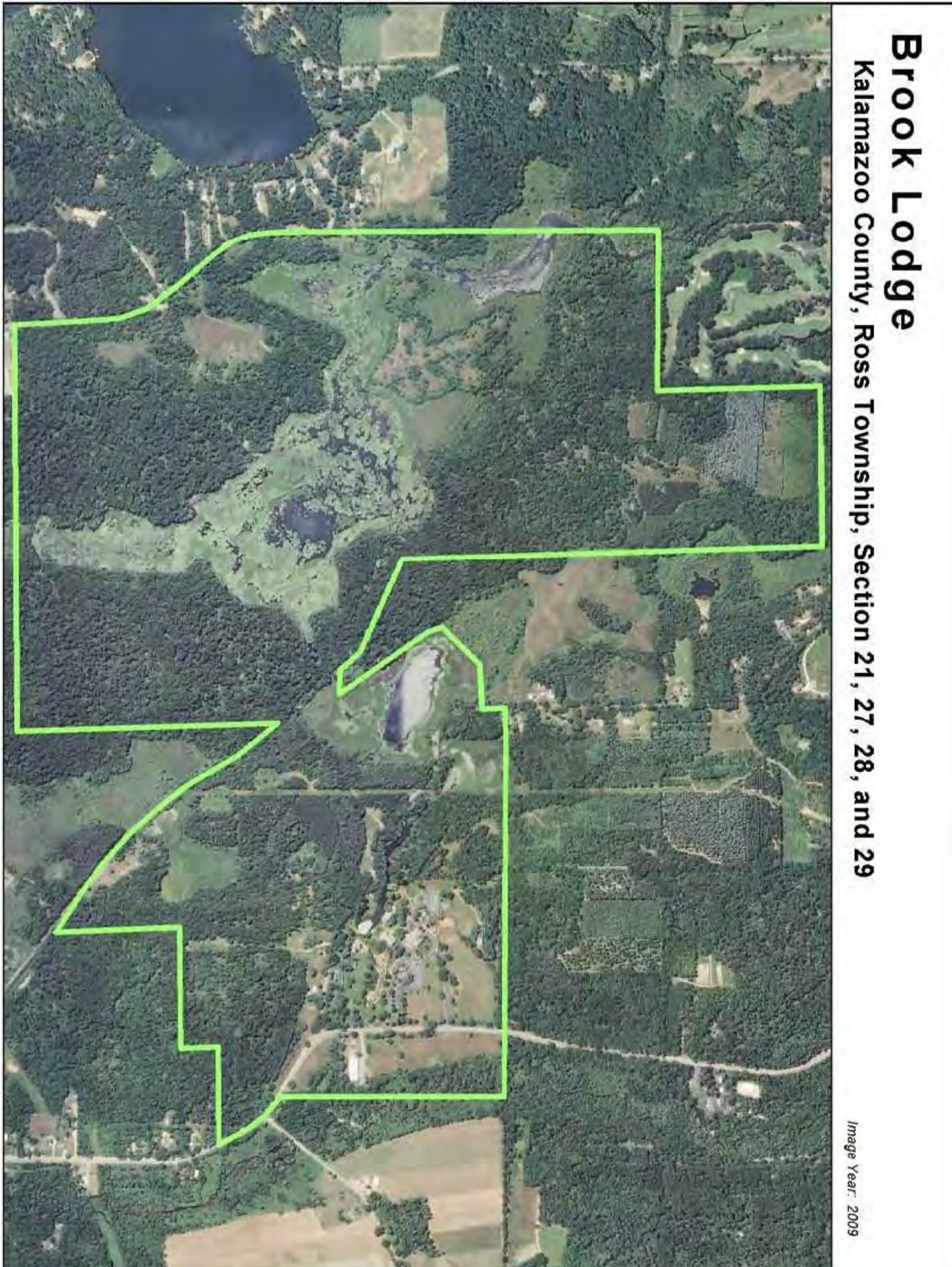
Oakland County

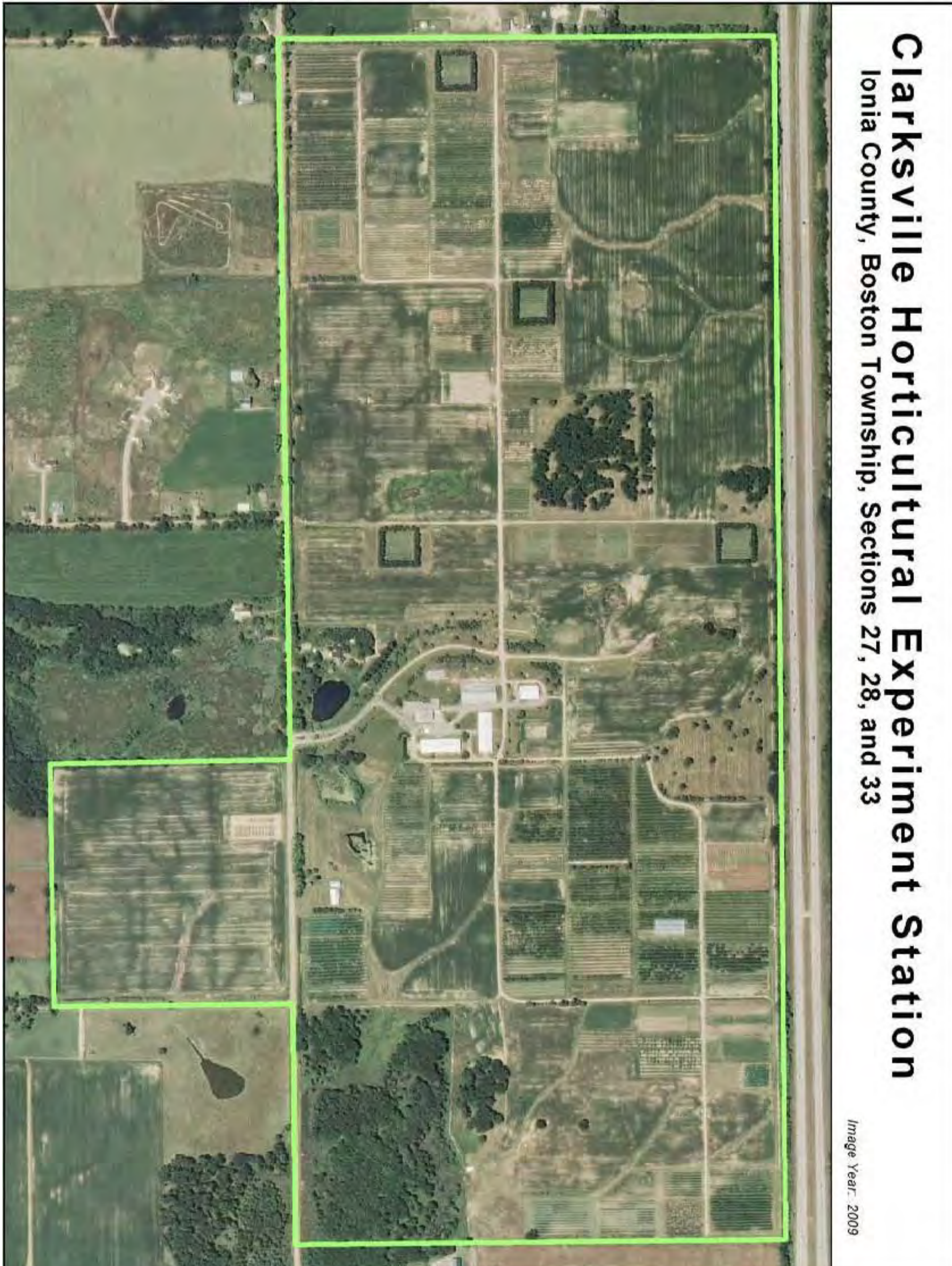

MSU Real Property

# BioEconomy Research and Development Center

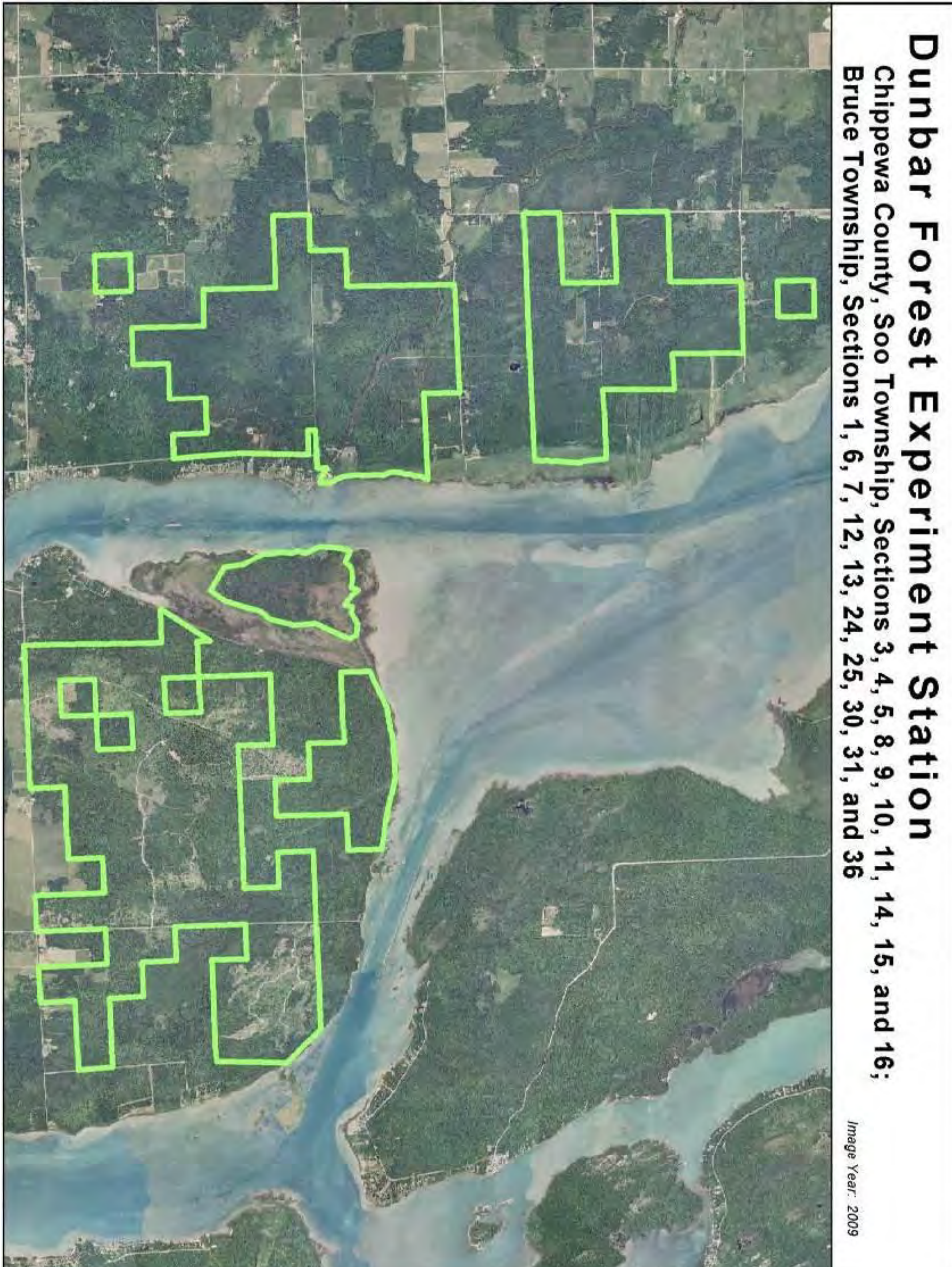
## Ottawa County, Holland Township, Section 19

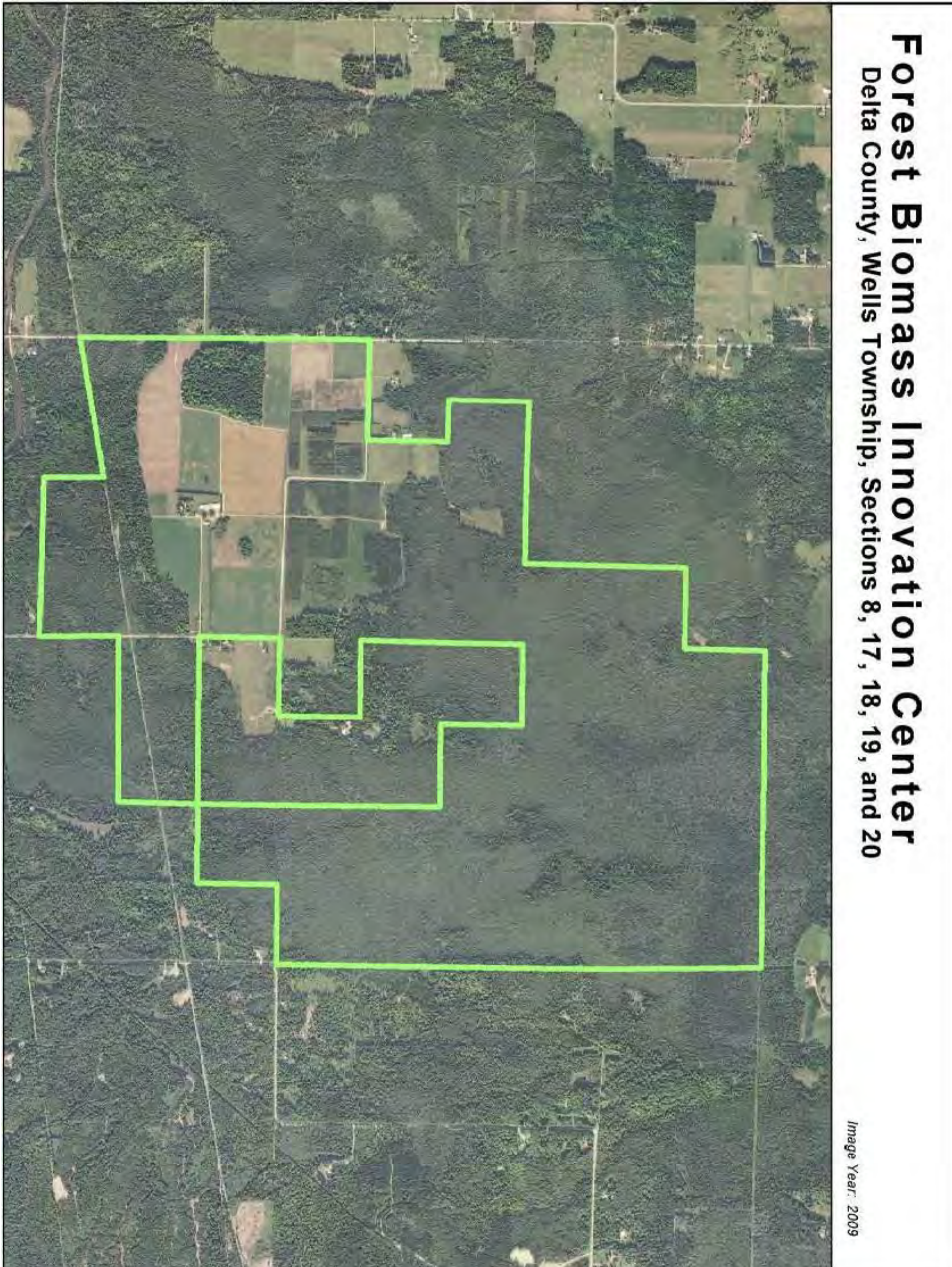
*Image Year: 2009*


Brook Lodge
Kalamazoo County, Ross Township, Section 21, 27, 28, and 29
Image Year: 2009


Clarksville Horticultural Experiment Station
Ionia County, Boston Township, Sections 27, 28, and 33
Image Year: 2009

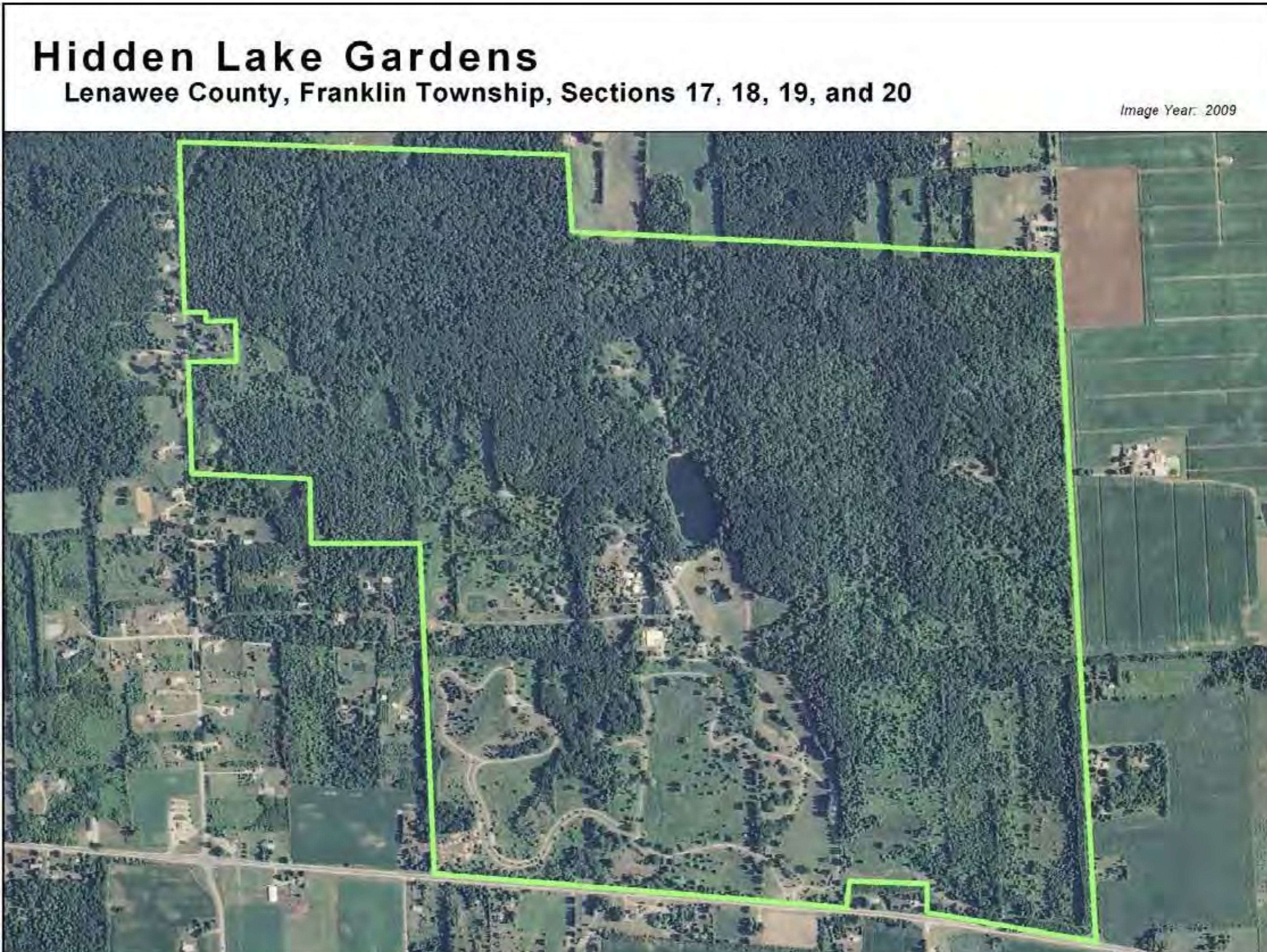

Dobie Road Property
Ingham County, Meridian Township, Section 27
Image Year: 2009


Dunbar Forest Experiment Station
Chippewa County, Soo Township, Sections 3, 4, 5, 8, 9, 10, 11, 14, 15, and 16;
Bruce Township, Sections 1, 6, 7, 12, 13, 24, 25, 30, 31, and 36
Image Year: 2009



Forest Biomass Innovation Center
Delta County, Wells Township, Sections 8, 17, 18, 19, and 20
Image Year: 2009


Gantos Property
Kent County, Kentwood Township, Section 23
Image Year: 2009


Hidden Lake Gardens
Lenawee County, Franklin Township, Sections 17, 18, 19, and 20
Image Year: 2009

# Hulett Road Engineering

**Ingham County, Alaiedon Township, Section 5**

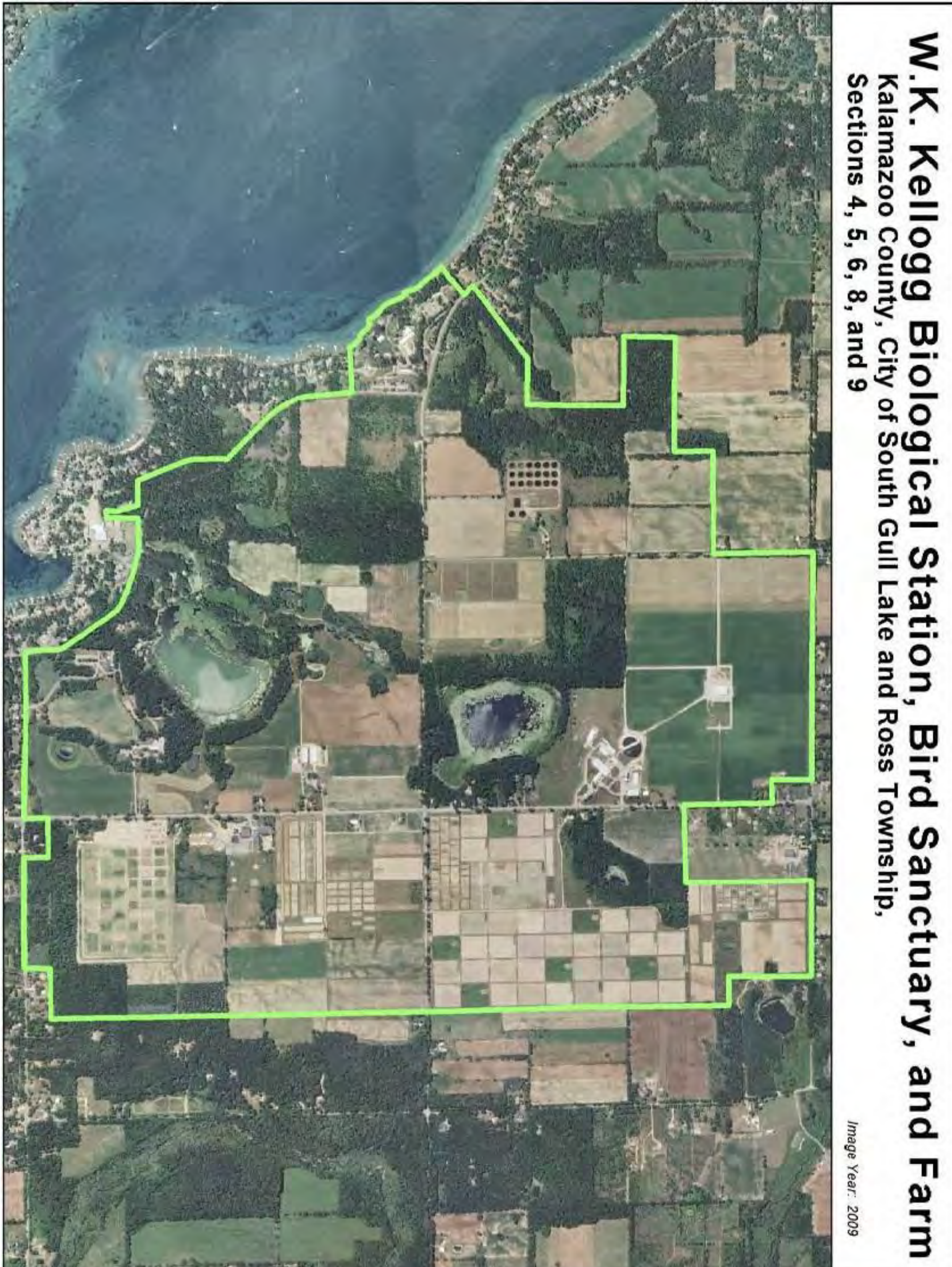
*Image Year: 2009*

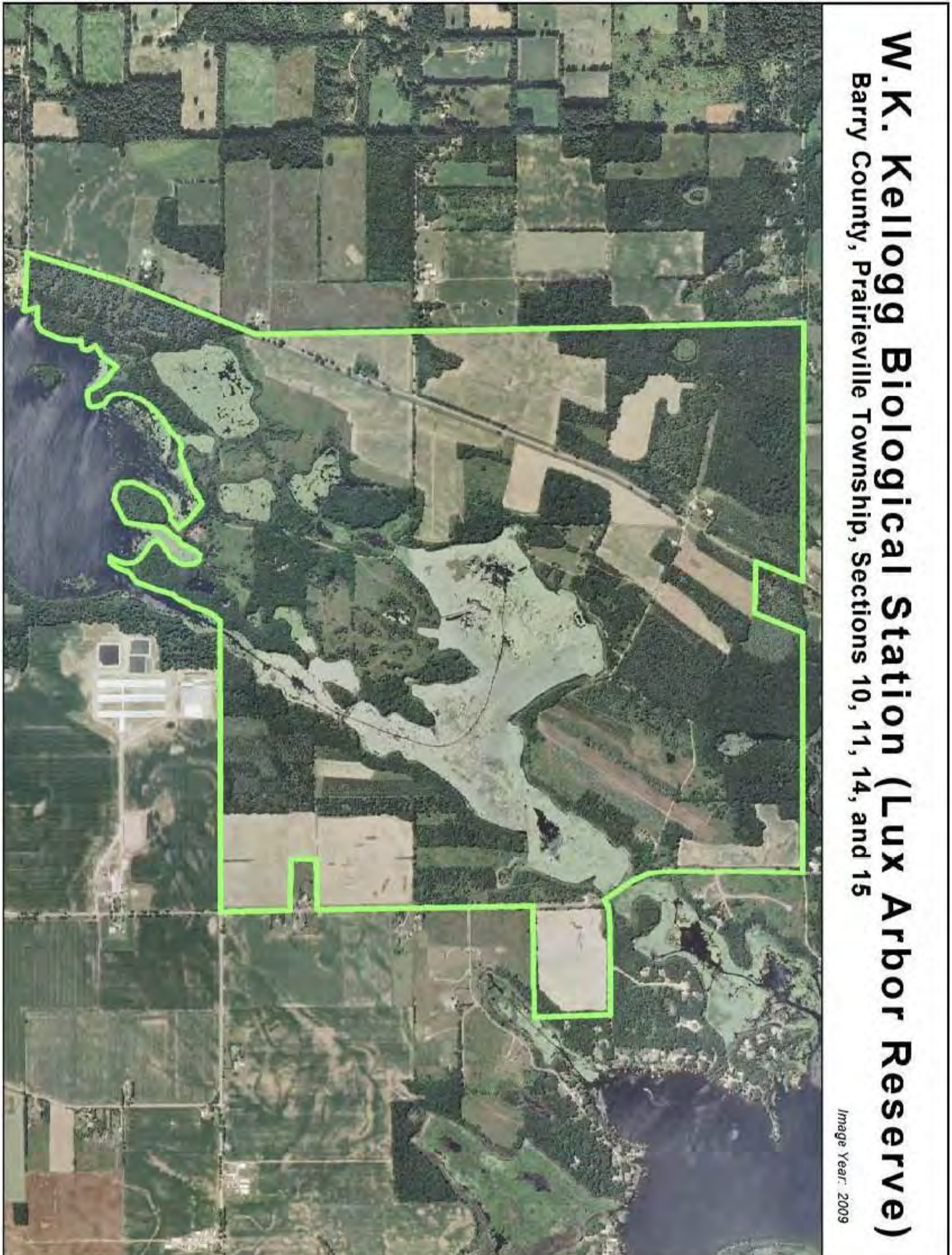

College of Human Medicine
Kent County, Grand Rapids Township, Section 19
Image Year: 2009

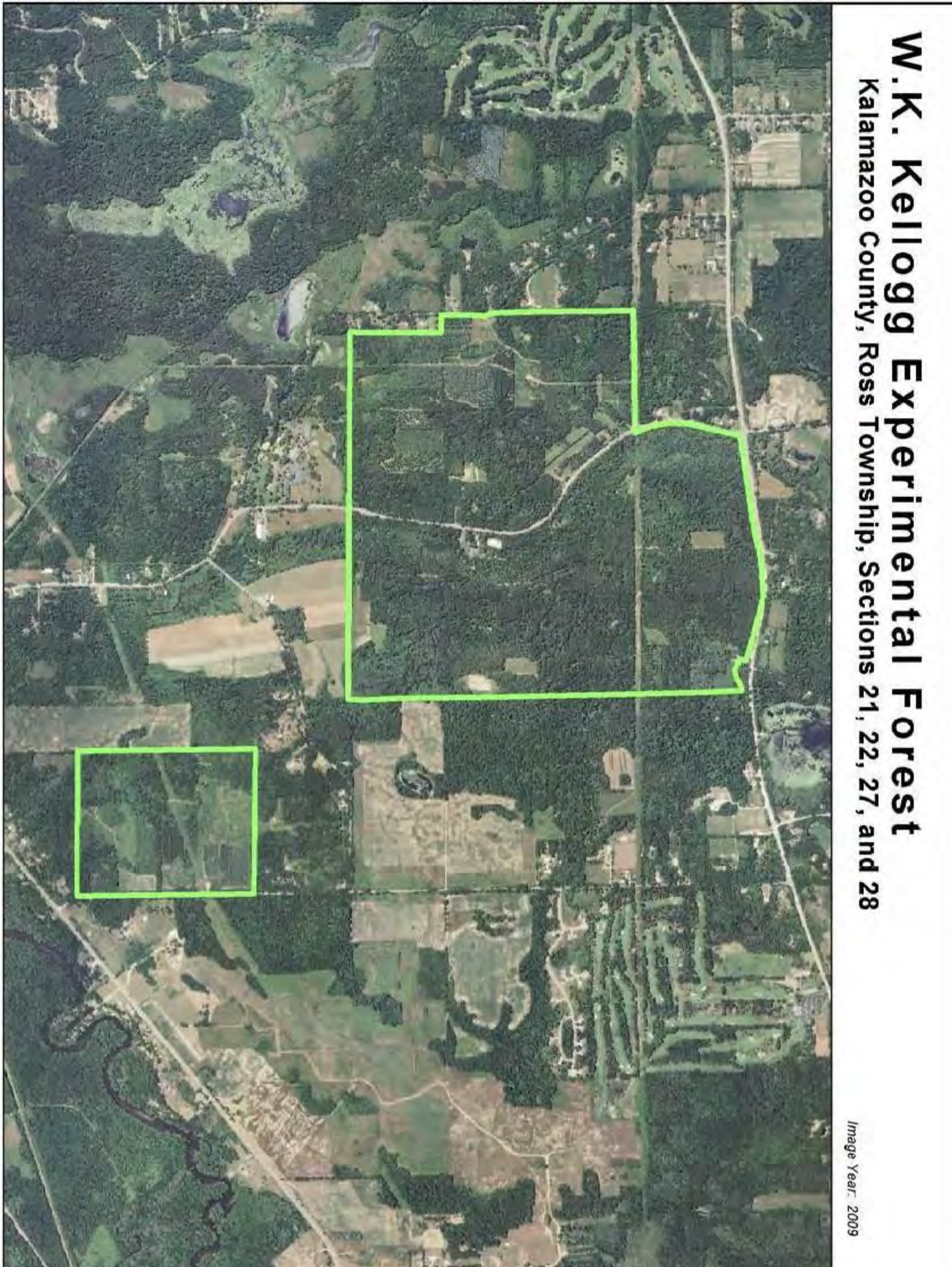
# Jolly Road Engineering and Civil Infrastructure Lab

**Ingham County, Alaiedon Township, Section 5**

*Image Year: 2009*


W.K. Kellogg Biological Station, Bird Sanctuary, and Farm
Kalamazoo County, City of South Gull Lake and Ross Township,
Sections 4, 5, 6, 8, and 9
Image Year: 2009

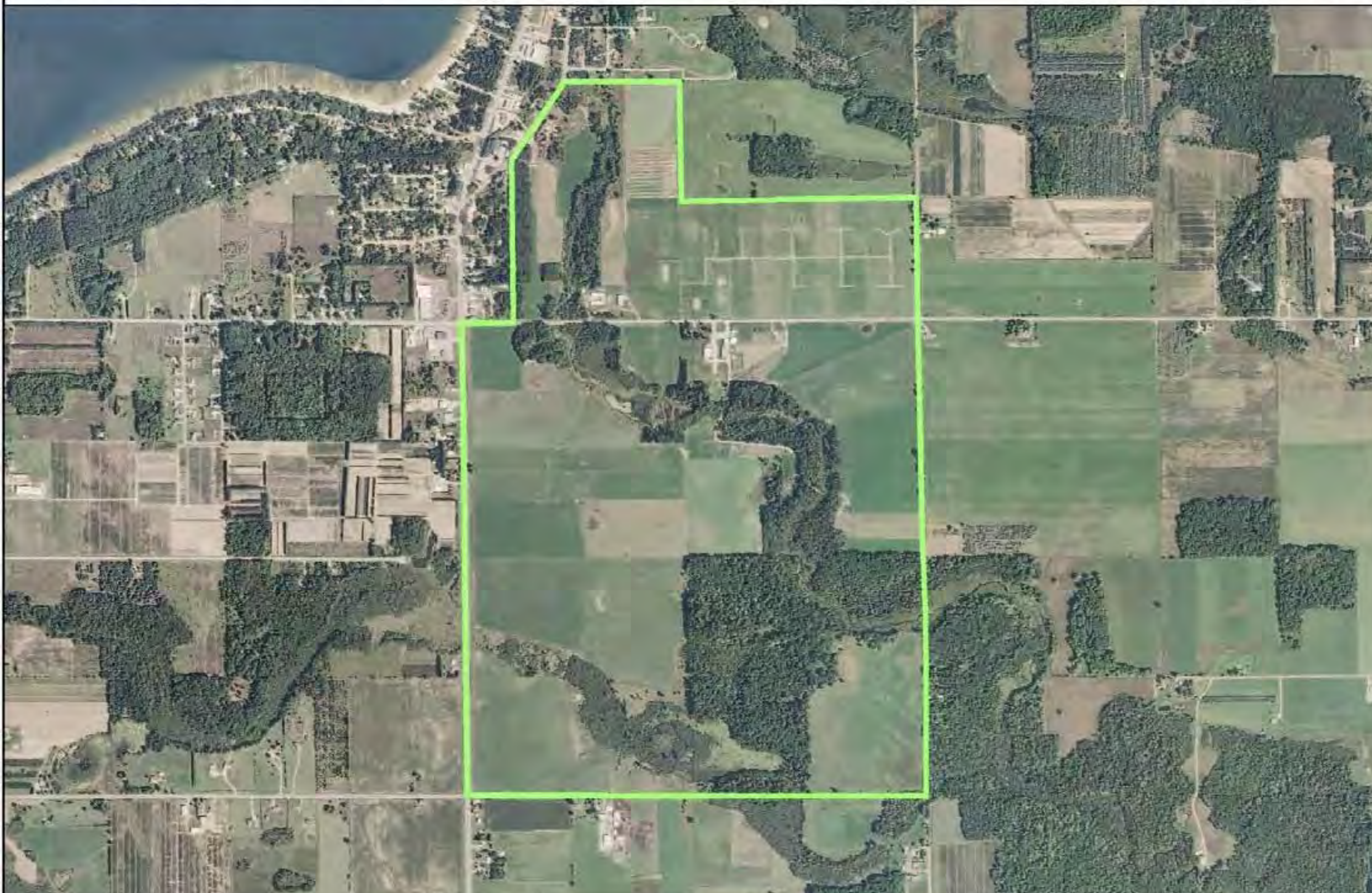

W.K. Kellogg Biological Station (Lux Arbor Reserve)
Barry County, Prairieville Township, Sections 10, 11, 14, and 15
Image Year: 2009


W.K. Kellogg Experimental Forest
Kalamazoo County, Ross Township, Sections 21, 22, 27, and 28
Image Year: 2009

# Lake City Experiment Station

## Missaukee County, Reeder Township, Sections 7 and 18

*Image Year: 2009*



# Leland Property

## Leelanau County, Leland Township, Section 9

*Image Year: 2009*

# MacCready Forest and Wildlife Reserve

Jackson County, Liberty Township, Sections 11 and 14

*Image Year: 2009*

# Management Education Center, Troy

**Oakland County, City of Troy, Section 9**

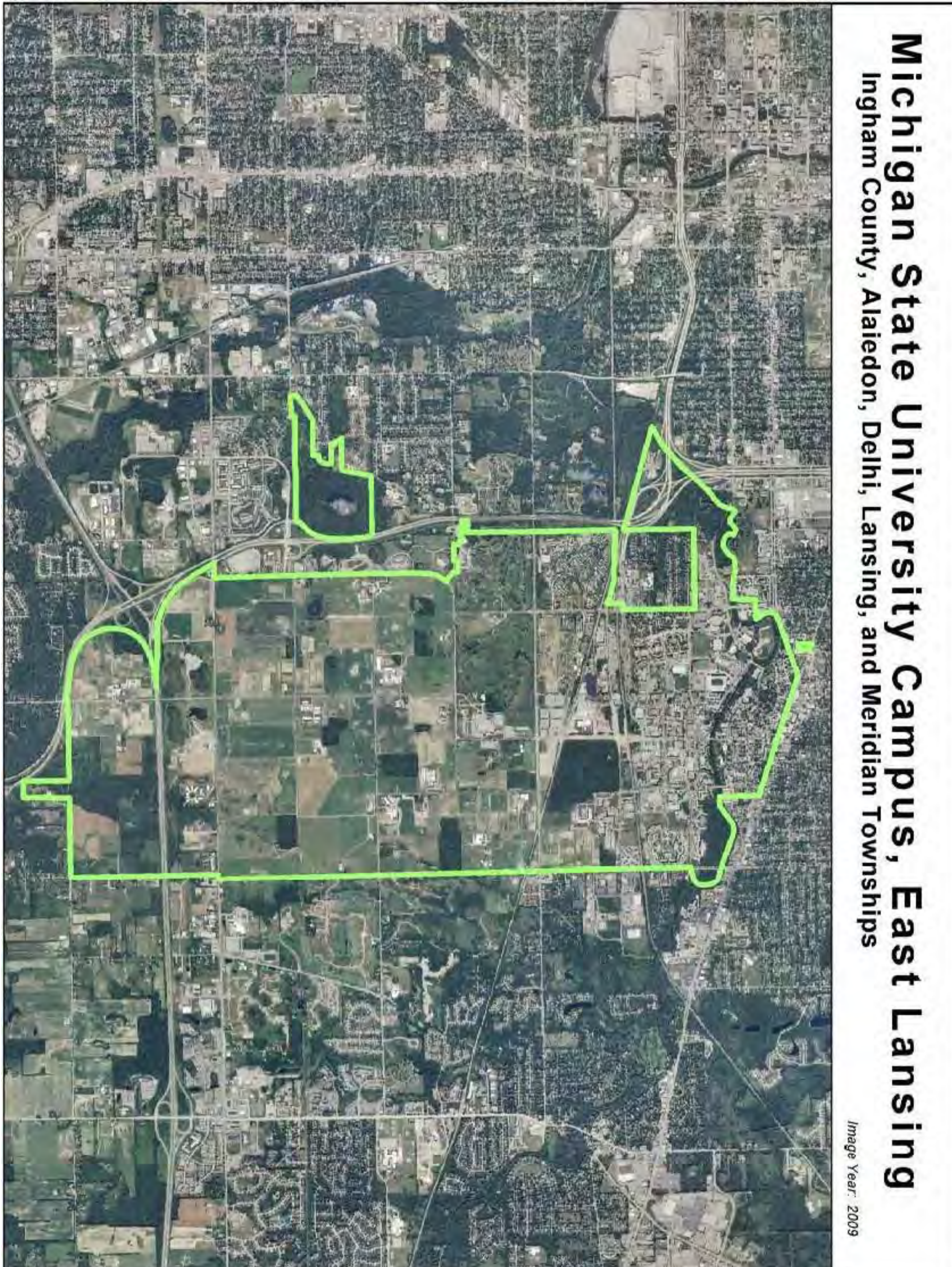
*Image Year: 2009*

# Martin Property (Rose-Dell Seed Orchard)

Calhoun County, Albion Township, Sections 23 and 24

*Image Year: 2009*

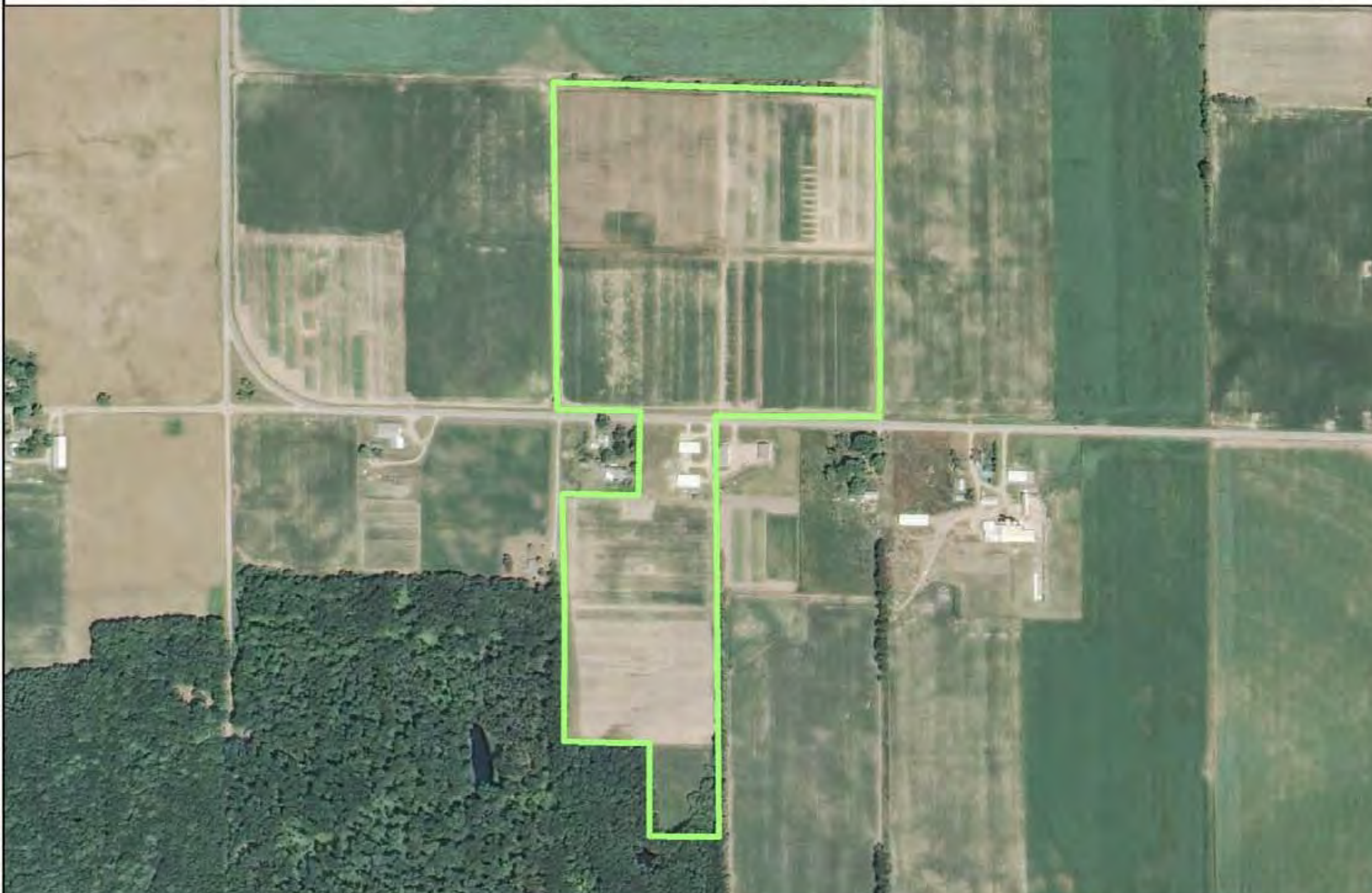

Mason Research Farm
Ingham County, Alaiedon Township, Section 21
Image Year: 2009


Michigan State University Campus, East Lansing
Ingham County, Alaiedon, Delhi, Lansing, and Meridian Townships
Image Year: 2009

# Montcalm Experimental Farm

## Montcalm County, Douglass Township, Sections 8 and 17

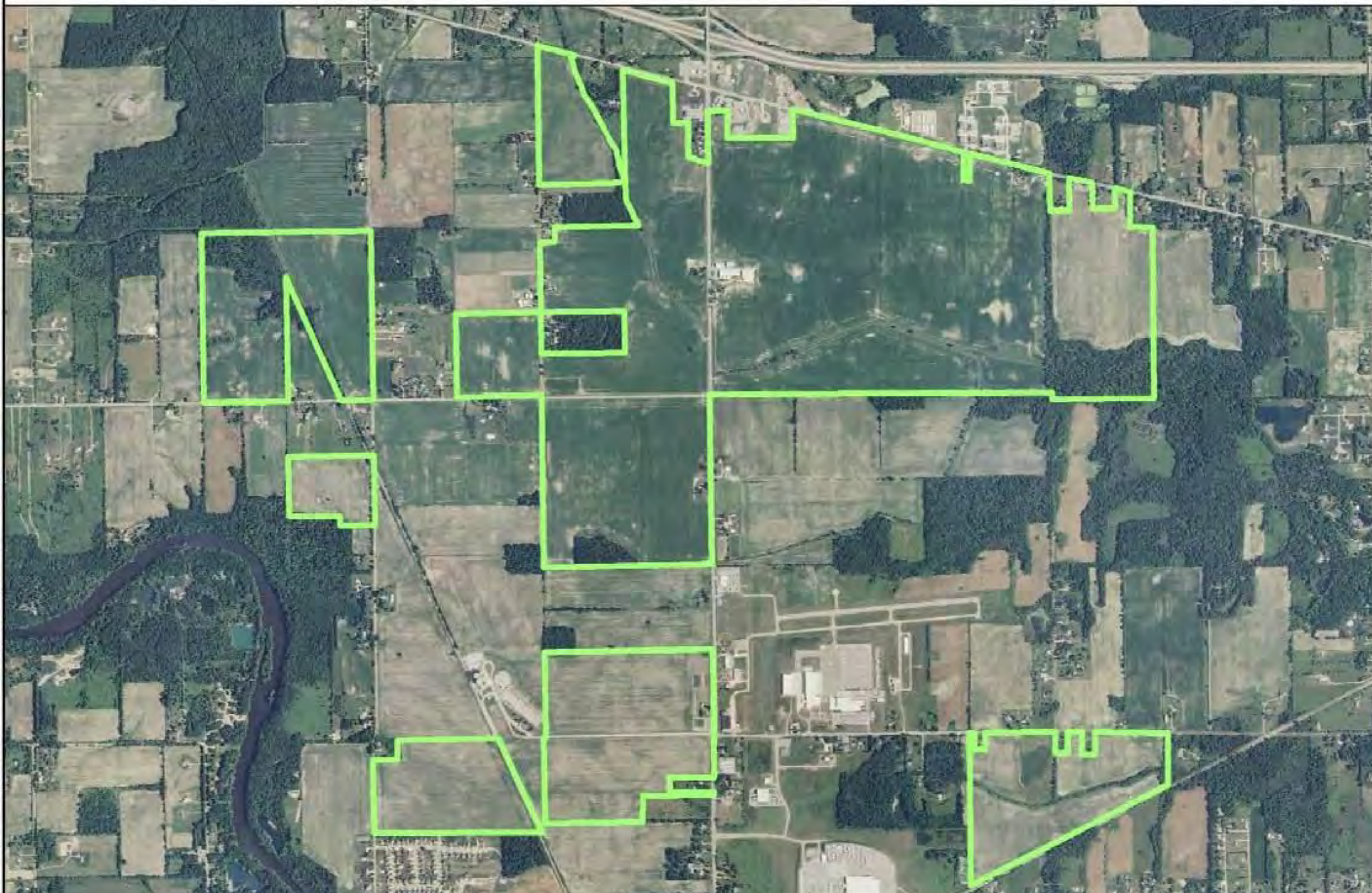
*Image Year: 2009*



# Morris Property

Clinton & Eaton Counties, Oneida Twp, Sections 1 and 2; Delta Twp, Section 6; Eagle Twp, Sections 23, 25, 26, 27, 34, 35; and Watertown Twp, Section 30

*Image Year: 2009*



# MSU Sailing Club

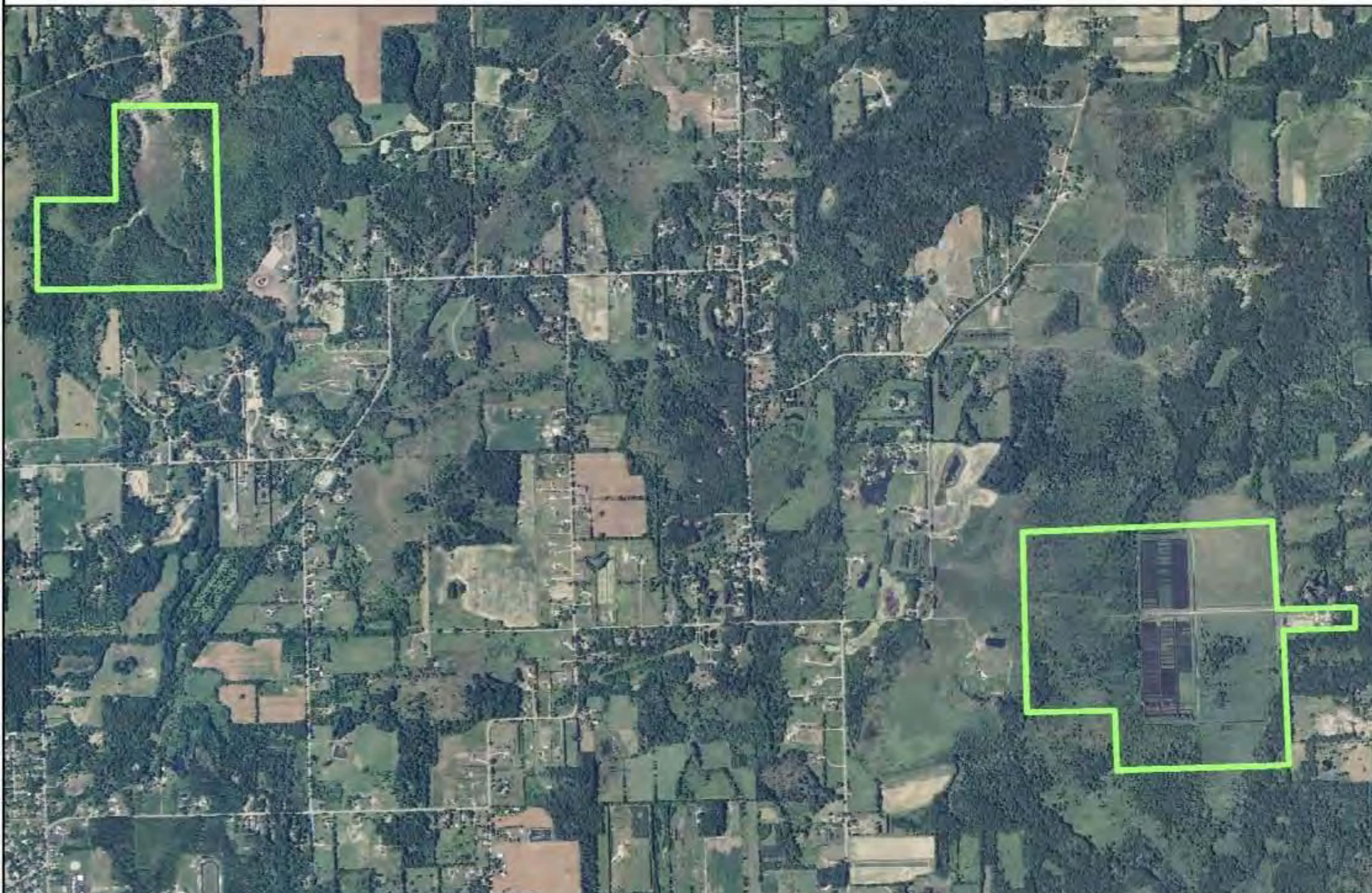
**Ingham County, Meridian Township, Section 11**

*Image Year: 2009*

# Muck Soils Research Farm

Clinton County, Bath Township, Sections 4, 5, 11, 12, 13, and 14

*Image Year: 2009*



# River Terrace Property

Ingham County, Meridian Township, Section 20

*Image Year: 2009*

# Rogers Reserve

## Jackson County, Liberty Township, Section 4

*Image Year: 2009*

# Russ Forest Experiment Station

Cass County, Volinia Township, Sections 20, 29 and 30;
Newberg Township, Sections 16, 17, and 21

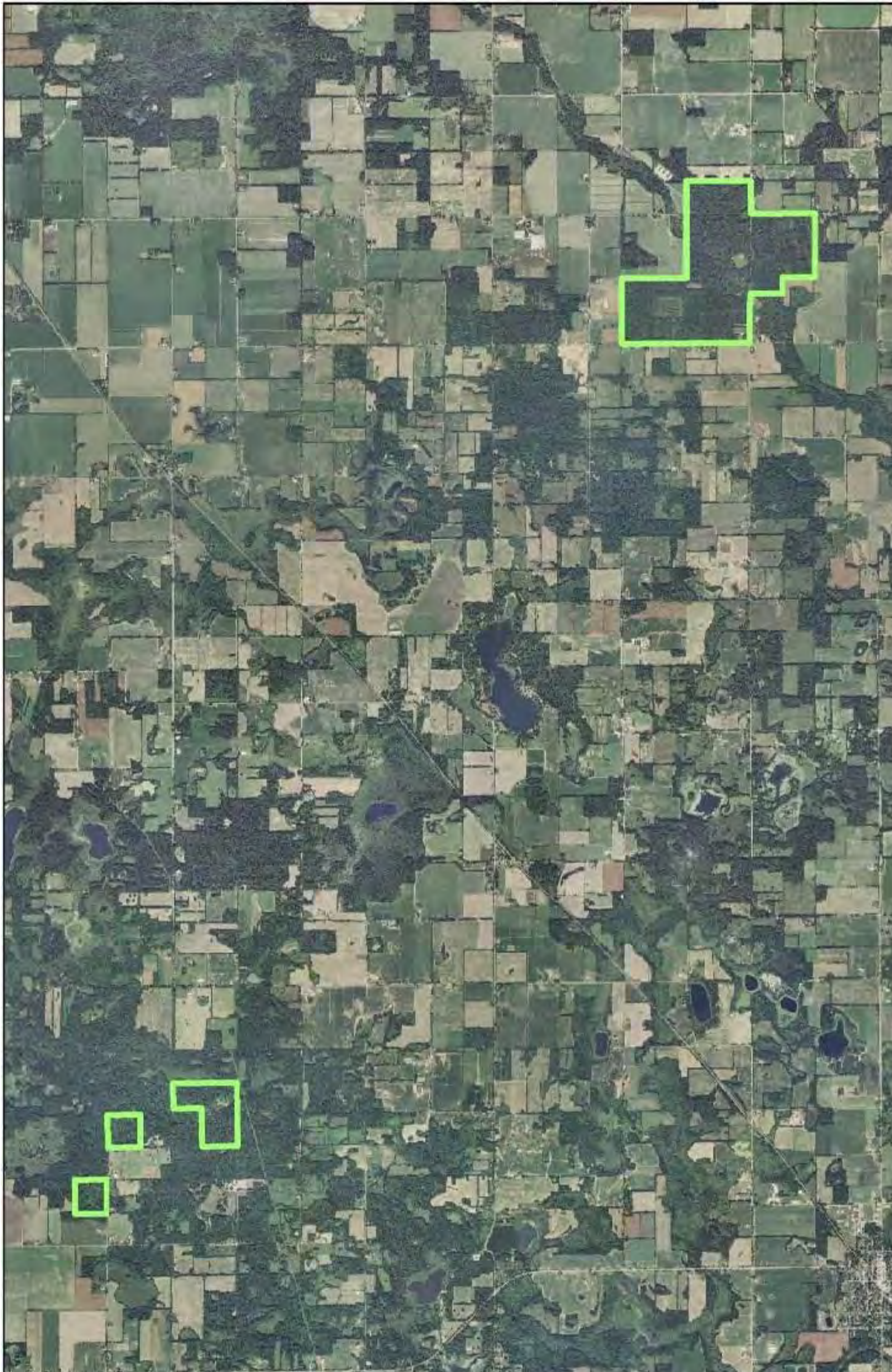
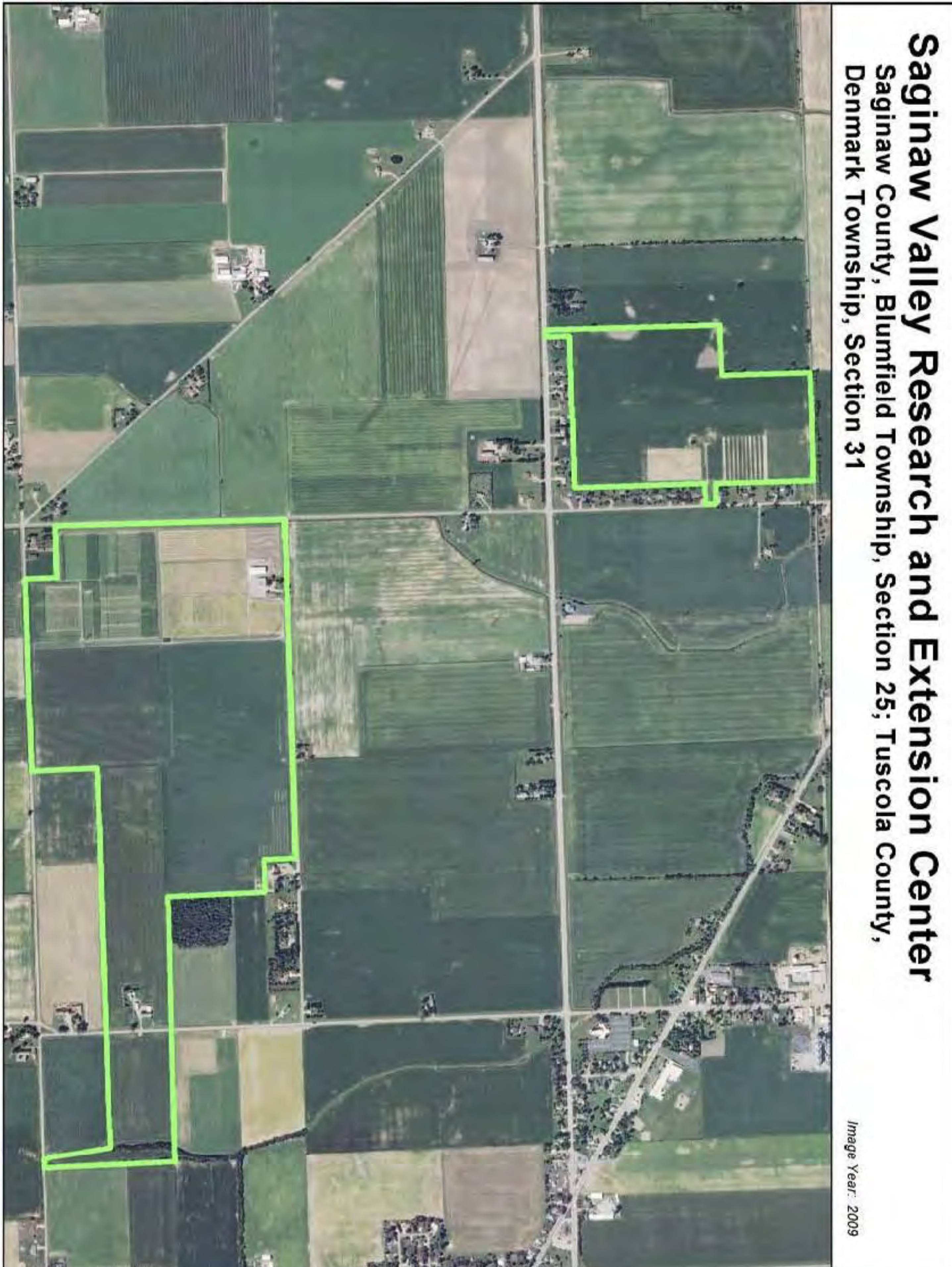


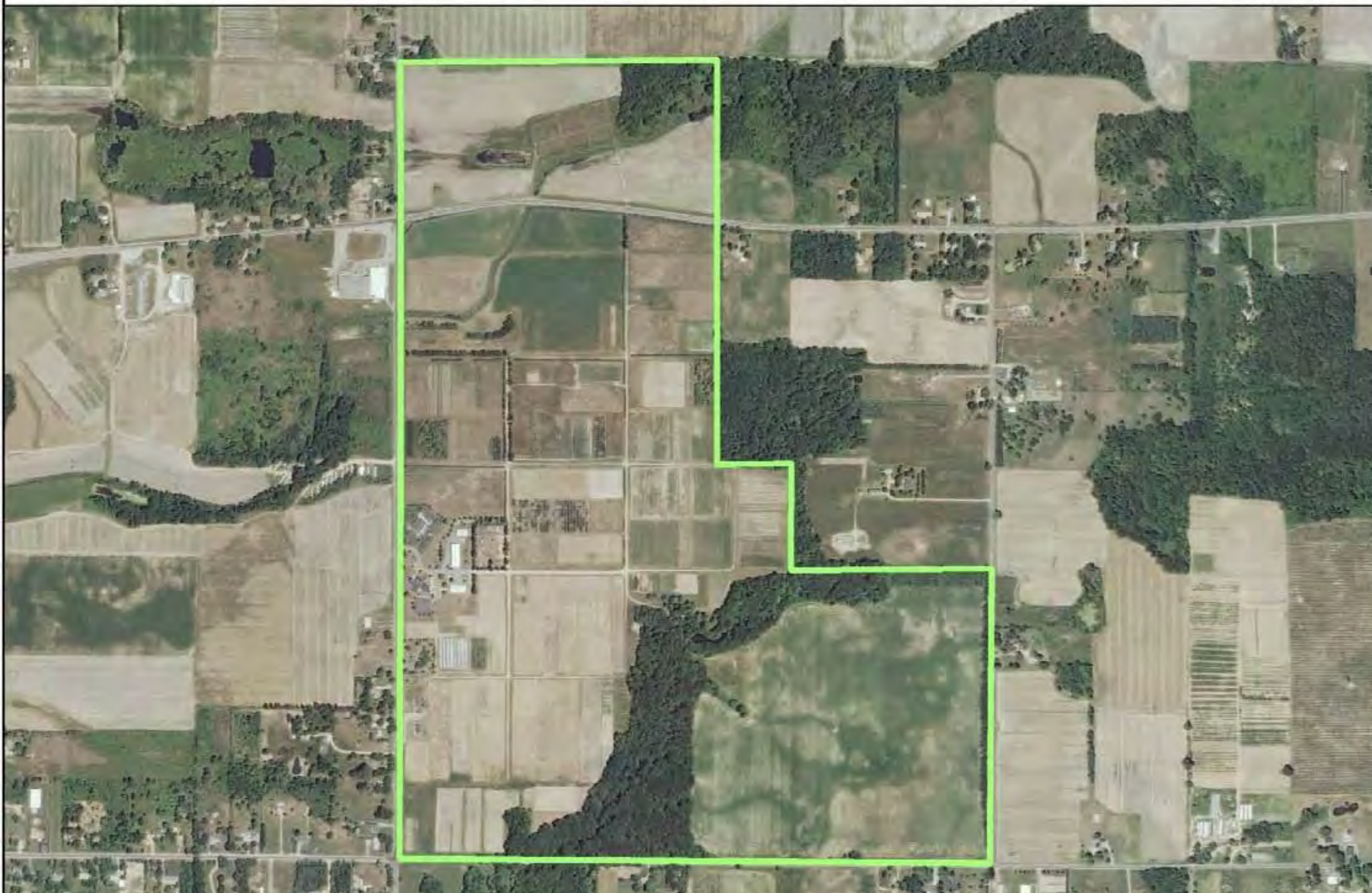
*Image Year: 2009*


Saginaw Valley Research and Extension Center
Saginaw County, Blumfield Township, Section 25; Tuscola County,
Denmark Township, Section 31
Image Year: 2009

# Southwest Michigan Research and Extension Center

**Berrien County, Benton Township, Sections 25 and 36**

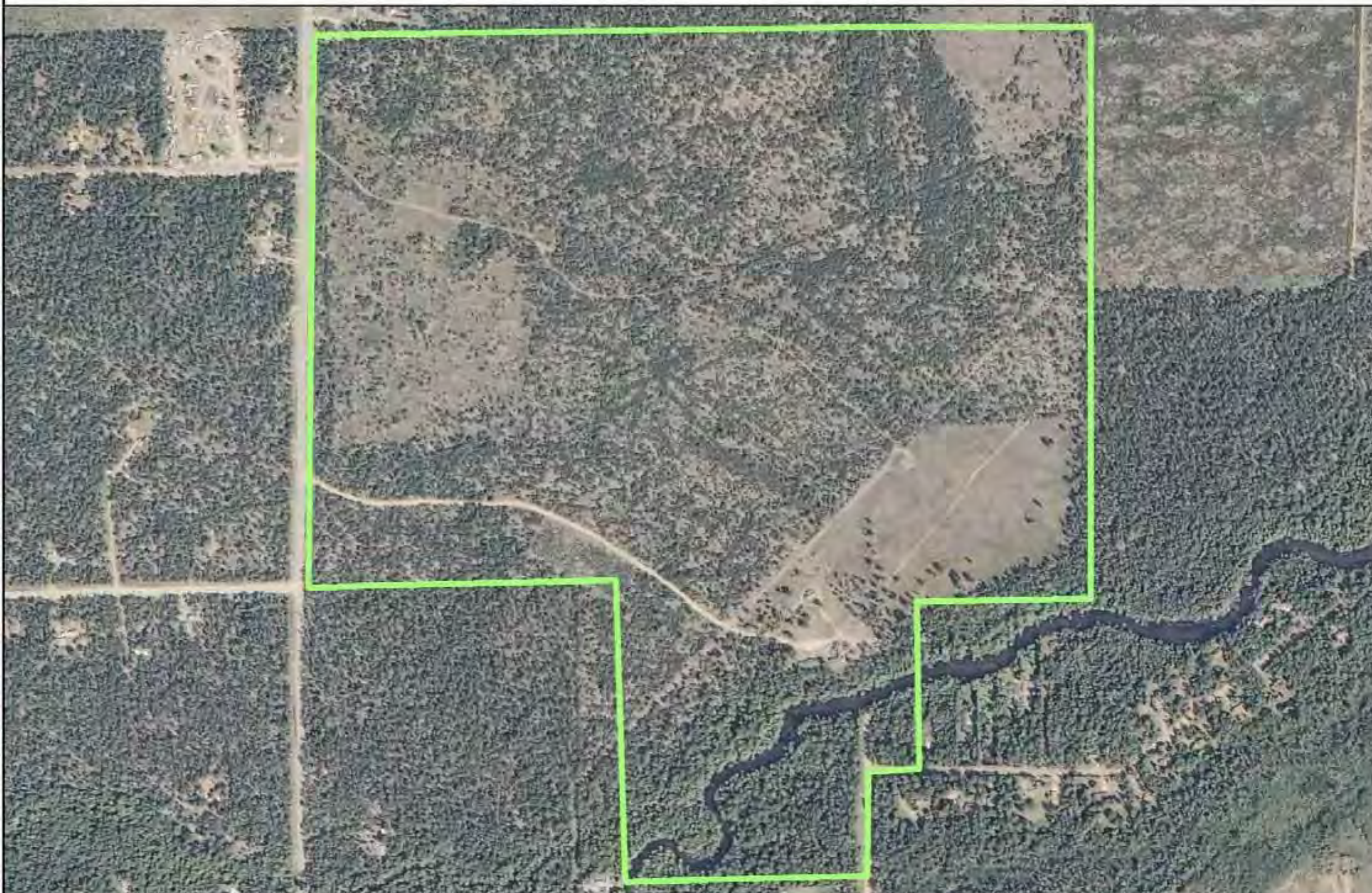
*Image Year: 2009*



# Stranahan-Bell Property (Wa Wa Sum)

Crawford County, Grayling Township, Sections 1, 6, and 12

*Image Year: 2009*

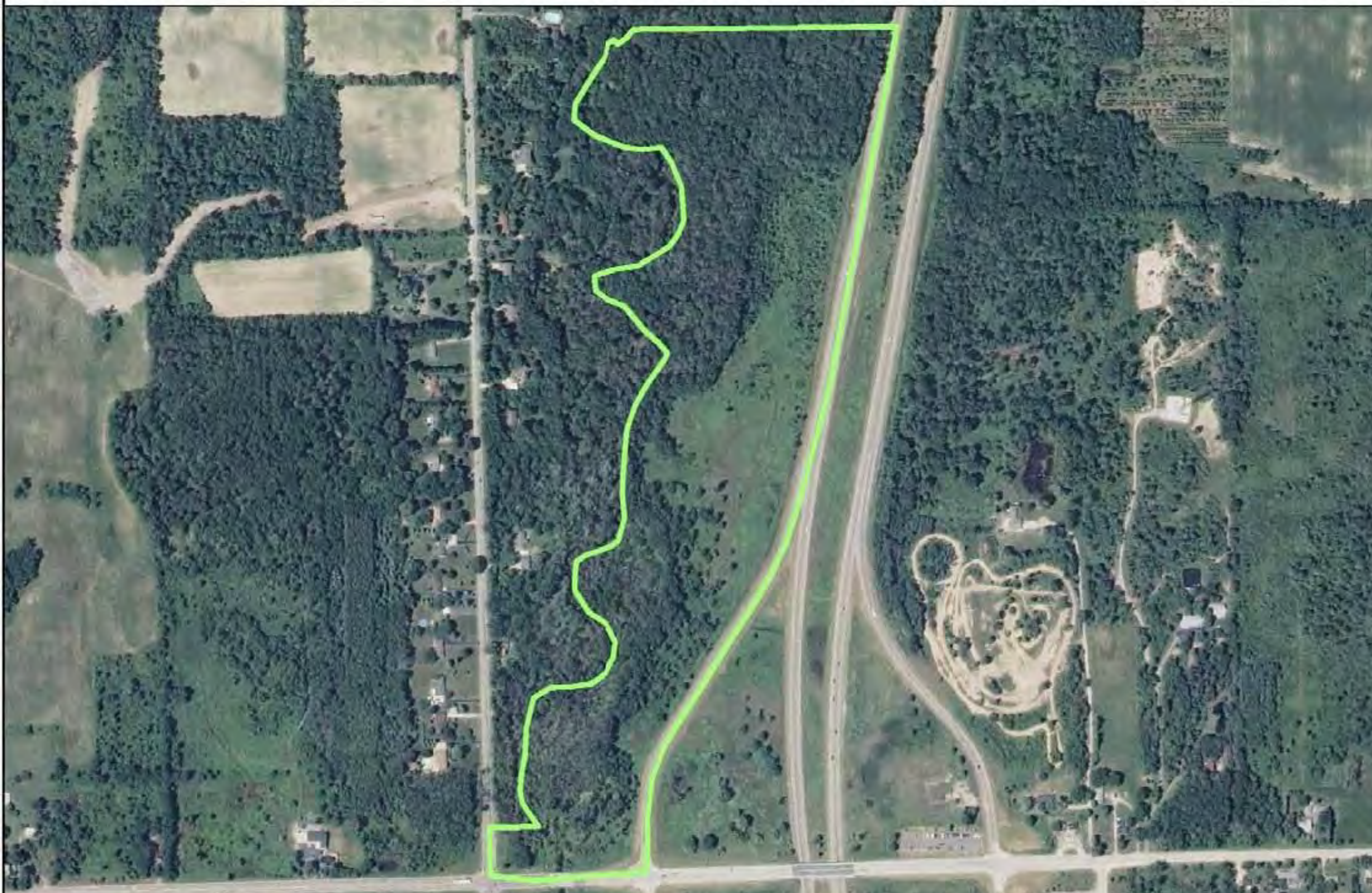



Stuckman Property
Clinton County, Bingham Township, Section 10
Image Year: 2009

# Sycamore Creek Property

## Ingham County, Alaiedon Township, Section 18

Image Year: 2009



# Tollgate Education Center and Americana Foundation Property

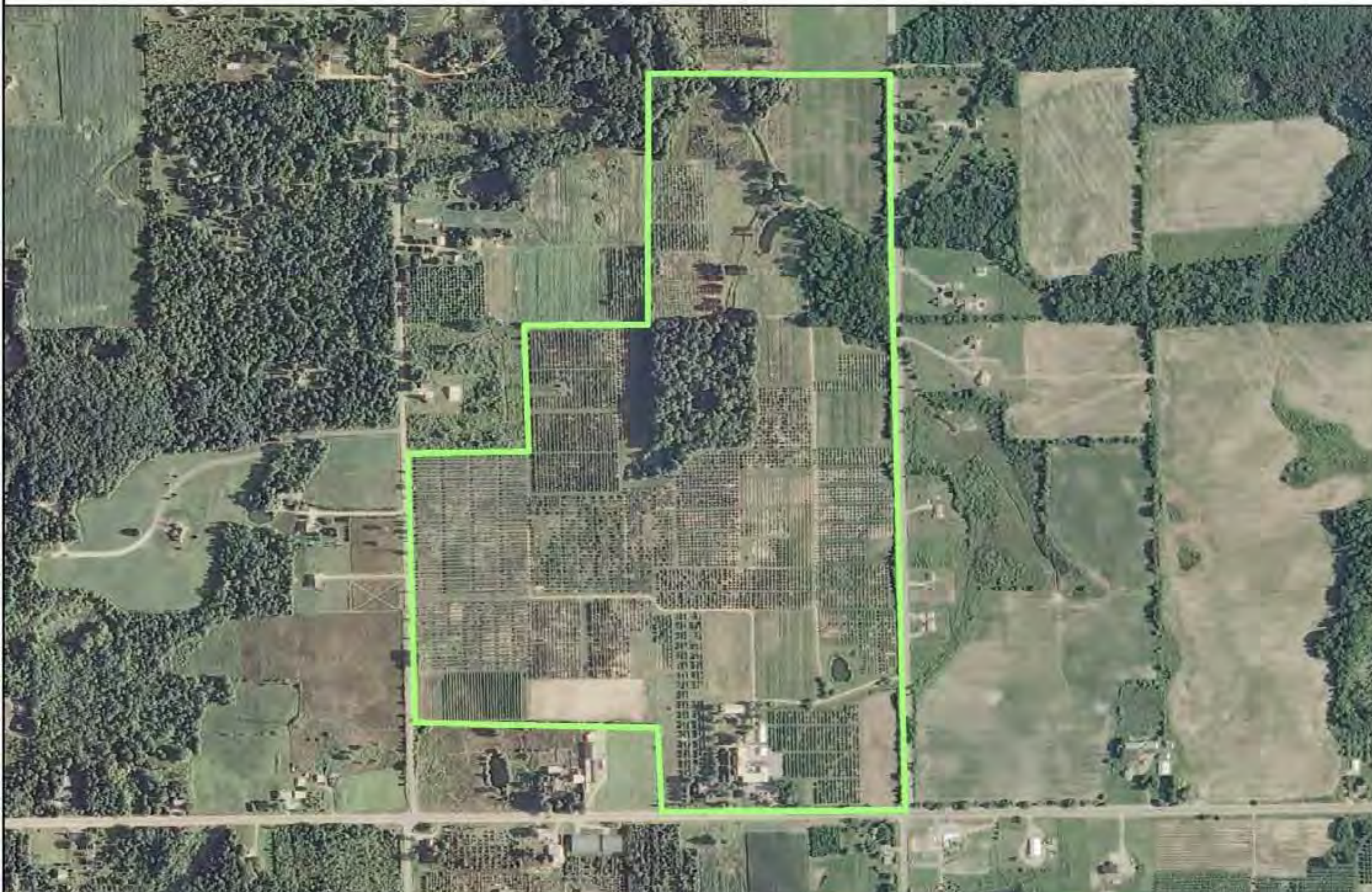
**Oakland County, City of Novi, Section 11**

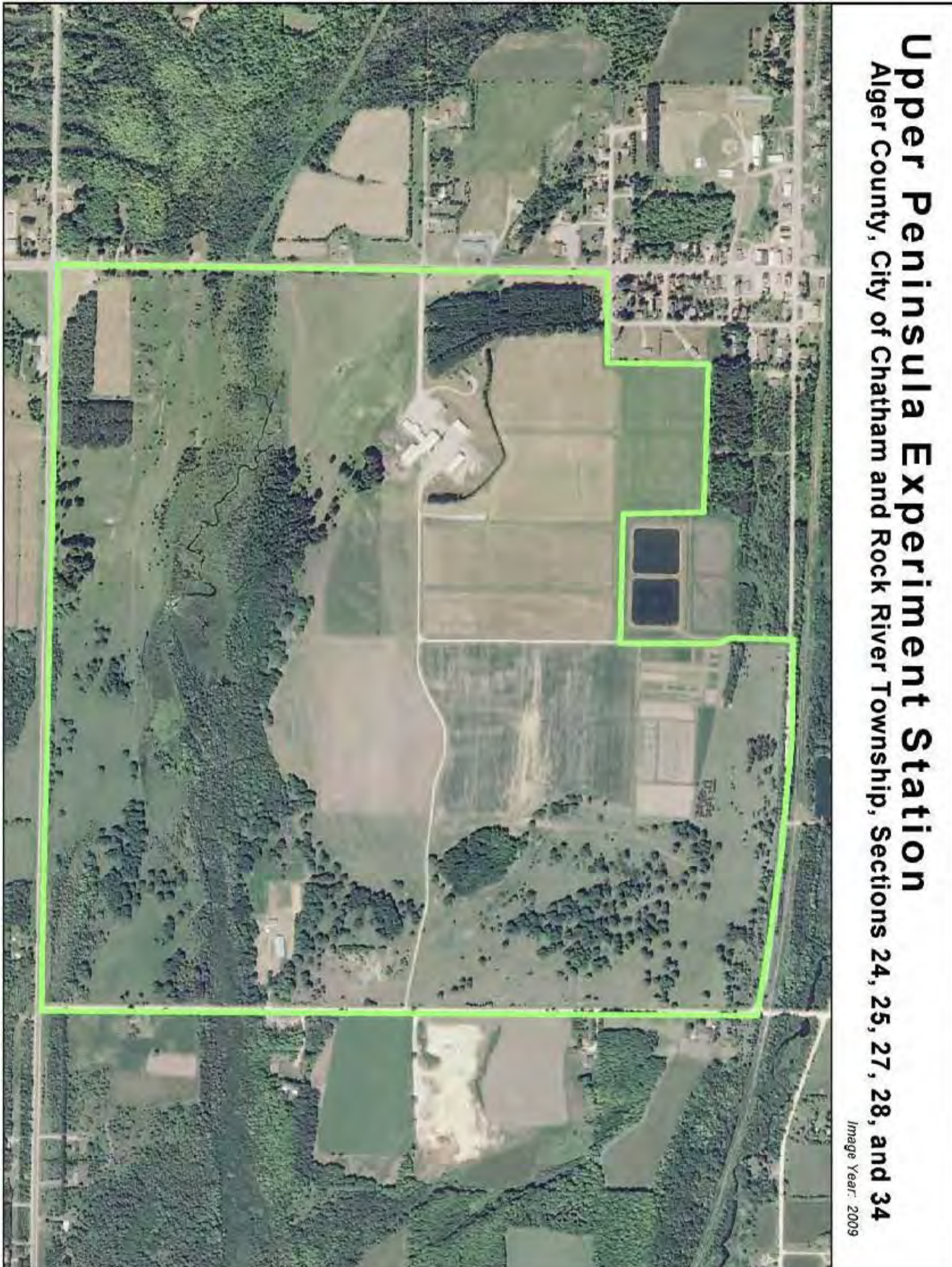
*Image Year: 2009*

# Trevor Nichols Research Complex

## Allegan County, Saugatuck Township, Section 35

*Image Year: 2009*




Upper Peninsula Experiment Station
Alger County, City of Chatham and Rock River Township, Sections 24, 25, 27, 28, and 34
Image Year: 2009


Van Hoosen Property
Oakland County, Avon Township, Section 1
Image Year: 2009