



## Environment and Natural Resources Trust Fund (ENRTF) M.L. 2017 LCCMR Work Plan

**Date of Submission:** September 14, 2016  
**Date of Next Status Update Report:** January 1 2018  
**Date of Work Plan Approval:** 06/07/2017  
**Project Completion Date:** June 30 2020  
**Does this submission include an amendment request?** No

**PROJECT TITLE:** District Heating with Renewable Biomass at Camp Ripley Training Center

**Project Manager:** Jay Brezinka/Josh Pennington  
**Organization:** MN Department of Military Affairs  
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**Web Address:** [www.minnesotanationalguard.com](http://www.minnesotanationalguard.com)

**Location:** Central Minnesota, Morrison County

|                                    |   |
|------------------------------------|---|
| <b>Total ENRTF Project Budget:</b> | <b>ENRTF Appropriation:</b> \$1,000,000 |
|                                    | <b>Amount Spent:</b> \$0                |
|                                    | <b>Balance:</b> \$1,000,000             |

**Legal Citation:** M.L. 2017, Chp. 96, Sec. 2, Subd. 07d

**Appropriation Language:**

\$1,000,000 the first year is from the trust fund to the commissioner of military affairs to install a 5,000,000-BTU centralized biomass boiler system utilizing the forestry management at Camp Ripley. This appropriation must be matched by at least \$900,000 of nonstate money and must be committed by December 31, 2017. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

## **I. PROJECT TITLE: District Heating with Renewable Biomass at Camp Ripley Training Center**

### **II. PROJECT STATEMENT:**

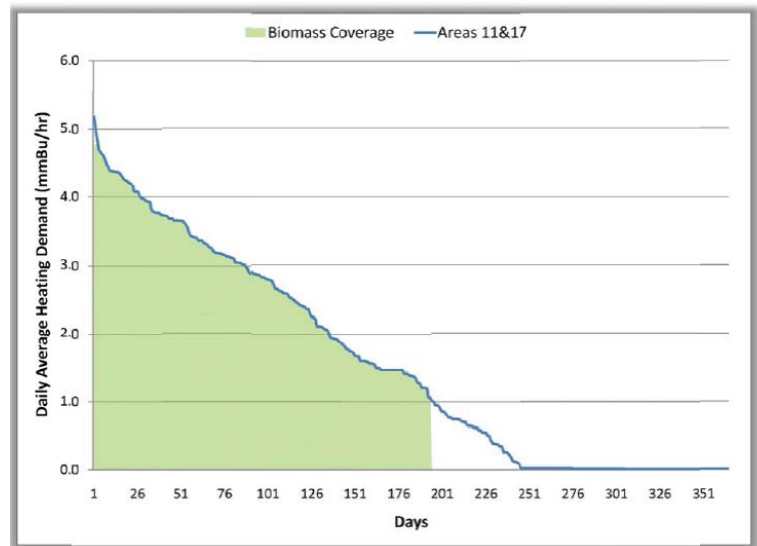
The Camp Ripley Biomass District Heating project will demonstrate, on a significant scale, sustainable forest management practices for the purpose of generating renewable biomass thermal energy. To facilitate these forest management practices, this project will construct and demonstrate the operation of a woody biomass district heating system for facilities within the Camp Ripley Training Center, located in central Minnesota. Camp Ripley is a 53,000 acre state owned facility with the capability to demonstrate an environmentally sound and sustainable process to heat numerous buildings. Selective harvesting paired with the utilization of storm blow-down material will be implemented and managed with assistance from the Minnesota Department of Natural Resources. Significant ecological benefits will be targeted in thinning of regenerative aspen in parallel with wildlife habitat improvement. A map of forested parcels within Camp Ripley Training Center available for selective harvest of biomass fuel is included in section IX, figure 1. There is an urgent need to find revenue-generating uses for forest biomass to mitigate environmental stressors and offset the public burden of funding their removal and utilization. Forest management practices that promote sustainability, if coupled with qualified industrial expertise, can provide opportunities for stable employment and economic growth in the Nation's forest products industry. The case for woody biomass can be made when it is used in a manner that enhances the environment and the well-being of the people, communities, and businesses dependent upon it. The result will be a vibrant forest products industry and resilient forests capable of providing an array of ecosystem goods and services.

A preliminary feasibility analysis for the Camp Ripley Biomass project was completed through a grant from the United States Forest Service and the Wood to Energy Resource Center in 2013. In Addition, the Minnesota Army National Guard was successful in receiving funds in May of 2015 for an engineering analysis and validation of the initial feasibility study. This effort was conducted by the National Renewable Energy Lab. Both studies regarded the project to be beneficial through both environmental and economical perspectives.

There is direct economic benefits and stimulus to the regional forestry industry by using locally-harvested biomass, generating a market demand that drives sustainable forest management practices. Camp Ripley Training Center has an integral role in the continuation of government for the state of Minnesota in the event of a major disaster; the Camp's federal and state military missions also necessitate resilient energy infrastructure for national security. A biomass district heating system at Camp Ripley would simultaneously address both aspects by providing a local, renewable and resilient energy source.

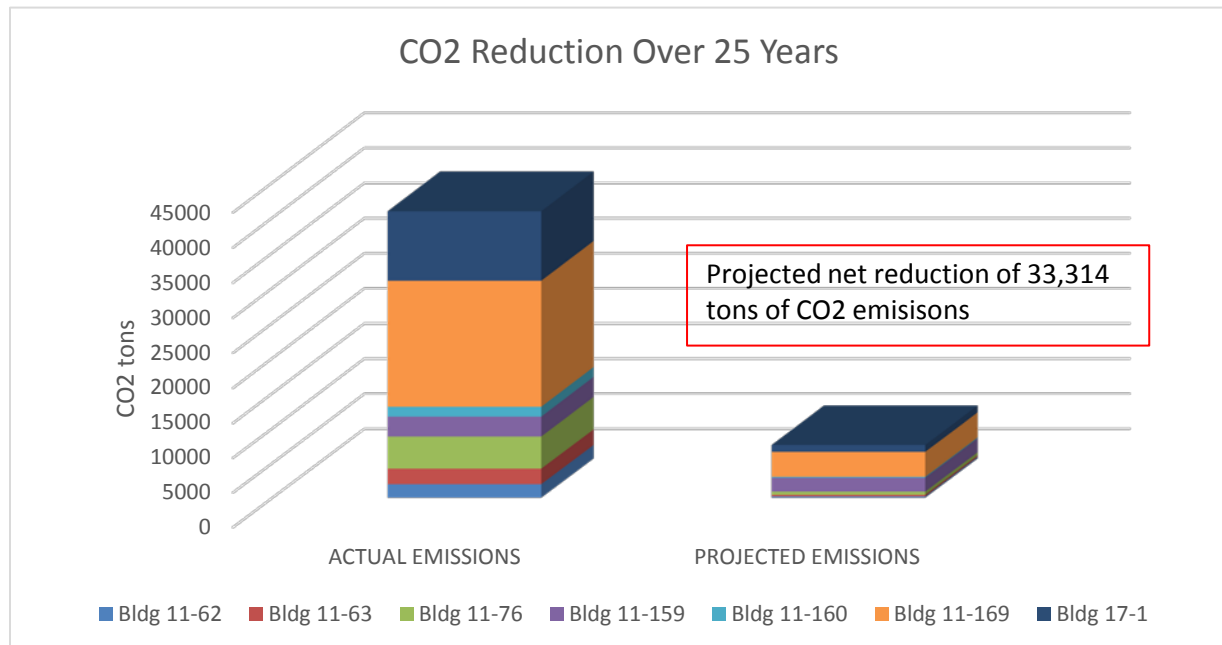
This project will install a 5.0 million Btu/hour advanced biomass combustion unit and hot water boiler capable of replacing 90% of the total natural gas usage at seven buildings within Camp Ripley Section IX Figure 2). The advanced biomass combustion unit and hot water boiler will be used to heat a 5,000 gallon thermal storage tank located in a biomass building. This high temperature water in the tank will be blended with return water and pumped from the biomass building to seven buildings in Areas 11 and 17. Buried pre-insulated piping will be installed to connect the central biomass plant to the existing heating systems at each building. The piping will tie into the existing hot water heating systems in the mechanical rooms within buildings in Areas 11 and 17. A schematic describing this system is provided in section IX, Figure 3. Also included in the project is the construction of a building to house the biomass system. This building will also include a lean-to covered day-bin for biomass storage, and will be an inexpensive pre-engineered steel building or of pole barn-type construction. This storage is needed to accommodate multiple fuel deliveries from forest management operations and to provide the flexibility to take advantage of other opportunity fuels. There are many potential configurations for the layout of the biomass system and may be revisited during the engineering design process.

This biomass system will operate most efficiently between 25% and 100% of the rated heating output of the boiler (1.25 to 5.00 million Btu/hour). This will enable the system to replace approximately 90% of the combined natural gas usage from buildings interconnected in Areas 11 and 17. The existing heating systems will remain and operate during periods of high heating demand to supplement the biomass system. The shaded area in this Figure illustrates the estimated biomass system coverage of the daily average heat demand.



In addition to the benefits described above, a biomass district heating system will mitigate the effects of climate change by reducing greenhouse gas emissions. The difference between biomass and fossil fuel combustion is the amount of carbon emissions being released in the atmosphere. Woody biomass is stored energy. The carbon released into the atmosphere when the wood burns is the same carbon the tree absorbed from the atmosphere when it was growing. As long as that tree is replaced with new growth and the soil biology is not significantly altered, the cycle is renewable. Camp Ripley's biomass district heating system will utilize on-site regenerative aspen harvests and other supplemental fuel sources that is critical in declaring carbon neutrality.

The Camp Ripley biomass district heating system is projected to offset approximately 33,314 net tons of CO2 emissions over the life of this project. The chart below illustrates the difference between a 25 year net average emissions for the seven facilities on Camp Ripley using natural gas and the projected emissions with a biomass district heating system.



The facilities in this project currently use a combination of natural gas fired hydronic, forced air, and radiant heating systems to satisfy the heating demand. The table below lists the facilities and current heating equipment.

These heating systems will remain in the facility as a supplemental heat source. The biomass district heat system will provide avoided costs of replacing the independent heating systems as they reach their end of useful life. Prior reports show significantly long payback periods for this type of project. Simple payback analysis however does not capture the avoided costs for the replacement of existing boilers over the life of the plant. The average replacement cost of these boilers is \$400,000. The table below represents the existing heating equipment in each facility and the age of that system.

| <b>Building</b>                                 | <b>Sq. Ft.</b> | <b>Heating Equipment</b>          | <b>Equip. Age (years)</b> |
|---|----------------|-----------------------------------|---------------------------|
| 17-001<br>Maintenance Facility                  | 63,568         | Two 1.75 mmBtu/hr output boilers  | 39                        |
|   |                | One 4.25 mmBtu/hr output boiler   | 22                        |
| 11-169<br>Maintenance Facility                  | 146,376        | Two 960,000 Btu/hr output boilers | 18                        |
| 11-159<br>Maintenance Shop/Office               | 23,168         | Two 330,000 Btu/hr output boilers | 23                        |
| 11-160<br>(Maintenance)                         | 9,120          | Two 724,000 Btu/hr output boilers | 38                        |
| 11-062 (Supply and Services Warehouse)          | 50,200         | Two 840,000 Btu/hr output boilers | 30                        |
| 11-063<br>Warehouse and Administrative Facility | 62,736         | Two 1.8 mmBtu/hr output boilers   | 30                        |
| 11-076<br>Maintenance and classroom Facility    | 29,250         | Two 2.2 mmBtu/hr output boilers   | 28                        |

The specific requirement for this funding recommendation is the utilization of matching funds for the remainder of the project. The costs are shown in detail in the project budget.

The Minnesota National Guard is pursuing matching funds through the Energy Conservation Investment Program (ECIP). ECIP is an appropriated military construction (MILCON) program, but funded separately by the Office of the Secretary of Defense (OSD). ECIP projects compete with other projects across national and international military installations. Projects are designed to dramatically change energy consumption at an installation or joint base, implement renewable energy technologies, and generate and store energy to improve resilience for critical loads. ECIP projects are competitively ranked by the federal savings to investment ratio (SIR). Without contributing funds, the Camp Ripley Biomass Project has an SIR of 1.0. Eligibility for ECIP funding requires a 1.0 or better SIR. This project does not compete well due to the relatively inexpensive fuel costs in Minnesota compared to the global energy market. Furthermore, ECIP does not account for the environmental and sustainability benefits in the decision making process. However, with the \$1,000,000 ENRTF as supporting dollars, the project competes for federal funds with a 3.5 SIR, making it among the most competitive ranked projects in the program. The selection process was announced in February 2017. The MNARNG was successful and ECIP funds in the amount of \$2,500,000 will be committed, to the Minnesota National Guard on 1 Oct 2018. This will leverage FY18 federal sustainment and modernization funds as the matching funds to complete the project. The modernization fund maximum contribution is \$750,000 and sustainment funds can be allocated for the remainder of the project cost. The FY18 sustainment and modernization funds will be available on October 01, 2017.

### **III. OVERALL PROJECT STATUS UPDATES:**

**Project Status as of January 01 2018**

**Project Status as of July 1 2018**

**Project Status as of January 01 2019**

**Project Status as of June 30 2020**

#### **Overall Project Outcomes and Results:**

### **IV. PROJECT ACTIVITIES AND OUTCOMES:**

This project will demonstrate sustainable forest management for the purpose of generating thermal energy using a locally harvested renewable energy. Onsite biomass as a fuel source can reduce carbon emissions by more than 33,000 tons over the life of the project. Utilization of onsite biomass will generate a demand for implementation of forest management practices, increase habitat restoration initiatives, decrease dependence on non-renewable gas and increase energy resiliency as an adaptation goal for a changing climate. A map of forested parcels within Camp Ripley Training Center available for selective harvest of biomass fuel is included in section IX.

In May of 2015, the National Renewable Energy Laboratory (NREL) conducted an analysis of the biomass fuel supply available to Camp Ripley. The 53,000 acre installation has an abundant, sustainable supply of biomass fuel, consisting largely of an adjacent 35,000-acre forest primarily of aspen trees. The proposed system would utilize approximately 2000 tons of wood chips per year, (equivalent of 900 cords of wood). Without supplemental fuel from storms or other activities, Camp Ripley would need to harvest less than 100 acres (approximately .9% of the targeted harvestable areas) every year to meet the fuel demands of the proposed systems. Aspens grow relatively quickly and a harvested area would be ready for harvesting again in approximately 20 years. Camp Ripley also has access to forested land adjoining the training area. These forested areas are accessible by paved highway, contributing to a lower fuel cost.

In order to facilitate these forest management practices, a biomass district heating system at Camp Ripley will be constructed. This project will install a 5.0 million Btu/hour advanced biomass combustion unit and hot water boiler capable of replacing 90% of the total natural gas usage at seven buildings within Camp Ripley. The advanced biomass combustion unit and hot water boiler will be used to heat a 5,000 gallon thermal storage tank located in a biomass building. This high temperature water in the tank will be blended with return water and pumped from the biomass building to seven buildings in Areas 11 and 17. Buried pre-insulated piping will be installed to connect the central biomass plant to the existing heating systems at each building. The piping will tie into the existing hot water heating systems in the mechanical rooms within buildings in Areas 11 and 17. A schematic describing this system is provided in section IX, Figure 3. Also included in the project is the construction of a building to house the biomass system (example of a site building layout included in section IX Figure 4). This building will also include a lean-to covered day-bin for biomass storage, and will be an inexpensive pre-engineered steel building or of pole barn-type construction. This storage is needed to accommodate multiple fuel deliveries from forest management operations and to provide the flexibility to take advantage of other opportunity fuels. There are many potential configurations for the layout of the biomass system and may be revisited during the engineering design process.

#### **ACTIVITY 1: Competitive bid for the design and construction of biomass district heat system**

##### **Description:**

Professional and technical contract for the design and construction of a biomass district heating system. This includes the architectural, mechanical, electrical and structural services for the engineering design, contractor

material and labor, overhead, and site work. Budget and cost summary is developed by Department of Military Affairs Mechanical Engineer. All contracting will occur through the State of MN contractual process.

The ENRTF budget will be matched >100% by funding activities from the Minnesota Army National Guard (MNARNG).

**Summary Budget Information for Activity 1:**

**ENRTF Budget:** \$ 1,000,000  
**Amount Spent:** \$ 0  
**Balance:** \$1,000,000

| <b>Outcome</b>                                   | <b>Completion Date</b> |
|--|------------------------|
| <b>1. Biomass District Heating System Design</b> | JAN 2018               |
| <b>2. Site Work and Construction</b>             | OCT 2019               |
| <b>3. Implementation and Demonstration</b>       | OCT 2020               |

**Activity 1 Status as of January 1 2018:**

**Activity 1 Status as of July 1 2018:**

**Activity 1 Status as of January 1 2019:**

**Activity 1 Status as of June 30 2020:**

**Final Report Summary:**

**V. DISSEMINATION:**

**Description:** The Department of Military Affairs and Minnesota National Guard will use the final project as an example of cost effective locally-produced renewable thermal energy for other campuses and installations to replicate. A project of this magnitude will offer tremendous educational outreach for the tens of thousands of our Soldiers and other customers (including state agency staff) who train at Camp Ripley. The project will also serve as a national model since it will be the first biomass facility on a National Guard Installation. Additionally, Camp Ripley environmental staff sponsor over 100 presentations a year and reach about 6,000 students and visitors. This biomass project will be showcased as one of many sustainable initiatives underway at Camp Ripley in addition to a 10 megawatt solar array that has been installed on Camp Ripley by Minnesota Power which is also the largest of its kind on any National Guard Installation.

**Status as of January 01 2018:**

**Status as of July 01 2018:**

**Status as of January 01 2019:**

**Status as of June 30 2020:**

**Final Report Summary:**

**VI. PROJECT BUDGET SUMMARY:**

**A. Preliminary ENRTF Budget Overview:**

*\*This section represents an overview of the preliminary budget at the start of the project. It will be reconciled with actual expenditures at the time of the final report.*

The estimated budget below represents the total estimated project cost of the biomass district heating system at Camp Ripley. This estimate was produced through the MN Department of Military Affairs mechanical engineer utilizing the State of MN's construction cost estimate works program.

| <b>ENRTF Budget</b>          |                  |                              |
|------------------------------|------------------|------------------------------|
| <b>Budget Category</b>       | <b>\$ Amount</b> | <b>Overview Explanation</b>  |
| Professional Design Services |                  |                              |
|                              | \$366,000        | Design @12%                  |
| Professional/Technical Costs |                  |                              |
|                              | \$562,500        | Biomass Boiler and labor     |
|                              | \$60,000         | Boiler room piping and pumps |
| <b>TOTAL ENRTF BUDGET:</b>   | <b>\$988,500</b> |                              |

| <b>Total Estimated Budget</b>                    |                      |                   |                   |
|--|----------------------|-------------------|-------------------|
| <b>ITEM DESCRIPTION</b>                          | <b>MATERIAL COST</b> | <b>LABOR COST</b> | <b>TOTAL COST</b> |
| Biomass Boiler                                   | \$506,250.00         | \$56,250.00       | \$562,500.00      |
| Auxiliary Natural Gas Boilers                    | \$225,000.00         | \$25,000.00       | \$250,000.00      |
| Boiler Room Piping & Pumps                       | \$60,000.00          | \$20,000.00       | \$80,000.00       |
| Material Handling & Storage                      | \$200,000.00         | \$40,000.00       | \$240,000.00      |
| Thermal Storage Tank                             | \$45,000.00          | \$5,000.00        | \$50,000.00       |
| Primary Distribution Piping                      | \$157,500.00         | \$191,800.00      | \$349,300.00      |
| Branch Distribution Piping                       | \$66,000.00          | \$109,600.00      | \$175,600.00      |
| Trenching and Backfill                           | \$51,700.00          | \$51,700.00       | \$103,400.00      |
| Horizontal Boring                                | \$19,200.00          | \$8,800.00        | \$28,000.00       |
| 6" Elbow Kit                                     | \$1,160.00           | \$1,160.00        | \$2,320.00        |
| 6" Anchor Kit                                    | \$1,400.00           | \$1,400.00        | \$2,800.00        |
| Tee/Main Tap                                     | \$1,200.00           | \$1,200.00        | \$2,400.00        |
| Building Connections                             | \$133,000.00         | \$7,000.00        | \$140,000.00      |
|  |                      |                   |                   |
| MATERIAL SUB-TOTAL                               | \$1,467,410          |                   |                   |
| LABOR SUB-TOTAL                                  |                      | \$518,910         |                   |
|  |                      |                   |                   |
| MATERIAL AND LABOR SUB-TOTAL                     |                      |                   | \$1,986,320.00    |
| Site work, demolition, connections, hangars, etc | 1%                   |                   | \$19,863.20       |
| Sub-Contractor's Overhead                        | 10%                  |                   | \$198,632.00      |
| Subcontractor's Profit                           | 10%                  |                   | \$198,632.00      |
| Sub-Contractor's Estimate                        |                      |                   | \$2,403,000.00    |
|  |                      |                   |                   |
| Prime Contractor's Overhead                      | 10%                  |                   | \$240,300.00      |
| Prime Contractor's Profit                        | 10%                  |                   | \$240,300.00      |

|                         |        |                |
|-------------------------|--------|----------------|
| Prime Contractor's Bond | 1%     | \$24,030.00    |
| Contractor Estimate     |        | \$2,908,000.00 |
|                         |        |                |
| Contingency             | 5%     | \$145,400.00   |
|                         |        |                |
| Total Contractors Cost  |        | \$3,053,000.00 |
| SIOH                    | 5.70%  | \$174,000.00   |
| Design Cost             | 12.00% | \$366,000.00   |
|                         |        |                |
| Total Project Cost      |        | \$3,593,000.00 |

**B. Other Funds:**

| Source of Funds                            | \$ Amount Proposed | \$ Amount Spent | Use of Other Funds   |
|--|--------------------|-----------------|--|
| <b>Non-state</b>                           |                    |                 |  |
| DoD Energy Conservation Investment Program | \$2,500,000        |                 | Capital expenditure expenses for project implementation              |
|  |                    |                 |  |
|  |                    |                 |  |
| <i>Federal Modernization</i>               | <i>\$750,000</i>   |                 | <i>Capital expenditure expenses for project implementation</i>       |
| <i>Federal Sustainment</i>                 | <i>\$200,000</i>   |                 | <i>Retrofitting expenses of existing equipment within facilities</i> |
| <b>TOTAL OTHER FUNDS:</b>                  | <b>\$3,450,000</b> |                 |  |



## VII. PROJECT STRATEGY:

### A. Project Impact and Long-term Strategy:

Camp Ripley's Biomass district heating can stimulate economies, create jobs, offset imported fossil fuels, and promote the sustainable use of natural resources for the 25+ years of the biomass project life expectancy. This project will demonstrate sustainable forest management for the purpose of generating thermal energy using a locally harvested renewable energy. Onsite biomass as a fuel source can reduce carbon emissions by more than 33,000 tons over the life of the project. Utilization of onsite biomass will generate a demand for implementation of forest management practices, increase habitat restoration initiatives, decrease dependence on non-renewable gas and increase energy resiliency as an adaptation goal for a changing climate. Utilization of onsite biomass resources decreases the dependence on non-renewable natural gas and increased heating system redundancy for up to seven buildings at Camp Ripley.

According to the USDA Community Biomass Handbook (Becker, D.; Lowell, E.; Bihn, D.; Anderson, R.; Taff, 2014) Greater Minnesota has a surplus of underutilized biomass abundantly available from our forests and other public and private lands and in some locations this biomass fuels the catastrophic wildfires experienced in the last two decades. The potential benefits of using woody biomass are significant, but there is a lack of uniform knowledge about successful project siting and operation, how to coordinate investments with ongoing public and private forest management activities, and other critical project development tasks. There is an urgent need to find revenue-generating uses for forest biomass to mitigate environmental stressors and offset the public burden of funding their removal and utilization. Forest management practices that promote sustainability, if coupled with qualified industrial expertise, can provide opportunities for stable employment and economic growth in the Nation's forest products industry. The case for woody biomass can be made when it is used in a manner that enhances the environment and the well-being of the people, communities, and businesses dependent upon it. The result will be a vibrant forest products industry and resilient forests capable of providing an array of ecosystem goods and services.

### B. Funding History:

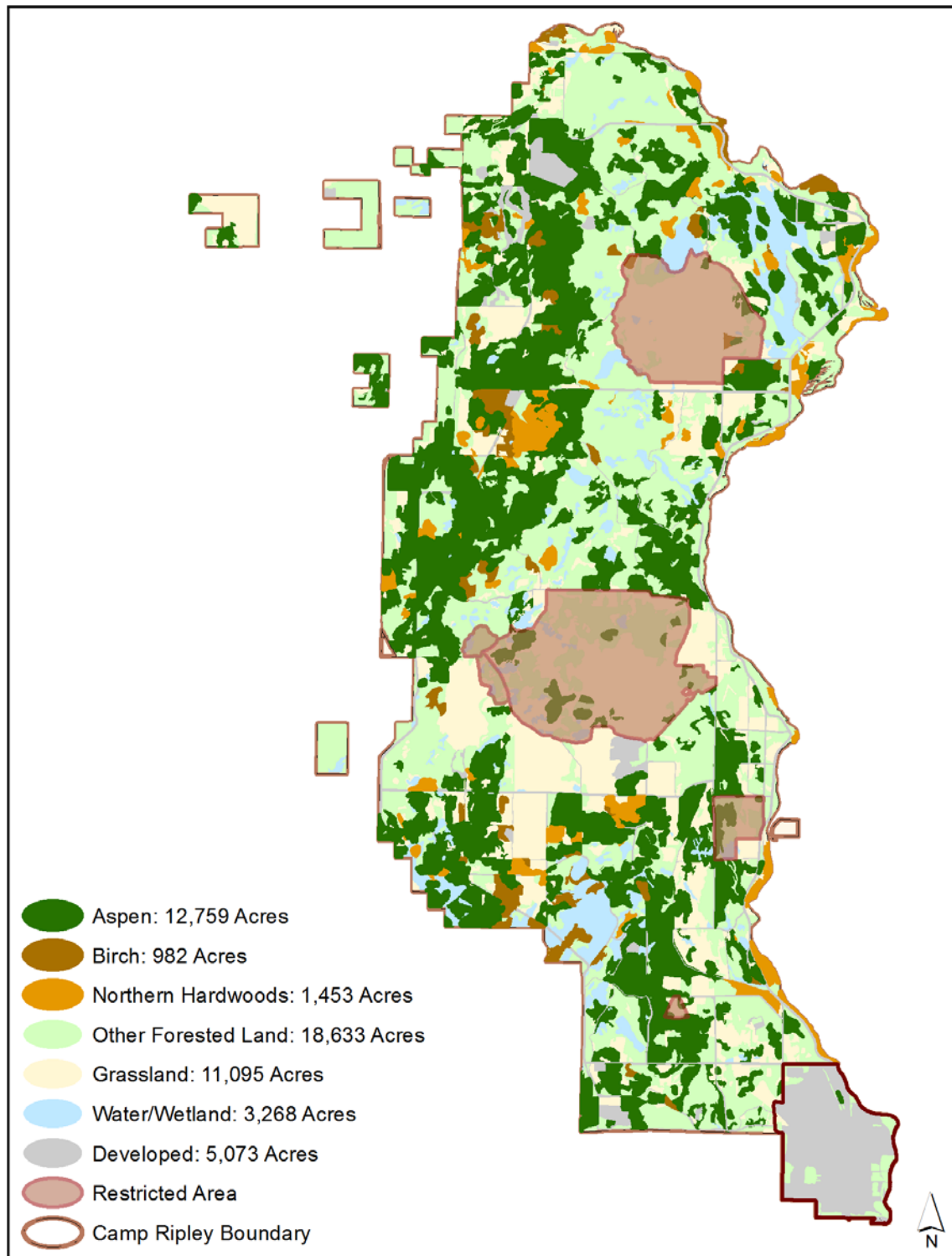
| <b>Funding Source and Use of Funds</b> | <b>Funding Timeframe</b>  | <b>\$ Amount</b>   |
|--|---|--------------------|
| DoD ECIP                               | Award Announcement in<br>FEB 1 2017. Funding avail.<br>OCT 1 2018 | <b>\$2,500,000</b> |
| <i>Federal Modernization Funds</i>     | <i>October 1 2017</i>   | <i>\$750,000</i>   |
| <i>Federal Sustainment Funds</i>       | <i>October 1 2017</i>   | <i>\$200,000</i>   |

## VIII. REPORTING REQUIREMENTS:

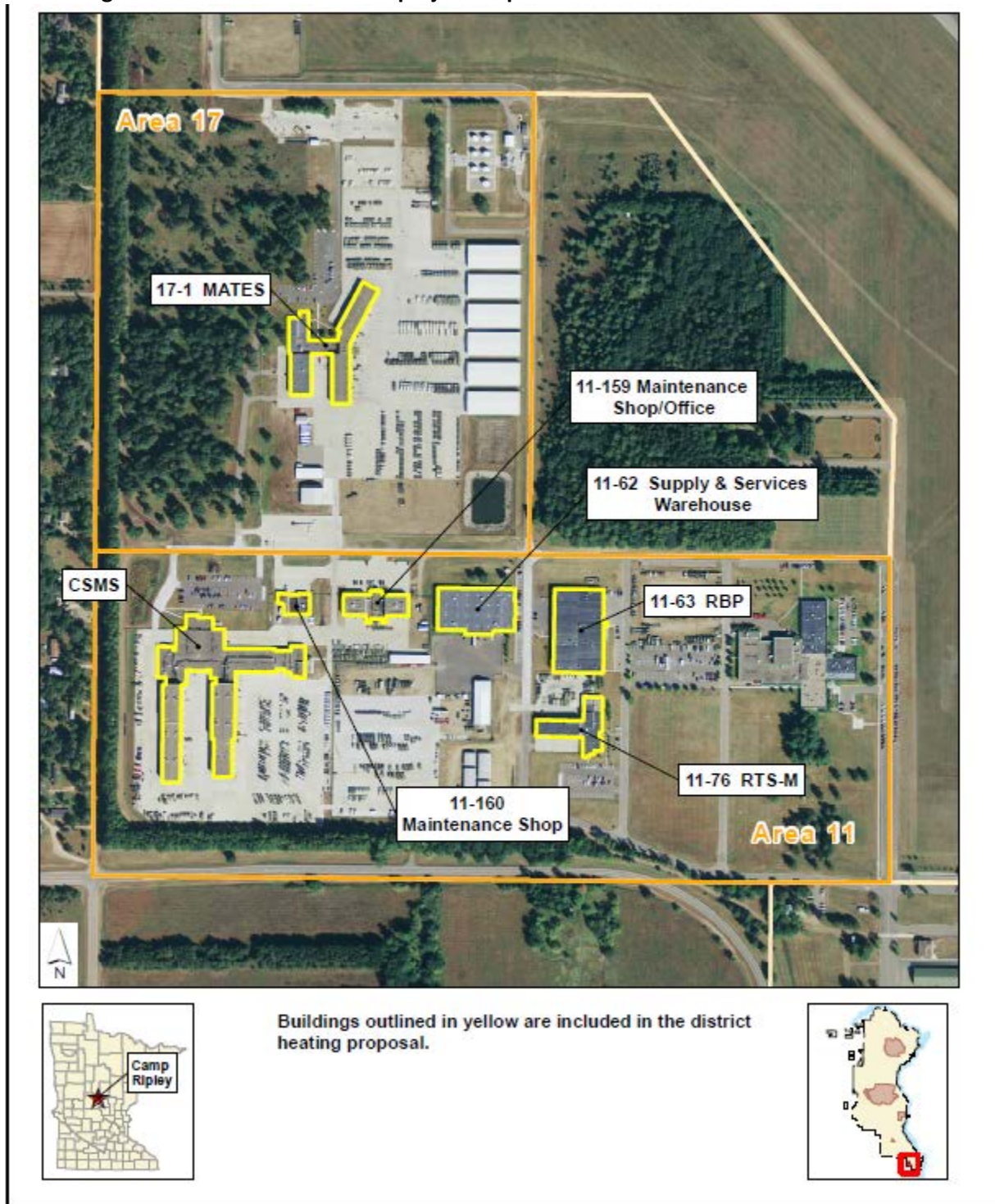
- The project implementation period is 3 years, will begin on 1 July 2017, and be completed/implemented by 30 June 2020.
- Periodic project status update reports will be submitted *[April/01]* and *[October/01]* of each year.
- A final report and associated products will be submitted between Oct 1 and Nov 30, 2020.

**IX. VISUAL COMPONENT or MAP(S):**

- 1. Map of forested parcels within Camp Ripley Training Center available for selective harvest of Biomass fuel.**

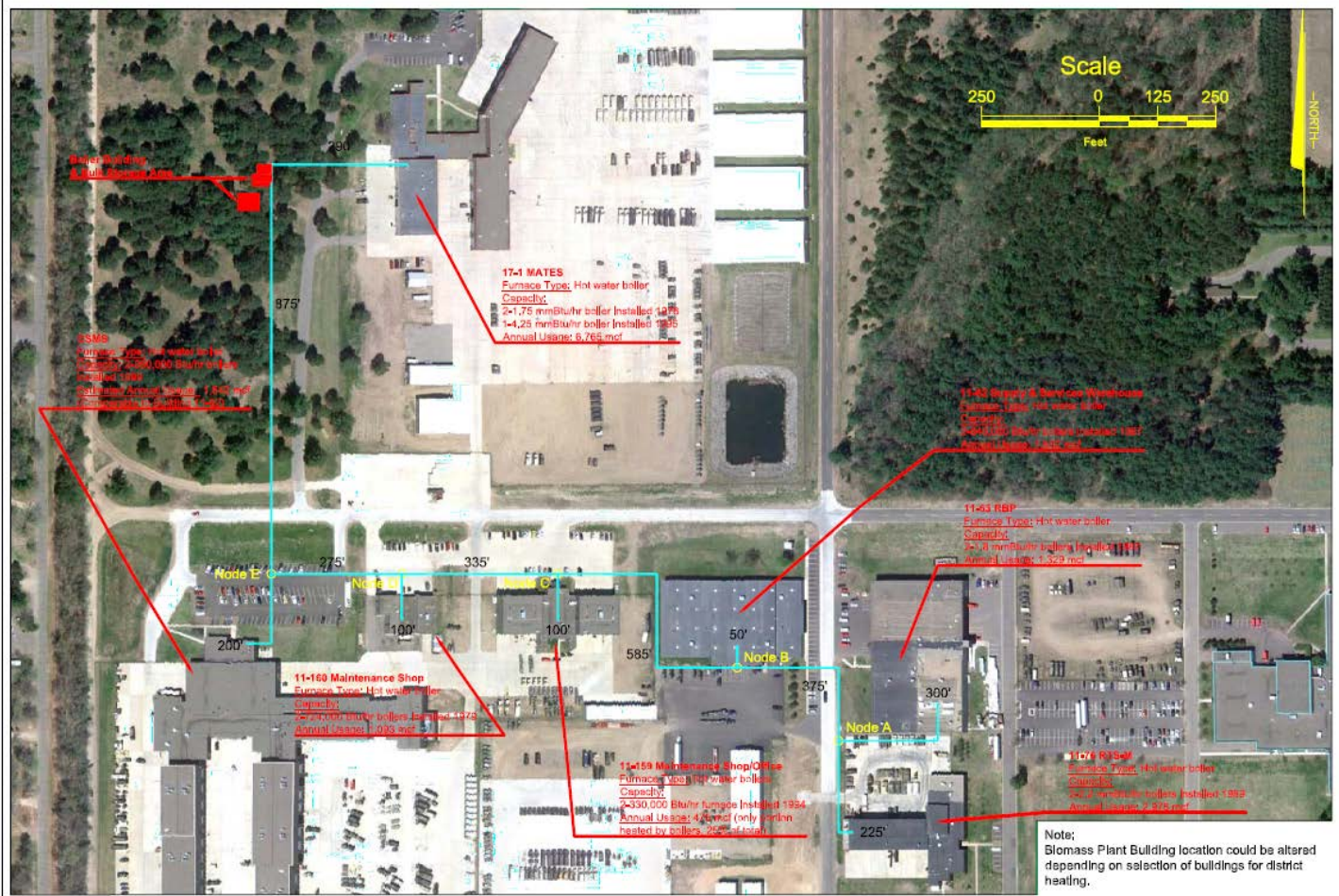


IX. 2. Buildings that will be serviced in the project scope.



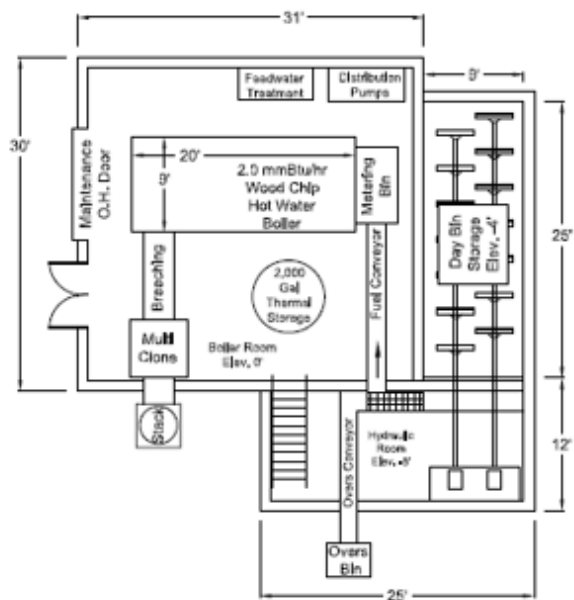


### IX 3. Schematic describing hot water distribution lines

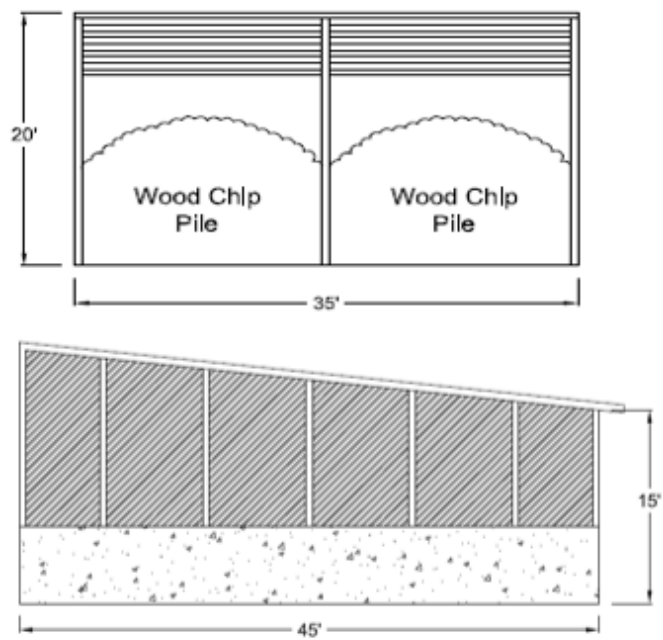


#### IX 4. Schematic describing the boiler and storage facility

Boiler room and wood handling facility



Wood chip storage steel building



**Environment and Natural Resources Trust Fund**  
**M.L. 2017 Project Budget**

**Project Title:** District Heating with Renewable Biomass at Camp Ripley Training Center

**Legal Citation:** M.L. 2017, Chp. 96, Sec. 2, Subd. 07d

**Project Manager:** Jay Brezinka /Josh Pennington

**Organization:** Department of Military Affairs

**M.L. 2017 ENRTF Appropriation:** \$ \$1,000,000

**Project Length and Completion Date:** 3 years, June 2020

**Date of Report:** September 14, 2016



| ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET  | Activity 1 Budget   | Amount Spent | Activity 1 Balance |  |  |  | TOTAL BUDGET | TOTAL BALANCE |
|--|---|--------------|--------------------|--|--|--|--------------|---------------|
| BUDGET ITEM  | <i>Competitive bid for the design and construction of biomass district heating system</i> |              |                    |  |  |  |              |               |
| Professional/Technical/Service Contracts   | \$988,500   |              | \$988,500          |  |  |  | \$988,500    | \$988,500     |
| <i>Contract TBD with engineering firm on design through construction. Contractor will be responsible for all sub contracts related to construction activities. All contracts will follow State competitive process and guidelines and will be administered through DMA contracting office.</i> |   |              |                    |  |  |  |              |               |
| Professional Design Services-estimated \$366,000   |   |              |                    |  |  |  |              |               |
| Biomass Boiler and labor estimated \$562,500   |   |              |                    |  |  |  |              |               |
| Boiler Room piping and pumps estimated \$60,000  |   |              |                    |  |  |  |              |               |
|  |   |              |                    |  |  |  |              |               |
|  |   |              |                    |  |  |  |              |               |
|  |   |              |                    |  |  |  |              |               |
| Unallocated Amount   | \$11,500  |              | \$11,500           |  |  |  | \$11,500     | \$11,500      |
|  |   |              |                    |  |  |  |              |               |
|  |   |              |                    |  |  |  |              |               |
| COLUMN TOTAL   | \$1,000,000   |              |                    |  |  |  | \$1,000,000  | \$1,000,000   |

The estimated total cost is \$3,593,000 for the contract to be put out for bid for the Camp Ripley five million BTU centralized boiler system. The costs within the estimate have been prorated between ENRTF (\$988,500) and the MNARNG (\$2,604,500) to align with ENRTF eligible costs. This project is contingent on the validation of Federal energy funds that have been awarded to the MNARNG.