2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 DESCRIPTION OF THE PROPOSED ACTION

2.1.1 Project Applicants

The project applicant, OSU, has assembled a project team to develop a prototype commercial-scale project that is planned to utilize green building technologies in Franklin County, Ohio. The project team includes Lincoln Street Studio Ltd. (architects), Jezerinac, Geers & Associates Incorporated (structural engineers), W. E. Monks & Company (mechanical/electrical engineers), Jane Amidon (landscape architect consultant) and Sands Decker, Ltd. (civil engineers). As described in Chapter 1, DOE proposes to provide funding in support of this project. Details of the Ohio 4-H Center project are described in the Construction Document Package which is available for public review in the OSU Office of Facilities, Operations, and Development, which includes the Offices of the University Architect and Engineer.

2.1.2 Project Location

The project site is located on the OSU campus northwest of the intersection of Lane Avenue and Fred Taylor Drive in Franklin County, Ohio (see Figure 1-2). Regional access to the site is provided by State Route 315 located about 500 feet (0.15 kilometers) west of the site, U.S. Interstate 670 located about 2.0 miles (3.2 kilometers) south of the site, U.S. Interstate 70 located about 3.5 miles (5.6 kilometers) south of the site and Interstate 71 located approximately 2.0 miles (3.2 kilometers) west of the site (Figure 1-1). Local access to the project site is via Fred Taylor Drive just north of West Lane Avenue. The proposed project location is relatively flat to gently sloping down toward the wooded north of the proposed project site. Surface runoff is generally toward Fred Taylor Drive to the east and toward a drainage swale on the north site of the building location. Storm water on the project site is directed to Chadwick Lake via a 2-foot deep, grass-lined shallow swale that begins in the northwest corner of the project site.

2.1.3 Building Design, Construction, Operation and Maintenance

Building Design

The Ohio 4-H Center has been designed by the project team identified above with energy efficient technologies including a hybrid geothermal system for heating and cooling and a structural system incorporating a recycled steel manufacturing process to produce structural steel members. Figure 2-3 shows the project site plan. The footprint of the proposed Ohio 4-H Center building plus parking lot and roadways is 1.4 acres (0.6 hectares). The building alone would cover 0.6 acres (0.2 hectares).

If the Ohio 4-H Center is constructed as designed, the north end of the structure would have a 5-story office tower constructed over a full basement. The central and southern portions of the structure would generally be a single-story, slab-on-grade building. A small section of the building would have a second story to house mechanical equipment. The proposed project site area would encompass 5.6 acres (2.26 hectares). Some of this area is planned to be used for vehicle parking, geothermal wells, landscaping and other ancillary learning facilities. Three-

dimensional computer model images of the proposed building are provided in Figure 2-1. Photographs of the physical model of the proposed construction are shown in Figure 2-2.

If this facility is constructed as designed by the OSU project team, the Ohio 4-H Center is planned to utilize a heat pump system, with the earth serving as both the heat source and as a heat sink. The Ohio 4-H Center geothermal system would utilize the earth for heating and cooling because the earth remains at a relatively constant temperature of 55 degrees Fahrenheit (55˚F), particularly at depth. The vertical geothermal heat exchanger is planned to consist of a series of 72-80 boreholes, each 5 inches in diameter and approximately 280 feet deep. A plastic pipe would be inserted into each borehole with a "U" shaped bend at the bottom so that the pipe doubles back on itself (like a paper clip) and comes back to the top. These pipes would be collected into groups of eight, so that when a glycol solution is pumped through the pipe it actually goes down and up through eight boreholes to form a geothermal heat exchanger loop.

Regardless of what temperature the heat exchanger solution is when it leaves the building and enters the geothermal heat exchanger loop, it comes out of the heat exchanger and back to the building at 55˚F. Each group of eight boreholes would have its own pump, and the circulating solution from each group would be connected to a building loop so that the 55˚F solution from all the pipes would be circulated in loop fashion around the building. At various places in the building, heat pumps would exchange the temperature from the heat exchanger solution to air at a prescribed temperature. In winter, the system would take heat out (cool down) of the 55˚F glycol solution to warm the air that would blow into spaces for heating. In the summer, the heat pumps would heat up the 55˚F glycol solution by taking heat out of the air in spaces to be cooled. So, in the summer, the heat exchanger solution would go into the loop hot and the earth would absorb the heat, cooling the solution back down to 55˚F. In the winter, the heat exchanger solution would go into the loop cold and the earth would warm it back up to 55˚F (Lincoln Street Studios 2003).

Figure 2-4 shows the layout of the geothermal heat exchanger including borehole locations and supply and return headers. The vertical geothermal heat exchanger is planned to be covered by a research and display garden and surrounded by the Ohio 4-H Center parking lot. Additional heat rejection would be accomplished through a closed circuit cooling tower located in the building's north tower. The heat exchanger fluid contained in the closed loop piping would be a solution 20% Dowfrost HD® heat transfer fluid and 80% water, and, under normal operation, would not contact the soil or ground water. Dowfrost HD® with propylene glycol was selected as the fluid with the least environmental impact in the event of a pipe rupture. The heat exchanger fluid would vary in temperature between 90˚F and 30˚F and individual space heat pumps would extract heat from or reject heat to this loop. Space temperature would be controlled through heat pumps located in mechanical rooms and air distribution would be through a low pressure duct system.

Outside air supply and exhaust fan speed would operate at a minimum speed when the building is not occupied and fan speed would be increased based on a need for additional ventilation as established by space carbon dioxide (CO_2) sensors. An electric canister-type humidifier with distribution manifold mounted in the outside air supply duct would maintain building relative humidity above 30%.

Recycled steel would be the main component in the Ohio 4-H Center structural system. The project would require 282 tons of structural steel that would be produced in domestic mills using the Electric Arc Furnace (EAF) process and would contain at least 90% total recycled content.

The use of recycled structural steel allows energy that would be used to extract raw material from the ground to be conserved and diverts waste from old steel products away from landfills.

Construction Requirements

Site topography is relatively flat to gently sloping toward the wooded area to the north. The southern portion of the building footprint would be cut to a finished floor grade of 749 feet elevation. The central portion of the building footprint would receive up to 5 feet of fill to reach finished subgrade elevation and the northern end of the building would be constructed with a full basement that would extend approximately 10 feet below existing surface elevation and have a finished floor elevation of approximately 735.5 feet. To ensure that trees indicated to remain on site are protected during construction and promptly and properly treated and repaired if damaged, a landscape architect and arborists from the Chadwick Arboretum and Learning Gardens will be available for consultation. Temporary fence will be erected around the drip line of trees and vegetation selected to remain. The temporary fencing will ensure that construction materials are not stored within the drip line and that vehicles and foot traffic are not permitted within this area. The fence will be removed when construction is complete. Figure 2-5 shows the plan for tree removal, transplant, and preservation. The Ohio 4-H Center's construction document package includes provisions for the installation and maintenance of lawn, grasses and exterior plants after construction. A qualified landscape installer will be employed to ensure the successful establishment of exterior plants.

During construction, measures would be taken to prevent soil sedimentation into the stormwater system as permitted through the National Pollutant Discharge Elimination System (NPDES) general permit. To minimize impacts associated with particulates, best management practices (BMPs) such as covering of dirt stockpiles and application of water sprays would be implemented. During construction the site would employ surface stabilization after clearing, silt fences and inlet protection. A temporary on-site detention pond would be constructed to store all groundwater encountered during borehole drilling. If groundwater is turbid it would be stored in the detention pond until suitably clarified for disposal through area storm sewers. The heat exchanger boreholes would be installed using two diesel drill rigs equipped with standard steel drill rods using sonic drilling techniques (Jackson Geothermal, personal communication on October 6, 2006). Each borehole will have an external diameter of 4.5 inches. Potable water supplied by the Columbus Division of Water will be used to aid the drilling process. No soil will be removed during borehole installation.

East Exterior

Great Hall

Interior View

Reception Area

Sketch By Gary Bumpus

Ohio State 4-H
Green Building Project

FIGURE 2-1.

Drawn By: connellkl
Date: 2006/07/26

Ohio State 4-H Center,
3-D Computer Model Images

South West View

West Main Entrance

South East View

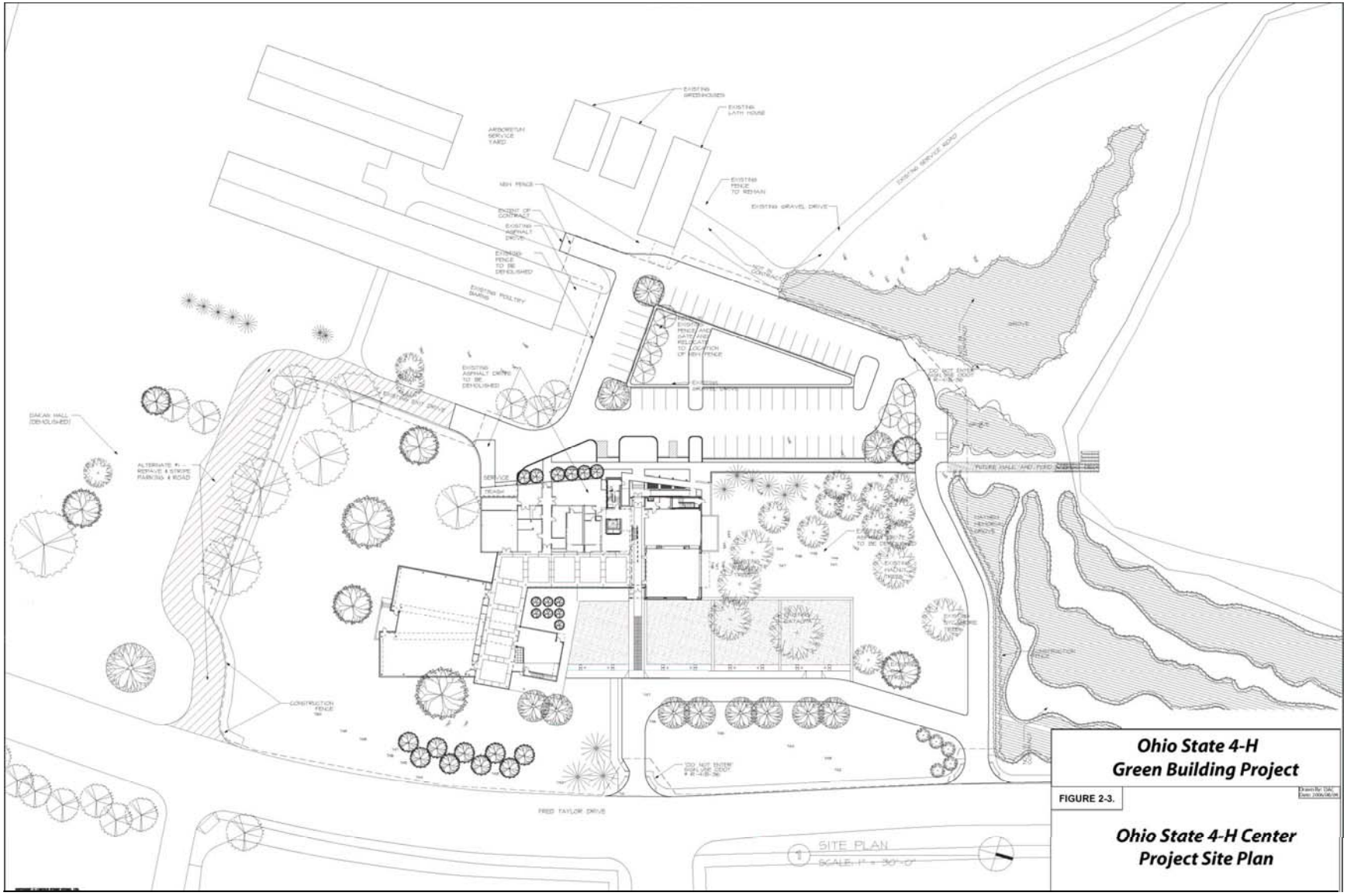
South East View

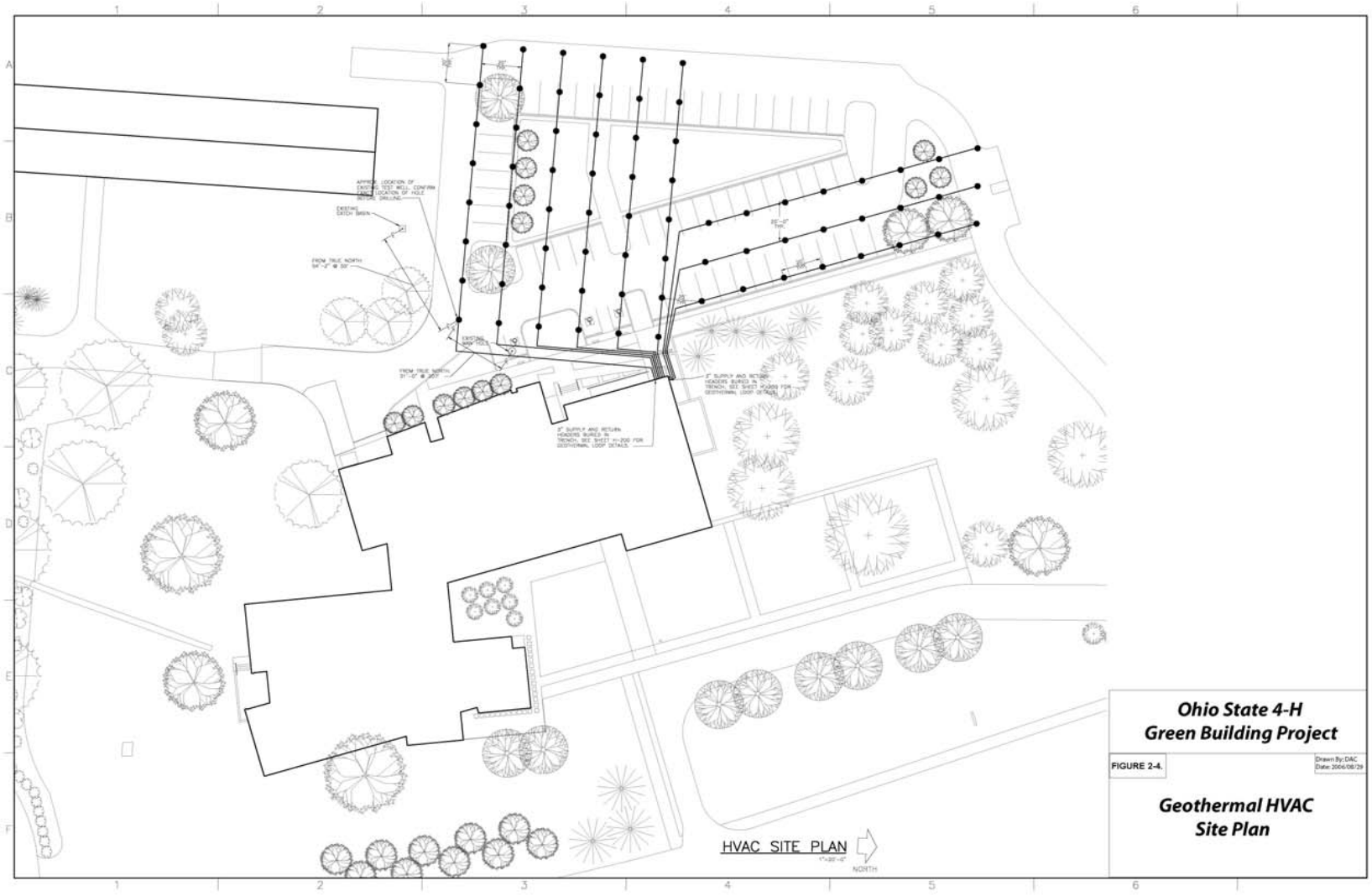
Ohio State 4-H
Green Building Project

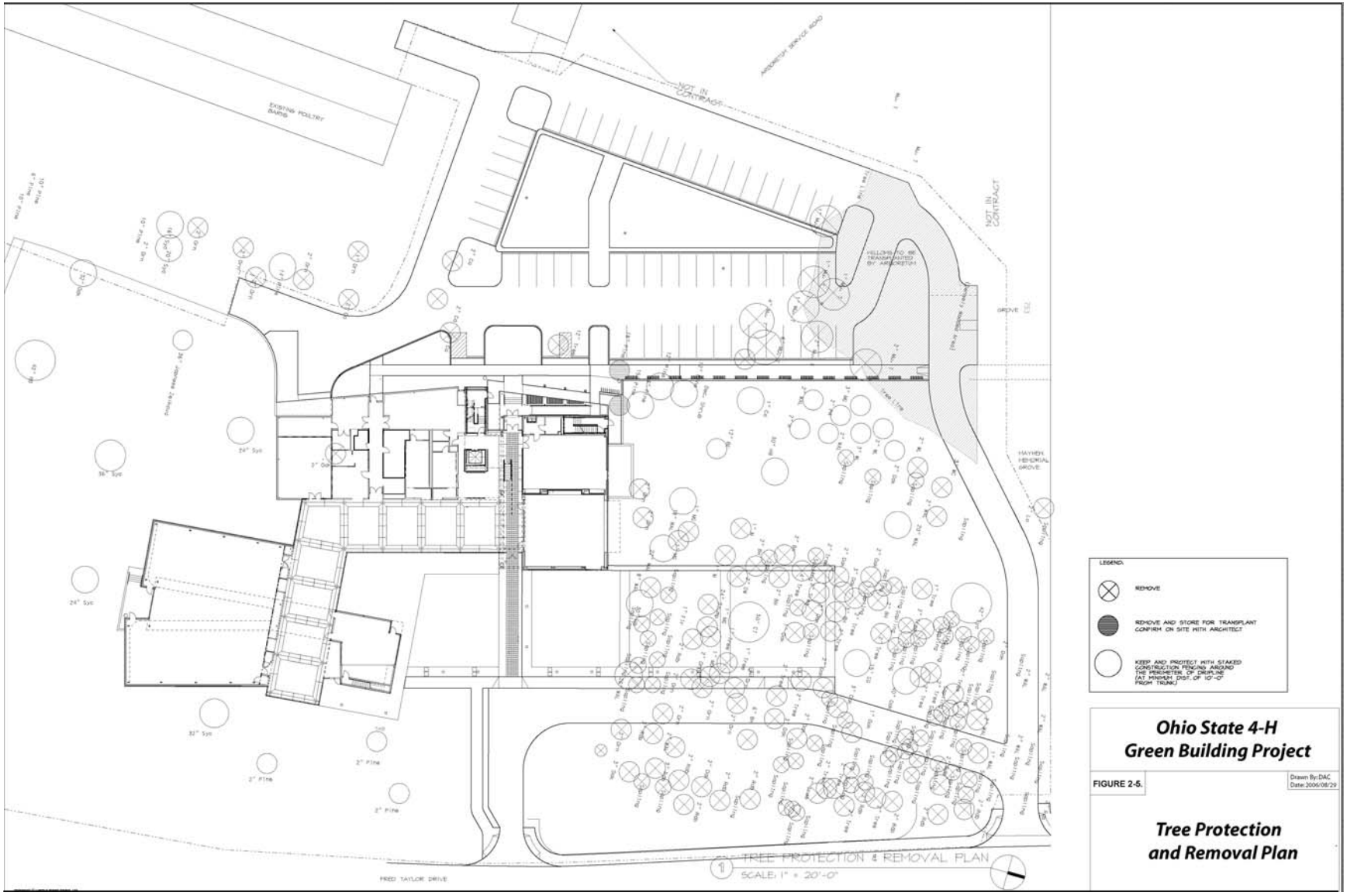
FIGURE 2-2.

Drawn By: cornelkl
Date: 2006.07.26

Ohio State 4-H Center,
Photographs of Physical Model


Ohio State 4-H
Green Building Project
FIGURE 2-3.
Ohio State 4-H Center
Project Site Plan
SITE PLAN
SCALE: 1" = 30'-0"
FRED TAYLOR DRIVE


Ohio State 4-H
Green Building Project
FIGURE 2-4.
Geothermal HVAC
Site Plan
HVAC SITE PLAN
NORTH


NOT IN CONTRACT
EXISTING POULTRY BARNS
NOT IN CONTRACT
YELLOWS TO BE TRANSPLANTED BY ARBORETUM
GROVE
HAYHEN MEMORIAL GROVE
FRED TAYLOR DRIVE
LEGEND:
REMOVE
REMOVE AND STORE FOR TRANSPLANT CONFIRM ON SITE WITH ARCHITECT
KEEP AND PROTECT WITH STAKED CONSTRUCTION FENCING AROUND THE PERIMETER OF DRIPLINE (AT MINIMUM DIST. OF 10'-0" FROM TRUNK)
Ohio State 4-H
Green Building Project
FIGURE 2-5.
Drawn By: DAC
Date: 2006/08/29
Tree Protection
and Removal Plan
1 TREE PROTECTION & REMOVAL PLAN
SCALE: 1" = 20'-0"

Building Description

The Ohio 4-H Center has been registered with the U.S. Green Buildings Council (USGBC), and the design is currently undergoing review for Leadership in Energy and Environmental Design (LEED) certification. The LEED Green Building Rating System® is a voluntary, consensus-based national standard for developing high-performance, sustainable buildings. LEED was created to define "green building" by establishing a common standard of measurement, to promote integrated, whole-building design practices, to recognize environmental leadership in the building industry and to raise consumer awareness of green building benefits (USGBC 2006). No findings from the USGBC regarding the Ohio 4-H Center are available at this time.

The OSU Office of Facilities, Operations, and Development, which includes the Offices of the University Architect and Engineer, reviewed the Ohio 4-H Center plans for conformity with university regulations and standards. No report of deficiencies or lack of conformance with standards was made.

2.1.4 Environmental Management Commitments

During construction, the Ohio 4-H Center will implement the following environmental management commitments:

- The use of paints, coatings, sealants, adhesives and carpets that have a low VOC content to reduce the levels of ozone (O_3) that would be generated (VOCs and NO_x react in the atmosphere to generate O_3.).

- Construction would preferentially use regional materials and products that are extracted and manufactured within 500 miles of the site. Reducing the length of material transportation reduces the emission of criteria pollutants from motor vehicles.

- The project is planned to utilize 282 tons of structural steel produced in domestic mills containing at least 90% total recycled content.

- Water efficiency would be achieved by using water conserving plumbing fixtures (e.g. dual flush toilets, waterless urinals, and faucet sensors).

- At least 50% of the construction debris would be recycled.

- Highly reflective roof material and parking surfaces would be used.

- Monitoring systems would be incorporated into the building design to measure energy use and consumption, and carbon monoxide levels and ventilation.

Based on a preliminary energy analysis performed by W. E. Monks & Company that compared a budget building design representing minimum standards in terms of energy efficiency for a building built today with the proposed design for the Ohio 4-H Center, it is estimated that the proposed energy efficiency design of the Ohio 4-H Center is planned to result in yearly annual savings of 30% for heating, ventilating and cooling alone. (W. E. Monks & Co. 2004).

Permits and Coordination with Agencies

A NPDES general permit for the Ohio 4-H Center was issued by the Ohio Environmental Protection Agency (Ohio EPA) on September 7, 2006 (Trishman, M., OSU Project Manager, personal communication on October 9, 2006). This permit reviews the measures to prevent soil sedimentation in the stormwater system during construction. The Ohio Department of Commerce, Division of Industrial Compliance issued a Certification of Plan Approval for the Ohio 4-H Center Project in February 2005 and granted an extension to this permit in February 2006 (Personal communication with Jeff Snively, Lincoln Street Studio on September 21, 2006).

2.2 DESCRIPTION OF THE NO ACTION ALTERNATIVE

The No Action Alternative would involve a DOE decision to not provide funding for the Ohio 4-H Center. OSU has already started the construction phase of the 4-H Center project, so for NEPA compliance purposes and to create a meaningful No Action scenario, impacts addressed in this EA are as compared to pre-construction baseline conditions. DOE funding for this project is contingent upon finding that there are no significant environmental impacts associated with the construction of the proposed facility. Should DOE conclude that there are significant impacts associated with the project, no DOE funds will be committed to the construction effort.

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