When the sun rises, I go to work.
When the sun goes down, I take my rest.
I dig the well from which I drink.
I farm the soil that yields my food.
I share creation. Kings can do no more.

Ancient Chinese 2500 B.C.
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Introduction
Today the rural environment includes many occupations besides farmers. It includes thousands of individuals who live in rural areas but work in nearby towns or cities. The rural environment includes a constant daily flow of population between city and country. With the rise in the number of people moving out to rural areas, planning for family needs and concerns within the rural environment becomes extremely important.

Life in rural areas is the embodiment of several norms: a healthier environment, an enhanced family life, and a simpler and less intense lifestyle which comes closer to the often held ideas of self-sufficiency and individualism. Within this frame-of-mind, planning involves the development, conservation, and management of human and natural resources, as well as the development of a purposeful and coherent policy for both present and future.

This study centers upon enhancing the lifestyle of the Uhl family of Yountsville, Indiana. The Uhls are one family who belong to a large group of Americans who have moved out of urban areas in order to establish a simpler lifestyle in rural areas. Like thousands of other families, the Uhls are developing a lifestyle which is characterized by: a limited degree of self-sufficiency (i.e., growing a large percentage of their food), social/family growth (i.e., establishing roots), and enjoying specific pursuits (i.e., gardening and outdoor recreation) while living in a beautiful natural setting.
The Uhls have background characteristics which are very common among people migrating to rural areas. The majority of these migrating families lived in a large central city before they moved to rural areas and these same people also grew up in suburban areas. The majority of the new rural population also holds a professional position and a high percentage of this group has over 16 years of education.¹

Since 1970, Indiana, a predominantly rural state with 51 percent of its population living in towns or small cities under 10,000 population or in dispersed rural areas, increased in population by approximately 3 percent. Over the same time period, Montgomery County, the county of residence for the Uhl family, grew in population by approximately 1 percent, from 34,200 to 34,550. Of this figure, approximately 65.3 percent are 20 years of age or older, and the median age in the county is about 29.²

The highest percentage of employed people work in manufacturing, and trade is the second most popular job occupation. Agriculture and related services are the third highest job category for people in the county, while finance-related jobs are fourth.³


Although agriculture is the third most popular occupation filled by county residents, 49.2 percent of the county population lives in rural areas in the county. Also important to note is the fact that "professional" occupations in the county have grown by over 30 percent since 1970 and the median income in the county has risen to approximately $15,000.4


History of Self-Sufficiency/Energy Conservation
Self-sufficiency/energy conservation has been a part of civilization since the beginning of time. Prehistoric man lived in earthsheltered dwellings and orientated openings so that they could take advantage of the sun's warming rays. The ancient Romans employed trellises as a way of cooling outdoor areas in their private gardens. They would also use running water in their gardens to cool seating areas. The combined use of water and trellises proved to have a significant effect on the microclimate in the Roman garden.

In the seventh century, the Persians were the first civilization to use windmills. The power that was harnessed from the wind was used to grind grain and pump water. Genghis Khan brought the idea of the windmill back to China and improved on the design.

European settlers who came to America in the 1600's depended on renewable energy sources for subsistence. In the bitter climate of New England, south-facing houses were built to capture maximum heat from the sun. New England "saltbox" homes evolved to meet the rigors of the regional climate. Saltbox houses were two-story structures with south-facing windows in front and roofs that sloped to a single story on the north side. This long-sloped roof provided protection from the winter winds. Often, a cover of deciduous vines provided shade in the summer and when it dropped its leaves in the winter, it let the sun warm the house.
Since Colonial days, rural American farmers employed renewable energy sources for specific applications. Farmers used windmills to pump water and generate electricity. Windbreaks were also used extensively to block wind and conserve energy in and around farm buildings. Conserving building heat was also achieved by insulating the lower portion of farm buildings with hay or dry leaves and cornstalks.
Site Survey
Montgomery County is an area made up of approximately 324,480 acres (507 sq. mi.) located in west-central Indiana. Within the county, 273,360 acres are used for agricultural purposes, 27,920 acres are designated as forested areas, and 9,300 acres are classified as urban.5

The town of Crawfordsville (pop. 15,000) is the county seat. Crawfordsville is approximately 50 miles northwest of Indianapolis.

Yountsville (pop. approximately 150) is located about 4 miles southwest of Crawfordsville and the UH1 Homestead is approximately 7 3/4 miles from the center of Crawfordsville.

The site is surrounded by forests on the north and west sides and there is one residence located to the west of the site and two homes located to the north of the site.

The land adjacent to the east of the site is used solely for agricultural purposes. The land to the south of the site is divided by a sharp incline and a gravel road (300 S). The land is used primarily to grow corn but a smaller trailer park exists to the southeast of the site. Sugar Creek also flows through this piece of land.

The south and east sides of the site are very open with the exception of the east side when the corn is full grown. A strong positive visual quality surrounds the site, especially toward the south with its view of Sugar Creek. The only negative impact exists to the southeastern part of

the site where a trailer park is located. The two-lane
gravel road (300 3) adjacent to the south end of the site
causes very little visual problem since it is located at
the bottom of an incline, but noise from the road becomes
an occasional problem.

The five-acre homestead is visually interesting. The
area on the southern part of the site is rather flat with
the exception of the steep incline adjacent to the gravel
road. On this part of the site is the driveway, house and
yard, garden, chicken coop, and a partially torn down barn.
Immediately north of the lawn area (north of the house) is
what remains of an apple orchard. North of the orchard is
an old agricultural field which has been levelled through
successive plowing. All of the site, with the exception of
the yard and garden area, is covered with scrub and is
slightly hilly.
SITE Survey

Open Field
- Neutral visual impact
- Access linked to work center
- Covered with shrubs
- Wooded area
- Strong visual impact

Existing Orchard
- Neutral visual impact
- Access linked to work center

Outdoor Work Zone House
- Strong visual impact
- Garden, chicken coop
- Barn, water well
- Storm sewer
- Eroding topography

Incline
- Noise & dust from road
- Steep incline
- Neutral visual impact
- Covered with shrubs, steep slope
- Visual barrier from road

Driveway
- Long, open view
- Down grade, gravel

Trailer Park
- Negative visual impact
- Light traffic
- Noise & dust

AGRICULTURAL FIELD

↑ NORTH!!
Site Inventory

Soils
Climate/Microclimate
Orientation/Topography
Runoff (Drainage)
Existing Land Use/Views
Vegetation/Utilities
The following is a description of the different types of soil found on the site.

**MSL:** Miami Silt Loam is a mellow, friable soil of easy tillage. Its loamy structure allows the free circulation of air and moisture and the land is in condition to plant at a relatively early date. The internal drainage is not sufficiently free to make the soil unretentive of moisture.

Truck crops and fruit are grown for home consumption in all parts of the county. Apples, pears, cherries, grapes, other small fruits, and most vegetables do well.

The Miami silt loam is naturally deficient in organic matter. This should be supplied by manure, the most valuable means of adding organic matter to the soil. Alfalfa, clover, and other leguminous crops also help maintain the nitrogen content of the soil through their ability to collect this constituent from the air.

**CSL:** The soil of the Clyde silty clay loam to a depth of 8 to 15 inches is a black or dark-grey heavy silt loam or silty clay loam. The characteristic dark color is due to the high content of organic matter. The subsoil is a drab-colored, sticky, and plastic silty clay, which varies to a mottled yellow and light-gray color.

This type of soil requires care in handling it. If worked when too wet, large clods form, which are subsequently pulverized with difficulty. Also, when disturbed in this condition, the soil is likely to run together and assume a hardened condition on drying out, frequently cracking.
The surface of this type of soil is level or slightly depressed, and the natural drainage is poor. However, this soil is especially adapted to corn and grass.

FSL: The Fox silt loam consists of a light-brown silt loam to a depth of about 15 inches, where it is underlain by a brownish heavy silt loam or silty clay loam. Below this material, at an average depth of about 30 inches, sandy clay of a slightly reddish brown color is encountered. Beds of gravel from four to seven feet below the surface insure good natural drainage.

The Fox silt loam is very suitable for most fruits and vegetables that are grown in the area. It is especially well suited for tomatoes, strawberries, lettuce, and other market-garden produce. 6

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The site of the Uhl homestead has a general climate which it shares with the surrounding area. Within the general climate area is included an entire series of microclimates that are affected by particular natural conditions. Examples of these conditions are: tree groupings, slopes, exposed flat areas, and the total land area of the site.

Man functions best within a given range of climatic conditions. The elements affecting climatic conditions include: air temperature, solar radiation, air movement, and humidity and precipitation.

Architectural elements can also affect climate. Along with this, manipulation of natural elements can affect the microclimate and energy usage of buildings.

A careful analysis of climate is very important when considering energy conservation. Therefore, it is necessary to analyze the precise climate of the site, the area, and the region. A study of the microclimate may provide insight into optimum location for functions or activities to best utilize the site to its fullest potential.

Climate information will influence the location for functions or activities through shielding or exposure to the sun, solar penetration and the cover planting in general. Some areas to be considered in microclimates are: cold slopes, warm slopes, and snow accumulation areas. The summer winds come from the southwest. Winter winds generally come from the northwest to west-northwest. The average temperature varies from 27° in the winter to 75° in the summer. The average precipitation for the year is about 39.5 inches.
There is a larger percentage of slopes with a southern exposure (warm slopes) than slopes with a northern exposure (cold slopes). This should be taken into consideration during periods of heavy snow.

<table>
<thead>
<tr>
<th></th>
<th>Air Temp.</th>
<th>Average High</th>
<th>Temperature</th>
<th>Wind Speed</th>
<th>Precipitation</th>
<th>Average Days Rain/Snow</th>
<th>Days of Possible Sunshine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan.</td>
<td>39.7/24.3</td>
<td>72.2°</td>
<td>11.1 NW</td>
<td>2.57</td>
<td>12</td>
<td>55%</td>
<td></td>
</tr>
<tr>
<td>Feb.</td>
<td>38.8/25.2</td>
<td>70.0°</td>
<td>11.2 W-NW</td>
<td>2.07</td>
<td>11</td>
<td>44%</td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>45.9/27.8</td>
<td>78.8°</td>
<td>11.9 W-NW</td>
<td>3.03</td>
<td>12</td>
<td>49%</td>
<td></td>
</tr>
<tr>
<td>April</td>
<td>59.5/38.2</td>
<td>88.1°</td>
<td>11.5 SW</td>
<td>4.24</td>
<td>13</td>
<td>48%</td>
<td></td>
</tr>
<tr>
<td>May</td>
<td>76.5/54.4</td>
<td>91.8°</td>
<td>9.7 SW</td>
<td>4.50</td>
<td>13</td>
<td>47%</td>
<td></td>
</tr>
<tr>
<td>June</td>
<td>81.2/61.7</td>
<td>91.4°</td>
<td>8.5 SW</td>
<td>4.68</td>
<td>11</td>
<td>55%</td>
<td></td>
</tr>
<tr>
<td>July</td>
<td>84.0/63.0</td>
<td>74.8°</td>
<td>7.4 SW</td>
<td>3.82</td>
<td>9</td>
<td>51%</td>
<td></td>
</tr>
<tr>
<td>Aug.</td>
<td>84.9/67.3</td>
<td>73.0°</td>
<td>7.2 SW</td>
<td>3.21</td>
<td>8</td>
<td>58%</td>
<td></td>
</tr>
<tr>
<td>Sept.</td>
<td>72.4/52.7</td>
<td>66.1°</td>
<td>8.1 SW</td>
<td>3.16</td>
<td>7</td>
<td>60%</td>
<td></td>
</tr>
<tr>
<td>Oct.</td>
<td>61.8/44.0</td>
<td>55.1°</td>
<td>8.9 SW</td>
<td>2.61</td>
<td>7</td>
<td>57%</td>
<td></td>
</tr>
<tr>
<td>Nov.</td>
<td>56.1/36.7</td>
<td>41.4°</td>
<td>10.7 SW</td>
<td>3.16</td>
<td>10</td>
<td>38%</td>
<td></td>
</tr>
<tr>
<td>Dec.</td>
<td>39.5/26.0</td>
<td>30.3°</td>
<td>10.5 SW</td>
<td>2.51</td>
<td>11</td>
<td>29%</td>
<td></td>
</tr>
<tr>
<td>Annual</td>
<td></td>
<td>51.8°</td>
<td>39.58</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ORIENTATION/TOPOGRAPHY

ORIENTATION of SLOPE

0-5% 0-5% CHANGE in Topography

5-10% 5-10% CHANGE in Topography

10-15% 10-15% CHANGE in Topography

15-20% 15-20% CHANGE in Topography

20%+ 20%+ CHANGE in Topography

NORTH
RUNOFF

- VERT SLOW RUNOFF
- SLOW RUNOFF
- MODERATE RUNOFF
- RAPID RUNOFF
VEGETATION/UTILITIES

- CANOPY TREE
- CLUSTER OF TREES (20'-65', LOCUST, ETC.)
- EVERGREEN TREE
- APPLE TREE
- ORNAMENTAL
- LARGE SHRUB
- AREA OF SCRUB
- X ELECTRIC/TELEPHONE LINES
- AMMONIA LINE
- WATER WELL
Site Analysis
Site Development Criteria
Site Development Criteria

The general site development criteria act as guidelines toward development of the homestead. The criteria should basically center upon the following:

* Increase the food production on the site to a limited degree.
  - utilizing an orchard, garden frames, solar greenhouse, and other vegetative food sources.
* Aid in development of energy sources/energy use modifiers on the site.
  - utilizing a woodlot, solar greenhouse/solar collectors, wind generator, and vegetative climate modifier.
* Increase the recreational potential of site.
  - utilizing trails, open space, and pond.
* Enhance site by controlling detrimental factors.
  - utilize erosion control, dust and herbicide control, view control, and glare/reflection control.

Energy

Energy is really the key to the self-sufficient lifestyle. Energy affects all aspects of any lifestyle, so in being able to reduce the dependence on costly energy, one can attain a more independent lifestyle. In determining how to handle the energy needs of the Uhl's and the necessary energy applications, the following criteria must be analyzed:

Amount of Energy Costs/Savings/On Site Energy Generation


b. Site Improvements which Respond to Energy Conservation.
c. Evaluate Site for Wind Energy Collection.
d. Evaluate applications to help determine which bring about the greatest savings (100 percent is ideal).
e. Affordability.

Food

Food needs are an important aspect of self-sufficiency. Considerable energy is used in the production of food, so home grown foods end up being more labor intensive. Home grown food is also healthier since there are less preservatives used in them. Of major importance, too, is the self-satisfaction of growing your own food. In understanding the importance of food needs, the following criteria are analyzed.

Amount of Food Costs/Savings/On Site Food Generation
a. Evaluate site for maximizing seasonal production of food crops.
b. Recycling.
c. Introduction of additional food sources.
d. Introduction of methods for extending growing season.
e. Affordability.

Transportation

Transportation comes into play when considering the self-sufficient concept. A more self-sufficient homestead would rely less on off-site considerations which would have a big effect on transportation. Transportation, therefore,
is directly related to other issues such as energy and food. The more self-sufficient the landscape, the less dependence on energy usage for transportation. Criteria for transportation are primarily tied to criteria for other areas. This criteria basically revolves upon the following main theme:

Evaluation of site for maximizing year-round activities on it.

Active Recreation/Passive Recreation

Active and passive recreation play an important part in developing a stronger relationship to the site. Recreation affects the lifestyle of all people and the Uhl's are particularly interested in developing this concept on their site. The following criteria should be analyzed:

Active Recreation

a. Introduction of trails for hiking, learning (education on nature and natural systems).

b. Evaluation of site for development of pond (passive, active).

c. Evaluation of site for open space activities.

Passive Recreation

a. Evaluation of site to identify passive use areas.

Early Retirement/Homestead Management

Early retirement and a life dedicated to enjoying a simpler way of living which employs the aforementioned aspects of a more self-sufficient lifestyle are important considerations. Incorporated in this concept is the manag-
bility of site applications. A self-sufficient homestead requires that time be dedicated to the maintenance of operations on the site. With this in mind, the preceding criteria should have this as an underlying objective.

Energy/Self-Sufficient Applications

In developing a more energy efficient homestead, energy uses and energy-use patterns must be examined. The physical surroundings, designed for efficient living must be combined with the same psychological commitment to energy conservation and the use of renewable energy sources.

Energy Sources

Passive energy supplies are those which stress the reclamation of energy, generally in non-mechanical ways. This includes recycling and conservation, composting and the use of nitrogen-fixing plants, passive solar, and on-site food production.

Active energy supplies may be defined as those which employ mechanical means of extracting usable energy from an energy source. These means include wind generators, active solar systems (photovoltaic cells and collectors), the combustion of organic materials (the Utis presently use a wood-burning stove), and methane production.*

Applications Used to Enhance Self-Sufficiency

Raised bed garden (already in practice on site): Gardening is perhaps the most common method of the self-sufficient applications. Raised bed gardening is probably the

*Certain energy conserving applications are not included because of cost and site factors.
most popular gardening method among those seeking to produce foods in high quantity. Raised beds use about 1/100 as much energy and about 1/8 as much water as does commercial agriculture. Of vital importance is the placement of the garden in an area where the soil is good and sunshine is very accessible.

Raised beds rise above the ground approximately 18 inches. The raised soil bed acts like a "cushion" of well-worked soil and this "cushion" helps plants send their tiny root hairs to gather water and nutrition (supplied by compost ashes, bone meal, and other such organic plant foods) that are necessary to healthy, insect-resistant, nutritious, and delicious vegetables.

The raised bed garden is usually 10 to 18 inches above ground level and the edge of the usually 5 inch wide beds are angled down at a 45° slope. This effectively provides more growing area than if the same piece of ground were left flat. The raised bed garden on the Uhl homestead provides 50 percent of their food needs and saves them over 50 percent a year on their food costs.

Garden Frame: A garden frame extends the growing season of plants since it protects plants from light frost. The enclosed frame has a transparent cover on top which allows sunlight to enter through it while keeping colder weather out. A properly used garden frame can extend a growing season in the Midwest by approximately three months. A garden frame on the Uhl homestead can provide approximately 1½ percent more food.
Orchard: A small orchard will enable a family to grow varieties of fruit that are superior to commercial crops in flavor, texture, and length of bearing season.

Nut trees will also provide for a family, as well as provide some of the best wood for either building or fuel. Nuts add nutrition (protein, vitamins, minerals), rich flavor, and crunchy texture to numerous main dishes, baked goods, confections, or salads. The wide variety in both size and shape among nut trees makes it likely that one is available for a person's specific needs.

A small orchard with 10 regular apple trees can provide over 400 bushels of fruit per year. An important consideration with orchards is locating them in areas of good sunlight and good soil condition.

Solar Greenhouse: The solar greenhouse differs from other greenhouses in that it involves the most efficient collection of solar energy, its storage, and the prevention of heat loss during the following collection period. The benefits of the solar greenhouse are that surplus thermal energy produced in winter can be used immediately or stored for later use, independence from mechanical heating/cooling devices powered by fossil fuel is achieved, and food can be grown in the greenhouse on a year-round basis. A solar greenhouse should be orientated toward the south-southwest to receive as much sunlight as possible. On an average, a typical solar greenhouse could save 30 to 40 percent on heating bills.
Windpower: The major factors responsible for output of a particular wind machine are area and wind speed. Of these two factors, wind speed has the greatest effect. A minimum average wind speed of seven miles per hour is required to operate a windmill. Twice the normal wind speed will result in a power output eight times the original output. It is important then to locate wind machines in such a way so as to take best advantage of prevailing winds. Wind speed is affected by topography (hills and valleys) and surface roughness (buildings and trees). Surface roughness will naturally tend to reduce wind speed near the ground. Wind speed will continue to increase at higher elevations. A small windmill can generally provide 40 to 50 percent savings over regular electricity cost in Indiana.

Woodburning Stove: The woodburning stove is one of the most popular energy efficient devices available today. The stove in the Whl homestead provides 50 percent in savings over oil furnace use and uses 4 cords of wood per year.

A woodlot in the site could provide wood that is needed to keep the wood stove operating. The following types of trees are excellent sources of wood as far as BTU values: ash, red oak, white oak, beech, birch, hickory, hard maple (sugar, black), and dogwood.

Windbreaks:* Shelterbelts are trees planted in several rows and act similarly to porous fences in controlling wind and snow. However, they protect a much larger area than solid open fences and are often used to protect an entire farm-
stead. Shelterbelts are most effective if located about 150 feet upward from areas to be protected.

From a heat management standpoint, the best trees to plant around a home or farmstead area are evergreen species on the north and west sides to break the winter wind. Through the use of shelterbelts an energy savings of up to 20 percent can be realized.

Energy Acres:

Energy Acres are a way of fulfilling two major site objectives: First, fostering economic benefits for the homeowner by providing all his firewood needs through the use of a renewable, inexpensive energy source; and secondly, to enhance the natural environment through sound conservation practices. Energy Acres are basically a way of providing small landowners the opportunity to grow their own firewood on a small parcel of land (one to two acres). On the parcel of land, fast growing hard woods could provide fuelwood within 15 years.

Solar Batch Hot Water Heater:

Solar batch heaters are devices which catch the sun’s rays and use this energy to heat hot water. A typical batch collector uses solar radiation reflected off a reflective parabolic dish to heat water which is stored in a hot water tank that is painted black. This water is then piped into the existing plumbing system.
Location of collectors is probably the most important consideration to deal with. Solar skyspace is the area between a building's solar collectors and the sun. This area must be kept free from obstructions. At Crawfordsville's latitude (approximately 40° north) on December 21st, 90 percent of the sun's energy is received between the hours of 8:00 a.m. and 7:00 p.m. The bearing of the sun at these times is within 45° of due south. Thus, an area above 12° altitude and within 45° either side of south should be kept free of obstructions.

The use of a batch collector could provide 100 percent of the Uhl's hot water needs.

General Site Improvement/Enhancement:

A few general site improvements will be incorporated in the site development as requested by the owners. Of concern to the Uhls are the concepts of screening some undesirable views to the southeast, erosion control and noise/dust control on the south end of the site, and herbicide control along the area north of the driveway. Also of importance is glare and reflection control.

Another element that the Uhl's believe would enhance the site and provide food for them would be a pond. The pond would also serve as a source of recreation (swimming and fishing) as would the development of open space. Trails throughout the site would also enhance it by encouraging the educational aspect of development of the site.
Site enhancement could eventually include a waste disposal system. Waste can be taken care of in a self-contained, waterless, and odorless treatment system which requires no chemicals and has no polluting discharge. Human and organic waste can be decomposed biologically and converted into fertile, organic compost which can be used in a garden. A conventional toilet uses approximately 90 gallons of water a day for a family of four and this can be saved by a compost toilet system.

Vegetation can be used in a variety of ways.* A solid row of dense shrubs planted around the base of a structure tends to create a "dead air space" and thus improves the insulation value of the foundation or basement. Insulation could also be added inside the house for greater energy savings.

In summer, a properly located planting can channel air currents to remove heat by increasing wind velocity around a house.

Also, a dense tree area has a substantial cooling effect. On a hot summer day, there is up to a 10° difference in temperature between an open field and a grove of trees. This is more than shade effect. The leaves of one mature tree can evaporate over 200 gallons of water per day, producing an evaporative cooling equivalent to an 8 to 10 room air conditioner.

The following matrices reflect the suitability and spatial relationship between different spaces and functions. These matrices will help in the conceptual development.

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*See Appendix II.
<table>
<thead>
<tr>
<th>FUNCTION/SPACE</th>
<th>SLOPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5%</td>
<td></td>
</tr>
<tr>
<td>5-10%</td>
<td></td>
</tr>
<tr>
<td>10-15%</td>
<td></td>
</tr>
<tr>
<td>15-20%</td>
<td></td>
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<tr>
<td>20%+</td>
<td></td>
</tr>
<tr>
<td>OPEN SPACE</td>
<td></td>
</tr>
<tr>
<td>Woodlot</td>
<td></td>
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<tr>
<td>Orchard</td>
<td></td>
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<tr>
<td>Pond</td>
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<td>Trails</td>
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<td>Garden Frame</td>
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<td>Solar Greenhouse</td>
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<td>Wind Generator</td>
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<td>Veg. Climate Modifier</td>
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<tr>
<td>Veg. Food Source</td>
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<td>Erosion Control</td>
<td></td>
</tr>
<tr>
<td>Dust Control</td>
<td></td>
</tr>
<tr>
<td>Herbicide Control</td>
<td></td>
</tr>
<tr>
<td>View Control</td>
<td></td>
</tr>
<tr>
<td>Glare/Reflection Control</td>
<td></td>
</tr>
</tbody>
</table>

**SUITABILITY**
- ◆ HIGH SUITABILITY
- ◇ MODERATE SUITABILITY
- ▲ LOW SUITABILITY

**RELATIONSHIP**
- ◆ CO-OCCUPANT
- ◇ ADJACENT
- ● NEAR
- ○ REMOTE
- ⊕ NO RELATIONSHIP
Open Space

Open space on the site have certain criteria which relate to the suitability of conditions on the area and the relationship it has to other spaces. The following are criteria for open space development on the site: Soil condition should be good or moderate, some slight variation in topography, an orientation toward warm areas, some runoff, some variety of views and canopy. The area could occupy the same space as the wind generator and should be by the greenhouse. Other spaces which could be located nearby include: garden frames, trails, pond, woodlot, and orchard.

Woodlot

A woodlot on the site would have to meet certain criteria for development. This would include good soil suitability, slight slope with moderate runoff, south-southwest orientation for sun and warm weather, and be developed in an open area. The woodlot could co-exist with trails and also serve as a vegetative climate modifier. The woodlot should be near the pond, open space, and orchard but farther away from the wind generator, garden and solar greenhouse.

Orchard

The criteria for the development of an orchard are as follows: Good soil with slight slope and moderate runoff, a south-southwest orientation for sun (warm area), and be developed in a fairly open area. The orchard could relate to other functions such as erosion control, dust control,
vegetative climate modifier (food source), and view and glare control. Trails should be adjacent and the orchard should be near the pond, woodlot, open space, garden frame, and greenhouse.

Pond

The pond has certain criteria which should be met. These include lack of drainage (soil), moderate slope, south-southwest orientation (warm), screen views, and developed in an open area. The pond should relate strongly to such things as erosion control, vegetative climate modifiers, vegetable food sources. Of importance also is its location adjacent to trails and near the orchard, woodlot, open areas, garden frames, and greenhouse. The pond would be located farther away from the wind generator.

Trails

The development of trails on the site involves a specific set of criteria. Of importance is good soil on a variety of slopes with moderate runoff, a variety of views, climate, and vegetative cover. Trails would be found around with the woodlot, glare/reflection control, wind generator, solar greenhouse, vegetable food source, pond, garden frame, and vegetative climate modifiers. Trails would be near open space and farther away from dust, herbicides, and view controllers.

Garden Frames

The criteria for garden frames are as follows: area
of good soil with a slight slope and south-southwest orientation for sunlight (warm); this area should be open. Adjacent to the garden frames should be trails, open space, pond, and greenhouse. Near the garden frames should be the orchard and wind generator. Farther away from this area is the woodlot and other vegetative climate modifiers.

**Solar Greenhouse**

The criteria for the development of this activity include good soil with slight slope and south-southwest orientation in an open area. This activity co-exists as an energy source and food source. Adjacent to this area are the garden frames, trails, and open space. Near this area is the pond, orchard, and wind generator. The woodlot and vegetative climate modifiers should be farther away.

**Wind Generator**

A wind generator on the site has certain criteria which must be realized for its development. The criteria include slight slope with a west orientation in an open area. The wind generator co-exists with open space and adjacent to trails. It should be near the pond, vegetative climate modifiers, solar greenhouse, and garden frame. The orchard and woodlot are farther away.

**Vegetative Climate Modifier**

The criteria for this include good soil with moderate runoff and a north-south orientation in warm or cold areas in an open area. This could co-exist with view and glare/
reflection control, vegetative food source, dust, erosion, and herbicide control.

**Solar Batch Hot Water Heater:**

The criteria for the development of this activity primarily involves orientation toward the south to southwest. This activity should be adjacent to a solar greenhouse and garden frame and near the wind generator. Tall vegetation should be located farther away from this function.

**Vegetative Food Source**

Criteria include good soil with south-west orientation and moderate runoff in an open area. This could co-exist with vegetative climate modifiers, greenhouse, garden frame, orchard, dust and view controls, and glare/reflection control. The vegetative food sources would be adjacent to trails and near pond.

**Erosion Control**

Criteria include steep slope with south-orientation and rapid runoff in an open area. Erosion control could co-exist with dust, herbicide, view, and glare/reflection control. Also included is vegetative climate modifier and orchard.

**Dust Control**

Criteria include south-orientation in open area (without sufficient vegetation). Dust control can co-exist with
erosion control, vegetative food source, vegetative climate modifier, orchard, woodlot, herbicide, view and glare/reflection control. Trails are farther away.

Herbicide Control

Criteria include east-orientation in an open vegetative area. This activity would co-exist with view control, glare/reflection control, dust and erosion control and vegetative climate modifiers. This activity would not be near trails or the woodlot and the orchard.

View Control

Criteria include east-orientation in an open area. This would co-exist with herbicide, dust and erosion control, vegetative food source, climate modifier, orchard, and woodlot. Trails would not be found here.

Glare/Reflection Control

Criteria include south-orientation in an open area. This area would co-exist with view, herbicide, dust, and erosion control. Also included would be vegetative climate modifier and food source, garden frame, orchard, and woodlot. The pond would be adjacent to this area as would the solar greenhouse.
The design concept will reflect certain core development spaces and functions as well as specific spaces/functions which will provide a higher degree of self-sufficiency. These specific spaces/functions were analyzed and the final concept is a reflection of the cost, potential savings, and client preference of the space/function.

Core development spaces/functions include open space development, trails, pond, orchard, foundation plantings, shelterbelts, general vegetative food sources, and dust, erosion, herbicide, view and glare/reflection controls.

Specific spaces/functions include woodlot, photovoltaics, wind generator and solar greenhouse.

Fifteen different concepts are possible with these four different specific spaces/functions. Each of these concepts has the core development spaces/functions plus one, two, three, or all four of the specific spaces/functions. As stated earlier, the final concept reflects the cost of the specific spaces/functions, the potential savings that this concept and the specific spaces/functions will provide, and the client's preference. The concept will specifically include the woodlot and batch collector and within 10 years the potential of a wind generator or solar greenhouse will be looked into.

The following chart summarizes the variables affecting the specific spaces/functions and the combination of these activities in the site development.

*See Appendix III.
<table>
<thead>
<tr>
<th>Concept</th>
<th>Initial Cost of Specific Concept Development</th>
<th>Space Heating Savings</th>
<th>Electrical Savings</th>
<th>Food Savings</th>
<th>Maintenance</th>
</tr>
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<tbody>
<tr>
<td>A (Woodlot)</td>
<td>Very Low</td>
<td>50%</td>
<td>-</td>
<td>-</td>
<td>High</td>
</tr>
<tr>
<td>B (Wind Generator)</td>
<td>Moderate</td>
<td>-</td>
<td>50%</td>
<td>-</td>
<td>High</td>
</tr>
<tr>
<td>C (Solar Greenhouse)</td>
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<td>30%</td>
<td>-</td>
<td>2.3%</td>
<td>Low</td>
</tr>
<tr>
<td>D (Solar Batch Collector)</td>
<td>Very Low</td>
<td>-</td>
<td>48%****</td>
<td>-</td>
<td>Low</td>
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<tr>
<td>AB</td>
<td>Moderate</td>
<td>50%</td>
<td>50%</td>
<td>-</td>
<td>Very High</td>
</tr>
<tr>
<td>AC</td>
<td>Moderate</td>
<td>80%</td>
<td>-</td>
<td>2.3%</td>
<td>Moderate</td>
</tr>
<tr>
<td>AD</td>
<td>Low</td>
<td>50%</td>
<td>48%****</td>
<td>-</td>
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<tr>
<td>BC</td>
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<td>30%</td>
<td>50%</td>
<td>2.3%</td>
<td>Moderate</td>
</tr>
<tr>
<td>BD</td>
<td>Moderate</td>
<td>-</td>
<td>50%+48%****</td>
<td>-</td>
<td>Moderate</td>
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<tr>
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<td>80%</td>
<td>50%+48%****</td>
<td>-</td>
<td>High</td>
</tr>
</tbody>
</table>

*All Concepts will include core development (approx. cost $5,200 to $5,700).

**Low cost range (less than $2,500), moderate cost range (up to $12,000), high cost range (up to $22,000).

***Percent does not include 50% from core development.

****This 48% would be used for hot water heat.
Graphs depicting energy costs vs potential savings

- **Electricity**
  - 1981-82 Average: $437/yr
  - 1981-82 Average: $44/yr
  - 1981-82 Average: $915/yr

- **Wood**
  - # of cords: 4
  - 1981-82 Average: $300/yr

- **Oil (back-up system)**
  - 1981-82 Average: $375/yr
  - 1981-82 Average: $210 (1.09/yr/gal)

- **Total Wood & Electricity Cost**
  - 1981-82: $577.4
  - 1982: $574.4

- **Food Budget**
  - 1981-82 Average: $3220
  - 1981-82 Average: $2100

- **Total food & energy (wood & electricity) cost**
  - 1981-82: $430.4
  - 1981-82: $380.4

**Current self-sufficient/energy conserving applications & savings**

- 65% savings over oil furnace
- 50% of food eaten is grown on site

**Savings provided by self-sufficient/energy conserving applications**

- Additional energy conserving application
- Wood lot
- Small orchard
- Garden frame
- Solar greenhouse
- Wind generator
- Solar batch cooler

*Based on 1982 dollar value*
Site Section B-B
Appendices
Appendix I

Unobstructed winds move over the ground and they encounter objects that detract, deflect, obstruct, and lessen the impact or speed of the flow of the unobstructed wind. These natural elements may affect the wind in two different ways: 1) cut down on the impact of solar radiation or wind, or 2) accelerate or enhance the impact. The speed and direction of wind on a site determines a large part of the climate of an area or site.

Vegetation/Climatic Considerations

Vegetation can have a tremendous affect on altering climatic conditions. It probably can have the most impact on effectively influencing wind.

The means of controlling wind may vary from topography to various types of buildings to walls, fences, vegetation, and other natural or manmade obstructions which occur near the ground. Landforms are usually soft and rolling and have the tendency to pitch wind up or down.

An evergreen or row of evergreens placed next to a wall will create a "dead" air space between the plants and the wall. This space acts similarly to the dead air space in the wall of a house. The temperature difference between the interior of the house and the dead air space is reduced and held relatively constant, thus preventing heat loss from the building. Without evergreens, air currents would create a high temperature gradient and permit warm air to escape through the wall. These evergreens should be dense material
and placed close together.

There are various methods of wind control. These range from complete blockage to filtering, redirecting, channeling, guidance, deflection, or interception. The amount of blockage depends on the structure that is used to block the wind along with the materials used to channel and direct the wind into specific areas. A shelterbelt is a windbreak that is planted perpendicularly to the prevailing winds. Wind velocity may be reduced over 50 percent for a distance 10 to 20 times the tree height downwind from the shelterbelt. The degree of reduction depends upon the height, width, and penetrability of the plants used.

Along with controlling wind, plants also control solar radiation, precipitation and humidity. Deciduous plant materials allow sunlight to penetrate during winter months and provide shade for the same spaces during summer months. Evergreen plant material allow very little sunlight to pass through them at any time during the year.

Rain affects different elements in the environment in a wide variety of ways. For example, evergreen trees intercept raindrops allowing them to lose force before striking the ground, thus lessening the occurrence of splash erosion. This is an important fact to notice, especially since coniferous trees allow 60 percent of rainfall to reach the ground, while deciduous trees allow 80 percent of rain to reach the ground. Evergreen plant material also acts as
an effective barrier to drifting snow. Deciduous plant material is also effective but drifting snow is primarily affected by wind so evergreens usually work better.
Appendix II

On the site of the Uhl homestead, plants play a vital role in the quest for a more self-sufficient lifestyle. Vegetation can function in several ways: as architectural elements, engineering elements, as a source of heat, and as a source of food.

Architectural (Climatological) Uses

Vegetation is used frequently to help create a more comfortable microclimate. Properly used, it will contribute greatly to overall energy efficiency. Vegetation can be used to control the following climatological factors: solar radiation (both direct and reflected), wind, precipitation, transpiration and evaporation, humidity, temperature, and snow drifting patterns.

Engineering Uses

Many times plants become functional elements that help create a more quiet, peaceful, and orderly environment. The following engineering principles could be integrated in the Uhl homestead: erosion control (water and wind), acoustical control (plants absorb and disperse unpleasant noise and mask it with their own sounds), atmospheric purification (plants produce oxygen from carbon dioxide and filter out dust and other particulate pollutants, and glare and reflection control.)
Vegetation as a Source of Food and Heat

Vegetation can serve as a basic source of nourishment by providing fruits, vegetables, and nuts. Trees provide both fruit and nuts while smaller plants can provide vegetables and fruits.

Vegetation can also serve as a source of heat. Maximum use of woodlots as a source of fuelwood can occur without permanent disturbance to the natural environment.

Vegetation is a vital part of the Unl homestead. The functional role of plants as engineering elements, architectural elements, and sources of food and heat should be fully utilized to create a more self-sufficient landscape. Existing vegetation should be preserved and integrated to the greatest extent possible.
Appendix III

Woodlot

- remove clump of scrub planting on eastern border of proposed woodlot area.
- transplant dwarf apple trees into pond area.
- straighten out middle section of path.
- remove scrub material in lower portion of proposed woodlot area.
- transplant two existing apple trees in proposed orchard area.
- provide for truck path and turn-around in central portion of proposed woodlot area.
- discontinue use of path on northern border of proposed woodlot area.
- provide for turn-around in NE corner of site.
- plant 1/3 of proposed woodlot area (A) 1st year (black locust, river birch, sycamore).
- plant 1/3 of proposed woodlot area (B) 5th year.
- plant 1/3 of proposed woodlot area (C) 10th year.
- harvest 1/5 of proposed woodlot area (A) 15th year.
- etc.
- 60 year life expectancy, 6' x 6' plantings, 2 cords per year.
- plant sycamores, river birch (native to Eastern U.S.), and black locust in pattern of river birch (closest to pond), sycamore, and black locust (educate people by pond or energy acres).
- reddish brown exfoliating bark, whitish green exfoliating bark, and dark brown furrowed bark, all have yellow Fall color, medium texture to coarse texture to medium fine texture.

- Sycamore (Platanus Occidentalis): whitish green exfoliating bark, coarse texture, yellow Fall color.

- River birch (Betula nigra): reddish-brown exfoliating bark, medium texture, yellow Fall color.

- Black Locust (Robinia Pseudacacia): dark brown, furrowed bark, medium-fine texture, yellow Fall color.

**Orchard**

- remove 5 scrub trees on south end of existing orchard.

- keep big canopy tree on south end of existing orchard.

- transplant existing 5 apple trees to new configuration.

- transplant dwarf apple trees to pond area.

- Add 5 more apple trees to existing orchard (variety of trees to be selected by owner).

- additional dirt path on north side of proposed orchard for truck pick up.

**Windbreak**

- provide 30% savings on space heating with foundation plantings.

- zone of wind protection 10 times height of pine trees. 5 times height of tree is area of maximum protection.
- 4' earthmound.
- 12 Eastern White Pine
  * trim tree up.
  * plant 3' trees.
  * pine seed is edible, fine texture, fast grower, fruit bearing.
- 23 deciduous shrubs (blueberry, current, or gooseberry).
- evergreens planted first and a few years later plant shrubs.
- partially screen view from house, warning for children.
- seating for volleyball games in backyard, pond area, and around firepit.

Firepit
- outdoor dining and conversation area.
- seating on earthmound (see earthmound).
- view toward pond and woodlot.

Pond
- Montgomery County Soil Conservation Service to provide service.
- 6' to 7' minimum allowed for Miami Silt Loam.
- 10' deep with windpowered circulation pump.
- approximately 6,000 sq. ft.
- screen chicken coop area with the 2 transplanted dwarf apples.
- earthen dam with piping and natural spillway (overflow into ravine): earthmount to help with natural spillway.
- 3:1 slope on west side of dam, 2:1 slope on east side, 4:1 south side of pond, 3:1 east side, 4:1 north east corner, 2.5:1 on north.
- cut and fill almost in balance.
- stock pond with fish.
- plants for pond: lotus (seed or leaf).
- aware of liability of having an attractive nuisance.

Herbicide/Dust Control

- 18 white pines: edible seeds in pine nut, quick grower, 2 rows of white pines are effective.
- driveway is brought down 10' at loop.
- change contour south of loop.
- if herbicide in soil, it will not affect orchard or woodlot, Ron says.

Foundation Planting

- 20 rhododendron catawbiense on north, east, and west side of structure: evergreen planting which will grow in shade of Norway spruce (picea abies) and maple tree (rosy violet flowers in late May–early June).
- 10 pinus mugo "compacta" around east and west side of house (3' to 4' height).
- Foundation planting to provide 30 percent savings on space heating (with windbreak planting) by creating dead air space (buffer between house and air current).
- Planting by window on east side of master bedroom to control headlight glare from headlights from entry to drive.

Batch Heater
- One 4' x 7' batch heater located adjacent to front porch on south side of house integrated into porch structure (41° angle for dish-latitude).
- To provide all of the hot water needs with the capacity to produce more than that.

Garden Frame
- 18' long and 3' wide wire and plastic structure which could provide an additional 2.5 percent food and extends growing season by 3 months.
- Located east of the solar hot water heater and north of new asparagus beds. Creates a mini work/activity zone with 6' path separating the 2 activities. This mini work/activity zone is easily accessible from both the kitchen and the front door.
- Early spring and late fall vegetables: beets, broccoli, Brussels sprouts, cabbage, carrots, cauliflower, celery, chard, chicory, Chinese cabbage, corn salad, collards, cress, endive, escarole, garlic, kale, kohlrabi, leeks, lettuce, mustard greens, onions, parsnips, peas, radishes, spinach, and turnips.

Herbs include: chervil, chives, coriander, dill, fennel, horseradish, leek, marjoram, oregano, parsley, sage, savory, and sorrel.

General Site Improvement

- 1st: seal around windows to keep out air. Payback is right away.
- 2nd: add insulation to attic, sidewalls, floors.
- 3rd: insulate around heating vents and ducts.
- Savings on space heating cost up to 30 percent.

Erosion Control

- On hill south of house, currently weeds controlling erosion.
- Planting to beautify view—control erosion, and to control dust from road—which gets on clothes hanging outside.
- Plant Pfitzer junipers (34) down by road—10' ht. to control dust. Junipers have moderate growth rate, have fruit for jelly.
- Plant crown vetch behind junipers to control erosion, fast grower with 2' ht. and pink flower.
- plant *juniperis horizontalis andora* (43) north of crown vetch and closest to house, fast growing evergreen groundcover with dark green leaf turning purple in winter.

- 6 *crataegus phaenopyrum* (Washington Hawthorne) 25' ht., rapid growing tree with white spring flowers and reddish-orange winter fruit attracts birds.

**Snow Control**

- middle of driveway where there is no vegetation on south side—ammonia line right of way—use snow fence.

- east end of driveway—plant black locust and 8' high shrub in front of it, 10 black locust and 11 currant gooseberry, or blueberry.

**Trails**

- through woodlot, orchard, pond area, etc.—random path to utilize bark chips where necessary.

**Wind Generator**

- wind generator to be 1.5 to 2 times higher than surrounding vegetation.

- possible fence surrounding wind generator at 20' radius from center.

- wind generator cannot be within 80' radius of house—turbulence and safety factor.

- wind generator has to be within 150' to 200' of house because of transmission of electricity.
- location of wind generator is based on prevailing winds, site topography, and other things Toru told me