# St. Theresa Point Adelaide McDougall Memorial Health Facility

# Permaculture Design

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## 1. Introduction

Permaculture is a whole-systems design approach based in Indigenous methods to design natural and human systems that benefit and teach others, regenerate the earth, and promote equal distribution of resources (Morrow, 2006). Permaculture is sometimes referred to as cultivated ecology because of its goal to integrate and transform human societies to live in sustainably designed and productive ecosystems. Permaculture is different than agriculture or simply backyard gardening as it is based in using and mimicking patterns found in nature to provide designs that are multi-functional, time tested and help to extend and regenerate natural landscapes (Morrow, 2006).

This paper looks at a permaculture design of St. Theresa Point Adelaide McDougall Memorial Health Facility located in St. Theresa Point First Nation, Manitoba. St. Theresa Point is located 610 km northeast of Winnipeg, Manitoba in treaty 5 territory and is home to over 4,000 people. The community is accessible by plane and boat in the summer and roads in the winter. The main dialect of the area is Oji-Cree although English is also widely spoken (St. Theresa Point First Nation, 2016).

St. Theresa Point First Nation, like many other First Nations communities in Canada, were for thousands of years food secure, hunting, fishing, gathering, and cultivating plants and animals on their traditional lands, fields and waters (Rudolph & McLachlan, 2013; St. Theresa Point First Nation, 2016). Colonisation and the signing of treaties displaced Indigenous communities from traditional harvesting sites and broke up Indigenous social networks, kin systems and trading routes that had collectively provided food to communities for generations (Rudolph & McLachlan, 2013). The “Sixties Scoop” and residential school system took children away from their parents, disconnected families and communities and undermined traditional language, culture and values. Ultimately, colonisation resulted in the intergenerational loss of knowledge that affected the ability to procure and provide cultural foods that at one time satisfied nutritional, as well as social and cultural, needs (Willows, 2005; Thompson et. al, 2011).

## 2. Methods

This paper explores the vision for a permaculture design of St. Theresa Point health center including the permaculture strategies, principles, and techniques/specifications to be used. A site assessment, including an analysis of the climate, land, sectors (water, wildlife, fire, view, neighbourhood, zoning challenges, etc.), and key resources or capitals of the health center are also included. The permaculture design of the health center was developed in consultation with Aboriginal Diabetes Initiative heath workers, Leah Flett from St. Theresa Point First Nation and Cheyanne Harper-Mason from the Wasagamack First Nation, during the Winnipeg Permaculture Design Course organized at the Natural Resources Institute, University of Manitoba and Aurora Farm from May 8-16, 2017. Leah and Cheyanne were participants in the permaculture course.

A Google Earth Map image of the health center was used to create a rough sketch of the design. The design was next drafted into Google Earth Pro, a computer based, free design program. During the course, the permaculture design was presented to the course instructors and participants including the vision, principles, assessment, strategies, and techniques used in the design. The feedback received has been incorporated and addressed in this report. Inkscape, free and open source design software, was used to finalize and present the design for this report.

## 3. Vision of St. Theresa Point Health Center Permaculture

The vision of the St. Theresa Point health center permaculture design is **"to revitalize Indigenous culture and contribute to food security in St. Theresa Point First Nation through local food production and education."** Guided by the permaculture ethics, care for earth, care for people, and share the surplus, the permaculture vision for St. Theresa Point Health Center represents a movement toward cultural restoration and Indigenous food sovereignty. This movement is taking a stand against the unjust colonial history faced by the community in which Indigenous culture was actively supressed. Indigenous food sovereignty ultimately means sustained participation in traditional food strategies and practises and the right to make

decisions over the amount and quality of food hunted, gathered, grown and eaten for Indigenous people. It also means reduced reliance on the industrial food system (Working Group on Indigenous Food Sovereignty, 2017). The site aims to involve both youth and elders to promote and revitalize the intergenerational sharing of knowledge and skills. Youth are facing many barriers in the community and providing them additional education, resources and support is very important to St. Theresa community members. Language is an important component of the site design in that signs with the Oji-Cree names for plants will be displayed in the garden. For many Indigenous people, traditional language use is vital for cultural preservation and renewal. The traditional use for the plants will also be shared with community members by elders and incorporated into the education programs of the health care workers at the health center. The site also aims to be an example of ecological, systems based agriculture and an inspiration and model for community members who may want to start their own garden at home (see Figure 1).

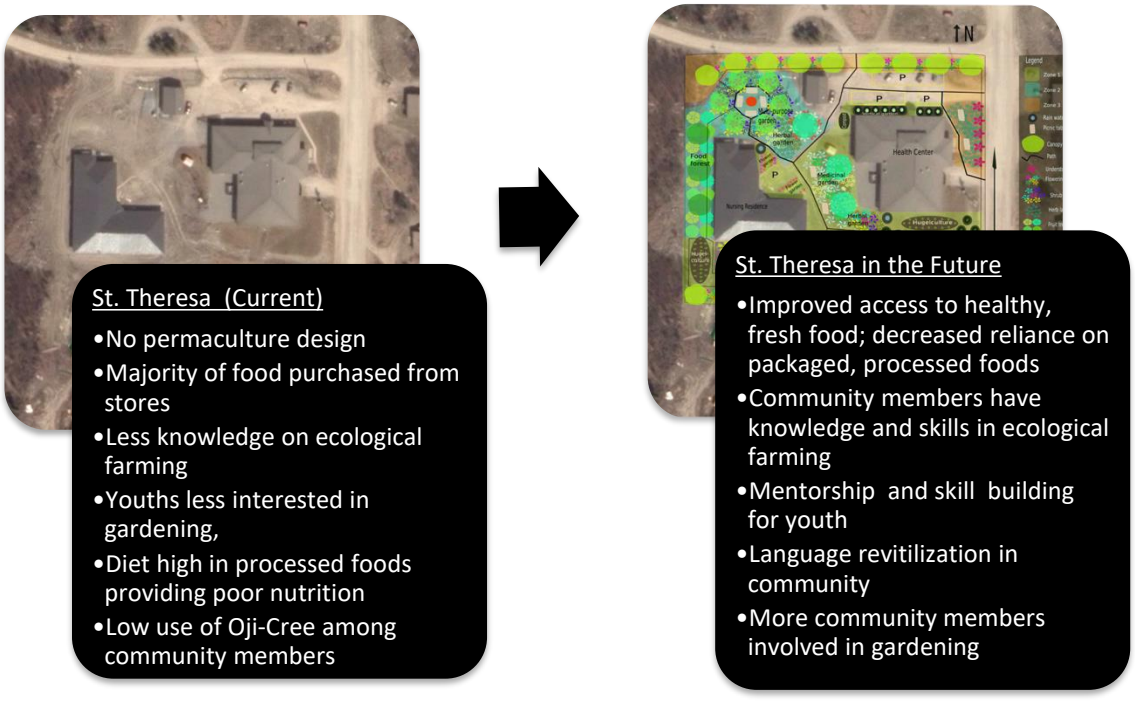


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**Figure 1:** The vision of St. Theresa health center permaculture in a diagram showing the key changes in the future.

## 4. Permaculture Principles

The use of permaculture principles can guide site planners to design a space to ensure a systems thinking approach which promotes synergies among the components of the site. When a site is designed in a synergistic and collective fashion, energy is used efficiently in the system and external inputs are minimized. Aligning with the vision of the St. Theresa Point Health Center permaculture design, the permaculture principles a)*obtain a yield, b)observe and interact, c)catch and store energy and e) and value diversity* have been incorporated into the design.

### *a) Obtain a yield*

Improved access to healthy and nutritious food is a priority for St. Theresa Point First Nation people. The community remains highly food insecure for reasons such as poverty combined with the high cost of foods in the grocery store and high cost of hunting and fishing. Lack of knowledge and skills to source, prepare and cook traditional foods also contribute to high food insecurity. The permaculture design integrates the principle *obtain a yield* to achieve high yield or harvest of annual and perennial plants to contribute to safe, affordable, quality and accessible food for the community. Challenged by the short growing season in northern Manitoba, the design includes strategies and techniques to lengthen the growing season to optimize food production.

### b) *Observe and interact*

Despite the history of farming in Island Lake area, gardening knowledge and skills are limited among the people living in St. Theresa Point First Nation. The environment in which the permaculture design is to be implemented is harsh, with extreme cold and wind and poor soils. The permaculture design is planned to evolve over time with local observation of what is working and what can be improved on. Interaction between people and between plants and

people is encouraged through site design. It is important to create a comfortable space of mutual learning and sharing to achieve the vision of food and language education.

### *c) Catch and store energy*

Energy is a key element for producing abundant food and its storage is important for long term sustainability of the site. In St. Theresa Point, the cost of fuel (diesel and petrol) is 3 to 5 times higher than in Winnipeg. To reduce environmental as well as financial costs, strategies to maximize the use of renewable resources on site and minimize the use of non-renewable energy sources are required.

### *d) Use and value diversity*

Diversity in both ecological and social systems contributes to strong and resilient communities. A diversity of plants grown can better meet the dietary needs of the community and provide resistance to disease and a changing climate. Attention is paid to creating different microclimates and plant guilds with the use of local and native plants as well as integration of prospective species from other locations. The space is also intended to be inviting to both youth and elders to promote social diversity and the integration of knowledge.

## 5. Assessment

### *Climate and land*

The following section discusses the general climate of St. Theresa Point First Nation. Climate means the precipitation, wind, and radiation in a given area. It is important to recognize the Health Center will be located in its own unique microclimate affected by topography, soils, water bodies, artificial structures and vegetation. Microclimates differ from the larger climate in which they are situated as they can have longer or shorter growing season, increased wind or warmth, or differences in humidity (Morrow, 2006). Observation and recording keeping over time at the specific site can provide more accurate climate data and trends but overall climate data provides an important starting point for site planning.

Figure 2 demonstrates the annual precipitation received at St. Theresa Point First Nation. Most of the precipitation falls May through October in the form of rain or snow, receiving approximately 40-50mm each month. This abundance of precipitation is a resource that can be stored and used on the permaculture site. The total amount of precipitation is also important to recognize when selecting plants for the site and planning for water storage. The graph also shows there is a risk of freezing until mid-June, which is fatal for most annual crops, therefore decreasing the growing season by about a month compared to more southern areas in Manitoba. Understanding the length of the growing season is important for selecting, planting and managing outdoor crops. This figure also illustrates the mean daily maximum and minimum temperatures each month.

Figure 2: Annual Precipitation and Temperature St. Theresa Point First Nation (Meteoblue, 2017)

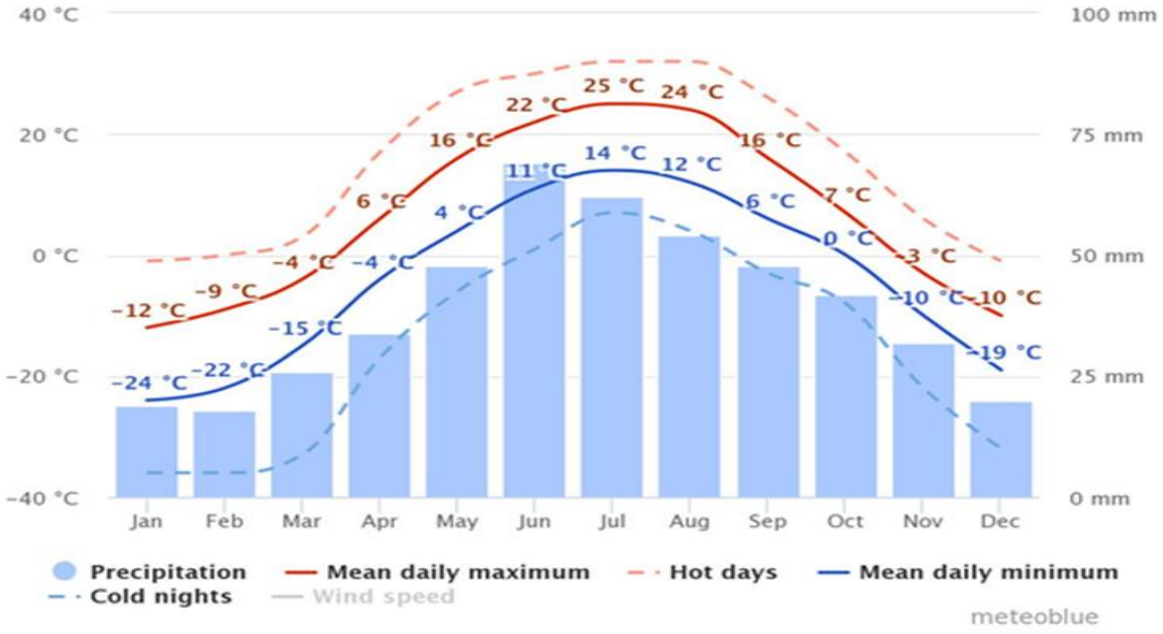



Figure 3 indicates plant hardiness zones for Canada. According to this figure, St. Theresa Point First Nation fits in a hardiness zone of 2b. A plant hardiness zone is a geographic area defined by the climatic conditions of the area, largely defined by the minimum temperature experienced in the area (Natural Resources Canada, 2014). Plants that will survive year round

(perennial plants) must have a hardiness rating of at least 2b for St. Theresa Point or be planted in a microclimate. As mentioned previously, microclimates in an area do exist or can be created to host less hardy plants. For example, St. Theresa Point is surrounded by water which has the capability to hold warmth and moderate temperature, which can extend growing seasons and allow for less hardy plant varieties.

Figure 3: Canada`s Plant Hardiness Zones
(Natural Resources Canada, 2014)

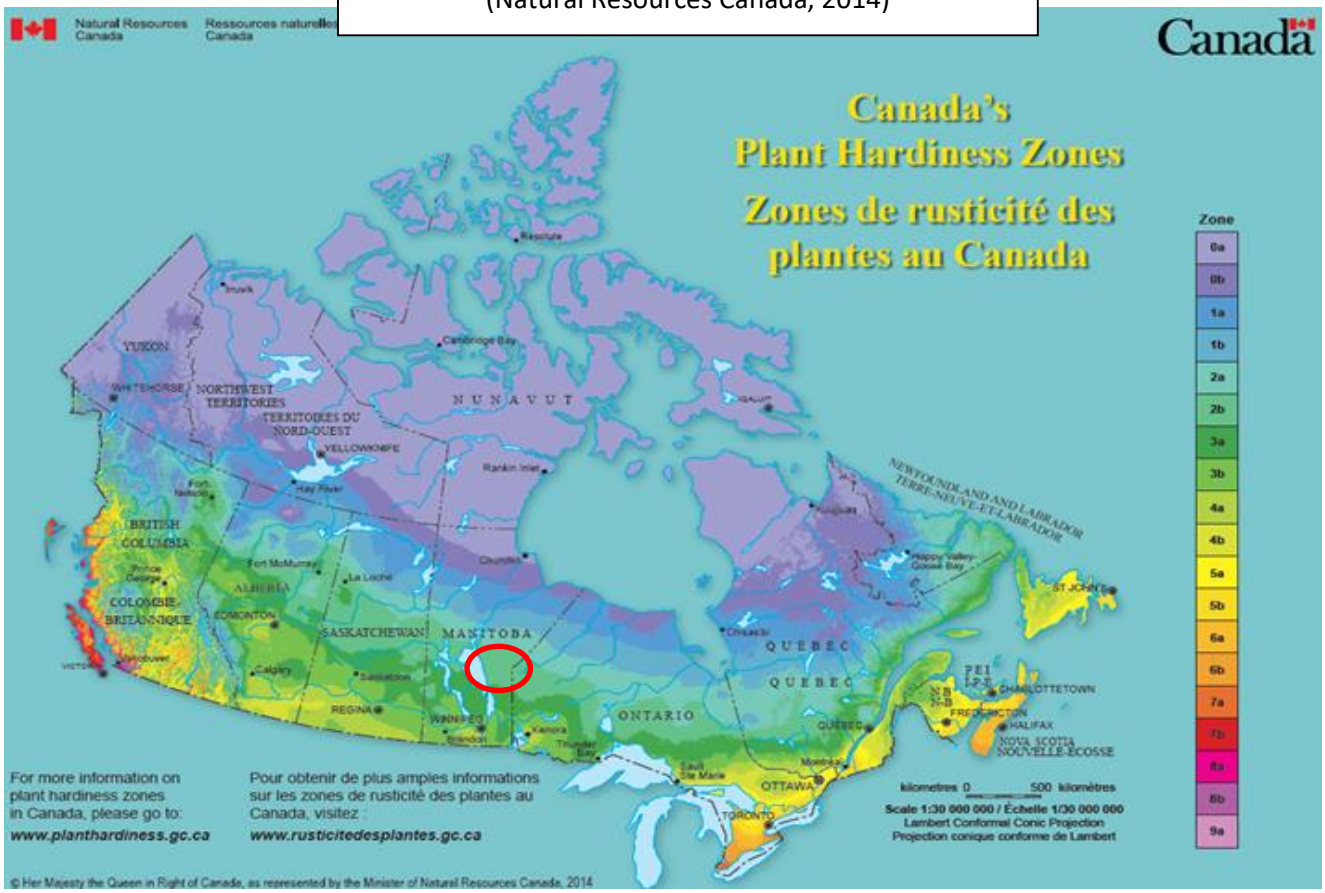



Figure 4 indicates the average wind speed and direction at St. Theresa Point First Nation. The wind direction is predominately north, west and northwest. The average speed is about 29-28 km/hr but can reach over 61km/hr. Strong winds can be very damaging for plants and humans, as they increase evaporation of water, wick away heat, erode soil, and carry viruses, bacteria and dust (Morrow, 2006). Knowing the dominant wind direction can help permaculture planners mitigate the damaging effects of wind by setting up shelter belts or other

infrastructure to block wind. Knowing the wind speed and direction is also advantageous to harness wind energy such as for wind turbines.

Figure 4: Average Wind Direction and Speed
St. Theresa Point First Nation
(Meteoblue, 2017)

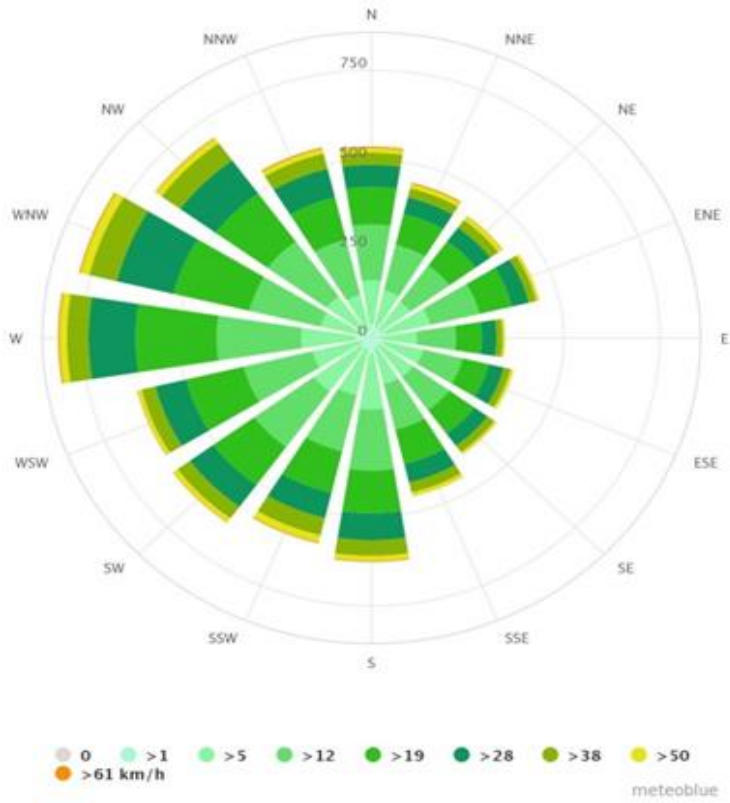
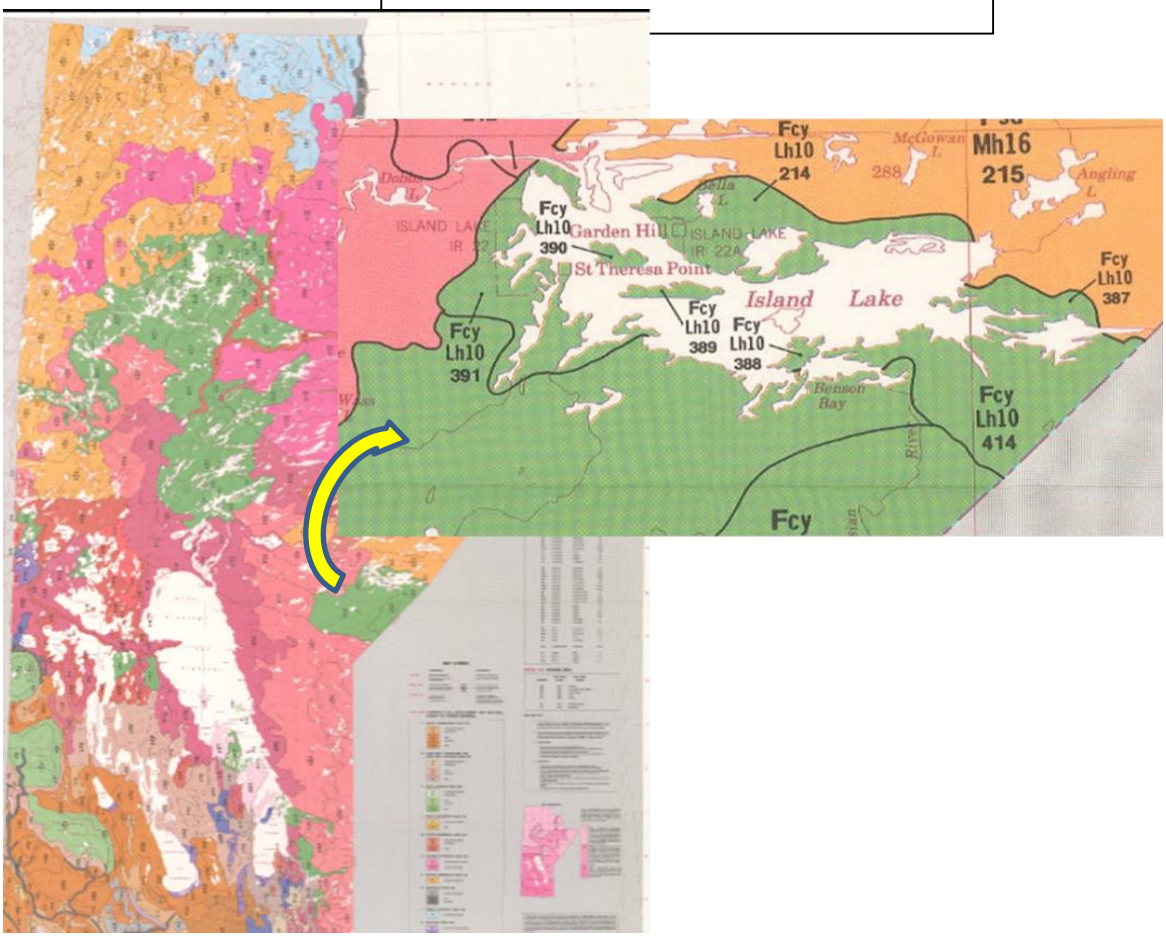



Figure 5 shows a soil map of Manitoba. The soil at St. Theresa Point First Nations falls under the Fcy, Lh10, 390 category. According to the legend, this means the predominant soil is clay with a hummocky surface form (extremely irregular surface with knolls or mounds above ground). Soil drainage is well to moderately well and the slope in this area is 10-15%. Sloping areas should be noted for potential soil erosion. Slopes also represent an opportunity for capturing and storing water and replenishing soil moisture through a method known as keyline plowing.

Although clay soil does have beneficial water retention capabilities, too much clay and the soil will not drain properly. Normally, healthy soil is made of a mixture of clay, sand and silt as well

as organic matter. Soil can be improved with the addition of organic matter. As the soil is mostly clay, attention will have to be given to soil improvement before the area can be food producing. A healthy soil has a balance of moisture, gases, minerals, micro-organisms and organic matter and provides services such as absorbing and holding water for plants use, holding and supporting plant root systems, digesting nutrients for plants to be more readily absorbed by plants, and absorbing and filtering toxins in organic matter (Morrows, 2006).

Figure 5: Soil Landscape of Manitoba
(Agriculture Canada, 1986)



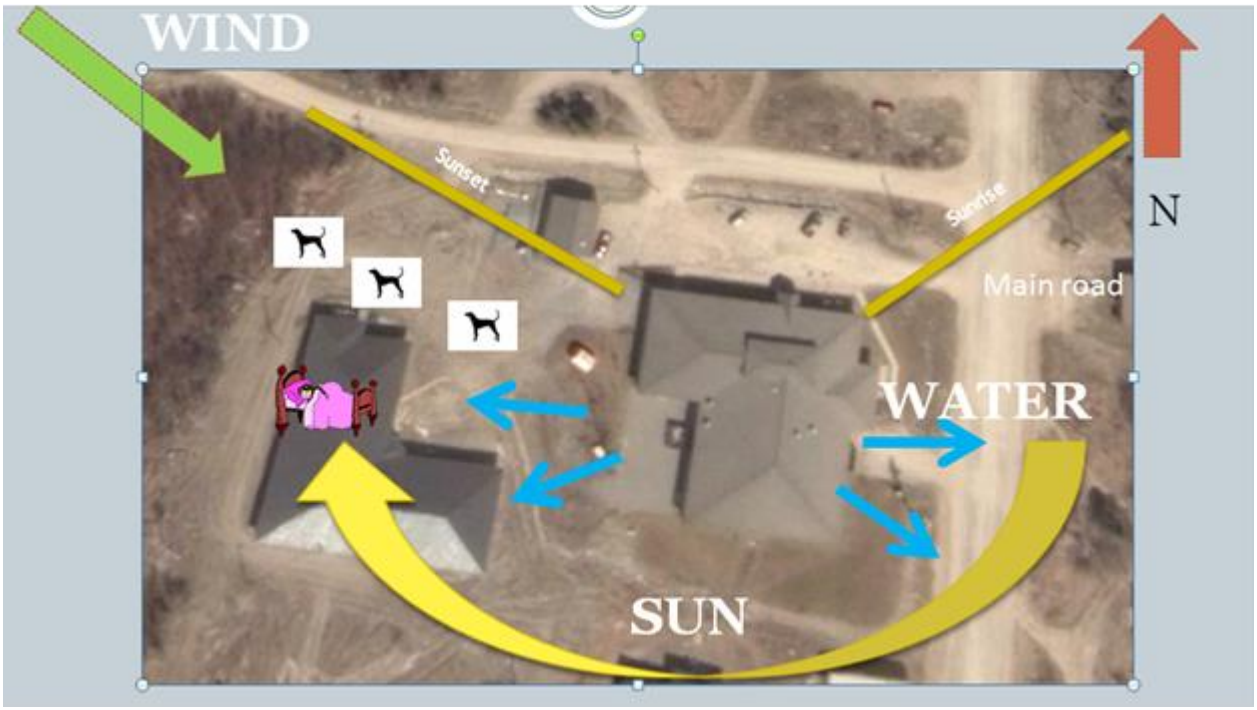

***Sector analysis***

Figure 6 shows a sector analysis of St. Theresa Point Adelaide McDougall Memorial Health Facility. The dominate wind pattern and water and sun movement are shown in the figure. As the main health center building is located on a hill, water runs away from the building. The sun movement is shown on the summer solstice, the longest day of the year. The sun will be the strongest on the south and west side of the building. Recognizing the movement of the sun, water and wind helps permaculture planners to work with these elements and either minimize or maximize them depending on the intent. For example, knowing that water runs away from the building in these areas could provide an opportunity to build a pond or plant more water loving species. Knowing the movement of the sun across the property is important for capturing and

Figure 6: Sector Analysis of St. Theresa Point Adelaide McDougall Memorial Health Facility

A sector analysis also includes the movement of people and animals on the property and

Figure 6: Sector Analysis of St. Theresa Point Adelaide McDougall Memorial Health Facility




***Key resources (in the form of capitals)***

Figure 7 goes through a capital assessment of St. Theresa Point First Nation based on an interview with a St. Theresa community member and a colleague who lives in the neighbouring community. The interviewees were asked to rate and explain the various forms of capital for St. Theresa Point. Experiential, financial, social and intellectual capitals were rated low by the interviewees. Spiritual and material capitals were rated average with cultural and natural capital being ranked the highest.

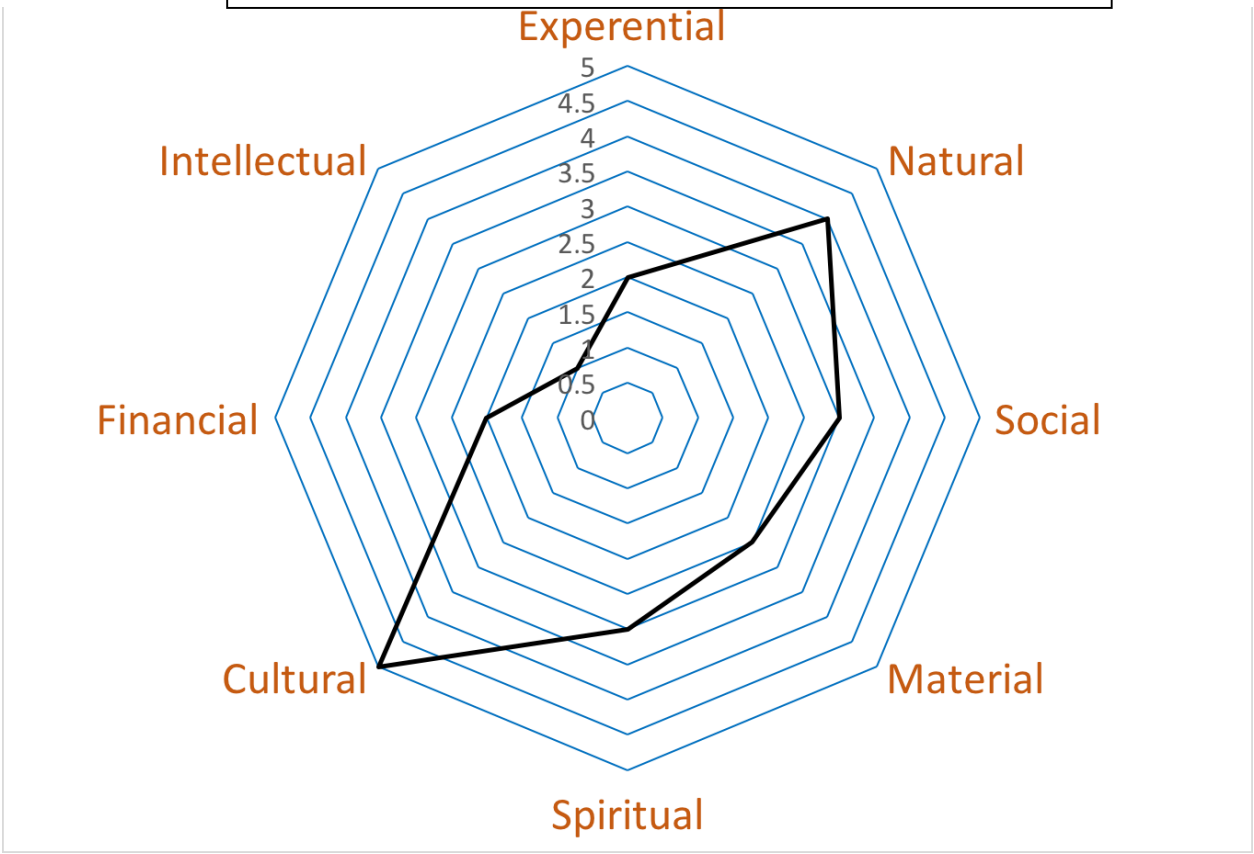
The low rating for experiential and intellectual capital was based on a lack of gardening experience in the community. According to the interviewees, most people do not know how to garden in St. Theresa Point and there are few training and educational opportunities to learn how. It was noted that many elders know how to garden but this knowledge is not necessarily being transmitted. The Aboriginal Diabetes Initiative (ADI) workers do have some gardening knowledge and skills they can share in the community. Financial capital was rated low as funding opportunities on the reserve are limited for gardening programs and projects although

external grant opportunities do exist. The interviewees believed that social connections are not strong in the community and more community building and engagement needs to occur. They believed most people would not willingly volunteer to help start a garden in the community. Jealousy and vandalism were also noted as obstacles to building a garden for community use.

Spiritual and material capitals were ranked higher. Many people do have spiritual connection and respect for the land and welcome opportunities to strengthen both Christian and Indigenous spirituality. The ADI workers receive gardening tools and equipment through Four Arrows Regional Health Authority to distribute in the community. Equipment provided includes tillers, rakes, hoses, pitch forks, seeds, bagged manure, trowels and trailers for storage. Natural capital was also ranked high as there is access to wood, peat, water, lakes, moss, leaves, fish for fertiliser, and land and there is strong biodiversity and numerous pollinators in the area. The natural capital also presents challenges as the soil content is high clay and is rocky, making for more difficult growing conditions. Culture was marked high as the people are very proud of their heritage and due to the isolation of the community, culture has remained relatively intact.

If all capitals were to be ranked high and in balance, Figure 7 would appear well-rounded. The figure is lopsided, as some areas need to be focused on for improvement. It is important to note that this assessment represents the voice of only a few people and is not representative of the community. Still, it gives an overview and indication of community strengths, weaknesses, threats and opportunities that exist.

**Figure 7: Capital Assessment of St. Theresa Point First Nation**




**6. Permaculture Strategies and Techniques**

This section presents the map of the permaculture design for the health center (figure 8), followed by the permaculture strategies and techniques to be applied in the design implementation.

**Strategy 1: Zoning**

The purpose of zoning in permaculture is to minimize use of inputs, save energy, and facilitate low maintenance of the farm (Morrow, 2006). The St. Theresa Point Health Center

permaculture design is divided into three zones: zone one, zone two, and zone three. The zoning is based on the use of inputs, getting yield for routine consumption, and requirements of maintenance and care for the garden. Figure 9, 10, and 11 present the closer view of zones one, two, and three respectively.

Zone one (figure 9) includes the majority of the areas in the southern part and few spots in the centre and northern parts of the health center. Zone one will primarily focus on producing annual and perennial vegetables and includes composting, rain water collection, hugelkultur, flower garden, vertical garden, youth garden, tire garden, medicinal and herbal gardens, green house, cold frames, and a row of windbreak trees and shrubs.

Zone two (figure 10) includes a food forest on the eastern part of the health center and a multipurpose garden and herbal garden on the northeastern part of the center. The purpose of the food forest is to maintain a permanent tree cover and supply a variety of fruits with minimum input and maintenance. The multipurpose garden is intended to promote interaction among the youth, elders, and adults in the community towards revitalizing Indigenous culture and empowering, particularly youth, in gardening through recreation and education.

Zone three (figure 11) includes a row of multipurpose trees as a canopy with a ground cover in the northern part of the health center and a row of ornamental understory trees with a ground cover in the western part of the health center. The multipurpose trees will act as wind break,

Figure 8: Permaculture design of the St. Theresa Point Health Center

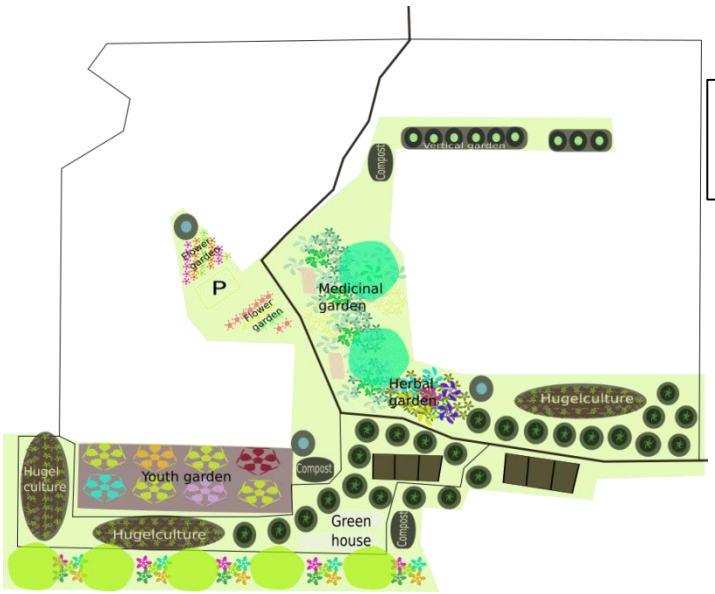



Figure 9:
Zone 1


Figure 10:
Zone 2

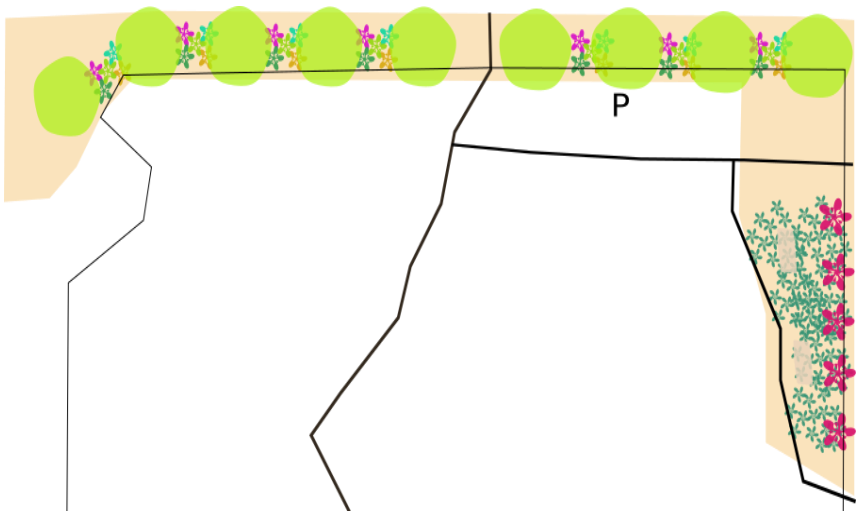



Figure 11:
Zone 3

provide firewood and fruits, provide mulch, reduce dust influx in to the health center, and contribute to the beautification of the area. The ornamental understory trees will increase beautification of the area and reduce an inflow of dust from the main road.

**Strategy 2: Increase soil fertility through locally prepared organic matter**

Soil is key for plant growth, so it is required for obtaining yield and sustaining the productivity of the system. As the soil of the health center is mostly clay and rock, soil fertility will be increased by adding organic matter prepared locally. The beauty of permaculture is that it facilitates the use of local resources. In order to increase the soil fertility, the following techniques are proposed for the health center.

*Technique 1: Compost*

Compost is one of the best sources of organic matter for gardening. Three compost pits are proposed in zone one to produce organic material for use on the site. The dimension of each compost pit will be 2 m length X 1.5 m width X 1 m depth. The key biodegradable wastes to include in the compost are fish, kitchen waste and organic waste from the operations of the health center. Such biodegradable waste can become a good source of organic matter through composting. Composting contributes to overall waste reduction in the community.

*Technique 2: Mulching*

Mulching is a technique to cover the soil with plant residues or any other easily degradable materials. Mulching helps reduce water evaporation from the soil, adds organic matter to the soil through decomposition, increases water infiltration into the soil, and minimizes erosion of top soil (Morrow, 2006). Mulching is proposed for all zones in the design. The materials to use as mulch include garden weeds, cardboards, food boxes, dried leaves, and plant leaves.

*Technique 3: Legume integration*

Legumes help in fixing atmospheric nitrogen in the soil. Integration of leguminous crops increases nitrogen content of the soil and the organic matter through the incorporation of the

dried leaves and plant parts of the leguminous crops. In this design, leguminous vegetables such as pea, different types of beans, cowpea, and groundnut are proposed for the vegetable garden in zone one. In the food forest (zone two) and zone three, the integration of nitrogen fixing shrubs such as false indigo and Siberian pea shrubs are proposed.

*Technique 4: Hugelkultur*

Hugelkultur beds are proposed for zone 1. The benefits of hugelkultur include the long term release of nutrients as the hugelkultur bed breaks down (for about ten years), the use of local materials such as unused and decayed woods and branches to form mounds, and the addition of organic material to the soil. Raising the planting beds above the ground also helps to trap heat and prevents the plant roots from being obstructed by the heavy clay and rocks. The dimension of each hugelkultur bed will be 4 m length X 1.5 m width X 1 m height. Vegetables such as pumpkin, asparagus, spinach, and stinging nettle will be the key crops in the hugelkultur beds.

*Technique 5: Green manuring*

Green manuring crops are crops that are cut and returned to the soil, prior to their flowering stage, to increase the soil fertility. Lupine, lucern and buckwheat will be used in zone 2 and zone 3 to enrich the soil with organic matter through these green manure crops.

**Strategy 3: Water catchment**

June, July and August are the rainiest months in St. Theresa Point. Although the snow covering the land during the winter provides moisture to the soil, water catchment is one of the key strategies to ensure water requirement for the plants throughout the growing season and during drought. In addition, catchment of rain water is important to reduce the cost of water management, work load, and input, particularly for collecting water from the lake for irrigation. In order to have a good system of water management and storage, the following techniques are proposed.

*Technique 1: Rain water harvesting*

The collection of rain water is important to irrigate annual crops in zone one. Rainwater collection is also effective to deal with the situation of water shortage. Three rainwater collecting poly tanks are proposed in the permaculture design to collect and store water for multiple uses on the site. The dimension of each tank will be 2.1 m height X 1.45 m diameter[2] with the capacity of storing 3,000 litre water per tank.

**Strategy 4: Wind and dust mitigation**

Wind from the northwest direction is severe in St. Theresa Point. Wind erodes uncovered soil (top soil) and damages the plants. Wind can also damage the entire property if it is not protected. Furthermore, wind increases moisture loss from the field. Due to the gravel road, wind brings dust particles that directly affect people. Thus, a strategy to mitigate wind and dust is important on site. The following techniques to mitigate wind and dust in the health center permaculture design are proposed.

*Technique 1: Wind breaks*

Windbreaks are the rows of trees (canopy and understory) planted on the site boundary to reduce the wind speed. By blocking the wind, windbreaks minimize the ill effect of gusting winds on crops and homes. In the design, canopy trees are proposed as windbreaks in the northern (zone three) and understory trees at the southern (zone one) side of the health center. The windbreak trees are selected to be multifunctional. The canopy trees in the zone three (northern side) are an alternate row of black alder (*Alnus glutinosa*) and balsam poplar (*Populus balsamifera*). Black alder is a nitrogen fixer, and it provides lumber in the long run; whereas balsam poplar is hardy and fast growing, and it can be used for pulp making and construction. The understory will include serviceberry (*Amelanchier arborea*), and the shrub layer will consist of false indigo (*Baptisia australis*), blackberry (*Rubus occidentalis*) and blueberry (*Vaccinium spp*). The trees on the southern side will consist of an understory layer of apple with shrubs such as raspberry, blackberry, and blueberry. In addition, it will include an herbaceous layer consisting of comfrey, mint, and wild lupine. Berries are an important

[2] http://www.nationalpolyindustries.com.au/info-centre/water-tank-specifications/

traditional food and used often in ceremony and thus are very important to include. Many berry plants are also natural to the area.

*Technique 2: Mixture of understory, shrub and ground cover*

At the eastern side of the health center, crab apple trees are proposed as understory, Saskatoon berry (*Amelanchier ainifolia*) and asparagus (*Asparagus officinalis*) as shrub layer, and white clover as a flowering ground clover.

**Strategy 5: Extend crop growing season**

In order to deal with the short growing season and extreme cold and obtain a higher yield and greater diversity of foods, the following techniques are proposed.

*Technique 1: Greenhouse*

A greenhouse maintains the temperature required for the growth of plants by blocking the passage of cold air from the atmosphere and intensifying radiation. A greenhouse with the dimension of 3 m length X 3 m width is proposed to cultivate vegetables almost all year round. In the greenhouse, vegetables such as tomato, peppers, cucumbers, potato, spinach, kale, carrot, squash, and etc. can be grown. Figure 12 includes a list of fast maturing vegetables for northern climates.

*Technique 2: Tire gardening*

Tire gardens offer an opportunity to use old car tires that are left and unused in the community. Tires also block cold air and trap heat. When the temperature goes down, each tire can be covered by plastic making a dome to protect vegetables from cold. In each tire, vegetables like potato, tomato, radish, carrot, turnip, cabbage, cauliflower, broccoli, and etc. can be planted. Many of these vegetables will be started in the greenhouse and transplanted to the tires outdoors once the risk of frost has passed.

**Figure 12: Fast Maturing Vegetables (Government of Manitoba, 2007)**

| Preliminary List of Vegetables for Northern Gardens | |
|---|---|
| **Vegetable** | **Variety Name (days to maturity)** |
| Leaf Lettuce | Buttercrunch (60 days), Simpson Elite (48 days), Esmeralda (53 days), Baby Star (65 days), Grand Rapids (45 days) - make two or three successive plantings |
| Radish | Cherry Belle (24 days), Champion (23 days), French Breakfast (20 days), Scarlet Globe (25 days), Lobuk Sweet Radish (55 days) - make two or three successive plantings and thin |
| Beets | Scarlet Supreme (48 days), Ruby Queen (55 days), Yellow Detroit (55 days) |
| Swiss Chard | Bright Lights (40 days), Fordhook Giant (55 days), Perpetual (50 days) |
| Turnip | Royal Crown (55 days), Early Snowball (45 days) |
| Carrot | Baby Spike (55 days), Little Finger (60 days), Scarlet Nantes (68 days) - thinning required |
| Cucumber | Straight 8 (58 days), 702 Burpless (50 days) |
| Potato | Shepody, Viking, Norland—hilling required |
| Pea | Spring (57 days), Alaska (55 days) - use net for climbing |
| Onions | Dacong Tall Green Onion (65 days), Yellow Onion—Candy hybrid (85 days); use onion sets (bulbs), pick as green onions |
| Tomato | Sub-Arctic Plenty (45 days), Siberia (53 days), Native Sun (50 days Yellow) - start as transplants |

*Technique 3: Cold frame*

Cold frames are very suitable for extending the growing season of vegetables in a cold climate. In the permaculture design, two cold frames are proposed in zone one. In the cold frames, vegetables such as tomato, radish, carrot, chilli, capsicum, onion, garlic, turnip, potato, etc. can be grown. The dimension of each cold frame will be 3 m length X 1 m width.

**Strategy 6: Reviving Indigenous culture and knowledge**

The health center permaculture site can become a platform for the community members to meet, interact and learn about Indigenous farming and Indigenous culture. In order to help revive Indigenous culture and knowledge, the following techniques are proposed in the design.

*Technique 1: Multipurpose garden*

The objective of multipurpose garden is to provide a platform for meeting and interaction among the community members to discuss Indigenous culture, knowledge and education. The multipurpose garden (figure 13) is proposed in zone two towards the northwestern side of the health centre featuring a bonfire at the center of the garden and four picnic tables around the bonfire. A scared fire for ceremonial purposes can also be planned for this space. The multipurpose garden would include understory trees such as willow and serviceberry and a shrub layer with a mixture of blueberries and false indigo. The multipurpose garden will also include sage and tobacco plants under the shrub layer and an herbaceous layer of white clover.

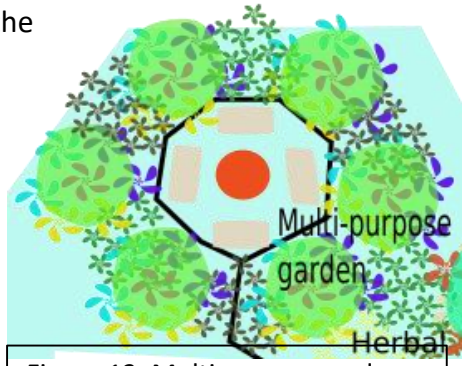


Figure 13: Multipurpose garden

*Technique 2: Youth garden*

Engaging youth in the community is an important part of this permaculture design. A garden in zone one will be set aside for community youth to plant and maintain. The potential crops in the youth garden would be potato, tomato, radish, garlic, pea, cowpea, turnip, kale, etc. Youth will receive an orientation to permaculture ethics, principles and key techniques as part of their involvement on the site and will be mentored by a community elder. Involving youth early in the permaculture garden is also important for vandalism prevention.

*Technique 3: Medicinal garden*

A medicinal garden is proposed in zone 1 at the center of the health center. The purpose of this garden is to promote plants having medicinal importance to the community. This garden will include one tree as a canopy as well as medicinal shrubs and herbs. The plants for the medicinal

garden have not yet been identified as this will be done by the community members when they gather and interact in the multipurpose garden. Signs in the garden featuring the plant names in Oji-Cree and their traditional use are an important part of culture revitalization. Tours with elders through the medicinal garden is also planned for patients and staff at the health center and with community members.

**Strategy 7: Promote and maintain agrobiodiversity**

Promotion of health and nutritious food is possible through the promotion of agrobiodiversity on site. In addition, agrobiodiversity increase resilience of the site against the various climatic and non-climatic shocks and vulnerabilities. Agrobiodiversity also reduces dependency on western foods found in the grocery stores for the nutritional requirements of the community. Thus, one of the permaculture strategies is to promote and maintain agrobiodiversity. Agrobiodiversity is promoted in each component of the design through the selection of various plants such as in the multipurpose garden, youth garden, hugelkultur, etc. The herb garden and food forest (not yet described) also promote agrobiodiversity on the site.

*Technique 1: Herbal garden*

The site will feature two herbal gardens: one in zone 1 beside the medicinal garden and the other in zone 2 in the southeastern side of the multipurpose garden. The herbal gardens will include various herbs such as lemon balm, parsley, oregano and thyme and a shrub layer of raspberry and Jerusalem artichokes.

*Technique 2: Food forest*

Food forest provides a regular supply of fruits and edible shoots and leafs from the perennial plants. A food forest promotes a diversity of plants and animals and needs low care and maintenance. In the permaculture design, a food forest is planned for zone 2, on the west side of the health center, at the back of the nursing residence. The plants in the food forests will include birch and pine, apple and hazelnut as understory, asparagus, blackberry, blueberry, elderberry, and raspberry as shrub layer, stinging nettle, fennel, dill, and comfrey as an

herbaceous layer and a ground cover of white clover.

**Strategy 8: Save energy**

The design targets to reduce the use of non-renewable energy sources for carrying out the site activities. This strategy reduces the use of energy that comes from diesel, petrol, and other non-renewable sources, and utilizes solar energy. In order to minimize the use of non-renewable sources of energy the following two techniques are planned.

*Technique 1: Passive solar harvesting*

Structures in the design such as tire gardens, cold frames and a greenhouse harvest and trap solar energy. The zoning concept in permaculture also facilitates use of sunlight to maximum food production. For example, the youth garden, hugelkulture beds, flower garden, green house, composts and cold frames are oriented to the south to use maximum sunlight for vegetable production.

*Technique 2: Use of locally available biodegradable waste*

Production of compost and use of locally available biodegradable waste also minimize the energy used in managing waste and bringing organic matter from outside the community. The compost produced locally will save energy and money.

*Technique 3: Vertical garden*

A vertical garden is planned for in front of (in the north) the nursing station in zone one. The vertical gardens will feature hardy, climbing vines such as clematis. A vertical garden is multifunctional as it harnesses the benefits of vertical space. When placed on or near a building, vertical gardens can also provide insulation in the winter and a cooling affect in the summer as well as aesthetic value.

**7. Conclusion**

The use of a permaculture design based in local Indigenous culture can positively contribute to active learning on the land, language revitalization, sharing of Indigenous knowledge, and

creating supportive social bonds in the community at St. Theresa First Nation. By providing a site for community gathering, community building can occur, youth can interact with and learn from elders, and the exchange of knowledge and ideas can occur. Culture is revitalized through language learning, introduction to medicinal and traditional plants, and discussion about Indigenous farming and culture. Youth, community members and patients at the health center have an opportunity to learn about new techniques and strategies to grow food that can be done in their own homes and contribute to food security in the community. In a community where the cost of bringing in materials is very high, permaculture also offers a unique opportunity to value and use local resources and technologies. As permaculture is based on local resources and knowledge, feedback and observation, it is suitable to contribute to the long term livelihood needs of the community.

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