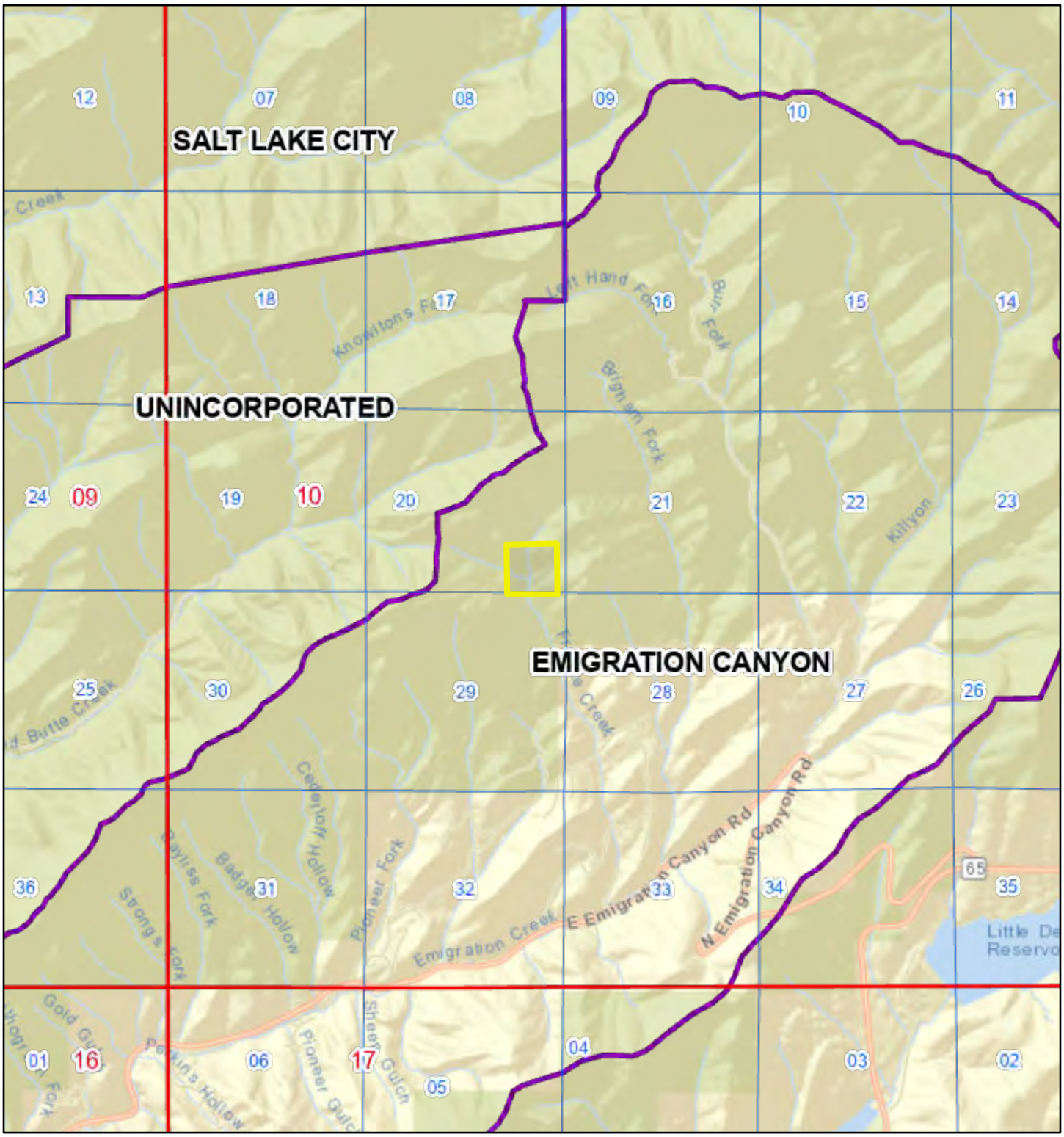
Exhibit 1

Salt Lake County Assessor Parcel Map

Parcel Map of APN 10-20-400-002



August 10, 2025

1:59,234

0 0.38 0.75 1.5 mi

0 0.5 1 2 km

Esri, HERE, Earthstar Geographics, County of Salt Lake, Bureau of Land Management, Utah AGRC, Esri, HERE, Garmin, INCREMENT P, NGA, USGS

Exhibit 2

Salt Lake County Recorder's Office Parcel Ownership Record

Rashelle Hobbs
Salt Lake County Recorder

Property Search

Start A New Search

10-20-400-002-0000

Property Address • 1475 PINECREST CANYON RD

Active Parcel Number

Recorded Documents • 29

14287206	9/11/2024	AMENDMENT
13954037	5/18/2022	PLAT
13555257	2/3/2021	WARRANTY DEED
13555256	2/3/2021	WARRANTY DEED
13555255	2/3/2021	WARRANTY DEED
13555254	2/3/2021	WARRANTY DEED

Current Owner(s) Of Record • 1

LEICK, RYAN

Legal Description • Property Description For Taxation Purposes Only

SE 1/4 OF SE 1/4 SEC 20 T 1N R 2E SL MER 40 AC 4767-0210 7213-1982 7773-2864 9216-4480

To view and download copies of documents, please purchase access.
There is a $5 24-hour access option.

Purchase Access To Data Services

Exhibit 3

Freeze Creek Forest Stewardship Plan

FREEZE CREEK PROPERTY
NATURAL RESOURCE ASSESSMENT AND FORESTRY ACTIVITY PLAN

Prepared by:
Scott Zeidler, Forester
Department of Natural Resources
Division of Forestry, Fire & State Lands
Wasatch Front Area Office
1594 West North Temple
Salt Lake City, Utah 84114
(801) 538-4818

Table of Contents

General Property Description

The Freeze Creek property owned by the Leick family consists of 40-acres in northcentral Utah, situated within the incorporated Emigration Canyon Metro Township. The property can be reached by foot or mountain bike travel via a 1.0-mile single-track trail originating at a parking lot administered by the Emigration Improvement District along Pine Creek Canyon Road. The property is zoned by Salt Lake County as *Recreation, Vacant Lot – Residential*, and occupies a wooded, mountainous setting.

The property legal description is as follows: SE ¼ of SE ¼ Section 20, Township 1N Range 2E, Salt Lake Meridian, Salt Lake County. The latitude and longitude of the middle of the property is (40.79986, -111.74258). The elevation at the middle of the property is 6,580 feet above sea level (ASL).

Freeze Creek, a perennial stream, originates on the property from springs. It is recognized as a tributary of Emigration Creek, a classified *Waters of the State*.

The property exists within the Upper Emigration Creek Sub-Basin located along the western flank of the central Wasatch Mountain Range in the Middle Rocky Mountain physiographic province.

The nearest weather station to the property records a January minimum average temperature of 34.2 degrees F., and an average July daily maximum temperature of 88.7 degrees F. The mean annual temperature is between 44 to 46 degrees F. The frost-free growing season ranges between 80 and 100 days. The mean annual precipitation amount is between 20 and 30 inches.

The Wasatch Range is home to a wide variety of plants and animal species. The topographic relief of the mountain hillsides and creek accommodates diverse vegetation communities on the property. Forest and woodland tree species include white fir (*Abies concolor*), quaking aspen (*Populus tremuloides*), Rocky Mountain juniper (*Juniperus scopulorum*), bigtooth maple (*Acer grandidentatum*), Gambel oak (*Quercus gambelii*), Douglas hawthorn (*Crateagus douglasii*), water birch (*Betula occidentalis*), and narrowleaf cottonwood (*Populus angustifolia*).

Forest management on the property is affected by the Salt Lake County - *Foothills and Canyon Overlay Zone* (Title 19, Chapter 19.72). Intent to alter living trees on the property must comply with processes described in the ordinance.

The property is categorized as high value spring and fall-season habitat for mule deer, elk, moose cougar and black bear. A fishery is not associated with Freeze Creek.

The Upper Emigration Creek Sub-Basin has been historically used for ranching, limited farming, quarrying, and summer retreats. In the last forty years, year-round urban residential development has increased within the sub-basin.

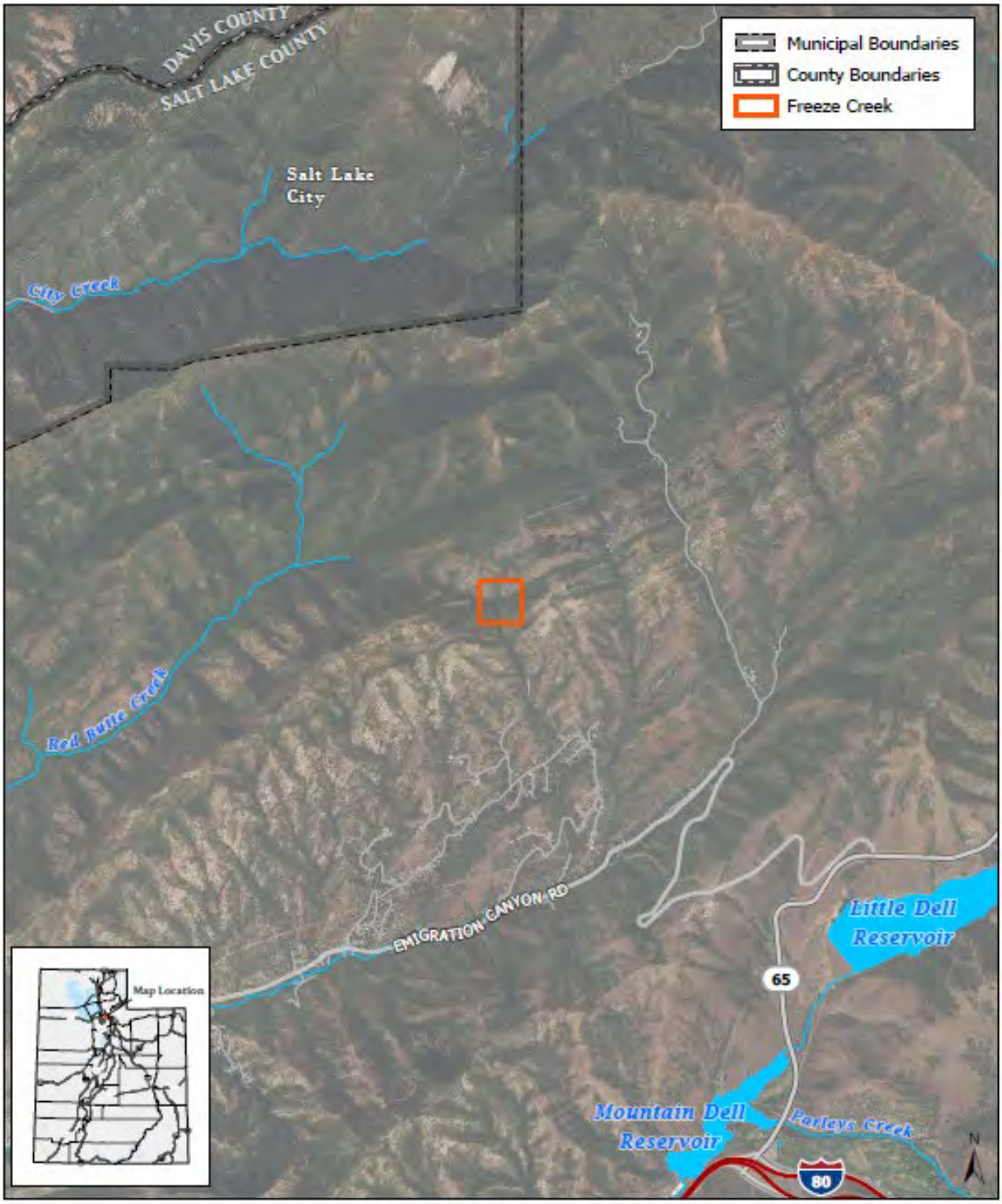
Wildland fire response, preparation, and prevention is provided by the Unified Fire Authority, through its tax collection authority. The agency maintains Fire Station #119 at 5025 Emigration Canyon Road.

Adjacent federal land holdings are managed and administered by the USDA Forest Service, Uinta-Wasatch-Cache National Forest, Salt Lake Ranger District. As well, land administered by Salt Lake City Public Utilities is situated east and south of the ownership. The Emigration Improvement District holds land northeast of the ownership.

Historical vegetation management is not evident on the private land ownership or adjacent public lands, aside from livestock grazing which is no longer a permitted use.

The following table summarizes the vegetative cover classifications for the Freeze Creek property.

Resource Component	Total Acres
Forested Acres	**6.5**
Woodland Acres	**2.5**
Rangeland Acres	**31**
Total Acres	**40**



Freeze Creek Property Overview

Scale: 1:50,000

0 0.5 1 1.5 2

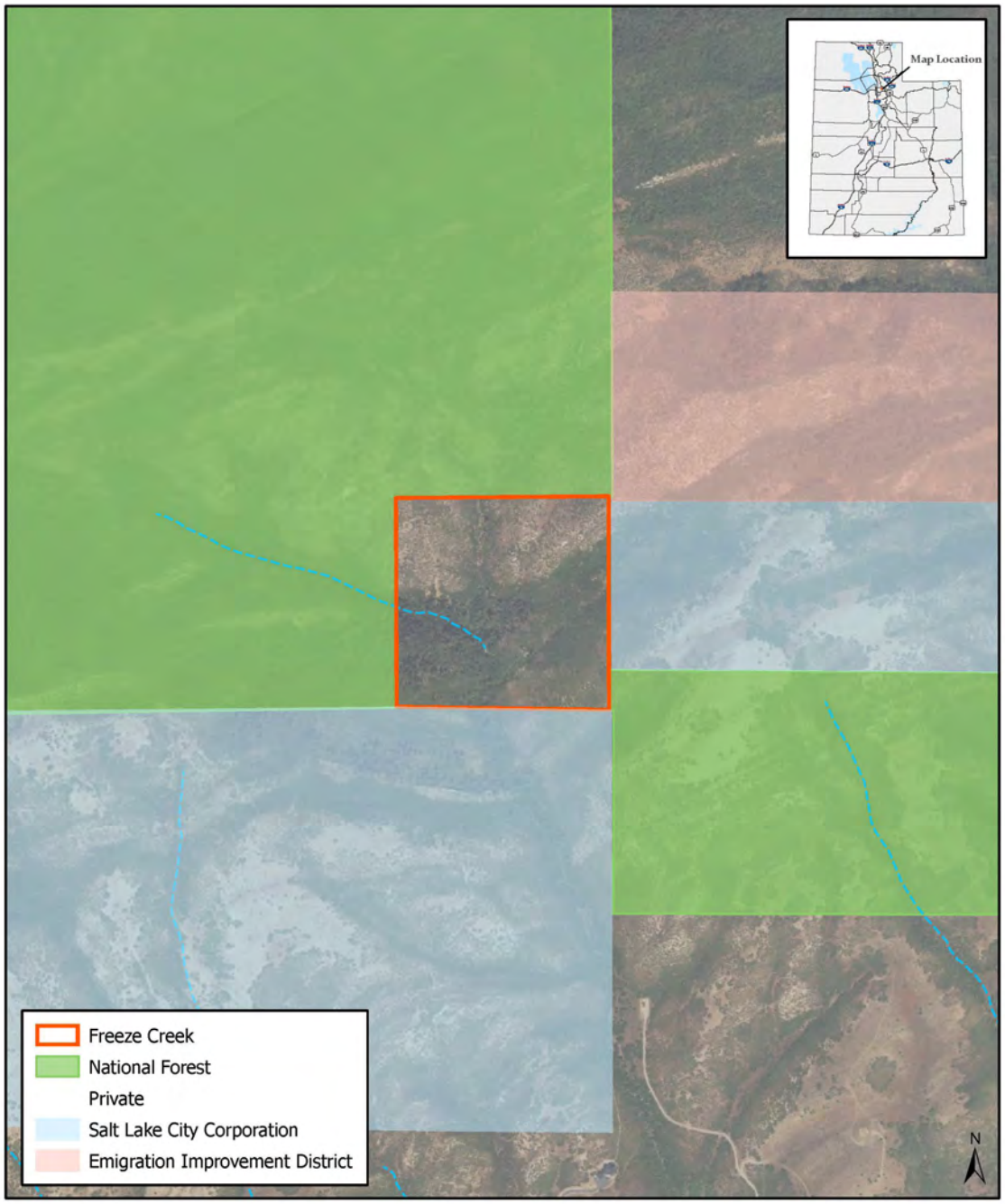
Miles

Freeze Creek Detailed

Scale: 1:3,000

0 250 500 1,000

Feet



Freeze Creek Land Ownership

Scale: 1:10,000

0 500 1,000 1,500 2,000

Feet

Landowner Objectives/Desired Future Condition

"I purchased this property as a retreat for family recreation. But as a researcher from a long line of farmers, my curiosity naturally desires to explore the role of silviculture in watershed conservation while validating the economic incentives of sustainable agroforestry. I believe nurturing proper soil ecology for biological diversity and the cultivation of drought-resistant species can replenish aquifers while supporting organic permaculture. I hope to facilitate research on silviculture practices managed specifically to minimize evapotranspiration and preserve snowpack later in the season." – Ryan Leick, Landowner - 2021.

This *Forestry Activity Plan* documents natural resource management activities for the property, over the next 10-year period ending in 2032.

Division Purpose

The purpose of the Division of Forestry, Fire and State Lands' (DFFSL) Forest Stewardship Program is to encourage long-term stewardship of non-industrial private forestlands, by providing technical assistance to private landowners toward their active management of forest and natural resources. The recommended management activities, during the next 10-year planning period, may sustain forestland conditions and move toward the landowner-defined *Desired Future Condition*.

The Division received funding to write this plan through the USDA Forest Service - State and Private Forestry Program, a federal activity re-authorized by Congress within the *Agriculture Improvement Act of 2018*.

Landowner participation in the Forest Stewardship Program is voluntary and withdrawal can be requested at any time.

Planning technical assistance offered through the Forest Stewardship Program may enhance access to federal and state cost-share programming, including USDA – Natural Resources Conservation Service (NRCS) assistance.

This plan supports the goals and objectives outlined in the *Utah Forest Action Plan 2020*. The land base and is located in the *Wasatch Front Priority Area* defined by the DFFSL.

The Utah Department of Natural Resources (Division of Forestry, Fire and State Lands) receives federal aid and prohibits discrimination on the basis of race, color, sex, pregnancy, age, religion, national origin, disability, sexual orientation, gender identity or Veteran status. For information or complaints regarding discrimination, contact Executive Director, Utah Department of National Resources, P.O. Box 145610, Salt Lake City, UT 84114-5610 or Equal Employment Opportunity Commission, 1801 L Street, NW, Washington DC 20507-0001.

Plan Elements- Description and Assessment

Soil and Water

Soils

Soil information was collected from the USDA-NRCS *Web Soil Survey*. Two soil units were identified within the boundaries of the property.

The *Brad very rocky loamy sand* soil type covers approximately 10 acres, situated in the northern quarter of the ownership. The *Emigration very cobbly loam* covers the middle and southern 30 acres of the property.
Both soils are exhibiting a well-drained character resulting from weathered sandstone and limestone. Both soils are shallow loams 12 to 20 inches thick above an unweathered bedrock layer.

According to the *Web Soil Survey*, the soil types suggest the prominence of two primary ecological cover types – sagebrush and curl-leaf mountain mahogany. It may be that current status of white fir forest on the property is a reflection of wildfire suppression since the settlement era.

Water

The property is assigned to Hydrologic Unit Code (HUC8) UT16020204. Water in creeks, springs and underground flow are recharged primarily from winter snow accumulation. Rainfall also adds to water resources.

Three springs exist on the property. Within the current drought cycle, two are not producing water, while one is rendering surface flow in the spring and summer season.

Freeze Creek collects and transports water which flows to Emigration Creek.
Waters descend to the Jordan River and eventually deposit into the Great Salt Lake.

Records suggest that underground water diversions and surface wells may be associated with the property. (*Emigration Creek TMDL*, Utah Division of Water Quality, 2011)

Water rights are not yet assigned to Freeze Creek property ownership.

Hydrologic processes (as relates to forest resources) on the property is influenced by species compositions, canopy structure and tree distribution patterns over time.

The on-site hydrologic processes are a result of water interception, infiltration into the soil, evapotranspiration, soil moisture storage and hillside erosion. A shallow bedrock layer exists on the property and throughout the Upper Emigration Creek Sub-Basin. The *Emigration Creek TMDL*

identifies the potential for three or four overlapping soil constraints on the property which affect watershed values.

Utah's Forest Water Quality Guidelines - A User's Guide for Landowners, Loggers and Resource Manager's – are voluntary measures that can be implemented to better protect the state's water quality where qualifying forest practices are being implemented. The *Guidelines* booklet is included in the Appendix of this plan.

Waterbodies (lakes, ponds, reservoirs)

No open water habitats exist on the property.

Biological Diversity

The property exhibits a biological diversity as reflected in the plant, animal and insect species compositions comprising five (5) terrestrial *Key Habitats* acknowledged by the UDWR. The key habitats that exist on the ownership are described in the **Fish and Wildlife** section of this plan. The **Resource Management Recommendations** identified in this plan supports the continuation of native species richness and genetic variability currently existing on the property.

Intriguing studies have been performed in the canyon setting north of Freeze Creek – Red Butte Canyon. Much can be learned and assessed by examining the *Red Butte Canyon Research Natural Area* website; https://redbuttecanyon.net

Published researched, referenced on the website, indicate ecological drivers and life form expression that may have correlation with the Freeze Creek property.

Range

Range resources are abundant and persist on south, west and southwest facing slopes on the property. Sagebrush (*Artemisia spp.*), bitterbrush (*Purshia tridentata*), rabbitbrush (*Chrysothamnus* spp.), mountain snowberry (*Symphoricarpos oreophilus*), diminutive Gambel oak scrub (*Quercus gambelii*), Utah serviceberry (*Amalanchier utahensis*), curl-leaf mahogany (*Cercocarpus ledifolius*), snowbrush ceanothus (*Ceanothus velutinus*), bunchgrasses and associated forbs (wildflowers) in varying combinations are plant species that comprise the rangeland cover type. The rangeland type includes elements of the *Mountain Shrub Key Habitat.*

Rangeland plants generally tolerate harsh growing conditions influenced by soil characteristics, full sun exposure, competition between drought-tolerant species, precipitation timing and

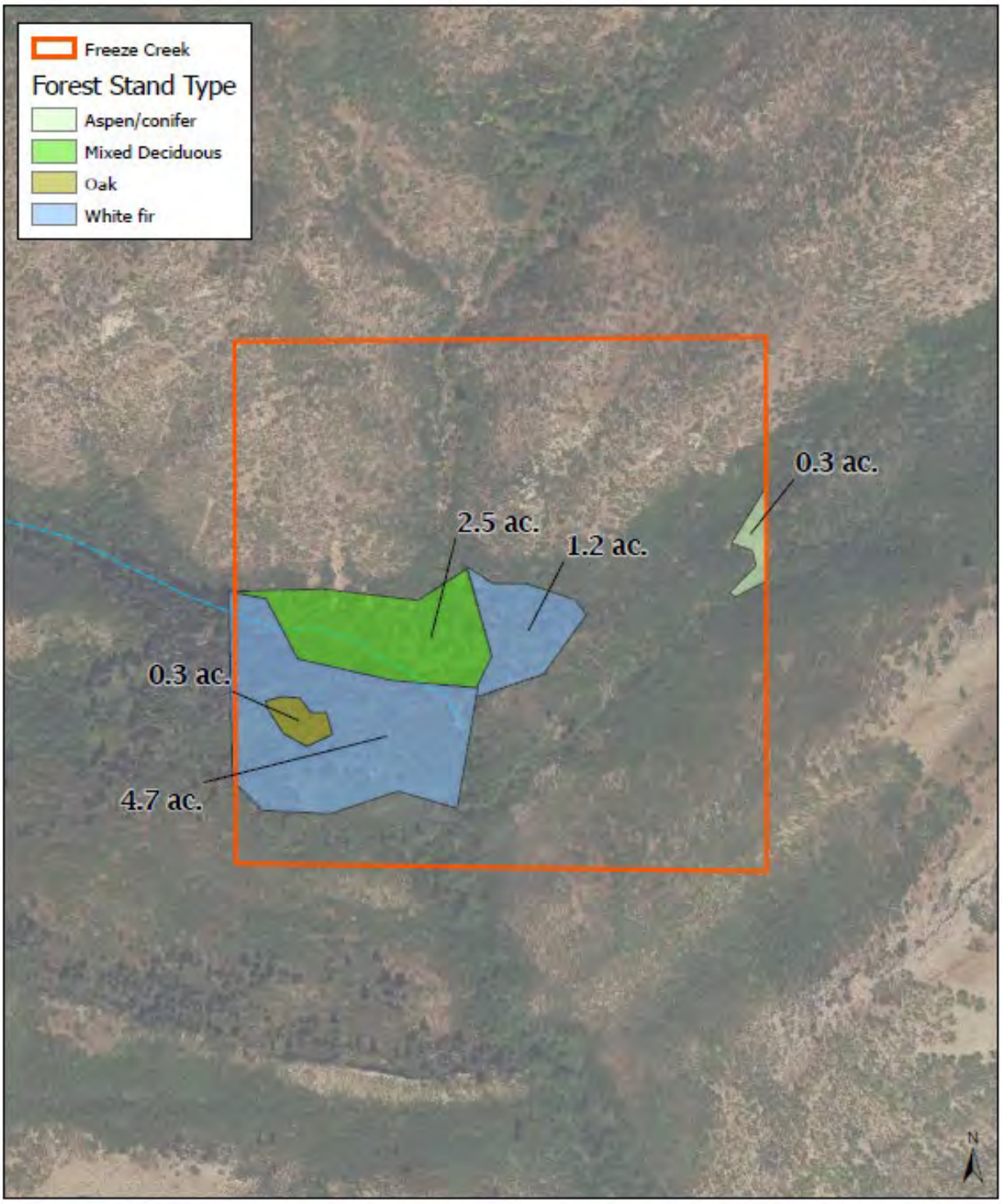
retention, and humidity. Disturbance agents, both biotic and abiotic, can also direct rangeland plant trends. Wildfire and its relation to Gambel oak and bigtooth maple regeneration and stature are observed on the property, as influenced by the 1988 *Emigration Wildfire*.

Browsing wildlife, especially Shiras moose may utilize rangelands year-round. Spring and fall-season forage is rendered for mule deer and elk on south and west-facing slopes that offer diminished snowpack. Gamble oak yield acorn crops on favorable years to black bear in the autumn season. Several shrub plants provide fleshy fruit to wildlife and birds. Access to springs and nearby flowing water provides important habitat for pollinators and wildlife dependent on the range resources.

Rangelands can be negatively impacted by establishment and expansion of non-native, invasive plant species.

Assessments and recommendations for rangelands that serve as wildlife habitat can be obtained by the UDWR, Central Region Office, 1115 N. Main Street, Springville, UT 84663 (801) 491-5678.

Additionally, advice concerning rangeland resources management can be gained through the USDA Natural Resource Conservation Service (NRCS) – Tooele Field Office, 185 N. Main Street, Tooele UT 84074, (435) 882-3018.



Freeze Creek Forest Stands

Scale: 1:4,000

0 500 1,000

Feet

Forest Resources

Trees and associated understory plants comprise forest vegetation resources. Varying combinations of forest plants are determined by sunlight intensity, available soil moisture capacity, inter-plant competition, age-related tree vigor, and an array of tree health drivers – in some part, or directly influenced by terrain features, soil chemistry and physical attributes, invasive species, climate, human manipulation and regenerative processes.

Forest and woodland resources on the property express structural, species and age-class diversity and richness.

Native shrubs and wildflowers (forbs) abundance across the property suggest that pollinators have effectively contributed to fruit and seed production which has enabled plant migration.

The most impactful recent occurrence on the property was the September 1988 *Emigration Wildfire*. That natural disturbance driver influenced aspen regeneration, oak-maple regeneration and mature and juvenile conifer tree mortality (likely dozens) on the eastern half of the property. The resulting vegetative responses to wildfire, expressed on the ownership, is in accordance with researched and published regional forest ecology.

There are two white fir dominated stands on the property. An aspen stand is situated on the eastern edge of the property. There is a diverse riparian zone associated with Freeze Creek which connects with a deciduous tree-dominated wetland forest type in proximity to water spring sources. A small but structurally unique grove of Gamble oak resides on the ownership.

A modified quick plot stand examination was conducted in May 2021. Botanical composition and structural attributes were noted.

White Fir Stand 1

This 1.2-acre stand is located east of a gully in the middle third of the property. It occupies a west-facing aspect with a mid and low slope position expressing thirty-two (32) to sixty-five (65) percent slopes at approximately 6,500 feet ASL. It's comprised of scattered, mature white fir trees with varying combinations of forb and grass understory plants including heartleaf arnica, mountain sweetroot, Utah sweetpea and waterleaf. Understory shrubs are significant and include snowberry, Oregon grape, kinnikinnick, bigtooth maple, Saskatoon serviceberry, and chokecherry. Fruit bearing shrubs are being sustained by native pollinators. The stand expressed an "open" character, allowing sunlight to reach the forest floor as shadows migrate underneath the white fir crowns. Fifty (50) to seventy (70) percent of open blue sky is observable in the daylight hours through the conifer tree canopy. Occasional remnant live mature aspen trunks are present, but have been in regression for some time due to lack of significant widespread disturbance and progressive sunlight filtering. The estimated basal area of mature white fir trees is around 70 square foot per acre. Estimated average trunk diameter at breast height (DBH) is 15 inches. The stand has been experiencing white fir tree blowdown for some time based on the scattered tree trunks deposited

across the stand. Remnant white fir lower trunks and root crowns of toppled trees demonstrate wood decay fungus tissue disease.
Many standing mature white fir exhibit previous damage from fir engraver beetle as tree tops are forked in structure. The largest tree encountered in the stand was a 35-inch DBH white fir with one-half of its crown blown down by wind at the junction of codominant leaders where included bark created a weak union. White fir tree seedlings and saplings are minimal within the stand. Available filtered sunlight is rendering advantage for grasses, forbs and shrubs on the forest floor, perhaps due to the sites "drier" quality. Evidence of historic fire is present on the uphill margin of the stand – likely the 1988 *Emigration Wildfire*. Charring within the stand is not widespread, but perhaps indicative of an isolated single tree lightning strike or a small spot fires. Game trails are evident within the stand. Previous tree harvest is not apparent.

White Fir Stand 2

This 4.7-acre stand is influenced by its east-facing aspect, which likely invites persistent spring snowpack guarded against the late afternoon sunlight. Twenty-five (25) to forty (40) percent of open blue sky is observable in the daylight hours through the conifer tree canopy. This mature white fir stand exists on a mid to low slope between nine (9) and forty-eight (48) percent value at an elevation of 6,575 feet ASL. The basal area of the stand is around 150 square foot per acre. Compared to White Fir Stand 1, this site contains many more small to mid-diameter class trees that boost its basal area value substantially. Average DBH is 12 inches. All dominant and co-dominant trees within the stand are white fir, which is the climax plant community tree type. The largest tree encountered has a DBH of 23 inches and a height of 80-feet. The understory is comprised of Fendler meadowrue, common yarrow, Utah sweetpea, and shade-tolerant grasses. Kinnikinnick, Oregon grape, bigtooth maple, Saskatoon serviceberry, snowberry, Wood's rose, and chokecherry shrubs also occupy. An occasional aspen stem or trunk can be observed in the stand, though the species is demonstrating a significant regression. Very few white fir saplings and no seedlings were noticed at observation points. Previous tree harvest is not apparent.

Freeze Creek Forested Wetland and Riparian Zone

In proximity to two water springs situated at the toe of three slopes, eroded deposited soils and modest ground angles have enabled the presence of mature narrowleaf cottonwood, abundant river birch, snake grass Equisetum, riparian grass-like plants and forbs to combine in what appears to be a small wetland forest approximately 2.5-acres in size. Wetland delineation by a qualified ecologist has not yet occurred. The site is depicted on the *Forest Stands Map* as *Mixed Deciduous*.

The opposing hillsides and mature white fir trees render late-morning and late-afternoon shade to the site, potentially conserving soil moisture. The cottonwoods appear overmatured and exhibit scaffold branch failure, likely attributed to wood decay and reduced tree vigor. Terrain influenced wind may play a role in branch break as well. Cottonwood tree regeneration is limited.

At the lower end of the wetland forest, water erosion appears evident. It is not known if water erosion is an ongoing process or a periodic reoccurring event during high water years. Localized creek headcutting has also occurred downslope in the Freeze Creek riparian channel as well.

The Freeze Creek Trail runs along the creek corridor taking advantage of the cool, shaded setting. In close proximity to the flowing water channel - narrowleaf cottonwood, river birch, Douglas hawthorn, boxelder, red-osier dogwood, shrub willow, and Wood's rose stabilize the creek banks at the southern boundary of the ownership. The riparian zone is rather narrow by way of riparian species reach from the water's edge. However, the adjacent upland slopes are also densely occupied with bigtooth maple, Gambel oak, currant, blue elderberry, snowberry, Saskatoon serviceberry, chokecherry, ninebark, and occasional Rocky Mountain juniper, aspen and white fir trees. Increased humidity near Freeze Creek has maintained plant vigor during the dry summer season compared to more sun-exposed upland sites. The riparian forest and creek corridor appear stabile and well stocked with vegetation. The shallowness of the soil above bedrock may be a compounding factor of observed headcutting erosion.

Aspen Stand 1

This stand is situated on the east boundary of the ownership at 6,750-foot ASL elevation. It's comprised of aspen trees regenerating from root masses as a result of the 1988 Emigration Fire. Large remnant aspen trunks are not present on the forest floor suggesting that the wildfire consumed most of the previous large woody material. The aspen on this site are the dominant tree species. The tallest heights of trees are around 30-feet. The average DBH of the stems is between two (2) and three (3) inches. The tree canopy blocks around 60% of available blue sky. Grasses, Fendler meadowrue, Utah sweetpea, Saskatoon serviceberry, chokecherry and bigtooth maple comprise the understory and stand margins.

Natural thinning is occurring within the stand, driven by competition for sunlight, and perhaps soil moisture. Some aspen are declining and dying as a result of being neglected from direct sunlight by companion stems. Aspen trunk canker disease is observed throughout the stand as well. The bigtooth maple may become an impactful competitor in the future if severe drought persists – as observed within other mixed deciduous stands in northern Utah. The stand's west- southwest aspect exposes the aspen to warm updraft summer winds which may favor the more drought-tolerant bigtooth maple.

Elk scat and beds were observed in the stand during the spring season. The stand extends onto the adjacent public land (Salt Lake City Public Utilities) to the east. A water spring is situated downhill and south of the aspen stand. The spring may have previously discharged water more abundantly and sponsored a small landslide some years after the wildfire. The localized spring exhibits other sapling species of trees related to aspen – narrowleaf cottonwood and willow shrub.

Matured Oak Grove

This 0.3-acre grove is situated in the middle of the White Fir Stand 2. Very mature Gamble oak with unique physical structures provide aesthetic contributions to the property. Several trunks and scaffold branches exhibit wind or snow load breakage. The understory is occupied by forbs, grasses and shrubs. Also within the understory are seedling and sapling white fir. To sustain the presence or Gambel oak, it is recommended that cleaning-weeding work be done to kill all encroaching white fir within the grove to maintain adequate long-term sunlight interception for the oak. The cleaning-weeding will likely take but one work day to accomplish, if residual material is cut and scattered on the ground. If conducted in the winter, removed trees might be considered as exportable Christmas tree stock as well.

Agroforestry

The landowner has expressed interest in collecting/cultivating Saskatoon serviceberry fruit, chokecherry fruit, blue elderberry fruit, and edible mushrooms within and adjacent to forest and woodland overstory trees. Late winter sap collection from maple trees is being examined for syrup production. Honeybee hives have been placed on the property for honey and wax production. Onsite processing of biochar soil amendments from woody plant residue is being investigated. The property owner has expressed potential for designing and implementing a multi-story food forest garden which may include non-native, introduced vegetables, vines, stone fruit trees, forbs and greens. All of these might be considered specialty crops and products. Space to conduct these activities may be sited and expanded through understory woody plant removal (cleaning-weeding) and residue management. Existing forest and woodland overstory may be physically manipulated to foster multi-story cropping system(s). White Fir Stand 2 and Rangeland are being considered candidate sites. Persistent observation and monitoring for the effects of introduced, non-native plants should accompany the experimentation of food forest gardening. Plants should be considered and selected to avoid invasive, weed plant potentials and escapes, including seed sources and purity.

As well, seedling trees may be planted to someday modify sunlight intensity (shadowing) and snow deposition through tree crown development - to benefit understory agricultural crops and soils. This endeavor may be employed on favorable habitat microsites on the southeast quarter of the property, where the 1988 *Emigration Wildfire* occurred.

The proposed agroforestry endeavors are novel and adaptive management will likely be employed to optimize the results.

The USDA Natural Resource Conservation Service is assisting the landowner through a Conservation Activity Plan which further explores the agricultural commodity potential(s) and activities. Assistance in these agricultural endeavors may be formulated through *NRCS conservation practice standards and supporting documents.* Landowner enrollment and direct implementation of practices are expected.

Aesthetic Quality and Desired Timber Species

The forest and woodland resources on the property offer diversity to the majority rangelands. Mature large trees may be an outcome of fire suppression that has likely occurred since the settlement era. The large trees offer shade and physical presence which increases its value as habitat and recreational potentials. Views are limited due to the creek-canyon landform, but on-site and visiting wildlife and insect resources are abundant and diverse. The properties Freeze Creek resource and water springs add to its value as a destination setting. The plant expression on the property appears adequate to the potential of the Emigration Canyon area. Invasive plants species remain an ongoing nearby threat to aesthetic and ecological resources.

Commercial timbering is not feasible due to the lack of roadway access and needed heavy equipment to conduct operations. The white fir stands are relatively small and volumes are not sufficient for third-party commercial interests in wood fiber. Wood decay diseases may persist indefinitely and expose large standing trees to windthrow potential. Wood decay diseases affecting white fir may diminish the volume and percentages of bole wood suited for processing into dimensional lumber.

White fir is adaptable as evident on the sites it occupies. White fir as the expected climax forest tree type is fulfilling its ecological trajectory. There may be potential to introduce (artificial regeneration) Douglas-fir *(Pseudotsuga menziesii var. glauca)* and ponderosa pine *(Pinus ponderosa)* to some sites, but experience and strategies will need to be developed to support the endeavors. Because no native ponderosa pine forests exist nearby, seed/genetic sources will have to originate from alternative locations. Some Douglas-fir seed/genetics may be introduced from stands elsewhere in Salt Lake County. Protecting transplanted trees from browse damage and persistent drought mortality will need to factor into management schemes.

Recreation

For some time, visitors to the forestland have in mostly been motivated by recreational pursuits – hiking in a natural setting, winter snowshoeing or skiing, wildlife and botanical viewing, and/or hunting of game animals. The primary trail on and leading to the property have likely been improved voluntarily by people residing in the Emigration Canyon community. The property and its resources are not well known or published. The owners are enjoying the property as a recreational destination that involves camping, observing nature and outdoors play. On-property work, in some forms, are valued as “recreational escape” enabling quality family time together as well.

The single, established on-property trail may gain some improvements. New trails may be established to facilitate fire breaks, emergency responder access, recreation and property management work. Recreation may impact riparian resources negatively, so actions should be assessed for unintended outcomes.

Recreation may increase or develop more broadly as the owners and guests become connected to the land. Amenities such as equipment storage caches and non-permanent tents/yurts may enable increased recreation and longer-duration stays.

Wood and Fiber Production

Woody forest plants are accumulating mass at varying rates, influenced by soil water quantities and temperatures/humidity regimes affecting spring-season terminal leader and lateral branch growth and ring wood diameter. Wood tissue accumulation is directly correlated with leaf photosynthesis and cellular respiration. Net-positive energy conversion and storage enables productive accumulation of chemicals that comprise plant tissues and tree specimen survival.
Wood decay diseases are abundant, affecting tree longevity and structural capacity to remain standing. Wood decay diseases reduce lumber quality and durability.

White fir wood fiber will begin to be utilized on the property for constructing small structures and amenities.

Deciduous (oak) wood may be used as feedstock (fungal inoculation sites) for cultivating edible mushrooms.

Wood may be collected and use as heating and cooking fuel.

Limited equipment access to the property will prolong the processing timelines and movement distance of wood as a local product. Most processing will be conducted by hand using small, portable tools to which personal injury potential must always be mitigated.

Fish and Wildlife

Wildlife occurring in Utah is a public resource of the state. To that end, the UDWR is charged with the management of wildlife and also aids and partnerships with private landowners and public land administrators where wildlife and habitat is a concern. Wildlife resources occurring in Salt Lake County are administered by the Northern Regional Office of the UDWR located at 515 E. 5300 S. Ogden, UT 84405, (801) 476-2740.

Fostering and sustaining wildlife populations is a function of managing natural resources on the property.

The UDWR has identified within the *Utah Wildlife Action Plan 2015-2025, Key Habitats* observed on the property. They include; 1) *Aspen-Conifer Forest,* 2) *Gambel Oak,* 3) *Aquatic – Forested,* 4) *Aquatic – Scrub/Shrub*, and 5) *Mountain Shrub.* A summary for each habitat and potential threats are included in the Appendix.

There are many species of wildlife that utilize the different habitat types on this property. Some are seasonal visitors while others remain year-round. Mule deer, elk, moose, foxes, gophers, cougars, black bear, mice, porcupines, coyotes, bobcats, rabbits, bats, skunks, squirrels, marmots, woodrats, raccoons, marten, fishers, mink, weasels and voles are common across the property. Beavers don't appear to be present. Snakes, salamanders, frogs and lizards are likely present. Songbirds, game birds and raptor birds are observed across the property.

Aspen-Conifer Forest Habitat

These *Key Habitat* sub-types occupy the property and are designated as:

Inter-Mountain Basins Aspen – Mixed Conifer Forest and Woodland - Low Elevation
Rocky Mountain Aspen Forest and Woodland

Large ungulate game species, predators, game bird species, raptors, songbirds and small mammals utilize this habitat for food and cover. Forest successional status and tree, shrub and forb stratum vary across the ownership.

Gambel Oak

These *Key Habitat* sub-types occupy the property and are designated as:

Rocky Mountain Gambel Oak-Mixed Montane Shrubland – Continuous
Rocky Mountain Gambel Oak-Mixed Montane Shrubland – Patchy

Larger continuous patches of Gambel oak as well as smaller populations intermixed on drier sites. Gambel oak habitats are observed to include companion bigtooth maple trees. Brushy growth forms of Gambel oak are utilized by big game and provide habitat for birds and rodents. Young oak pole stands provide sites for foliage-nesting birds. Mature growth forms provide acorn yields for squirrels, wild turkey, elk, deer and black bear. New, tender sprouts of Gambel oak are a major forage species for moose, deer and elk.

Aquatic-Forested

This *Key Habitat* is characterized by woody vegetation greater than 6-meters in height, commonly found around the margins springs and creeks. Narrowleaf cottonwood and water birch (Mixed Deciduous stand) is present on the property and contribute to this habitat type. This key habitat appears to be proximate to emergent wetland understory plants that tolerate long periods of soil saturation. Browsing ungulates, rodents, raptors and songbirds will utilize the vegetation as important food and cover. Riparian zones are comprised tall woody vegetation as well. Companion shrub species also provide shading to maintain cool creek temperatures and water oxygen content.

Aquatic-Scrub/Shrub

This *Key Habitat* is characterized by woody vegetation less than 6-meters in height, and can include those areas near flowing-water resources. Habitat sites include both intermittent and perennially flooded areas. Riparian zones are comprised of Aquatic – scrub/shrub habitats. Moose will utilize the willows and dogwood. River birch, thinleaf alder, Wood's rose and red-osier

dogwood also gain use by birds and mammals on the property. These shrub species also provide soil bank stabilization along the creek.

Mountain Shrub
These *Key Habitat* sub-types occupy the property and are designated as:

Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland
Rocky Mountain Bigtooth Maple Ravine Woodland
Rocky Mountain Lower Montane-Foothill Shrubland – No True Mountain Mahogany
Rocky Mountain Lower Montane-Foothill Shrubland – True Mountain Mahogany

Moose, elk and mule deer may use this zone for food and cover especially in the spring and fall seasons. Curl-leaf mahogany, chokecherry, snowbrush ceanothus, serviceberry (Utah and Saskatoon), snowberry, ninebark, blue elderberry and bigtooth maple are the dominant shrub species in this zone. Many songbirds and grouse frequent these areas at different times of the year to eat the berries produced by the shrubs. Black bears utilize mountain brush habitats for forage and cover. The floral habits of the mountain shrub plants are beneficial to native insects seeking pollen and nectar.

Threatened and Endangered Species

No known federally listed threatened or endangered species exist on the property. In the vicinity of the ownership, the following *Utah Species of Greatest Conservation Need* (SGCN) have potential for existence based on mapping published by the UDWR, Utah Conservation Data Center program.

Species	Listing Agency	Status
Utah Ambersnail, *Succinea rustincana*	State	SGCN
Flammulated Owl, *Psiloscops flammeolus*	State	SGCN
Northern Goshawk, *Accipiter gentilis*	State	SGCN
Western Toad, *Anaxyrus boreas*	State	SGCN
June Sucker, *Chasmist horus*	State	SGCN
Northern Leopard Frog, *Lithobates pipiens*	State	SGCN
Bald Eagle, *Halaeets leucocephalus*	State	SGCN
Cross Snaggletooth, *Gastrocoptera quadridens*	State	SGCN
Kit Fox, *Vulpes macrotis*	State	SGCN
Black Swift, *Cypseloides niger*	State	SGCN
Columbia Spotted Frog, *Rana luteiventris*	State	SGCN
Mitered Vertigo, *Vertigo modesta concinnula*	State	SGCN
Coarse Rams-horn, *Planobella binneyi*	State	SGCN
Ferruginous Hawk, *Buteo regalis*	State	SGCN
Western Pearlshell, *Margaritifera falcata*	State	SGCN
Lewis's Woodpecker, *Melanerpes lewis*	State	SGCN
Bonneville Cutthroat Trout, *Oncorhynchus clarkii Utah*	State	SGCN
Mountain Marshsnail, *Stagnicola montanensis*	State	SGCN
Least Chub, *Lotishthys phlegethontis*	State	SGCN

If threatened or endangered species are found during the course of implementing this plan, management activities should be reviewed to insure they do not harm the species, or destroy the habitat they occupy. The landowner is advised to contact the UDWR for direction.

Forest Health and Invasive Species

Tree health can be affected by plant tolerances and intolerances to growing conditions, the effects of destructive insect pests and diseases of woody plants, weather phenomena and the manipulation of vegetation through management and activities that occur in the forest. Forest health involves trees, but also companion plant forms and communities that reside on shared ground.

Drought has and will continue to be a significant agent of forest succession and health in the long-term. Drought is a re-occurring phenomena that has influenced plant communities in northern Utah for millennia. A severe drought is underway in the region and will likely affect perennial woody plants negatively by reducing vigor or defense mechanisms or by causing damage to water-conducting vascular system tissues – including rapid hydraulic collapse.

Variable climate patterns, especially affected by opposing eastern Pacific Ocean La Nina and El Nino, influence the gain of precipitation on the land and temperature averages. Unfortunately, years that either of these climate patterns dominate, the potential outcome is drier conditions than normal. Additionally, the property is situated against the eastern reach of the Great Basin and Range geophysical province where air masses derived from the distant Pacific Ocean can gain influence – elevated air temperatures and single-digit relative humidity can increase plant stress in the short term and elevate evaporative demand over many weeks.

Trees can also be negatively impacted by high-velocity, terrain-driven winds and snow avalanches that can damage or destabilize them. Human disruption or alteration of tree root functions by soil grade changes, trenching and/or root removal can predispose plants to growing condition stressors and subsequent attacks by insect pests and root decay diseases.

Regular, periodic surveys of forest stands on the property will help determine location, extend and potential management response needs to address forest health issues. Forest management action thresholds will be optimized by ongoing forest health monitoring and mapping work.

Forest pathology examines the role of diseases and wood tissue decays affecting trees. Forest entomology examines the role that insects play, especially ones that in disrupt tree tissues and plant survival. Diseases and insects can be secondary agents of drought-induced moisture stress, physical damage to trees and the effects of extreme temperature variations. The following table summarized common, potential forest insect pests and diseases which might impact tree health on the property.

Table: Potential and Active Forest Tree Insect and Disease Pests

Tree Species	Tree Pest(s)	Where to Examine	What to Look For
white fir, *Abies concolor*	Insects; fir engraver beetle, Douglas-fir tussock moth, western spruce budworm, balsam woolly adelgid, white fir needleminer, cutworms	Trunk, branches, buds, leaves	Needle drop, branch and tree top growth reduction and death, seedling mortality.
white fir, *Abies concolor*	Diseases; fir dwarf mistletoe, white fir mistletoe, Annosus root rot, yellowcap fungus, Indian paint fungus, white pocket rot	Trunk, roots, branches	Witches brooms on branches, tree top death, shortened terminal growth
aspen, *Populus tremuloides*	Insects; poplar/aspen borer, clearwing moths	entire tree trunk, branches and leaves	holes emitting sap, woodpecker mining, tree trunk color changes, leaf necrosis, early fall leave drop
aspen, *Populus tremuloides*	Diseases; black leaf spot fungus, trunk decay disease, root and butt rot pathogens, stems cankers,	Trunk, branches, leaves	leaf necrosis, trunk cankers and early fall leave drop, root decay
bigtooth maple, *Acer grandidentatum*	fall cankerworm, and wood boring insects	leaves	moderate to heavy defoliation by caterpillars
Gambel oak, *Quercus gambelii*	fall cankerworm, gypsy moth and wood boring insects	leaves	moderate to heavy defoliation by caterpillars

The following describes the major forest/woodland insect and disease agents that are, or may potentially be active on the property. Additional pamphlets and fact sheets are also included in the Appendix of the plan.

Balsam Woolly Adelgid (BWA)

Adelges piceae (Ratzeburg) is a non-native, invasive insect detected in northern Utah in 2017. It may have existed in Salt Lake County several years prior however. North American fir species have hypersensitive responses to the adelgid's feeding that disrupt the trees' metabolism, damage the vascular system, and reduce radial growth, which can kill the trees (Balch, 1952, Balch et al., 1964). In western North America, BWA is causing the slow disappearance of fir (*Abies*) from some ecosystems (Ragenovich and Mitchell, 2006). BWA insects may locally reach adult life stages in the spring and fall seasons, when storms descending from the Pacific Northwest illicit strong prefrontal winds and post storm winds. These directional winds could effectively disperse

the very small, mobile adults' miles away via air masses moving across forests comprised of true firs. If not already present, BWA has strong potential to exist on the property. The piercing-sucking feeding habit of BWA offers countless feeding points on individual trees. Populations build up quickly in forests.

The property has historically demonstrated and sustained the significant, but limited, white fir conifer component. The uncertainties of the long-term effects of BWA to white fir existence and productive capacity deserve awareness and caution. The current and future growth potential of white fir seedlings and sapling trees may be subject to impacts by BWA. The current and future cone productivity and viable seed yields rendered by mature white fir trees may be subject to impacts by BWA. Invasive species, BWA included, are sometimes referred to as biological wildfire equivalents. The fidelity of the white fir forest type (reproduction and dominance) may become casualty of the BWA – perhaps reflecting unsustainability that could impact the land for many decades. Employed management actions to white fir simultaneous to undetermined but potential negative effects of BWA, could affect resilience of the tree species to persist as it has in the past.

Dwarf Mistletoe

Mistletoes (*Arceuthobium* spp.) are parasitic plants that extract water and nutrients from their host tree. Witches brooms often form on infected branches. Top kill is common. Mistletoes affect tree form. They reduce growth, wood quality, seed production, and life span of host trees. Severe infections may eventually kill trees. Infected trees can increase activity of secondary pests that often attack and kill the infected trees (Hawkworth et al. 1996). Host-specific mistletoe diseases are associated with the white fir tree species, the dominant conifer present.

Fir Engraver

Fir Engraver (*Scolytus ventralis* LeConte) is a native bark beetle affecting white fir mostly, but occasionally subalpine fir. Adults and larvae feed in phloem layer of inner bark. Often trees are top killed although whole trees can be killed if attacked by enough beetles. Attacked trees are generally 5 inches or greater in diameter. Root diseases can be a precursor for fir engraver attack.

Root and Trunk Wood Pathogens

Root diseases are decay fungi that break down cellulose and lignin that comprise wood tissues in trees – mostly roots and lower tree trunks. They can also kill the cambium of roots and the root collar, resulting in girdling of the tree. Pathogens of conifer trees are sometimes referred to as white or brown rots, referring to the appearance of the fungal mycelium or decayed wood color staining. Older trees and high-density stands are at higher risk to some root and trunk rots compared to young or open stands. Once established on a site, root disease fungi persist or may become permanent, living for decades in the root and stumps and killing new trees that seed into the site (Hagle 2010). The result of the pathogens is usually several to hundreds of trees dying or dead in patches called root disease patches, or pockets. Tree crown symptoms of root pathogens vary according to rapidity of death, involvement of bark beetles, and season of death. Root diseases can be conveyed from diseased trees to healthy trees by root grafts that occur in the soil. Small

trees which are killed rapidly by root disease may turn uniformly red without having been attacked by bark beetles. Shortened terminal growth and short leaves are often symptoms of root disease infection. These symptoms are especially apparent in seedlings and saplings a year or two before death. Armillaria root disease, laminated root rot, Schweinitzii root and butt rot, Annosus root disease and Tomentosus root rot are potential root pathogens on the property. Root diseases can lead to tree instability or resulting windthrow as well as increased attack potential by bark beetles. Fir engraver beetle and western balsam bark beetle may be attracted to respective conifer tree hosts effected by diseased weakened roots (Hagle 2010).

Other Insects and Diseases

White fir on the property are hosts to additional insects and pathogens, though they may not become mass-mortality event drivers. Other insects and diseases include white fir needleminer, cutworms, gypsy moth (nonnative invasive), Douglas-fir tussock moth, western spruce budworm, western balsam bark beetle, fall cankerworm, aspen borer, blue stain fungus of sapwood, and aspen black leaf spot fungus.

As invasive, nonnative insects are detected in the state, the Utah Department of Agriculture and Food and Utah State University Extension Services will provide advisory documents and prescribe methods to suppress or eradicate them.

Annual surveys of forests for appearances and tree symptoms associated with insect and disease agents is a best practice to identify and potentially react to threats. Site disturbances or stressors to trees caused by environmental factors can elevate the risk of insect and pathogens.

If signs and symptoms of tree stress, steady decline, or mortality are observed the DFFSL may be able to diagnose and advise further on forest health issues. Please contact the Division's Forest Health Program Coordinator, 1594 W. North Temple, Suite 3520, Salt Lake City, UT 84114, (801) 538-5555.

Invasive Species

Noxious weeds (state recognized non-native invasive plants) are considered harmful to wildlife habitat and native plant communities. Invasive plant species can have a significant impact on an array of ecological facets. Invasive plants reduce species richness, plant diversity, and plant community productivity. Wildlife forage and cover species may be degraded; soil erosion and stream sedimentation may result; soil moisture and nutrient levels may be depleted; and wildfire regimes may be altered by invasive plant species. Working with the land and activities on it will enable property owners to readily observe and react to plants that demonstrate weed-pest attributes.

On-site technical assistance to identify and potentially control invasive species plant is available from the *Salt Lake County Weed Supervisor,* Salt Lake County Health Department, 2001 S. State Street, Ste. S2-600, Salt Lake City, UT 84190, (385) 468-4035. Partnerships and suppression

projects focused on invasive plants is available through the *Bonneville Cooperative Weed Management Area* workgroup.

As well, plant identification and weed control advice might be obtained from the *Utah State University – Salt Lake County Extension Services* which maintains an office at the Salt Lake County Government Center, 2001 S. State Street, Ste. S1-300, Salt Lake City, UT 84190 (385) 468-4828.

Listed in the Appendix of this plan the *2021 State of Utah - Noxious Weed List,* published by the Utah Department of Agriculture and Food. State law requires the active suppression of certain weed species designated by the County (Salt Lake) Weed Board.

Weed seed can migrate onto the property by wildlife, sporting equipment, construction equipment, pets, footwear and clothing. Some seed transports within soil clods and mud. Preventing weed seeds from migrating onto the property and suppressing newly established weed populations are very effective at preserving the ecological integrity of the property.

Early detection and rapid response are an effective weed management model that calls for annual surveys and focused intent to keep small problems small, and quickly eradicate threats.

The following listed weeds (selected for real and potential existence on the Freeze Creek property) are designated and published as noxious for the State of Utah, as per the authority vested in the Commissioner of Agriculture and Food under Section 4-17-3:
There are designated five classes of noxious weeds in the state: Class 1A (EDRR Watch List), Class 1 (EDRR), Class 2 (Control), Class 3 (Containment), and Class 4 (Prohibited for sale or propagation).
Class 1A: Early Detection Rapid Response (EDRR) Watch List Declared noxious and invasive weeds not native to the state of Utah and not known to exist in the State that pose a serious threat to the state and should be considered as a very high priority.
Class 1B: Early Detection Rapid Response (EDRR) Declared noxious and invasive weeds not native to the State of Utah that are known to exist in the state in very limited populations and pose a serious threat to the state and should be considered as a very high priority.
Class 2: Control Declared noxious and invasive weeds not native to the state of Utah, that pose a threat to the state and should be considered a high priority for control. Weeds listed in the control list are known to exist in varying populations throughout the state. The concentration of these weeds is at a level where control or eradication may be possible.
Class 3: Containment Declared noxious and invasive weeds not native to the State of Utah that are widely spread. Weeds listed in the containment noxious weeds list are known to exist in various populations throughout the state. Weed control efforts may be directed at reducing or eliminating new or expanding weed populations. Known and established weed populations, as determined by the weed control authority, may be managed by any approved weed control methodology, as determined by the weed control authority. These weeds pose a threat to the agricultural industry and agricultural products.
Class 4: Prohibited Declared noxious and invasive weeds, not native to the state of Utah, that pose a threat to the state through the retail sale or propagation in the nursery and greenhouse industry. Prohibited noxious weeds are annual, biennial, or perennial plants that the commissioner

designates as having the potential or are known to be detrimental to human or animal health, the environment, public roads, crops, or other property.

Table 5: Detected Weed Pests

Common Name	*Scientific Name*	*Class*
Canada Thistle	*Conium maculatum*	*3*
Houndstongue	*Cynoglossum officianale*	*3*
Dalmatian Toadflax	*Linaria dalmatica*	*2*
Downy Brome	*Bromus tectorum*	*none*

Table 6: Potential Weed Pests

Common Name	*Scientific Name*	
Purple Loosestrife	*Lythrum salicaria L.*	*2*
Medusahead Rye	*Taeniatherumcaput-edusae*	*2*
Yellow Starthistle	*Centaurea solstitialis*	*2*
Vipers Bugloss	*Echium vulgare*	*1B*
Oxeye Daisy	*Leucanthemum vulgara*	*1B*
Common St. Johnswort	*Hypericum perforatum*	*1B*
Leafy Spurge	*Euphorbia esula*	*2*
Poison Hemlock	*Conium maculatum*	*3*
Ventenata	*Venteneata dubia*	*1A*
Dyers Woad	*Isatis tinctoria L.*	*2*
Spotted Knapweed	*Centaurea stoebe*	*2*
Black Henbane	*Hyoscyamus niger*	*2*
Cutleaf Vipergrass	*Scorzonera lacinata*	*1B*
Japanese Knotweed	*Polygonum cuspidatum*	*1B*
Purple Starthistle	*Centaurea calictrapa*	*1B*
Diffuse Knapweed	*Centaurea diffusa*	*2*
Myrtle Spurge	*Euporbia mysinites*	*4*
Yellow Toadflax	*Linaria vulgaris*	*2*
Jointed Goatgrass	*Aegilops cylindrica*	*3*
Garlic Mustard	*Alliaria petiolata*	*1B*
Hoary Cress	*Cardaria draba*	*3*
Scotch Thistle	*Onopordium acanthium*	*3*
Musk Thistle	*Carduus nutans*	*3*
Field Bindweed	*Convolvulus arvensis*	*3*
Bulbous Bluegrass	*Poa bulbosa*	*none*
Japanese Brome	*Bromus japonica*	*none*
White Bryony	*Bryonia alba*	*none*
Phragmites	*Phragmites australis*	*none*

Invasive species might also include new insect and aquatic species that threatened natural resources. As newly identified species are detected in the state, the Utah Department of Agriculture and Food and Utah State University Extension Services will provide advisory documents and prescribe methods to manage them.

Conservation-based Estate Planning/Legacy Planning Information

No conservation easements are currently assigned to the property. There exist several conservation easement programs and organizations active in the state of Utah. Some have been involved in

previous work in the Emigration Creek basin and are familiar with the resources and values contained in the area. Estate planning, conducted under advisement by legal professionals, may facilitate landowner long-term interests.

The DFFSL in coordination with the USDA Forest Service – State and Private Forestry Program administers a federal conservation easement program titled Forest Legacy. For information about the program, its requirements and outcomes, contact the Forest Legacy Program Coordinator (435) 210-1206.

Archaeological, Cultural and Historic Sites

Any steps to protect archaeological resources that may be found on the property are highly encouraged. If evidence of sites is discovered during the course of implementing this plan, the landowner must notify the Division of State History as required by Utah Code Title 9-8-307. If the landowner receives state or federal grant funds for project implementation, then archeological clearance is required. If, upon completion of a survey done by the Division of State History, archaeological resources are found to be present, mitigating measures may have to be addressed for protection. The landowner should consider any of all viable management alternatives if such sites are discovered on or near areas designated for management. This information is provided to assist in identifying historic properties, per the consultation procedures of the National Historic Preservation Act's Section 106 regulations (36 CFR 800).

Utah Code Section 9-8-302, Definitions, states:
(4) "Archaeological resources" means all material remains and their associations, recoverable or discoverable through excavation or survey, that provide information pertaining to the historic or prehistoric peoples of the state.
(9) "Excavate" means the recovery of archaeological resources.
(17) "Site" means any petroglyphs, pictographs, structural remains, or geographic location that is the source of archaeological deposits or specimens.
(18) "Specimen" means all man-made artifacts and remains of an archaeological or anthropological nature found on or below the surface of the earth, excluding structural remains.

Utah Code Section 9-8-307, Report of discovery on state or private lands, states:
(2) Any person who discovers any archaeological resources on privately owned lands shall promptly report the discovery to the division [of State History].
(4) Nothing in this section may be construed to authorize any person to survey or excavate for archaeological resources.

The Utah Division of State History can be contacted at 3760 S. Highland Dr., Salt Lake City, UT 84106, (801) 245-7263. https://history.utah.gov/about-us/contact-us/

Wetlands

There is potential that a jurisdictional wetland resource exists near the middle of the property at the convergence of the three major mountain slopes contributing to the existence of the mixed deciduous forest type (depicted by the green polygon on the *Forest Stands Map*, page 12). There, a water spring(s) is evident and narrowleaf cottonwood and water birch trees are present. Freeze Creek might also support jurisdictional wetlands along its conveyance. A site assessment by a qualified wetland ecologist would help determine the physical attributes and associations of prolonged water presence.

Wetlands are an important, limited resource in Utah. Several land management policies apply to wetlands. To better determine wetland classification and extent, the Utah Geological Survey would be the good resource for inquiry and advise pertaining to wetlands. The agency is located at 1594 W. North Temple, Salt Lake City, UT 84114 (801) 537-3300.
https://geology.utah.gov

Fire

A major problem when attempting any generalization about the effects of fire is the variation in fire intensity, duration, frequency, location, shape, extent, season, fuels, site and soils.

Fire creates, destroys, enhances, or degrades wildlife habitat thereby causing changes in the subsequent occurrence and abundance of animal species on, and in proximity to, a burned area.

Fires role as a natural forest ecological agent is recognized and situationally promoted by public land management agencies.

The vegetation on the property exhibits risk potentials for unintended wildfire. The annual and decades-long accumulation of woody matter, leaf litter and duff are a natural phenomenon that predisposes plant communities for a wildfire event(s). The risk of *stand-replacing fires* is real, but the outcome is not certain. Such disturbance fires are typically followed by early succession plant species taking advantage of reduced perennial plant competition, greater sunlight exposure and increased moisture interception – if soils are not sluffed off by secondary erosive forces. Stand replacing fires could alter the settings where mature plant communities now reside. The status of white fir climax forest stands may wholly, or in part, be influenced by the exclusion of natural fire for many decades. As the published soil survey suggests, the existence of forests in their current mature state may not be the long-term destination potential based on aspect, soil character, and reoccurring drought cycles for the region. Shrubs and deciduous woodlands may be the better-suited woody cover species for the site. The shrubby expression of Gamble oak is a persistent, fire adapted species that likely will, and has demonstrated favorable response to wildfire.

All soils comprising the property are highly susceptible to water erosion. Wildfire, specifically stand replacing ones, have potential to contribute to mass erosion events years after the fire. Perhaps too, a substantial rain-on-snow spring season event could sponsor landslides and erosion

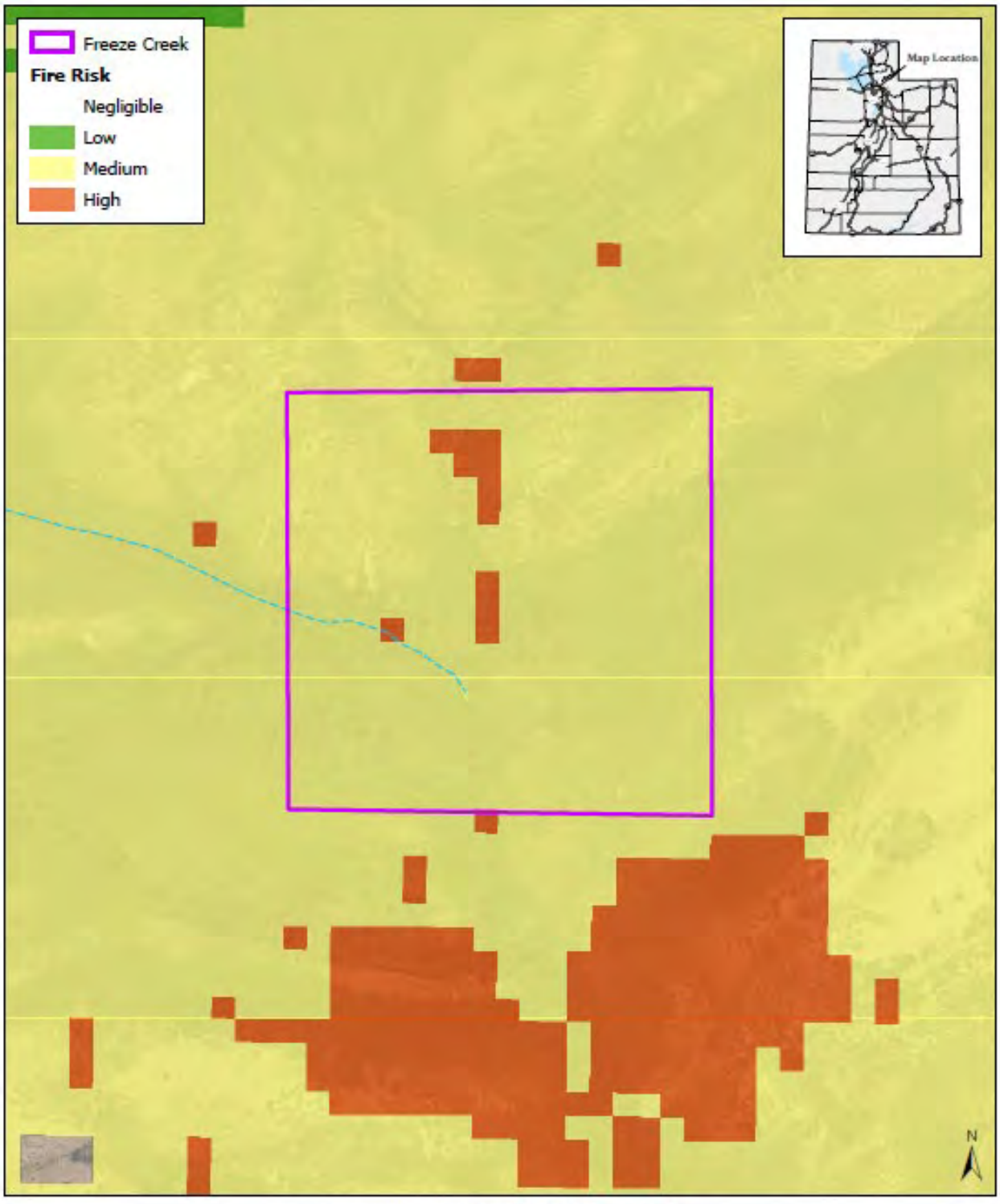
based on the shallow bedrock layers existing in Emigration Canyon. The Wasatch Range mountains do also express landslide in the absence of wildfire impacts.

Wildland fire is a re-occurring phenomenon in Salt Lake County. Over the progression of the summer season and perhaps well into the fall, the potential for wildfire can steadily increase, especially in drought years. Autumn-season wildfires along the Wasatch Mountain Range can be very erratic, fast-moving and sizeable. The September 1988 Emigration fire impacted the property and influenced the successional pathway and current conditions for rangeland, woodland and forest resources on the property. Observed outcomes from the 1988 wildfire do not suggest catastrophic long-term impact, but there may be some results and actions in the first decade that are not well-known.

Local and regional emergency responders and community representatives have participated in creating the *Emigration Canyon Wildfire Preparedness Plan.* No specific recommendations from that plan have been prescribed for the property. Whereas no permanent structures exist on the property, defensible space strategies are not applicable. Wildland fire response is a local government public service assigned to Unified Fire Authority.

In 2016, the *Utah Cooperative Wildfire System* was enacted by the Utah State Legislature. The system is based on the simple principle of risk reduction; wherein the state will pay the costs of large and extended attack wildland fire ("catastrophic fires") in exchange for local government providing initial attack and implement prevention, preparedness and mitigation actions that are proven to reduce the risk and costs of wildland fire in the long run. The local government entity eligible to participate is the Unified Fire Authority.

Technical assessments and advice to prepare for wildfire and mitigate risk can be obtained from the Unified Fire Authority, most likely from the experienced local firefighters working from Station 119, situated in the Emigration Canyon community.



Freeze Creek Wildfire Risk

Scale: 1:5,000

0 500 1,000 1,500 2,000

Feet

Carbon Sequestration and Climate Resilience

All forest plants and supportive soils have an essential relationship with the earth element carbon. Water, carbon dioxide and oxygen are both drivers and byproducts of two highly ordered and repeated biochemical processes – photosynthesis and plant cell respiration. Trees, shrubs, grasses, forbs, mosses, bacteria, fungi, viruses, insects and animals are forest life forms comprised of carbon. As plants encounter and convert sunlight energy to glucose chemical energy forms, carbon, in part, is constructed into plant tissues. As plants produce litter through leaf drop, branch drop, and root decay, a wide range of soil organisms consume cellulose (carbon containing) plant tissues for their energy. Soils, especially those comprised of high organic matter, retain and process carbon. Soils prone to organic layer loss due to slope steepness and erosive character can be reduced in their carbon storage and processing potential.

The acquisition and temporary storage of carbon from the atmosphere into plant tissues and soils is a termed coined carbon sequestration. Sequestration occurs at the single plant level and as well as a stand level. The repositioning of carbon into soils is an outcome of forest and rangeland plant tissue life and death. The forests and rangelands express carbon utilization, storage and releases at varying rates and in varying volumes across the land.

Applied forestry and rangeland management can maintain and expand opportunities to sequester atmospheric carbon while providing additional land-resource contributions, such as wildlife habitat, rainfall energy dissipation, water filtration, soil nitrogen mineralization, waterway shading, heating wood, construction lumber and some pretty great places to live, work and recreate. Forest and rangeland management work can influence plant type presence on the land, plant community competitions and relations with water and soil.

This plan is intended to identify and prioritize work and outputs in accordance to the strategies implemented in the effort of *forestry*. Fostering natural regeneration, planting new trees and maintaining future forest canopy, through targeted thinning and select mature tree removal are some of the ways to direct forest carbon gain and storage potential in the long run.

Applied forestry and rangeland management may be considered a suited action alternative to the uncertainties and challenges expressed by climate change. Variations in plants' annual growing and dormancy seasons, as affected by temperature and precipitation, can influence the highly ordered photosynthetic and cell respiration biochemical processes. Creating opportunities for genetic migration or the emergence of plant trait characteristics previously conditioned to be resilient to climate change may hasten the conservation of forest, woodland and rangeland types. Regenerating and maintaining diverse vegetation cover types (species, ages, structure, genetics, and vigor) are endeavors that may hasten resilience.

Recommendations and Implementation Schedule

This section of the plan contains potential outcomes based on practices and strategies for achieving objectives identified by the landowner as important. Recommended practices are based on current resource conditions, identified in the **Resource Description and Assessment** sections. Recommendations are limited to the acreages described in the plan, and do not reflect advise to other entities or interests.

Date	Recommend Practice(s) Description	Location	Desired Future Conditions
2022, then ongoing	Survey for invasive, noxious weeds – map locations then suppress them	Entire property	Native plant communities are conserved against the threats of noxious, invasive weeds. Small weed plant outbreaks are detected early and gains treatment. Weed seed production and transport is effectively curtailed.
Every 5 to 10 years when conditions are favorable	Prepare planting sites, procure and plant Douglas-fir tree seedlings in gully landform situated in the southeast quarter of the property affected by the 1988 Emigration wildfire. Install seedling browse protection devices and mulch barrier products. Formulate actions based on NRCS practice codes (490) and (612)	Rangeland	New trees and shrubs are established on favorable microsites to diversify species and perhaps modify surface shading and snow deposition attributes.
2022, then ongoing	Selectively fell and process intermediate diameter-class white fir trees/bole wood into dimension lumber material for use on site. Lop and scatter crown materials. Formulate actions based on NRCS practice code (666)	White fir Stand 2	Achieve a target basal area volume around 70 square feet per acre. Wood fiber is yielded for personal use on the property.
2022	Clean-weed all understory white fir saplings within the matured oak grove. Sustain sunlight availability to favor Gambel oak. Formulate actions based on NRCS practice code (666)	Matured Gamble Oak grove	Matured oak grove is maintained for overstory dominance/advantage.
Favorable water years	Enhance the forested wetland stand with native riparian tree transplants. Implement planting trials where available sunlight favors crown growth. Formulate actions based on NRCS practice codes (490) and (612)	Mixed Deciduous Stand	Riparian appropriate trees persist on the wetland site and express age-class diversity.
2022, then ongoing	Survey and document site attributes that favor specialty products that will be cultured on the property. Prepare multi-story cropping areas through understory cleaning-weeding or woody perennial plant establishment. Conduct practices after designing risk mitigations to conserve native plant community fidelity	Select areas across property	Novel specialty products and land management work is employed based on the interests of the landowner.

Appendix

Appendix A: Glossary of Terms and Definitions

Appendix B: Soil Maps, Descriptions and Ratings

Appendix C: Key Habitat Descriptions, Species Characteristics

Appendix D: Range Productivity Maps and Ratings

Appendix E: Forest Health Pamphlets; Insect, Disease, Weeds

Appendix F: Seedling Nursery Vendor List and Use Pamphlets

Appendix G: Utah Noxious Weed Control Act

Appendix H: Literature Cited

Exhibit 4

USDA NRCS Schedule of Operations

US DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PLAN OR SCHEDULE OF OPERATIONS

NRCS-CPA-1155
03/2019

PARTICIPANT	COUNTY AND STATE	PROGRAM AND CONTRACT NUMBER	SUBACCOUNT
RYAN LEICK	SALT LAKE County, UT	EQIP 2018 748D43220U0 **PY 2017 Prior Year Funds Used**	FY 22 Utah BFR

LAND UNITS OR LEGAL DESCRIPTION	WATERSHED	ACRES	EXPIRATION DATE
Farm:1179 Tract(s):10780.	Emigration Creek	40.8	12/31/2028

Contract Items 1: Forest Stand Improvement(666) **Practice Lifespan:** 10 years **Status:** Planned 2023

Forest Stand Improvement - Treat species composition, stand structure or density by cutting or killing selected trees or understory vegetation to achieve desired forest conditions or obtain ecosystem services.

Fields:
Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR									
					2023 $	2024 $	2025 $	2026 $	2027 $					
1	Forest Stand Improvement(666)	10.7 Ac			22,251									
1a	HU-Even-aged Hand and Light Mechanized Equipment on Slopes Greater than 25%	10.7 Ac	$2,079.5100 / Ac	PR[1]	22,251									

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

Contract Items 2: Herbaceous Weed Treatment(315) **Practice Lifespan:** 5 years **Status:** Planned 2023

Herbaceous Weed Treatment - Remove or treat herbaceous weeds including invasive, noxious and prohibited plants using chemical, biological or mechanical methods, either alone or in combination to meet management objectives.

Fields:
Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR									
					2023 $	2024 $	2025 $	2026 $	2027 $					
2 AP	Herbaceous Weed Treatment(315)	40.8 Ac			3,027									
2a	HU-hand and chemical	40.8 Ac	$74.1700/ Ac	PR[1]	3,027									

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

Notes: "AP" denotes the participants' intent to receive an Advance Payment for this Contract Item. The participant must contact the field office to request the Advance Payment and to ensure requirements are met.

Contract Items 3: Upland Wildlife Habitat Management(645) **Practice Lifespan:** 1 year **Status:** Planned 2023

Upland Wildlife Habitat Management; Low - Enable movement and / or provide food and cover to sustain wildlife that inhabit uplands. Application of this practice will meet wildlife habitat planning criteria.

Fields:

PARTICIPANT	COUNTY AND STATE	PROGRAM AND CONTRACT NUMBER	SUBACCOUNT	
RYAN LEICK	SALT LAKE County, UT	EQIP 2018 748D43220U0 **PY 2017 Prior Year Funds Used**	FY 22 Utah BFR	
		WATERSHED Emigration Creek	ACRES 40.8	EXPIRATION DATE 12/31/2028

Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR									
					2023 $	2024 $	2025 $	2026 $	2027 $					
3	Upland Wildlife Habitat Management(645)	40.8 Ac			231									
3a	HU-Monitoring and Mgmt, Low Intensity, no FI	40.8 Ac	$5.6400/ Ac	PR[1]	231									

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

Contract Items 4: Channel Bed Stabilization(584) **Practice Lifespan:** 10 years **Status:** Planned 2024

Stabilization - Use measures to stabilize the bed or bottom of a channel.

Fields:
Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR									
					2023 $	2024 $	2025 $	2026 $	2027 $					
4	Channel Bed Stabilization(584)	200 Ft				23,095								
4a	HU-Wood structures	7 No	$3,299.1700 / No	PR[1]		23,095								

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

Contract Items 5: Channel Bed Stabilization(584) **Practice Lifespan:** 10 years **Status:** Planned 2025

Stabilization - Use measures to stabilize the bed or bottom of a channel.

Fields:
Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR									
					2023 $	2024 $	2025 $	2026 $	2027 $					
5	Channel Bed Stabilization(584)	200 Ft					23,095							

PARTICIPANT	COUNTY AND STATE	PROGRAM AND CONTRACT NUMBER	SUBACCOUNT	
RYAN LEICK	SALT LAKE County, UT	EQIP 2018 748D43220U0 **PY 2017 Prior Year Funds Used**	FY 22 Utah BFR	
		WATERSHED Emigration Creek	ACRES 40.8	EXPIRATION DATE 12/31/2028

5a	HU-Wood structures	7 No	$3,299.1700 / No	PR[1]			23,095								

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

Contract Items 6: Grade Stabilization Structure(410) **Practice Lifespan:** 15 years **Status:** Planned 2026

Stabilization - Install a structure to control the grade in natural or constructed channels.

Fields:
Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR									
					2023 $	2024 $	2025 $	2026 $	2027 $					
6	Grade Stabilization Structure(410)	12 No						56,071						
6a	HU-Log Drop Structures	12 No	$4,672.5400 / No	PR[1]				56,071						

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

Contract Items 7: Restoration of Rare or Declining Natural Communities(643) **Practice Lifespan:** 1 year **Status:** Planned 2024

Restoration of Rare or Declining Communities - Reestablish abiotic (physical and chemical) and biotic (biological) conditions necessary to support rare or declining natural assemblages of native plants and animals in situations where it is not possible to meet target conditions solely through implementation of annual management actions such as prescribed burning, prescribed grazing, forest stand improvement, or pest management.

Fields:
Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR									
					2023 $	2024 $	2025 $	2026 $	2027 $					
7	Restoration of Rare or Declining Natural Communities(643)	0.3 Ac				9,063								
7a	HU-Beaver Dam Analogues or Post-Assisted Log Structures	250 LnFt	$36.2500/ LnFt	PR[1]		9,063								

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

PARTICIPANT	COUNTY AND STATE	PROGRAM AND CONTRACT NUMBER	SUBACCOUNT	
RYAN LEICK	SALT LAKE County, UT	EQIP 2018 748D43220U0 **PY 2017 Prior Year Funds Used**	FY 22 Utah BFR	
		WATERSHED Emigration Creek	ACRES 40.8	EXPIRATION DATE 12/31/2028

Contract Items 8: Restoration of Rare or Declining Natural Communities(643) **Practice Lifespan:** 1 year **Status:** Planned 2025

Restoration of Rare or Declining Communities - Reestablish abiotic (physical and chemical) and biotic (biological) conditions necessary to support rare or declining natural assemblages of native plants and animals in situations where it is not possible to meet target conditions solely through implementation of annual management actions such as prescribed burning, prescribed grazing, forest stand improvement, or pest management.

Fields:
Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR									
					2023 $	2024 $	2025 $	2026 $	2027 $					
8	Restoration of Rare or Declining Natural Communities(643)	0.3 Ac					9,063							
8a	HU-Beaver Dam Analogues or Post-Assisted Log Structures	250 LnFt	$36.2500/ LnFt	PR[1]			9,063							

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

Contract Items 9: Riparian Forest Buffer(391) **Practice Lifespan:** 15 years **Status:** Planned 2025

Riparian Forest Buffer - Establish, restore or enhance woody plant communities located adjacent to watercourses or water bodies.

Fields:
Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR									
					2023 $	2024 $	2025 $	2026 $	2027 $					
9	Riparian Forest Buffer(391)	4.5 Ac					10,382							
9a	HU-Bare-root, hand planted	4.5 Ac	$2,307.0600 / Ac	PR[1]			10,382							

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

Contract Items 10: Tree/Shrub Site Preparation(490) **Practice Lifespan:** 1 year **Status:** Planned 2026

Site Preparation - Treat area to support establishment of woody plant species.

Fields:

PARTICIPANT	COUNTY AND STATE	PROGRAM AND CONTRACT NUMBER	SUBACCOUNT	
RYAN LEICK	SALT LAKE County, UT	EQIP 2018 748D43220U0 **PY 2017 Prior Year Funds Used**	FY 22 Utah BFR	
		WATERSHED Emigration Creek	ACRES 40.8	EXPIRATION DATE 12/31/2028

Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR									
					2023 $	2024 $	2025 $	2026 $	2027 $					
10	Tree/Shrub Site Preparation(490)	40.8 Ac						9,192						
10a	HU-Hand site preparation	40.8 Ac	$225.2900/ Ac	PR[1]				9,192						

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

Contract Items 11: Tree/Shrub Establishment(612) **Practice Lifespan:** 15 years **Status:** Planned 2026

Natural Regeneration - Establish, restore or enhance woody plant communities through natural regeneration methods.

Fields:
Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR									
					2023 $	2024 $	2025 $	2026 $	2027 $					
11	Tree/Shrub Establishment(612)	40.8 Ac						12,174						
11a	HU-Medium Density-hand plant Conifer	40.8 Ac	$298.3800/ Ac	PR[1]				12,174						

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

Contract Items 12: Firebreak(394) **Practice Lifespan:** 5 years **Status:** Planned 2027

Firebreak Establish bare ground or vegetation to manage or control fire.

Fields:
Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR									
					2023 $	2024 $	2025 $	2026 $	2027 $					
12	Firebreak(394)	1564 Ft							44					
12a	HU-Constructed - Light Equipment	0.4 Ac	$108.0700/	PR[1]					44					

PARTICIPANT	COUNTY AND STATE	PROGRAM AND CONTRACT NUMBER	SUBACCOUNT	
RYAN LEICK	SALT LAKE County, UT	EQIP 2018 748D43220U0 **PY 2017 Prior Year Funds Used**	FY 22 Utah BFR	
		WATERSHED Emigration Creek	ACRES 40.8	EXPIRATION DATE 12/31/2028

			Ac												

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

Contract Items 13: Firebreak(394) **Practice Lifespan:** 5 years **Status:** Planned 2027

Firebreak Establish bare ground or vegetation to manage or control fire.

Fields:
Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR									
					2023 $	2024 $	2025 $	2026 $	2027 $					
13	Firebreak(394)	1488 Ft							33					
13a	HU-Constructed - Light Equipment	0.3 Ac	$108.0700/ Ac	PR[1]					33					

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

Contract Items 14: Firebreak(394) **Practice Lifespan:** 5 years **Status:** Planned 2027

Firebreak Establish bare ground or vegetation to manage or control fire.

Fields:
Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR									
					2023 $	2024 $	2025 $	2026 $	2027 $					
14	Firebreak(394)	891 Ft							22					
14a	HU-Constructed - Light Equipment	0.2 Ac	$108.0700/ Ac	PR[1]					22					

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

Contract Items 15: Firebreak(394) **Practice Lifespan:** 5 years **Status:** Planned 2027

Firebreak Establish bare ground or vegetation to manage or control fire.

Fields:

PARTICIPANT	COUNTY AND STATE	PROGRAM AND CONTRACT NUMBER	SUBACCOUNT	
RYAN LEICK	SALT LAKE County, UT	EQIP 2018 748D43220U0 **PY 2017 Prior Year Funds Used**	FY 22 Utah BFR	
		WATERSHED Emigration Creek	ACRES 40.8	EXPIRATION DATE 12/31/2028

Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR									
					2023 $	2024 $	2025 $	2026 $	2027 $					
15	Firebreak(394)	845 Ft							22					
15a	HU-Constructed - Light Equipment	0.2 Ac	$108.0700/ Ac	PR[1]					22					

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

Contract Items 16: Firebreak(394) **Practice Lifespan:** 5 years **Status:** Planned 2027

Firebreak Establish bare ground or vegetation to manage or control fire.

Fields:
Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR									
					2023 $	2024 $	2025 $	2026 $	2027 $					
16	Firebreak(394)	1949 Ft							55					
16a	HU-Constructed - Light Equipment	0.5 Ac	$108.0700/ Ac	PR[1]					55					

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

Contract Items 17: Firebreak(394) **Practice Lifespan:** 5 years **Status:** Planned 2027

Firebreak Establish bare ground or vegetation to manage or control fire.

Fields:
Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR									
					2023 $	2024 $	2025 $	2026 $	2027 $					
17	Firebreak(394)	1912 Ft							44					
17a	HU-Constructed - Light Equipment	0.4 Ac	$108.0700/	PR[1]					44					

PARTICIPANT	COUNTY AND STATE	PROGRAM AND CONTRACT NUMBER	SUBACCOUNT	
RYAN LEICK	SALT LAKE County, UT	EQIP 2018 748D43220U0 **PY 2017 Prior Year Funds Used**	FY 22 Utah BFR	
		WATERSHED Emigration Creek	ACRES 40.8	EXPIRATION DATE 12/31/2028

			Ac											

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

Contract Items 18: Trails and Walkways(575) **Practice Lifespan:** 10 years **Status:** Planned 2027

Trail or Walkway - Construct a trail with a vegetated or earthen surface or a walkway with an artificial surface to facilitate the movement of animals, people, or off-road vehicles.

Fields:
Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR									
					2023 $	2024 $	2025 $	2026 $	2027 $					
18	Trails and Walkways(575)	1550 Ft							2,093					
18a	HU-Earth or Vegetated Trail	7750 SqFt	$0.2700/ SqFt	PR[1]					2,093					

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

Contract Items 19: Trails and Walkways(575) **Practice Lifespan:** 10 years **Status:** Planned 2027

Trail or Walkway - Construct a trail with a vegetated or earthen surface or a walkway with an artificial surface to facilitate the movement of animals, people, or off-road vehicles.

Fields:
Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR									
					2023 $	2024 $	2025 $	2026 $	2027 $					
19	Trails and Walkways(575)	885 Ft							1,195					
19a	HU-Earth or Vegetated Trail	4425 SqFt	$0.2700/ SqFt	PR[1]					1,195					

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

Contract Items 20: Trails and Walkways(575) **Practice Lifespan:** 10 years **Status:** Planned 2027

Trail or Walkway - Construct a trail with a vegetated or earthen surface or a walkway with an artificial surface to facilitate the movement of animals, people, or off-road vehicles.

Fields:

PARTICIPANT	COUNTY AND STATE	PROGRAM AND CONTRACT NUMBER	SUBACCOUNT	
RYAN LEICK	SALT LAKE County, UT	EQIP 2018 748D43220U0 **PY 2017 Prior Year Funds Used**	FY 22 Utah BFR	
		WATERSHED Emigration Creek	ACRES 40.8	EXPIRATION DATE 12/31/2028

Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR									
					2023 $	2024 $	2025 $	2026 $	2027 $					
20	Trails and Walkways(575)	2000 Ft							2,700					
20a	HU-Earth or Vegetated Trail	10000 SqFt	$0.2700/ SqFt	PR[1]					2,700					

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

US DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PLAN OR SCHEDULE OF OPERATIONS

NRCS-CPA-1155
03/2019

PARTICIPANT	COUNTY AND STATE	PROGRAM AND CONTRACT NUMBER	SUBACCOUNT
RYAN LEICK	SALT LAKE County, UT	EQIP 2018 748D43220U0 **PY 2017 Prior Year Funds Used**	FY 22 Utah BFR

LAND UNITS OR LEGAL DESCRIPTION	WATERSHED	ACRES	EXPIRATION DATE
Farm:1179 Tract(s):10780.	Emigration Creek	40.8	12/31/2028

	Total Cost-Share or Payment by Year										Total Contract Payment
Year	2023	2024	2025	2026	2027						
Amount($)	$25,509	$32,158	$42,540	$77,437	$6,208						**$183,852**

NOTES: A. All items numbers on form NRCS-CPA-1155 must be carried out as part of this contract to prevent violation.
B. When established, the conservation practices identified by the numbered items must be maintained by the participant at no cost to the government.
C. All cost share rates are based on average cost (AC) with the following exceptions:
AA = Actual cost not to exceed average cost; FR = Flat Rate; NC = Non cost-shared; AM = Actual cost not to exceed a specified maximum; PR = Payment rates.
D. By signing, the participant acknowledges receipt of this conservation plan including this form NRCS-CPA-1155 and agrees to comply with the terms and conditions here of.

Certification of Participants

Signature	Date	Signature	Date	Signature	Date
RYAN LEICK e-Signed by Ryan Leick For, if applicable: On 09-02-22					

Signatures of Reviewing Officials

Designated Conservationist - Technical Adequacy Certification	NRCS Approving Official
Signature: JEDIDIAH REEDER	**Signature:**
Date: 9/2/2022	**Date:**

PARTICIPANT	COUNTY AND STATE	PROGRAM AND CONTRACT NUMBER	SUBACCOUNT	
RYAN LEICK	SALT LAKE County, UT	EQIP 2018 748D43220U0 **PY 2017 Prior Year Funds Used**	FY 22 Utah BFR	
LAND UNITS OR LEGAL DESCRIPTION Farm:1179 Tract(s):10780.		WATERSHED Emigration Creek	ACRES 40.8	EXPIRATION DATE 12/31/2028

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US DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	**CONSERVATION PLAN OR SCHEDULE OF OPERATIONS**		NRCS-CPA-1155 03/2019
PARTICIPANT RYAN LEICK	COUNTY AND STATE SALT LAKE County, UT	PROGRAM AND CONTRACT NUMBER CSP 2018 818D43220XG	SUBACCOUNT Utah-CSP-NIPF-BFR
LAND UNITS OR LEGAL DESCRIPTION Farm:1179 Tract(s):10780.		WATERSHED Emigration Creek	ACRES 40.8 / EXPIRATION DATE 12/31/2026

Contract Items 1: Existing Activity Payment-Land Use(E300EAP1) **Practice Lifespan:** 1 year **Status:** Planned 2022

Manage a level of stewardship on eligible land uses to receive an existing activity payment.

Fields:
Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR									
					2022 $	2023 $	2024 $	2025 $	2026 $					
1	Existing Activity Payment-Land Use(E300EAP1)	40.8 Ac			21									
1a	CSP EAP NIPF	40.8 Ac	$0.5000/ Ac	PR[1]	21									

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

Contract Items 2,5,8,10,13: Existing Activity Payment-Resource Concern(E300EAP2) **Practice Lifespan:** 1 year **Status:** Planned

Manage a level of stewardship by addressing a number of resource concerns to receive an existing activity payment.

Fields:
Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR									
					2022 Contract Item $	2023 Contract Item $	2024 Contract Item $	2025 Contract Item $	2026 Contract Item $					
					2	5	8	10	13					
a	Existing Activity Payment-Resource Concern(E300EAP2)	30 No			1,800	1,800	1,800	1,800	1,800					
	CSP EAP RC met at time of enrollment	6 No	$300.0000/ No	PR[1]	1,800	1800	1800	1800	1800					

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

Contract Items 3: Snags, den trees, and coarse woody debris for wildlife habitat(E666O) **Practice Lifespan:** 10 years **Status:** Planned 2022

Implement forest stand improvement by utilizing snags, den trees and coarse woody debris for wildlife habitat.

US DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	**CONSERVATION PLAN OR SCHEDULE OF OPERATIONS**		NRCS-CPA-1155 03/2019
PARTICIPANT RYAN LEICK	COUNTY AND STATE SALT LAKE County, UT	PROGRAM AND CONTRACT NUMBER CSP 2018 818D43220XG	SUBACCOUNT Utah-CSP-NIPF-BFR
		WATERSHED Emigration Creek	ACRES 40.8 / EXPIRATION DATE 12/31/2026

Fields:
Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR 2022 $	2023 $	2024 $	2025 $	2026 $					
3	Snags, den trees, and coarse woody debris for wildlife habitat(E666O)	7.09999990463257 Ac			386									
3a	Snags, den trees, and coarse woody debris for wildlife habitat	7.1 Ac	$54.2700/ Ac	PR[1]	386									

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

Contract Items 4,7,9,12: Existing Activity Payment-Land Use(E300EAP1) **Practice Lifespan:** 1 year **Status:** Planned

Manage a level of stewardship on eligible land uses to receive an existing activity payment.

Fields:
Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR 2022 Contract Item $	2023 Contract Item $	2024 Contract Item $	2025 Contract Item $	2026 Contract Item $					
a	Existing Activity Payment-Land Use(E300EAP1)	163.1999969482424 Ac				4 21	7 21	9 21	12 21					
	CSP EAP NIPF	40.8 Ac	$0.5000/ Ac	PR[1]		21	21	21	21					

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

Contract Items 6: Biochar production from woody residue(E384A) **Practice Lifespan:** 10 years **Status:** Planned 2023

Utilize woody residue remaining after fuel reduction harvests or wildfires to create biochar.

US DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	**CONSERVATION PLAN OR SCHEDULE OF OPERATIONS**		NRCS-CPA-1155 03/2019
PARTICIPANT RYAN LEICK	COUNTY AND STATE SALT LAKE County, UT	PROGRAM AND CONTRACT NUMBER CSP 2018 818D43220XG	SUBACCOUNT Utah-CSP-NIPF-BFR
		WATERSHED Emigration Creek	ACRES 40.8 / EXPIRATION DATE 12/31/2026

Fields:
Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR									
					2022 $	2023 $	2024 $	2025 $	2026 $					
6	Biochar production from woody residue(E384A)	4 Ac				17,278								
6a	Biochar production from woody residue	4 Ac	$4,319.3100 / Ac	PR[1]		17,278								

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

Contract Items 11: Adding food-producing trees and shrubs to existing plantings(E612D) **Practice Lifespan:** 15 years **Status:** Planned 2025

Implement tree/shrub establishment by adding food-producing trees and shrubs to existing plantings.

Fields:
Tract: 10780 Fields: 1;

Contract Item	Planned Conservation Treatment	Planned Amount	Unit Cost	Cost Share Rate/Method	COMPLETION SCHEDULE AND ESTIMATED COST-SHARE OR PAYMENT BY YEAR									
					2022 $	2023 $	2024 $	2025 $	2026 $					
11	Adding food-producing trees and shrubs to existing plantings(E612D)	2.5999999046325 7 Ac						526						
11a	Adding food-producing trees and shrubs to existing plantings	2.6 Ac	$202.2700/ Ac	PR[1]				526						

Notes: [1]Payment rates define the unit cost rate of compensation to be received by the participant.

US DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	**CONSERVATION PLAN OR SCHEDULE OF OPERATIONS**		NRCS-CPA-1155 03/2019
PARTICIPANT RYAN LEICK	COUNTY AND STATE SALT LAKE County, UT	PROGRAM AND CONTRACT NUMBER CSP 2018 818D43220XG	SUBACCOUNT Utah-CSP-NIPF-BFR
LAND UNITS OR LEGAL DESCRIPTION Farm:1179 Tract(s):10780.		WATERSHED Emigration Creek	ACRES 40.8 / EXPIRATION DATE 12/31/2026

	Total Cost-Share or Payment by Year										Total Contract Payment
Year	2022	2023	2024	2025	2026						
Amount($)	$2,207	$19,099	$1,821	$2,347	$1,821						**$27,295**

NOTES: A. All items numbers on form NRCS-CPA-1155 must be carried out as part of this contract to prevent violation.
B. When established, the conservation practices identified by the numbered items must be maintained by the participant at no cost to the government.
C. All cost share rates are based on average cost (AC) with the following exceptions:
AA = Actual cost not to exceed average cost; FR = Flat Rate; NC = Non cost-shared; AM = Actual cost not to exceed a specified maximum; PR = Payment rates.
D. By signing, the participant acknowledges receipt of this conservation plan including this form NRCS-CPA-1155 and agrees to comply with the terms and conditions here of.

Certification of Participants

Signature	Date	Signature	Date	Signature	Date
RYAN LEICK Ryan Leick	4/11/2022				

Signatures of Reviewing Officials

Designated Conservationist - Technical Adequacy Certification	**NRCS Approving Official**
Signature: JENNY COX	**Signature:**
Date: 4/4/2022	**Date:**

US DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	**CONSERVATION PLAN OR SCHEDULE OF OPERATIONS**		NRCS-CPA-1155 03/2019
PARTICIPANT RYAN LEICK	COUNTY AND STATE SALT LAKE County, UT	PROGRAM AND CONTRACT NUMBER CSP 2018 818D43220XG	SUBACCOUNT Utah-CSP-NIPF-BFR
LAND UNITS OR LEGAL DESCRIPTION Farm:1179 Tract(s):10780.		WATERSHED Emigration Creek	ACRES 40.8 / EXPIRATION DATE 12/31/2026

PRIVACY ACT

The following statements are made in accordance with the Privacy Act of 1974 (5 U.S.C 522a). Furnishing this information is voluntary; however failure to furnish correct, complete information will result in the withholding or withdrawal of such technical or financial assistance. The information may be furnished to other USDA agencies, the Internal Revenue Service, the Department of Justice, or other state or federal law enforcement agencies, or in response to orders of a court, magistrate, or administrative tribunal.
This information collection is exempted from the Paperwork Reduction Act under 16 U.S.C. 3801 note and 16 U.S.C. 3846.

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To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at How to File a Program Discrimination Complaint and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov

USDA is an equal opportunity provider, employer and lender.

Exhibit 5

EID March 2025 Board Report - 20250320

MEETING DATE: March 20, 2025
SUBJECT: Restricted Uses in Drinking Water Source Protection Zones

SUMMARY

The owner of A.P.N. 10-20-400-002, which is known as 1475 Pinecrest Canyon Road, is requesting approval of Restricted Uses under Emigration Canyon Code 9.25 for development related to a permitted Agricultural use allowed under 19.02.090 and 19.12.020(B) and accessory structures allowed under 19.12.020(A). These structures will be used to support sugar/syrup production from native perennial crops (big tooth maple syrup, honey, elderflower/elderberry, chokecherry, serviceberry, etc.) and silviculture (forest stewardship) operations as well as soil and water conservation projects funded by the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS).

BACKGROUND

Agriculture and silviculture are practice on the site as permitted by Emigration Canyon Code 19.02.090 and 19.72.110(B)(3). U.C.A. § 15A-1-204(11)(a) exempts agricultural structures from state building code permit requirements. However, Emigration Canyon Code 19.72.030(A) outlines "the site plan application and approval process required for all development or construction activity, including tree/vegetation removal and grading, or subdivision of land, in the Foothills and Canyons Overlay Zone [(FCOZ)]."

Salt Lake County Health Department review of the FCOZ site plan application noted:

> "Some of the proposed uses are also restricted per [Emigration Canyon Code] 9.25, Appendix A, specifically but not limited to: Agriculture experimental station, apiary and lumber processing. Restricted means they may be allowed but applicant will need to get written approval from Emigration Improvement District for each restricted use."

Emigration Canyon Code 9.25, Appendix A identifies the following applicable Restricted Uses for Drinking Water Source Protection Zones: 1) Agriculture experimental station (sap collection), 2) Apiary (Bee yard), 3) Farm maintenance garage, 4) Fruit and vegetable storage and packing plant, 5) Greenhouse or nursery, and 6) Logging and lumber processing.

Emigration Canyon Code 9.25.110 – Review of Applications, Subpart A states:

> Restricted use - a restricted use poses some risk of causing pollution or potential contamination in a specified protection zone. Following preliminary staff review of an application, the planning and development services division will request a verification of compliance from the SLVHD and from the appropriate public water system. The applicant shall submit to the appropriate public water system the best management practices and engineered and/or construction controls, or land management strategy to be implemented. Upon acceptance and approval, the appropriate public water system must issue a recommendation letter to the SLVHD listing the best management practices, engineered and/or construction controls, or land management strategy to be implemented as part of the recommendation. Any engineered and/or construction controls must be illustrated on the site plan or construction drawings. A public water system shall respond to an applicant's best management practices, engineered and/or construction controls, or land management strategy within forty-five days of submission. If a public water system does not approve of the best management practices, engineered and/or construction

controls, or land management strategy submitted by an applicant, or cannot come to an agreement on the issue, the public water system will submit the reason that approval is not given and provide recommendations for additions or changes. The recommendation must also comply with this chapter and any applicable SLVHD health regulations. The SLVHD shall review all recommendations received and specify the conditions of any approval before forwarding the approval to the planning and development services division.

Best Management Practices (BMPs)

The National Best Management Practices (BMPs) Program was developed to improve management of water quality consistently with the Federal Clean Water Act and State water quality programs. BMPs are specific practices or actions used to reduce or control impacts to water bodies from nonpoint sources of pollution, most commonly by reducing the loading of pollutants from such sources into storm water and waterways. BMPs can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants to receiving waters.

Sedimentation is the most common source of agricultural water pollution. Most agricultural BMPs help to control sediment carried off agricultural lands, encourage sound pest and nutrient management techniques, and prevent or minimize potential runoff to ensure economic, environmental, and agronomic sustainability. Adopting agricultural BMPs can ultimately increase efficiency and profits, increase property values, improve water quality, and benefit the local community.

Agricultural BMPs can be structural or nonstructural. Structural practices, such as fences and buffer strips, often involve some sort of construction, installation, and maintenance. Structures can be vegetative (buffers) or nonvegetative (fencing). Nonstructural practices, on the other hand, are activities or behaviors that reflect better planning and management and increased education and awareness.

Nonstructural BMPs

The following agroforestry practices will be implemented on the site. No-till practices leave soil undisturbed from planting through harvest to reduce sediment and nutrients that move into water from agricultural lands. Applying drip irrigating only when needed by crops is an effective BMP for reducing nonpoint source pollutants and insects. Contour farming is the alignment of all farm tillage, planting, and harvesting practices with the contour of the land. The goal is to reduce erosion and surface runoff and thus the transport of nutrients and pesticides from the field. Contoured rows retain rainwater, which increases infiltration and reduces runoff. Vegetative buffer strips or filter strips are strips of grasses or other vegetation placed along streams or drainage areas to slow down runoff water, trap sediment, filter nutrients and other pollutants, and promote the infiltration of water into the soil.

Structural BMPs

Channel Bed Protection: Water and sediment-control structures, such as beaver dam analogs (BDAs), are erosion-control structures commonly installed across the bottoms of drainage ways to prevent channel incising and minimize sedimentation of nearby waterbodies. These structures improve water quality downstream by trapping sediment, controlling water flow within a drainage area, and storing runoff water to allow it to slowly infiltrate into the soil profile.

Streambank and Slope Protection: The use of vegetation, structures, bioengineering, or management techniques stabilize and protect riparian areas, streambanks, and steep slopes. Log drop, Mechanically Stabilized Earth (MSE), and Reinforced Soil Slope (RSS) structures are commonly used to reduce soil erosion causing sediment and nutrients to enter waterways by stabilizing streambanks and steep slopes. These often incorporate woody vegetation to reinforce the structures and create healthy riparian areas along streambanks that lower stream temperature and improve wildlife habitat.

USDA Funded Conservation Practices

1. Grade Stabilization Structures (CSP 410)
2. Channel Bed Stabilization (CSP 584)
3. Restoration of Rare or Declining Natural Communities – B.D.A.'s (CSP 643)
4. Trails and Walkways (CSP 575)
5. Firebreak (CSP 394)
6. *Forest Stand Improvement (CSP 666)**
7. Biochar production (E384A)
8. *Herbaceous Weed Treatment (CSP 315)**
9. Tree/Shrub Site Preparation (CSP 490)
10. Food-Producing Trees and Shrubs (E612D)
11. Riparian Forest Buffer (CSP 391)
12. *Snags, den trees, and coarse woody debris for wildlife habitat (E6660)**
13. *Upland Wildlife Habitat (CSP 645)**

**Indicates implemented projects in the management/maintenance phase.*

Use Specific Best Management Practices

1. Agriculture Experimental Station (Maple Sugarbush)

- USDA Natural Conservation Research Service (NRCA) Conservation Practice Standard (CPS) E612F – Sugarbush management.
- **Soil Conservation**: Implement contour farming, buffer zones, and no-till practices to minimize water runoff and soil erosion.
- **Fertilizer & Pesticide Management**: Follow USDA Certified Organic standards. No herbicides, pesticides, or chemical fertilizers will be applied or stored onsite.
- **Water Management**: Utilize drip irrigation and rainwater harvesting to minimize water use and prevent contamination. Purchased 1.98-acre feet of surface stock water rights with points of diversion from Freeze Creek and Twin Creek in 2025 with the intent to submit a change application for irrigation use. Obtained rainwater harvesting permit for 2,500 gallons in 2021.

2. Apiary (Bee Yard)

- Utah Department of Agriculture and Food licensed honeybee apiary since March 2021. Honeybees are artificially bred, domestic agricultural animals classified as livestock by the US Department of Agriculture (USDA) and the US Food and Drug Administration (FDA).
- **Annual Inspections**: In compliance with the Utah Bee Inspection Act, Salt Lake County Bees and Noxious Weeds program conducts apiary and best management practices inspections by state inspectors licensed through the Utah Department of Agriculture and Food (UDAF).
- **Fertilizer & Pesticide Management**: Follow USDA National Organic Standards Board (NOSB) Livestock Committee 2010 Apiculture Recommended Standards. USDA-accredited certifying

agents may certify beekeeping operations under organic regulations for livestock (7 CFR 205.236 – 205.240). No herbicides, pesticides, or chemical fertilizers will be applied or stored onsite.

- **Chemical Use Control**: Oxalic acid is a naturally occurring organic, non-toxic compound that is safe for bees and humans but an effective miticide treatment against varroa mites. Oxalic acid is ubiquitous in the environment, found naturally in many plants and vegetables, as well as in honey. It occurs naturally as the potassium or calcium salt in plant sap. It can be a considerable constituent of the dry weight of some plants, such as beet leaves, cocoa, tea, spinach, rhubarb, and chard. In water, its negative ion forms complexes with a number of metal ions, immobilizing oxalic acid as a result of this formation of complexes. Both aerobic and anaerobic conditions biodegrade oxalic acid in less than one day.
- **Integrated Pest Management (IPM):** Implement IMP strategies including bottom board screening, proper hive sanitation, drone brood removal, brood interruption, and requeening to reduce chemical dependence on organic miticide.
- **Brood Management:** Saskatraz honey bees are a hybrid bee breed known for their strong foraging and honey production, varroa mite and brood disease resistance, hygienic behavior, resilient wintering ability, as well as a relatively calm temperament.
- **Vegetation Management**: Maintain native flowering plants to support pollinator health.
- **Erosion Control**: Utilize ground cover and mulch around hives to minimize soil loss.

3. Farm Maintenance Garage

- **Spill Prevention Control and Countermeasure (SPCC) Plan**: Petroleum-based liquids will be stored in secondary containment units to prevent leaks. Storage containers will be limited to five gallons. Spill kits will be kept in structures housing vehicles or equipment.
- **Waste Disposal**: Used oils, lubricants, and batteries will be disposed or recycled off site.
- **Vehicle & Equipment Maintenance**: Regular maintenance will be conducted off-site or in designated areas with spill control measures.
- **Vehicle & Equipment Storage**: Vehicles will be stored indoors on non-permeable pads to prevent soil contamination.
- **Reporting**: Any discharges of petroleum-based liquids in quantities greater than five gallons will be immediately reported to Emigration Improvement District Manager Eric Hawkes.

4. Fruit and Vegetable Storage & Packing Plant

- **Cleanliness Standards**: Evaporators, reverse osmosis equipment, storage tanks, filters, and surfaces will be cleaned with soap and water immediately after each use and towel dried. Following the processing season, sap fermented for 3-4 weeks will be use as an acidic descaler. If sanitization is necessary, a 1:20 ratio of unscented household bleach to water will be used. Equipment will be stored in enclosed containers safe from rodents and other pests in a dry area free of dust, cobwebs, or other foreign matter.
- **Wastewater Management**: Wastewater is drained into a packed bed media filtration basin or an approved alternative wastewater treatment system.
- **Chemical Use & Storage**: Cleaning agents are stored in a designated, contained area.
- **Waste Management**: Organic waste will be properly stored until disposed of by composting.

5. Greenhouse or Nursery

- **Water Conservation**: Closed-loop irrigation systems and rainwater collection will be used.
- **Fertilizer & Pesticide Management**: Follow USDA Certified Organic standards. No herbicides, pesticides, or chemical fertilizers will be applied or stored onsite.

- **Nutrient Management**: Regular soil testing will be conducted, and if necessary, slow-release organic fertilizers will be applied to prevent over-application.

6. Logging & Lumber Processing

- The Utah Division of Forestry, Fire & State Lands has completed a Forestry Activity Plan for the site under Utah Rule R652-140, Utah Forest Practices Act, consistent with the federal Forest Stewardship Program National Standards and Guidelines.
- **Erosion & Sediment Control**: Riparian buffers will be maintained to stabilize exposed soils.
- **Sustainable Harvesting**: Selective cutting will be practiced to maintain established basal density goals by forest stand.
- **Road & Trail Maintenance**: Gravel or grass-covered pathways will be maintained to minimize soil displacement and water contamination.
- **Lumber Processing**: Logged trees will be processed into lumber for on-site storage and use. A portable sawmill will be operated in a purpose-built structure following best management practices established for Farm Maintenance Garage operations.
- **Waste Management**: Sawdust, wood chips, and other woody residues will be properly stored until disposed of by composting or use in biochar production.

Monitoring & Compliance

- Regular water quality testing for nitrates, phosphates, and sediments.
- Annual audits on BMP implementation and compliance with state/local regulations will be conducted by an independent third-party.
- An annual review and update of BMPs will be completed based on audit findings, monitoring data, and regulatory changes.

E.C.C. 9.25.110 – Review of Applications

The applicant shall submit to the appropriate public water system the best management practices and engineered and/or construction controls, or land management strategy to be implemented. **A public water system shall respond to an applicant's best management practices, engineered and/or construction controls, or land management strategy within forty-five days of submission.**

1. **Upon acceptance and approval**, the appropriate public water system must issue a recommendation letter to the SLVHD listing the best management practices, engineered and/or construction controls, or land management strategy to be implemented as part of the recommendation. Any engineered and/or construction controls must be illustrated on the site plan or construction drawings.
2. **If a public water system does not approve** of the best management practices, engineered and/or construction controls, or land management strategy submitted by an applicant, or cannot come to an agreement on the issue, the public water system will submit the reason that approval is not given and provide recommendations for additions or changes.

EXHIBITS

1. FCOZ Site Plan Application Narrative
2. USDA NRCA Conservation Standard Practice (CSP) E612F – Sugarbush management.
3. USDA NOSB Livestock Committee 2010 Apiculture Recommended Standards
4. Freeze Creek Forest Stewardship Plan prepared by the Utah Department of Natural Resources

Exhibit 6

Documentation of Historical Agricultural Use

A F F I D A V I T

STATE OF UTAH)
: ss.
County of Salt Lake)

EMMA BERTAGNOLE, being first duly sworn, deposes and says that she is the sister of Leo M. Bertagnole, now deceased, and is 89 years of age; that her father and later her brothers were engaged in the sheep business for many years beginning about 1914 and had their headquarters in Salt Lake Valley, but grazed their sheep during the summer in the Wasatch range of mountains north and east of Salt Lake City, Utah. The herd of sheep varied in numbers, but averaged about 6,000 ewes.

Your affiant, at times, accompanied the herds of sheep during summer grazing and she recalls that from about the year 1900 until recent times the sheep grazed in Salt Lake County in the vicinity of the springs hereinafter described located in side canyons in the Emigration Canyon drainage. Affiant further states that the springs were banked up with earth to form ponds and in some instances were collected in wooden troughs. The area surrounding the springs appeared to have been used for many years for watering sheep and she was told and understood that the springs had been used since prior to the year 1900 for watering sheep and other livestock. The location of the springs is as follows:

Freeze Creek

400 feet North and 750 feet West of the Southeast corner of Section 20, Township 1 North, Range 2 East.

Emma Bertagnole
EMMA BERTAGNOLE

SUBSCRIBED AND SWORN to before me this 16th day of July, 1976.

Notary Public

My Commission Expires:

~~September 5, 1978~~

Residing At:

Salt Lake City, Utah

Exhibit 7

Documentation of Current Agricultural Production

Evidence of Current Agricultural Production

Parcel 10-20-400-002 (SE 1/4 of SE 1/4, Sec 20, T1N R2E SLBM) — Emigration Canyon, Utah

This consolidated exhibit compiles all current agricultural production occurring on the subject parcel for purposes of the Agriculture Protection Area (APA) approval criteria. It includes maple sap production from native bigtooth maple, apiary operations, native fruit harvesting, and syrup production with a local market outlet, ongoing agricultural conservation practices that support production, and eco agritourism combining public recreation with agricultural education and watershed awareness.

Snapshot Summary (2025)

- Maple sap collected: 137.50 gallons (collection window: Feb 27, 2025 – Apr 06, 2025) with support from Utah State University Extension funded research.
- Apiaries: Active, UDAF-licensed on-site apiary operations.
- Native fruit and value-added: Seasonal harvest (elderberry, chokecherry, Oregon grape, serviceberry, thimbleberry) for syrups supplied to a local cider house as ingredients for hard ciders.
- Conservation: NRCS practices implemented (e.g., CPS 666, 315, 645; improving site productivity, soils, and water retention.

1) Maple Sap Production (Acer grandidentatum)

- Trees tapped: 25 bigtooth maples (per field log and USU-supported pilot).
- Method: gravity tube feed into central collection; batch records maintained.
- Use: syrup reduction trials and research/extension collaboration; retail for hard cider.

2) Apiary Operations (UDAF-Licensed)

On-site apiary operations are registered with the Utah Department of Agriculture and Food (UDAF). Seasonal hive placement supports pollination services and honey products at a small scale compatible with the site's conservation focus. (Copy of license included)

3) Native Fruit Harvest & Syrup Production (Value-Added)

Species include elderberry, chokecherry, Oregon grape, serviceberry, and thimbleberry. Fruit is hand-harvested from mapped patches under stewardship buffers, processed into syrups using food-grade sanitation, and supplied in closed, labeled containers to a local cider house.

Compliance & BMPs: DWSP setbacks from springs/watercourses; no synthetic herbicides/pesticides/fertilizers stored or applied; sanitation logs; cold storage; erosion control on footpaths; avoidance of >30% slopes.

4) Conservation-Agriculture Practices Supporting Production (NRCS/Stewardship)

Active practices include Forest Stand Improvement (CPS 666), Brush Management (CPS 314), Woody Residue Treatment (CPS 384), Critical Area Planting (CPS 342), Upland Wildlife Habitat Management (CPS 645), and—where permitted—channel/grade stabilization structures (e.g., CPS 584/410/643). These actions improve soil moisture, stability, pollinator habitat, and access, thereby sustaining agricultural production on the site.

5) Eco-Agritourism and Compatible Recreation

Low-impact public recreation (trail-based hiking, nature observation) occurs on established routes while agricultural and conservation activities are underway. Wayfinding and safety signage restrict public access to protected areas. This concurrent use supports education and community connection while maintaining operational safety.

Statutory Tie-In (APA Criteria)

The foregoing activities constitute current agricultural production for purposes of the APA statutory factors and demonstrate the land's viability for continued agricultural use. Agricultural conservation practices simultaneously mitigate health/safety and environmental risks while enhancing productivity.

Exhibits

Documentation of Existing Permitted Agricultural Use (Jan. 24, 2024) — incorporated by reference

January 30, 2024

RE: EXISTING PERMITTED ARGICULTRUAL USE (PARCEL ID: 10-20-400-002)

Two definitions of "agriculture" apply to the subject property, the UCA and ECMT definitions:

1. UCA 15A-1-202(1) - "Agricultural use" means a use that relates to the tilling of soil and raising of crops, or keeping or raising domestic animals.
2. ECMT Code 19.04.020 - "Agriculture" means the tilling of the soil, the raising of crops, horticulture and gardening, but not including the keeping or raising of domestic animals or fowl, except household pets, and not including any agricultural industry or business such as fruit-packing plants, fur farms, animal hospitals or similar uses.

Below I will provide evidence of the keeping and raising of domestic animals (UCA) and horticulture (ECMT) that satisfy each definition.

I have had a Utah Department of Agriculture and Food licensed honeybee apiary (License No. 1201-014652, 1201-016187, 1201-021411) on the property since March 18, 2021. Honeybees are artificially bred, domestic agricultural animals classified as livestock by the US Department of Agriculture (USDA) and the US Food and Drug Administration (FDA). USDA-accredited certifying agents may certify beekeeping operations under the existing organic regulations for livestock ([7 CFR] Sections 205.236 – 205.240). The entire property is managed in accordance with organic livestock pasture regulations but is not certified organic by the USDA. I intend to adopt the USDA National Organic Standards Board (NOSB) Livestock Committee 2010 Apiculture Recommended Standards in the future.

I entered into contract EQIP 2018 748D43220U0 and CSP 2018 818D43220XG on September 2, 2022 with the USDA Natural Resources Conservation Service (NRCS) to implement and/or maintain specific conservation practices, as set forth in the attached Conservation Plan Schedule of Operations on the full 40-acre property (USDA Farm ID 1179, Tract ID 10780) through December 31, 2028. These include horticulture practices intended to improve soil and water quality of the organic livestock pasture foraged by the honeybees. This year I started Conservation Practice Standard (CPS) 666 - Forest Stand Improvement and CPS 315 - Herbaceous Weed Treatment to reduce understory brush and basal density to target levels identified for each forest stand. These practices reduce competition for water and nutrients thereby improving the vigor of native trees found across the entire property including elderberry, serviceberry, chokecherry, bigtooth maple, and the juniper sage grasslands.

I have experimented with fruit-producing trees and vines on the property, including American persimmon, paw paw, medlar, hearty kiwi, and others to propagate across the property for CPS 612 - Tree/Shrub Establishment and CPS 612D - Adding fruit producing trees and shrubs to existing plantings. I'm also working with faculty out of Utah State University to explore the viability of commercial maple syrup production from Bigtooth maples native on the site. USU students will be tapping dozens of trees in February and March to harvest maple sap for syrup production.

Producer Farm Data Report
Crop Year : 2025

Date: 8/10/25 10:53 PM CST

Producer Name and Address

LEICK, RYAN
9716 S SITZMARK DR
SANDY, UT 84092-3124

Telephone: (801) 999-8748
Email: rleick@avantknight.com

Recording County Office Name

SALT LAKE, UTAH

Number of Farms	Number of Tracts	Farmland	Cropland	DCP Cropland	CRP Cropland	Eff DCP Cropland	Total Base Acres
1	1	40.75	0	0	0	0	0

Admin State & County	ARC/ PLC Elig	Farm	Tract / Physical Location	Relationship to Farm / Tract	Producer	Farmland	Cropland	DCP Cropland	CRP Cropland	Eff DCP Cropland	Total Base Acres	HEL Code	Wetland Code
TOOELE, UT	EG	1179	10780 SALT LAKE, UT	Owner/ Operator	LEICK, RYAN	40.75	0.00	0.00	0.00	0.00	0.00	06	NC

HEL Codes:
01 = HEL determinations not completed for all fields on the tract
02 = HEL field on tract. Conservation system being actively applied
03 = HEL field on tract. Conservation system is not required – no agricultural commodity
04 = HEL field on tract. 2 years to implement conservation system on former CRP land
05 = HEL field on tract. Conservation system not being actively applied
06 = NHEL: No agricultural commodity planted on undetermined fields

Wetland Codes:
NC = Wetland determinations not complete
TN = Tract does not contain a wetland
TY = Tract contains a wetland or farmed wetland
CW = Converted wetland
PCW = Planted converted wetland

ARC/PLC Elig Codes:
CG = Ineligible - Complete G/I/F History
EG = Eligible
IG = Partial or Missing G/I/F History

STATE OF UTAH

DEPARTMENT OF AGRICULTURE AND FOOD

P.O. Box 146500 Salt Lake City UT 84114-6500
https://ag.utah.gov/ | 801-982-2200

Please visit our web site at
https://ag.utah.gov/
to view current LICENSE information

Fee for Duplicate LICENSE : $15.00

Year: 2025

LICENSE: 1201-021411

As A Beekeeper

LICENSE

Ryan Leick

1475 PINECREST CANYON ROAD
EMIGRATION CANYON UT 84108
40.802908 -111.741791

LOCATION ADDRESS

Ryan Leick
1475 PINECREST CANYON ROAD
EMIGRATION CANYON UT 84108
40.802908 -111.741791

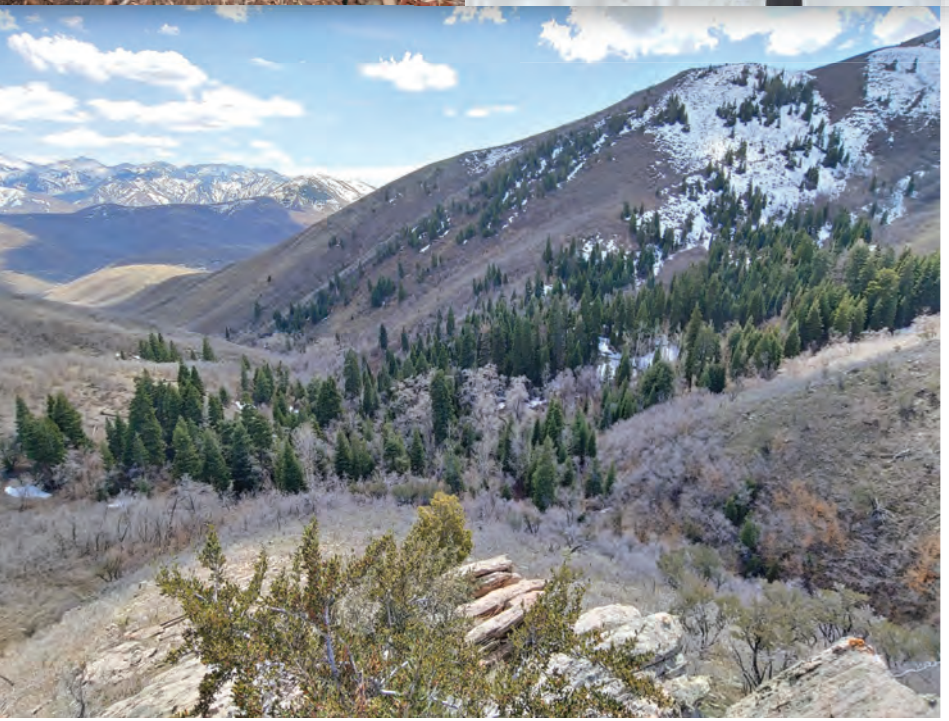
MAILING ADDRESS

Ryan Leick
9716 S SITZMARK DR
SANDY UT 84092

Important Licensure Reminders

Your license/permit is valid until the expiration date listed on this form. Approximately 60 days prior to this expiration you will receive a renewal notice. Please note the information listed. This is your public information of record for the division and all future correspondence from the division will use this information. If you move, it is your responsibility to notify us of the change. Maintaining current information with us is the easiest way to ensure continuous licensure.

Expiration: 12/31/2025



Landowner Objectives

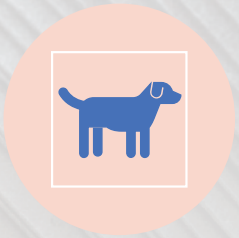
Family owned/operated permaculture farm on 40-acres of pristine wilderness in Emigration Canyon.

Living food forest for guests to enjoy and understand the role of silviculture in watershed conservation and carbon sequestration while advancing high-altitude, semi-arid agroforestry.

Experimental research station to validate economic incentives of dryland agriculture in harmony with environmental conservation.

Shared Objectives

Preserve water quality in EID's source protection zone



Restrict public and pet access to sensitive watershed

Mitigate the risk of wildland fire while restoring mosaic habitat

Minimize physical disturbance to the land, including natural causes

Federal Investment

Record of Decision authorizing approximately $200k in US Department of Agriculture (USDA) Natural Conservation Resource Service (NRCS) grants, including:

1. Grade Stabilization Structures (CSP 410)
2. Channel Bed Stabilization (CSP 584)
3. Restoration of Rare or Declining Natural Communities – B.D.A.'s (CSP 643)
4. Trails and Walkways (CSP 575)
5. Firebreak (CSP 394)
6. ~~Forest Stand Improvement (CSP 666)~~
7. Biochar production (E384A)
8. ~~Herbaceous Weed Treatment (CSP 315)~~
9. Tree/Shrub Site Preparation (CSP 490)
10. Food-Producing Trees and Shrubs (E612D)
11. Riparian Forest Buffer (CSP 391)
12. ~~Snags, den trees, and coarse woody debris for wildlife habitat (E6660)~~
13. ~~Upland Wildlife Habitat (CSP 645)~~

Exhibit 8

Freeze Creek Forest - Conceptual Site Design

CONCEPTUAL SITE DESIGN

FREEZE CREEK FOREST

Emigration Canyon, UT

ACKNOWLEDGEMENTS

Produced by Backyard Abundance
Revised: January 2024

Figure 1. Cover
Shiitake mushroom (*Lentinula edodes*), ginseng (*Panax quinquefolius*), and hazelnut (*Corylus americana*) are all high-value agroforestry crops.
Photos by dominik18s, Priya Jaishanker, Fred Meyer / CC BY ND

Figure 2. Above
Once established, the Chinese chestnut (*Castanea mollissima*) tree will yield food and habitat for decades.
Photo by Otto Phokus

Backyard Abundance

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Figure 3. Pawpaw
The pawpaw (*Asimina triloba*) is a mid-sized understory tree that yields potato-sized fruit in part shade or full sun.
Photo by Fred Meyer

AGROFORESTRY DESIGN STRATEGIES

Figure 4. Elderberries
Elderberry shrubs (*Sambucus canadensis*) yield fruit in full sun or part shade and prefer moist, well-drained soil.
Photo by Andy Rogers / CC BY SA

1 INTRODUCTION

Agroforestry is the growing of a combination of crops (plants, animals, fungi) and trees in forest-inspired agricultural systems. These systems benefit human communities through a greater connection to landscapes, improved stewardship of resources, and enhanced economic opportunities.[1]

Following best-practice agroforestry designs allow producers to overcome the significant time commitments, monetary investments, and risk associated with researching planting configurations, estimating implementation costs and payback, and experimenting with planting techniques.

This document provides a custom design of edible agroforestry practices to aid Freeze Creek Forest with the design, implementation, and management of environmentally-beneficial ecosystems that support personal income and community needs. Much information is summarized from existing resources.

Freeze Creek Forest is located on a 40-acre parcel in Emigration Canyon, UT approximately six miles east of Salt Lake City. The site is comprised of a 10-acre mature white Fir stand mixed with gambrel Oak, bigtooth Maple, and quaking Aspen. Chokecherry, blue Elderberry, and Utah Serviceberry are also found intermixed in this stand and the surrounding sage juniper grassland. The site forms a bowl with all aspects present with slopes exceeding 50 percent accounting for the majority of the parcel.

Figure 5. Aronia Berry
The black aronia berry shrub (*Aronia melanocarpa*) yields nutritious berries in a wide variety of soil types.
Photo by Fred Meyer

Overview of Site Areas

Alley Crop Orchard. Grow agricultural crops between strips of food-bearing trees and shrubs.

Edible Forest Edge. Maximize food growth potential at the edge of an existing forest.

Shady Edible Forest. Incorporate edibles and medicinals under the canopy of a forest.

Edible Riparian Buffer. Protect waterways from pollution and erosion with an edible low-land habitat.

Edible Windbreak. Protect crops, livestock, and buildings with a linear planting of edible trees and shrubs.

Homestead Orchard. Increase the value and yield of the land with intensively managed edible landscaping around agricultural accessory use structures.

Silvopasture. Silvopasture, the practice of combining forestry and animal grazing, is addressed in all designs. Most research separates silvopasture from other agroforestry practices, but given the maintenance value provided by animals across many settings, specialized techniques are described in each design. In addition, honeybee apiaries will be an integral part of each design.

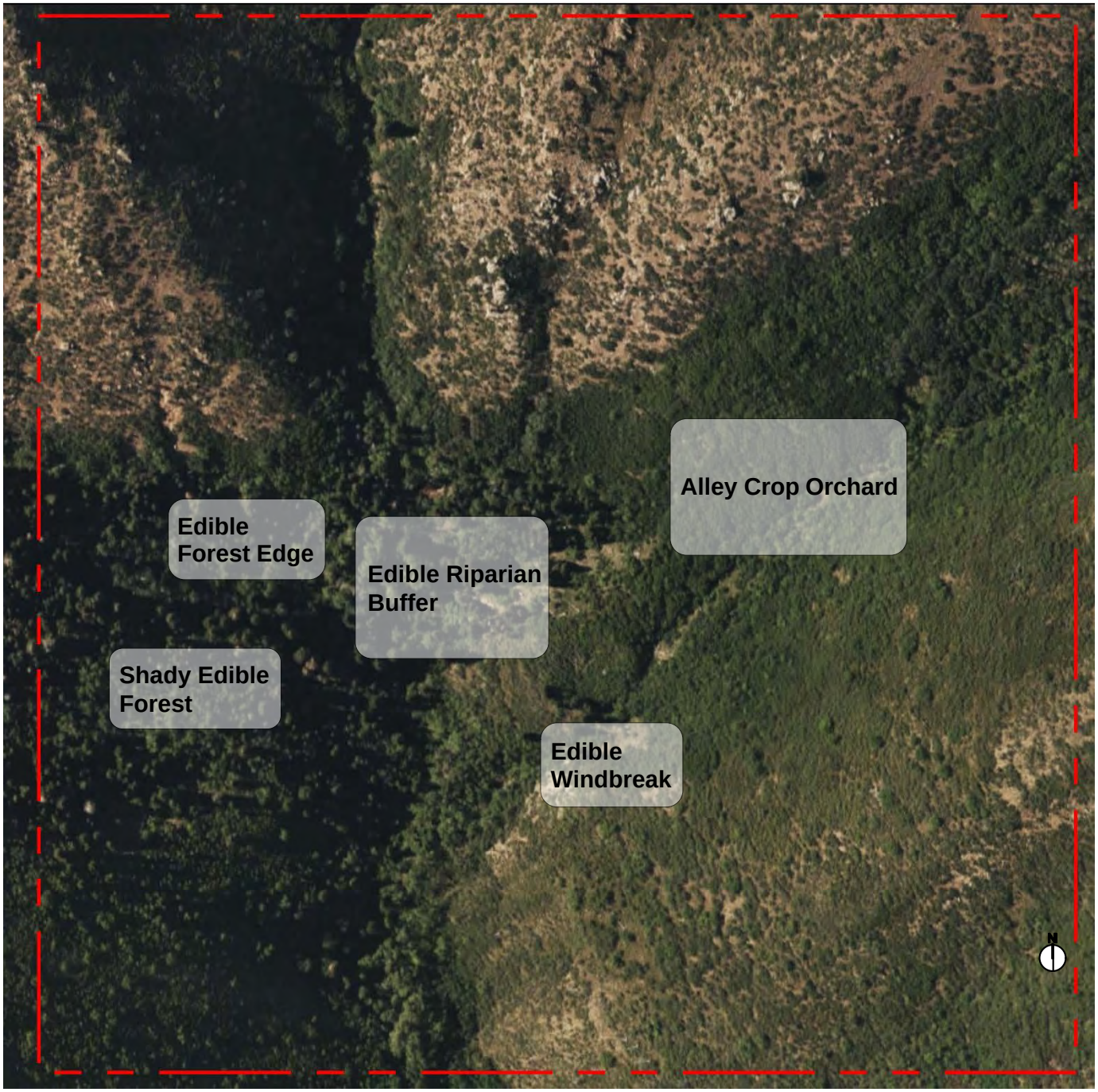

Figure 6. Realistic Designs
Locations on Freeze Creek Forest were used to provide realistic designs and plant selections. Freeze Creek is located at 6,400' MSL in northern Utah in hardiness zone 5b.

2 GOALS

Each design area attempts to meet a variety of important goals to ensure it maximizes value to the producer and the landscape.

Figure 7. Chestnut and Aronia Berry Tour
Tom Wahl, co-owner of Red Fern Farm, hosts educational field day tours of their family-owned tree nursery near Wapello, Iowa.
Photo by Fred Meyer

LOW MAINTENANCE

An established agroforestry system requires some management even if it was designed to mimic self-renewing, self-fertilizing, and self-maintaining properties of a diverse woodland. Leaving energy-intensive maintenance (seeding, planting, weeding, fertilizing, watering) to plant, insect, and animal allies frees up time for additional harvesting, processing, and resting. The grower's role is management—not maintenance—of the ecosystem, guiding it in a desired direction through periodic disturbances of mowing, thinning, pruning, and harvesting. Through these methods, growers become an integrated working part of nature, catalyzing healthy ecosystems that improve over time without constant oversight.

HIGH YIELDS

Food and profit often receive the most emphasis when designing and managing an agricultural landscape. Maximizing long-term success, however, means designing for additional yields that come from the development of an entire system, not just a single element.[2 3]

Agroforestry emulates nature's processes and patterns to decrease labor and financial inputs. While the food productivity of a single plant is considered, yields are additionally measured in terms of the entire system: labor saved, soil fertility increased, weeds suppressed, habitat created, carbon sequestered, beauty enjoyed.

For example, planting chives (*Allium* spp.) and gooseberries (*Ribes uva-crispa*) under the light shade of a pear tree (*Pyrus* spp.) creates a system of cumulative yields: chives accumulate calcium and potassium in the soil for use by the gooseberry and pear while also supporting pollinators and confusing pests with a strong smell, the pear protects the gooseberries from scorching sunny days, and the thorny gooseberry can help deter some animals from browsing the pear. These yields could not be achieved if the elements were planted separately.

Growing food and increasing environmental health are typically considered to be separate endeavors, but by holistically viewing the landscape as a system, edible agroforestry demonstrates that achieving both goals is possible on a single plot of land. The following yields can be realized and greatly increased through the integration of plants, wildlife, insects, and humans.

Food

Integrating a food-bearing plant into a polyculture may decrease its food yield due to competition with other plants for nutrients, water, and sunlight. A thoughtful layout can minimize this competition and promote collaboration so that the entire polyculture produces a crop that is greater than the individual plant. Forage for livestock is also a valuable yield that can be incorporated.

Money

Profit is obviously important but can be difficult to estimate due to many factors: seasonal weather patterns, maturity of perennial crops, soil fertility over time, fluctuations in regional market demand, value-added processing. Establishing annual crops in and around maturing perennial patches can help mitigate these factors.

For information about effective economic planning, see Economic Considerations in the Center for Agroforestry's *Training Manual for Applied Agroforestry Practices*.[4]

Soil Fertility

Industrialized agricultural systems assume soil will degrade over time and therefore attempt to simply minimize losses. Agroforestry systems seek to build new soil, mimicking nature's processes to indefinitely increase tilth and nutrient-holding capacity.

Water Management

Perennial plants are better than annuals at conserving water on the landscape. The persistent canopy created by trees and shrubs holds water for wildlife and insects while slowing rain impacts on soil. Perennial plant roots slow water flow year-round and turn soil into a moisture-retaining sponge. These features help create a drought-resistant landscape that eliminates erosion problems.

Materials

Food-bearing plants and their supporting species can have valuable secondary yields of materials. The trunk of a honey locust (*Gleditsia triacanthos*) can provide rot-resistant lumber and can serve as a living fence post when thoughtfully placed. Hazelnut (*Corylus americana*) wood can be used for basketry or burned for charcoal.

Habitat and Pest Management

The majority of insects and wildlife benefit perennial crops. Without birds and insects the expensive and time-consuming burden of pollinating and protecting crops falls exclusively on producers. Through proper plant selection and layout, we can provide homes and support for beneficial helpers while discouraging severe crop herbivory.[5]

Climate Change Mitigation

Pulling atmospheric carbon into soil and plants helps mitigate climate change. Perennial crops sequester vastly more carbon than annual crops due to their longer growing period and minimal soil disturbance.[6]

EFFICIENT HARVEST

Patches of the site are designed to accommodate a planned harvesting schedule with accessible pathways and physical "windows" into vegetation. Plant varieties are grouped based upon a common ripening period to minimize the fuel consumption and the time required to move through the site. Plants are spaced based upon equipment requirements to make reaching a patch and harvesting within it as efficient as possible.

RESILIENCY AND STABILITY

Mimicking a woodland's vegetation layers, density, and diversity are fundamental to creating resiliency and stability. Left unmanaged, the yields and functions of a well-designed agroforestry site stabilize or improve over the years even when faced with extreme drought, herbivory, wind, and other external stresses.

3 DESIGN STEPS

Designing a landscape that is based upon ecological principles requires thought, patience, and adherence to a good design process.

These following steps were used in creating the Conceptual Site Plans for each area.

1. Articulation of goals
2. Base mapping
3. Inventory and assessment
4. Concept designs
5. Plant list
6. Conceptual Site Plan

Figure 8. Drawing
Tracing paper on top of a base map is an inexpensive and effective method of creating landscape drawings from a variety of viewpoints.
Photo by Fred Meyer

ARTICULATION OF GOALS

The goal of Freeze Creek Forest is to create a living food forest garden for the public to enjoy and understand the role of silviculture in watershed conservation and carbon sequestration while advancing high-altitude, semi-arid agroforestry practices. The intent is to validate economic incentives of sustainable agriculture in harmony with environmental conservation.

BASE MAPPING

A scaled map of the site was created identifying elements that can and cannot be removed.

INVENTORY AND ASSESSMENT

Existing site elements were identified and documented for a thorough understanding of all limiting factors, landforms, water flow and erosion patterns, circulation paths, vegetation, wildlife and insect life, microclimates, frost pockets, wind speed and direction, pesticide drift, buildings, soil fertility, soil texture and drainage, aesthetics, sun and shade, and surrounding ecosystems. Usage zones were designed with frequency of areas are visited in mind.

During the design steps, these careful assessments helped in placing the right plant in the right place which will greatly improve chances for success while lowering maintenance chores.

Species Inventory

The function of existing vegetation on the landscape were inventoried, including all weeds, native species and exotic species. For each plant, sunlight conditions, soil types, common plant groups, and amount of shelter were noted. This research was used to guide the search for desired plants that have attributes similar to thriving plants on the land. This approach will greatly increase plant establishment, yields, disease resistance, pest tolerance, and drought-tolerance.

Existing edible and marketable plants, such as Elderberry and Serviceberry have been prioritized in the existing forest. These plants are expected to expand or establishing higher-yielding varieties to greatly increase chances of success.

Water Flow Patterns

An emphasis was placed on precisely identifying the contours of the landscape to better understand how to minimize drought. USGS contour maps were used for initial planning and design. Detailed maps will be created from USDA GIS data collected on site using Real-Time Kinematic (RTK) via NTRIP positioning correction transmission protocol for more precise maps and designs.

Eroded areas represent high-priority opportunities for catching and impounding large amounts of water for the benefit of nearby plants.

Limiting Factors

The site’s limiting factors and resources are key to designing resilient polycultures that produce high yields at desired times. Latitude, annual precipitation, landform, and biome are factors that cannot be easily changed. Plants were selected to match the site instead of attempting to alter the site so desired plants will thrive on it.

Plant selections will minimizing competition between plants for limited moisture, nutrients, or sunshine by using limitations as a guide.[9] For example, species with high drought tolerance or deep taproots, or both, were selected to not compete for scarce moisture.

The availability to harvest crops is another limitation. Time windows for harvesting throughout the seasons were considered and species and varieties selected that accommodate the schedule.

CONCEPT DESIGNS

Initial designs were sketched using free flowing bubble-like shapes and loose lines. The entire landscape with functional areas were created using the site inventory and assessment to inform this brain-storming. Each area is designed with a specific purpose that helps fulfill the producer's goals. The ecosystem of each area is intended to help define plant communities: forest, woodland, shrubland, prairie, wetland. Pathways are defined between areas to create an elegant flow throughout the landscape. Beneficial relationships are created between elements to increase their value; for example, a terraced swale on contour is used to hold and infiltrate rainwater.

PLANT LISTS

The design started with a desired plant list. The mature size of each plant, its optimal growing conditions, and its functions were identified. Plants were identified that suppress weeds (i.e., ground covers, fix nitrogen in the soil, accumulate nutrients, and/or attract beneficial insects and birds. Including these highly functional plants in the landscape means less maintenance because plants, animals, and insects perform this maintenance.

For each area in the concept design, desired plants were divided into individual plant lists using the designated ecosystem, desired functions, and limiting factors to guide decisions.

CONCEPTUAL SITE PLAN

For each area in the concept design, infrastructure elements, trees, and shrubs were first selected and then herbaceous plants and ground covers placed. The area’s plant list was used to place plants based upon desired harvesting schedules. Trees and shrubs were selected based upon their mature size to minimize future competition for sunlight.

Several conceptual site plans were created for different periods to show growth over time. For example, the alley crop contains mostly windbreak and soil anchor trees during its initial establishment. After 3-5 years, the widening tree canopy will help to establish perennial plans with the understory shielding harsh sunlight.

The Center for Agroforestry’s *Training Manual for Applied Agroforestry Practices guidelines were incorporated to develop the work plan, site assessment, and market plan* .[10]

4 ORGANIzING PATTERNS

Each agroforestry design shares an underlying framework of patterns that aid in the maintenance, yield consistency, stability, and resiliency of the system. Understanding these patterns allows plant substitutions and design changes to be made for different growing conditions and desired yields.

Figure 9. Ostrich Fern Fiddlehead
Young shoots of the ostrich fern (*Matteuccia struthiopteris*) are edible and can be prepared like asparagus.
Photo by Priya Jaishanker / CC BY ND

WATER MANAGEMENT AND LANDSCAPE CONTOUR

Plants need water to thrive, so a critical first step was to carefully create a water management plan. Topography, current soil moisture levels, annual rainfall, and each plant's water needs were considered and then a plan that distributes and infiltrates rainwater at specific locations was created. Establishing swales and ponds, keyline plowing, and placing pathways and plants on a landscape's contour are water management techniques that will form a strong foundation for perennial crops. See *The Keyline Plan* for information about keyline design and plowing to create a drought-resistant landscape.[11]

PATHWAYS

Decreasing management time requires that site designs accommodate light equipment, off-highway vehicles (OHV), wheel barrows, and other equipment. Path widths and turn-around headlands (space at the end of a field) are based upon existing and future equipment.

WOODLAND ECOSYSTEM

Achieving the many goals of an edible agroforestry system requires a high input of energy. This energy can come from our labor and a declining supply of fossil fuels or we can place a majority of the burden onto Mother Nature's strong shoulders. Understanding the ecological niche of plants is key to leveraging nature's free benefits.

Most orchard crops originated in woodlands. All design templates, therefore emulate a woodland ecosystem as a design foundation to ensure the broadest array of these crops will reside in familiar biological communities with desired sun, soil, nutrient, and water needs fulfilled. This ecosystem has a high level of ecological productivity, giving plants a home in which they will inherently thrive and maximize food yields without constant oversight.

Where existing mature forest stands are overgrown, tree spacing will adhere to the diameter plus ½ guide, that is the distance in feet between adjacent trees should be equal to 1½ times the tree diameter in inches. Upright, undamaged, full crowned trees will be retained where possible. Thining activities will be performed during late fall and winter.

Infested trees will be felled by early May, before the adult beetles emerge. Mechanical treatments include splitting, chippping, and peeling bark from infested trees to be burned are highly effective but also highly labor intensive.

NATIVES AND ECOLOGICAL ANALOGS

Whenever possible, species native to the property were selected to take advantage of their inherent ability to adapt to regional stresses and provide desired habitat for local wildlife and insects. If a native could not appropriately fulfill a needed function or fit within a space, an attempt was made to find an ecological analog: a species or variety that has a high degree of similarity with the native species. For example, the native saskatoon (*Amelanchier arborea*) may be too tall to grow alongside a semi-dwarf fruit tree in a Mountain West polyculture so the shorter Regent variety of the *Amelanchier alnifolia* species could be selected instead.

When selecting any species, especially non-natives, the plant's replication methods were carefully researched, which can vary depending upon the region and site conditions. Highly dispersive and expansive species were avoided.

Figure 10. Contour Planting
These newly planted fruit trees at Versaland Farm follow the contour of the landscape to slow rain water and help it infiltrate rather than run off.
Photo by Paul Trieu

Figure 11. Saskatoon Harvest
Saskatoons (also known as serviceberries and Juneberries) yield sweet berries in late June. They have few pest or disease problems. Native species can be found throughout much of the United States.
Photo by Fred Meyer

VEGETATION LAYERS

The vertical structure of a woodland is defined by several vegetation layers, all of which are capable of yielding food. Each layer interacts with the other layers to keep the entire system functioning. Resiliency in the woodland is increased with more vegetation layers due to redundant functions and additional availability of species niches.

The soil of healthy woodlands is composed of mycorrhizal fungi due to the constant presence of woody trees and shrubs. Therefore, to help orchard crops thrive, a fungal-dominated soil must be encouraged by establishing a large number of trees and shrubs with undiseased debris from regular pruning dropped directly to the ground. Interplanting species that can be exclusively used for mulch is recommended, such as the fast-growing, nitrogen-fixing black alder (*Alnus glutinosa*).

Tall Tree

Some woodlands may not have a tall tree layer or may only have only a few tall trees. The overstory defines the amount of sunlight available to lower layers and consumes the most nutrients and water in the woodland. Due to this fact, great consideration must be given to the amount of food yield desired in lower layers; a sparse overstory will increase food yields in lower layers (see “High-Yielding Upper Canopy” on page 13). Examples: bigtooth maple (*Acer grandidentatum*), chestnut (*Castanea mollissima*), heartnut (*Juglans ailantifolia*).

Low Tree

Understory trees are often shade tolerant, but fruit yields increase with more sun. Trees in this layer can be designed to replace tall trees from accidental or purposeful disturbances. Examples: elderberry (Sambucus cerulea), saskatoon (Amel-anchier alnifolia), pawpaw (*Asimina triloba*), pear (*Pyrus* spp.), apple (*Malus* spp.), hickory (*Carya ovata*).

Shrub

Just like understory trees, shrubs are often shade tolerant and add diversity and yields to the system. Examples: aronia berry (*Aronia melanocarpa*), gooseberry (*Ribes uva-crispa*), bush cherry (*Prunus japonica*), hazelnut (*Corylus americana*).

Herb

In addition to providing food and medicine, the flowers and vegetation of perennial herbs often support a wide variety of insects that assist in the pollination and protection of the system. Examples: ginseng (*Panax quinquefolius*), anise hyssop (*Agastache foeniculum*), purple coneflower (*Echinacea purpurea*), comfrey (*Symphytum x uplandicum*), rhubarb (*Rheum x cultorum*).

Ground

Low-growing, spreading perennials help suppress weeds and conserve moisture. Huge amounts of nutrients are stored and cycled in the herb and ground layers. Examples: Utah sweetpea (Lathyrus pauciflorus), Dutch white clover (*Trifolium repens*), garden strawberry (*Fragaria ananassa*), yarrow (*Achillea millefolium*), mushrooms.

Root

Plant roots can help condition poor soil sometimes to great depths. Examples: Jerusalem artichoke (Helianthus tuberosus), alfalfa (*Medicago sativa*).

Vine

Vines can grow in any layer using other layers for structural support. Pruning may be required to ensure they do not suffocate other vegetation. Examples: hardy kiwi (*Actinidia arguta*), grape (Vitis spp.), maypop (*Passiflora incarnata*).

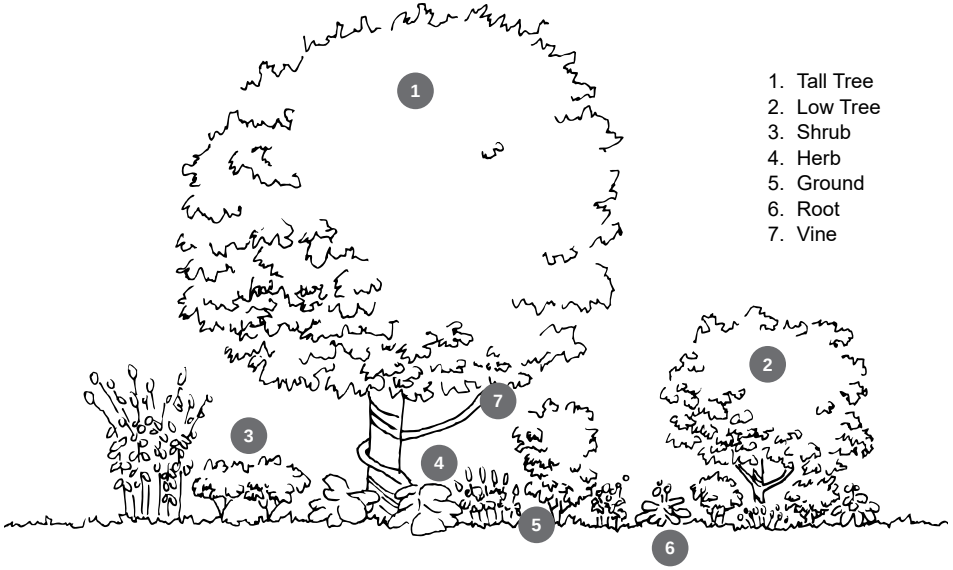

Figure 12. Vegetation Layers
Up to 7 layers can exist in an edible agroforestry planting.
Drawing by Fred Meyer

VEGETATION DENSITY

A woodland tree canopy ranges from 40% to 99% coverage (a forest has 100% coverage).[12] Most orchard crops yield more food with increased sunlight. The density of a woodland’s upper canopy, therefore determines the amount of food that can be expected to grow in lower layers.

High-Yielding Upper Canopy

To maximize food yields in the upper canopy, space trees so their mature crowns touch, but do not interlock. This design keeps the most sunlight in the upper canopy which may decrease yields in lower layers.

High-Yielding Understory

To maximize food yields in lower layers, focus first on providing required sunlight to understory plants and then integrate upper canopy trees. For example, space understory shrubs so their mature crowns do not interlock and then surround or bookend them with trees ensuring mature tree crowns do not shade the shrubs.

Increase Yields in New Orchards

Far more sunlight is available to the lower layers of a newly planted orchard. Establish fast-yielding crops between trees to provide yields while trees mature; for example, annual vegetables, French sorrel (*Rumex acetosa*), rhubarb (*Rheum x cultorum*), aronia berry (*Aronia melanocarpa*), and bush cherry (*Prunus japonica*) often provide food within two years after planting. As the canopy closes, sun-loving species can be replaced with shade-tolerant plants; for example, gooseberry (*Ribes uva-crispa*), and elderberry (*Sambucus canadensis*).

VEGETATION DIVERSITY

Physical and functional diversity in a woodland increases the ecosystem's stability, resilience, and self-maintenance.[13] Competition between plants with similar resource needs decreases yields. Resiliency and yields are maximized by using a variety of diverse plants which encourage harmony and cooperation.

Resource Partitioning

Varied plant heights minimize competition for sunlight. Plants with roots of varied depths are also utilized to partition the soil for nutrients and water; for example, taprooted comfrey (*Symphy-tum x uplandicum*), dandelion (*Taraxacum officinale*), and French sorrel (*Rumex acetosa*) are unlikely to sap resources from a nearby shallow-rooted fruit tree.

Polycultures

A well-designed, intercropped mix of plant species provides several benefits:

- Food yields increase due to decreased competition for similar sunlight, water, and nutrient resources.
- Disease problems decrease because parasites cannot jump as easily between different species.
- Herbivory is decreased because it is more difficult for pests to find desired plants.

Integrated pest management strategies often suggest avoiding monocultures of long rows and large masses of the same species.[14] When designing blocks or short rows of plants, try to increase harvest ease by keeping species with similar ripening times in the same patch.

Uneven Structure

A woodland with a level canopy height is not desired. Plantings of varied dimensions throughout all layers are established to promote air circulation, increase sunlight availability, and increase niches for beneficial insects, birds, and soil organisms.[15] Intermixing varieties of the same species creates varied heights and widths while also increasing disease and pest resistance. Within rows, plants are slightly offset rather than planted in a straight line.

Redundancy

To increase system resiliency, similar functions are fulfilled multiple times in different ways. If deer nibble all fragrant false indigo (*Amorpha nana*) to the ground, a backup ground cover of perennial Dutch white clover (*Trifolium repens*) exists to replace its nitrogen-fixing function.

FUNCTIONALLY INTERCONNECTED POLYCULTURE

Maximizing food yields is a primary focus, but to remain stable, resilient, and self-maintaining, a woodland ecosystem requires that its inhabitants fulfill other functions, not just producing food. Every area was designed to build soil, suppress weeds, cycle nutrients, support pollinators, and resist pests by leveraging inherent functions of plants and attracted animals. Elements in the ecosystem all work in an interdependent web of relationships, each fulfilling each other's needs and caring for one another. Ideally, a single plant, insect, or animal will provide multiple functions to the system, increasing chances for redundancy and other yields.

Soil Building Nutrient Accumulators

Plants that generate biomass filled with nutrients accumulated from subsoil or gathered from topsoil detritus are used to eliminate fertilizers. Comfrey (*Symphytum x uplandicum*), dandelion (*Taraxacum officinale*), French sorrel (*Rumex acetosa*), and Roman chamomile (*Chamaemelum nobile*) are examples of plants that build soil and reduce leaching losses by accumulating nutrients and then releasing them through root and foliage decomposition.

Nutrient accumulators are placed near the dripline of the mature outer canopy of food-bearing plants where feeder roots are commonly located.

Figure 13. Strawberry and Garlic Polyculture

This polyculture of strawberries and garlic yields more food per square foot together than it would if the plants were separated. The different leaves and root structures do not compete for sunlight or water.

Photo by Fred Meyer

Figure 14. Comfrey

The deep roots of comfrey bring up nutrients from the subsoil and do not compete with surrounding plants.

Photo by Fred Meyer

Nitrogen Fixers

Nitrogen is often the least available soil nutrient, but one that all plants need. Nitrogen-fixing plants sequester atmospheric nitrogen and then release ("fix") it into the soil where it can be used by surrounding plants. Good examples include leadplant (*Amorpha canescens*), lupines (*Lupinus* spp.), alfalfa (*Medicago sativa*), and clovers (*Trifolium* spp.).

Just as with nutrient accumulating plants, nitrogen fixers are placed near the mature outer canopy of food-bearing plants where feeder roots are commonly located.

Ground Cover Weed Suppressors

Ground covers can form a thick mat under crops and in pathways to make it difficult for weeds to gain a foothold. Ideal ground covers are low-growing, provide habitat for beneficial insects and soil organisms, do not harbor pests, eliminate erosion, do not compete with crop plants for water and nutrients, and decrease or eliminate mulching and mowing maintenance. Achieving all these goals can be difficult and trade-offs are often needed.

Vegetation under crop plants yield soil development, pollinator habitat, and reduced maintenance, but sacrifice some food yields due to competition for nutrients and water. Yields from the entire system are less important then trying to design for that balance. Permanent vegetation under crop plants that eliminate mowing, but also reduce food yields, were selected instead of maximizing food yields by replacing vegetation under crop plants with chop-and-drop mulch from native grasses.

When designing a ground cover mix, 2-4 species with both clumping to accomodate all weed niches and running habits in the each area. After a few years, the clumpers will appear to be islands in a sea of runners.

- Running species spread indefinitely, weaving among other plants filling in soil and sunlight gaps. Examples: dwarf yarrow (*Achillea tomentosa*), wild strawberry (*Fragaria virginiana*), sweet woodruff (*Galium odoratum*), peppermint (*Mentha spicata*), apple mint (*Mentha suaveolens*).
- Clumping species grow to only a specific width and typically spread slowly. Clumpers should be tall enough to ensure they are not overtaken by runners. Examples: creeping thyme (*Thymus serpyllum*), oregano (*Vulgare hirtum*), chives (*Allium* spp.), Roman chamomile (*Chamaemelum nobile*), self-heal (*Prunella vulgaris*).

See Washington State University's *Orchard Floor Management* publications[16] for additional information and research about weed management strategies.

Slow-Growing Grass Mix

The shallow, dense roots of conventional turfgrass robs young orchard crops of nutrients and water. A slow-growing, lower-competition native grass mix for pathways and mowed areas under tree crops will use:[17]

- Creeping red fescue (*Festuca rubra ssp. rubra*).
- Chewings fescue (*Festuca rubra ssp. commutata*) and/or hard fescue (*Festuca longifolia*).
- Dutch white clover (*Trifolium repens*).

Deter Voles

Eliminating vole habitat is important as these rodents can girdle and kill trees by eating bark. Voles take up residence in most tall ground covers and deep woodchip mulch. They prefer to eat white clover so this will not be planted under crop trees where vole activity is high.

Voles will also be deterred by mixing gravel with the soil at the base of trees, installing hardware cloth around trunks, encouraging predator activity, and establishing vole-repelling plants, such as sweet woodruff.[18] Providing habitat for predatory snakes and birds will also help manage rodent population.

Nectaries

Flowers blooming throughout the growing year provide support for beneficial insects and birds that in turn provide pollination and pest-management services. Native flowers are incorporated that bloom early or late in the season or have blooms for 2-4 months. This includes plants with short and long nectar tubes to encourage insect diversity.

Most flowers serve as food sources for "generalist" insects, but also select plants that attract "specialist" predatory insects to help control pests. All plant lists in this document designate nectary plants as generalists (G), specialists (S), or both (GS).

Long-blooming examples include anise hyssop (*Agastache foeniculum*), purple coneflower (*Echinacea purpurea*), blanket flower (*Gaillardia aristata*), fennel (*Foeniculum vulgare*), aster (*Aster* spp.), mint (*Mentha* spp.) and yarrow (*Achillea millefolium*).

Pest Confusers

Strong-scented plants can confuse pests and reduce their ability to find crops. Good aromatic plants include anise hyssop (*Agastache foeniculum*), yarrow (*Achillea* spp.), bee balm (*Monarda fistulosa*), broadleaf sage (*Salvia officinalis*), and mint (*Mentha* spp.).

	Crop Tree Size and Setting		
	• Standard-sized crop trees less than 4 years old. • Dwarf crop trees of any age.	• Standard-sized crop trees that are 4+ years old.	
		• High vole activity. • Large area.	• Low vole activity. • Medium to small area.
Pathway ground cover	• Slow-growing grass mix with alfalfa.	• Slow-growing grass mix with Dutch white clover.	
Crop ground cover	• Mulch of mowed grass and alfalfa blown from pathway. • Woodchip mulch.	• Chives, mint, sweet woodruff. • Slow-growing grass mix.	• Chives, dwarf yarrow, wild strawberry, Dutch white clover, creeping thyme, oregano, Roman chamomile, self-heal.
Notes	• Young trees grow faster in mulch with no competition from ground covers. • Due to weak root systems, crop yields from dwarf trees decrease when ground covers are present. • Successfully using mowed and blown grass as mulch requires narrow crop rows.	• For settings completely covered by grass, trees spaced evenly in a grid pattern will improve mowing efficiency. • Dropped fruit may be difficult to harvest in tall ground covers. • Rotating geese or other animals can keep grass low while cleaning up fallen fruit.	• Plants may be costly if they cannot be established through direct seeding.

Figure 15. Ground Cover Strategies

Use the tree size and setting to inform a mix of ground covers that will maximize crop yields while suppressing weeds.

5 CROP YIELDS AND HARVEST TIMES

Crop yields and harvest times are influenced by hardiness zone, sunlight and water availability, soil conditions, competition from other plants, pruning regimes, rootstock, variety, and plant age.

Figure 16. Black Cohosh
Black cohosh (*Actaea racemosa*) is a medicinal herb that can be grown under the shade of black walnut and other tree crops.
Photo by rockerBOO / CC BY

Approximate crop harvest times and yields for which data was available is shown in Figure 16. This information was used to inform decisions on which crops to grow. Harvest labor is reduced by grouping crops with similar harvest times.

Form	Common Name	Genus / Species	Hardiness Zones	Crops	Crop Yield Pounds / Plant	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Vine	Grape, Fox	Vitis labrusca	5-8	Fruit	12.5									
Tree	Apple, Dwarf	Malus spp.	4-8	Fruit	48.0									
Tree	Cherry, Sour Dwarf	Prunus cerasus	4-8	Fruit	22.0									
Tree	Cherry, Sweet Dwarf	Prunus avium	5-8	Fruit	22.0									
Tree	Chestnut, Chinese	Castanea mollissima	4-8	Nuts	30.0									
Tree	Crabapple, Siberian	Malus baccata	3	Fruit										
Tree	Mulberry	Morus spp.	5-9	Berries	17.5									
Tree	Pawpaw	Asimina triloba	4-8	Fruit	12.5									
Tree	Peach, Dwarf	Prunus persica	4-8	Fruit	57.0									
Tree	Pear, Asian	Pyrus pyrifolia	4-9	Fruit										
Tree	Pear, European Dwarf	Pyrus communis	4-9	Fruit										
Tree	Persimmon, American	Disospiros virginiana	5-9	Fruit	27.5									
Tree	Plum, American Standard	Prunus americana	3-8	Fruit	122.5									
Tree	Plum, European Dwarf	Prunus domestica	4-8	Fruit	8.8									
Tree	Plum, Japanese	Prunus salicina	6-10	Fruit										
Tree	Walnut, Black	Juglans nigra	4-7	Nuts	120.0									
Shrub	Aronia Berry, Black	Aronia melanocarpa	3-9	Berries										
Shrub	Beach Plum	Prunus maritima Ecos	3-6	Fruit										
Shrub	Blueberry, Half-High	Vaccinium spp.	3-7	Berries										
Shrub	Blueberry, Highbush	Vaccinium corymbosum	3-7	Berries	7.5									
Shrub	Blueberry, Lowbush	Vaccinium angustifolium	2-6	Berries	1.9									
Shrub	Cherry, Bush	Prunus japonica	4-8	Fruit										
Shrub	Currant, Black	Ribes nigrum	3-7	Berries	10.0									
Shrub	Currant, Red	Ribes silvestre	3-7	Berries	6.5									
Shrub	Elderberry	Sambucus canadensis	3-10	Berries	15.0									
Shrub	Gooseberry	Ribes uva-crispa	3-8	Berries	9.0									
Shrub	Hazelnut	Corylus americana	4-9	Nuts	22.5									
Shrub	Nanking Cherry	Prunus tomentosa	3-7	Fruit										
Shrub	Raspberry	Rubus idaeus	4-8	Berries										
Shrub	Saskatoon	Amelanchier alnifolia	2-7	Berries	5.7									
Herb	Asparagus	Asparagus officinalis	2-9	Shoots	0.4									
Herb	Blackberry, Thornless	Rubus fruticosus	5-8	Berries										
Herb	Rhubarb	Rheum x cultorum	1-9	Stalk	3.5									
Herb	Strawberry, Garden	Fragaria ananassa	4-9	Berries	1.0									

Figure 17. Approximate Crop Yields and Harvest Times

Yields and harvest times may vary greatly based upon site conditions. Estimates are provided from several sources.[19] [20] [21]

6 ESTABLISHMENT AND MANAGEMENT

Establishing an edible agroforestry system takes years or decades depending upon weather, soil conditions, the size of the site, and the amount of pressure from undesired weeds and animals. After the design was completed, a realistic establishment strategy was created that is within the available time, resources, and budget.

Figure 18. Woodland Medicinal Starter Beds
Raised beds can help keep weeds from intermixing with these newly planted medicinal herbs.
Photo by Katie Trozzo / CC AT ND

Weed Management

It is very important to create a weed management strategy before planting begins. The selected strategy influenced the site layout, plant selection, mowing regime, use of animals, and needed equipment. These designs demonstrate a “sandwich system” of grass pathways between wide strips of orchard crops with perennial ground covers.

Vigorous and persistent weeds exist on the site, so patiently taking multiple years to eliminate the weeds prior to planting will be necessary since it is more difficult to eliminate weeds around existing plants. Landscape fabrics that biodegrade in a year are also a good option for eliminating weeds.

See “Ground Cover Weed Suppressors” on page 15 for information about designing polycultures to manage weeds.

Soil Development

For all plants, the existing soil pH range, drainage, texture (sand, silt, clay), and organic matter were considered. Soil will not require remediation prior to planting because soil conditions already match plant needs.

Instant Succession

Succession is the observed process of change in the species structure of an ecological community over time.[22] A woodland normally takes a very long time to establish as it linearly goes from bare ground through successive stages of annual herbs, perennial forbs and grasses, pioneer shrubs and trees, to hardwood trees. By thoughtfully establishing high-functioning herbs, shrubs, and trees all at the same time, all layers of the woodland instantly begin growing. This strategy bypasses natural stages, greatly accelerating succession and yields while suppressing weeds.

Limiting factors may greatly influence resource needs and succession speed for each site. For example, a low-nutrient sandy site may require immense amounts of compost or an emphasis on temporary soil-development plants in early years. As nutrient levels increase, the soil-developers can be replaced with permanent plants.

Islands that Merge

Small islands of plantings that slowly expand and eventually merge will be utilized to minimize resources and labor where weed competition is high. These islands keep weeds at bay using wide, temporary barriers of landscape fabric and/or heavy mulch. The weed barrier will be expanded and plants propagated into the weed free area when weeds surrounding the islands are thoroughly suppressed by the barrier and ground covers within the islands are established.[23]

Over Planting

Trees and shrubs will be overplanted and then thinned as they reach maturity to allow several varieties or species to be evaluated for the most resilient, highest yielding plants in a specific area of the landscape. After several years, low-yielding plants will be removed and fragile plants may die. New plants may need to be planted if large gaps emerge where plants once stood.

Maintaining sunlight in lower layers may require removing perfectly good plants if preferred resilient species are planted too close. A staggered planting pattern will be used to help minimize this situation.

Animals

A Utah Department of Agriculture and Food licensed honeybee apiary has been operatd on the property since March 2021. Honeybees are artificially bred, domestic agricultural animals classified as livestock by the US Department of Agriculture (USDA) and the US Food and Drug Administration (FDA). USDA-accredited certifying agents may certify beekeeping operations under the existing organic regulations for livestock ([7 CFR] Sections 205.236 – 205.240). The entire property is managed in accordance with organic livestock pasture regulations but is not certified organic by the USDA. The USDA National Organic Standards Board (NOSB) Livestock Committee 2010 Apiculture Recommended Standards will be implemented on the site.

Additionally, domestic animals may be used seasonally (May - October) to prepare the land for permanent plantings, depending on the condition of the site and its vegetation. Drinking water source protection will be the top consideration when giving animals access to cropland. Where the land is lightly vegetated and prone to erosion, a movable poultry tractor may be used to quickly remove the tops of weeds and lay down a light coat of manure. Pigs, goats or cattle can initially prepare land crowded with weeds when the area is too rough for poultry.

Select areas far from sensitive soil or riperian zones can be partitioned with electric mesh or virtual fencing to contain animals that clear weed trees and brush before planting. For example, goats can initially graze tall, thick weeds, followed by poultry which spread manure and interrupt parasite life cycles. A pig tractor can be used to remove deeply rooted woody weeds. Pigs can also be rotated seasonally to clean up crop wastes or fallen fruit.[24]

Animal tractor systems are very effective for ground cover maintenance and work well with orchard or tree crops. In an orchard animal tractor system, the animals are rotated through the orchard, either in movable pens or in a series of fixed paddocks. The animals clean the area between and under the trees of grasses, weeds, and weed seeds, scavenge wastes and windfall fruits, and eat insects and their larvae. At the same time, animals add manure to help fertilize the crops. When the pen area has been cleared and fertilized by the animals, they are moved on to the next section of orchard. With the appropriate combination of animals and crop trees, this system has been effective with chickens, guinea fowl, turkey, pheasant, quail, sheep, and pigs in alley orchards.

On a healthy mixed diet from the orchard, animals tend to have less disease problems. Lighter animals such as chickens or other poultry can be rotated permanently through an orchard system. Geese can be employed to control grasses in orchards.[25]

Young saplings are susceptible to animal damage while the orchard is being established. Once perennial plantings, including ground covers, are established small breeds of chicken can be introduced to the orchard. The chickens will eat insects and the fruit that falls to the ground, stopping pests from gathering, and fertilize the soil. This can be done at a ratio of about 10 chickens per acre. When the orchard is 3-7 years pigs can be introduced, after 7 years, sheep. When the orchard is 15 years old cattle can be allowed to periodically graze in the orchard.[26]

When animal grazing is not possible, brush-hogs, tractors, winches, chainsaws, and hand tools will be used instead for manually removing undesired plants.

Pest Management

Crops will be periodically inspected to detect and manage pests. Fencing will be implemented around tree seedlings to protect from animal browsing. Non chemical corrective actions will be used, if any, to minimize negative impacts on beneficial insects.

AGROFORESTRY DESIGNS AND CONCEPTUAL SITE PLANS

Figure 19. Tour of Red Fern Farm
Red Fern Farm is family-owned nursery near Wapello, Iowa that grows a variety of tree crops.
Photo by Fred Meyer

7 ALLEY CROP ORCHARD

Alley cropping is broadly defined as the planting of two or more sets of single or multiple rows of trees or shrubs at wide spacings, creating alleys within which agricultural, horticultural, or forage crops are cultivated.[27]

Figure 20. Alley Crop Orchard
Walnut trees surround an alley of corn in this agroforestry planting.
Courtesy of USDA National Agroforestry Center

INVENTORY AND ASSESSMENT

The contours of the site were identified and used as a design foundation for long strips of plantings. The plantings will follow the contour of the land to maximize rainwater catchment and reduce erosion without needing irriation. Sunlight availability, soil types, frost pockets, and warm microclimates throughout the area were identified.

The direction of prevailing summer and winter winds are noted below.

The design considers required path width and turnaround space by light equipment for management and harvesting.

The travel routes of local wildlife are also considered where young plantings will need protection.

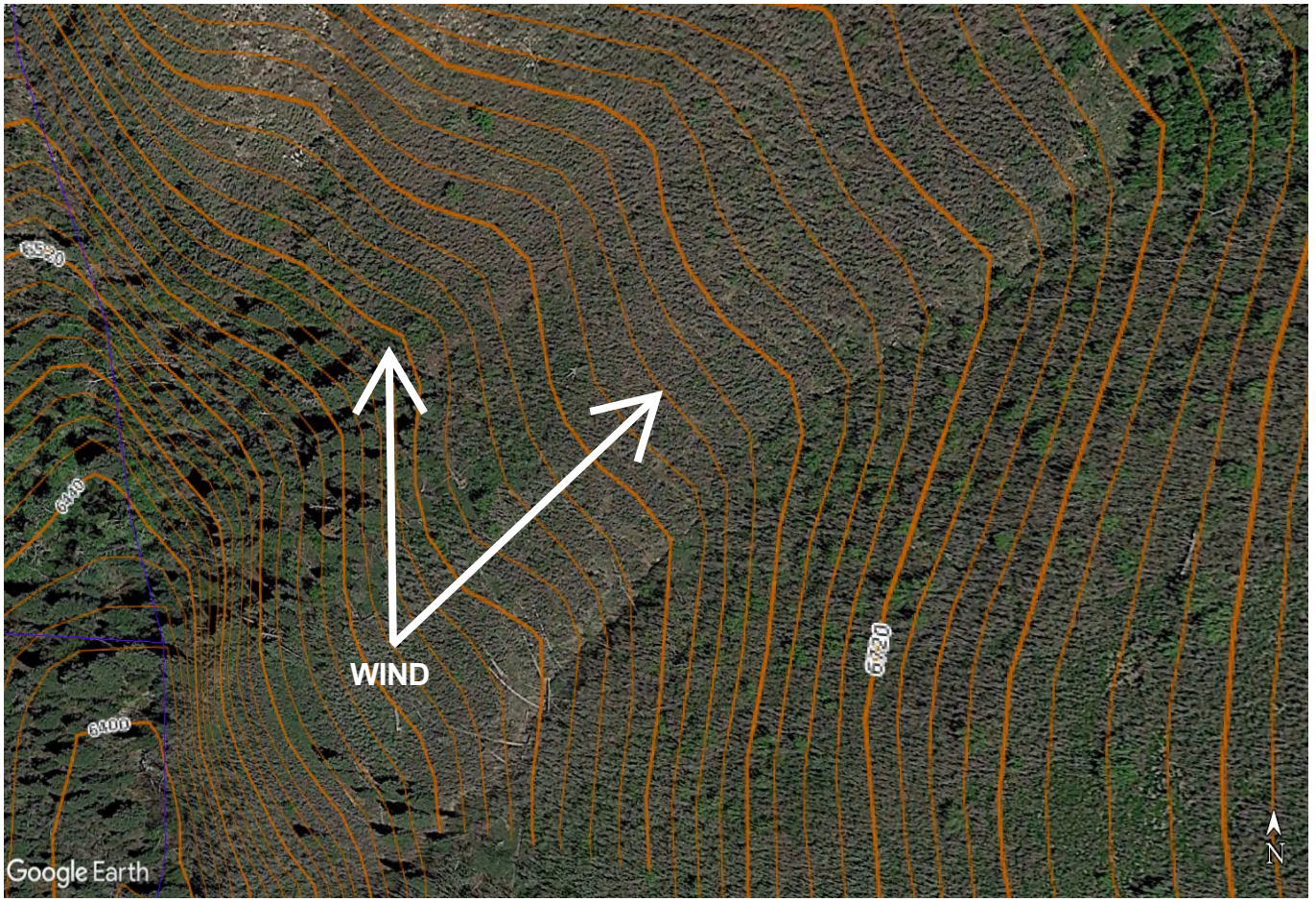

Figure 21. Alley Crop Orchard Base Map
Contour lines help form the foundation for the design.

CONCEPT DESIGN

Rows of woody perennials are placed at intervals of 60' - 100' on contour across the crop field. The width of the alleys between the rows of trees or shrubs were determined by considering slope length, field width, crop sunlight requirements, and equipment width. A north-south orientation of tree rows will maximize snowpack conserved in the alley crop.

Blocks of plants are organized strategically based on harvest times. These polycultures also help reduce pest pressure.

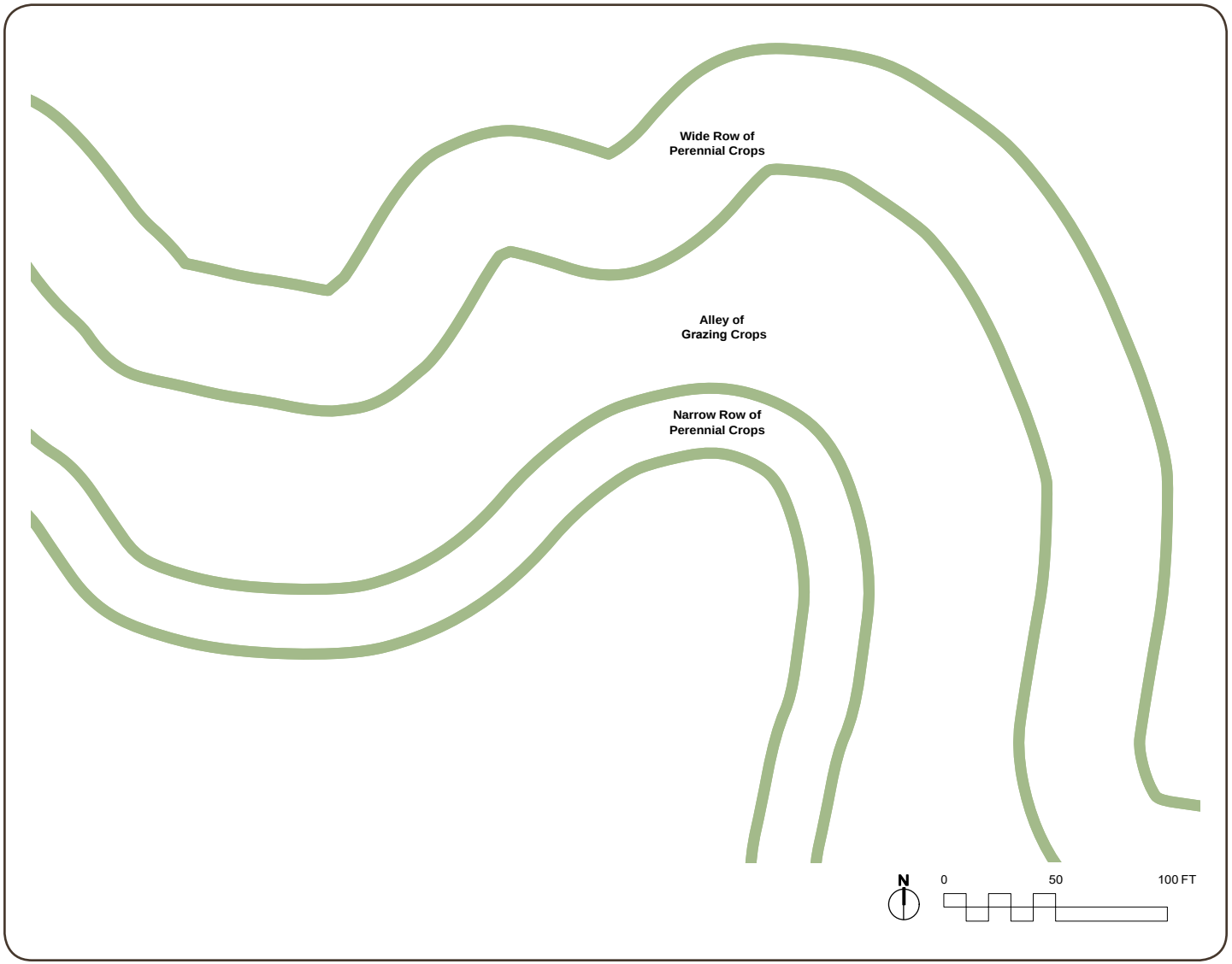

Figure 22. Alley Crop Orchard Concept Design
A wide row and narrow row of perennial crops surround a 60’ wide row of annual crops.

Competition and Cooperation

Trees compete with companion crops for sunlight, moisture, and nutrients. Attention was given to the root type and size of neighboring plants within the design to minimize competition. For example, root systems associated with warm season forages are typically deeper than cool season grasses. This makes them an excellent choice for controlling erosion and protecting subsurface water from leached nutrients. These warm season grasses will be less competitive in the early spring when many trees are beginning their annual growth. However, warm season forages grow vigorously in the hot summer months which may put them in competition with trees and other woody vegetation at a time of the year when water is possibly the most limited resource. Seasonal compatibility was considered when selecting the trees, shrubs, grasses, and crops for the alley cropping practice.

Perennial alley crops have positive influences on tree crops by suppressing weeds, providing nutrients, and creating microclimates. For example, many legumes fix nitrogen that can benefit nearby fruit trees while deterring weeds. Sunflowers can speed tree growth by creating a greenhouse effect for trees.[28] Chemical interactions can be controlled by choosing plant combinations that work together.

Multiple Rows

Multiple rows of trees and shrubs provide the same benefits as a single row of perennials, but allow structure and species diversity to be increased through vertical and horizontal vegetative layering. Water and nutrient loss is also improved by using multiple rows.

To enhance the growth of trees and shrubs in multiple-row plantings, plants are staggered between adjacent rows. This will permit maximum crown development by providing more room to grow. In addition, competition for sunlight between plants can be reduced through offset row configurations.[29]

Row Spacing

Wider row spacing is preferred for stock grazing. Closer spacing will provide better erosion control. Eighty to 120 foot spacing will allow production for up to 20 years or more. As the shade increases over the life of the trees, it may be necessary to change the companion crop being grown in the alleyway. As the alleyways become more shaded, shade tolerant species can be grown.[30]

Figure 23. Alley Crop Orchard.
Walnut trees surround an alley of soybeans.
Courtesy of USDA National Agroforestry Center

PLANT SELECTION

When selecting a tree species, the sunlight needs of the alley crop throughout its growth cycle were considered. Small tree leaves and light shade is preferable to heavy shade.

A thorny hedge of roses, such as dog rose (*Rosa canina*) or rugosa rose (*Rosa rugosa*), can be planted around the perimeter of an orchard to contain and shelter.

Dutch white clover (*Trifolium repens*) in preferred instead of red clover for areas where livestock may forage.

Hickories (*Carya* spp.), walnuts (*Juglans* spp.), oaks (*Quercus* spp.), persimmons (*Diospyros* spp.), and honeylocust (*Gleditsia triacanthos*) are recommended trees for North American systems.[31]

Form	Common Name	Genus / Species	Hardiness Zones	Height	Width	Light	Water	Crops	Materials	Nitrogen Fixer	Nutrient Accumulator	Ground Cover	Nectary	Medicine
Tree	Chestnut, Chinese	Castanea mollissima	4-8	40'	40'	Full Sun		Nuts						
Tree	Locust, Honey, Thornless	Gleditsia triacanthos	3-8	50-75'	50-75'	Full Sun	Xeric - Hydric	Seeds					G	x
Tree	Pawpaw	Asimina triloba	4-8	20-30'	20-30'	Full Sun - Part Shade	Mesic	Fruit						
Tree	Persimmon, American	Disospiros virginiana	5-9	15-75'	15-50'	Full Sun	Xeric - Mesic	Fruit					G	
Tree	Serviceberry, Downy	Amelanchier arborea	4-9	15-25'	15-25'	Full Sun - Part Shade	Mesic	Berries						
Tree	Walnut, Black	Juglans nigra	4-7	50-70'	30-50'	Full Sun	Xeric - Mesic	Nuts	Lumber		K, P, Ca			
Shrub	Aronia Berry, Black	Aronia melanocarpa	3-9	5-6'	5-6'	Full Sun - Part Shade	Mesic - Hydric	Berries						
Shrub	Elderberry	Sambucus canadensis	3-10	6-12'	6-12'	Full Sun - Part Shade	Xeric - Hydric	Berries					GS	
Shrub	Goumi	Elaeagnus multiflora	5-9	6-8'	6-8'	Full Sun - Part Shade	Xeric - Mesic	Berries		x				
Shrub	Hazelnut	Corylus americana	4-9	12-20'	12-15'	Full Sun	Mesic	Nuts						
Shrub	Saskatoon	Amelanchier alnifolia	2-7	5-15'	5-15'	Full Sun	Mesic	Berries						
Shrub	Sea Buckthorn	Hippophae rhamnoides	3-8	10-20'	10-20'	Full Sun - Part Shade	Xeric - Mesic	Fruit		x				
Herb	Clover, Dutch White	Trifolium repens	4-8	4-10"	6-36"	Full Sun - Part Shade	Xeric - Mesic			x		x		
Herb	Clover, Miniclover	Trifolium repens	4-8	4"	6-36"	Full Sun - Part Shade	Xeric - Mesic			x		x		
Herb	Comfrey	Symphytum x uplandicum	4-9	3-5'	3-5'	Full Sun - Full Shade	Xeric - Mesic				K, P, Ca, Cu, Fe, Mg			x

Figure 24. Alley Crop Orchard Plant List

Figure 25. Harvesting Pawpaws

Pawpaw trees (*Asimina triloba*) grown from seed begin yielding fruit in 4-8 years depending on seed quality, suitability of the location, the care the tree receives, and the species.

Photo by Fred Meyer

CONCEPTUAL SITE PLAN

This design depicts row crops of nuts and fruits with alleyways for annual crops. The top row, which is upslope, is comprised of a black walnut (*Juglans nigra*) polyculture of complementary plants. Plants were chosen that tolerate the juglone compound that is produced by black walnuts in seed husks, leaves, and roots. The polyculture was placed downslope to avoid complications with other rows containing crops that are sensitive to juglone.

Nitrogen Fixers

Nitrogen fixing plants include rows of alternating sea buckthorn (*Hippophae rhamnoides*) and goumi (*Elaeagnus multiflora*) with white clover (*Trifolium repens*) in the ground cover.

Pollinators

Plants that support pollinators and beneficial predatory insects include white clover, goumi, aronia berry (*Aronia melanocarpa*), American elderberry (*Sambucus canadensis*), saskatoon (*Amelanchier alnifolia*), and comfrey (*Symphytum x uplandicum*). The saskatoon alternates with aronia berry for pest interruption.

Harvest Strategy

Since walnuts, persimmons (*Disospiros virginiana*), and pawpaws (*Asimina triloba*) are har-vested by hand, the shrub understory will not interfere with harvesting. Trees are spaced to allow access to the shrubs for harvesting.

Competition Considerations

Sun-loving saskatoon and sea buckthorn shrubs were placed on southern rows while shade-tolerant goumi, elderberry, and aronia were placed north of trees. Wide spacing between shrubs reduces competition while easing harvesting and management.

Alleyway Crops

Crops chosen for the alleyways are determined by farm needs and the age of the perennial plantings. When trees are young, sun-loving perennial forage grasses for animal fodder are planned. As the trees mature, shade-tolerant perennials can be introduced into the alleys such as hazelnuts, elderberries, and aronia berries.

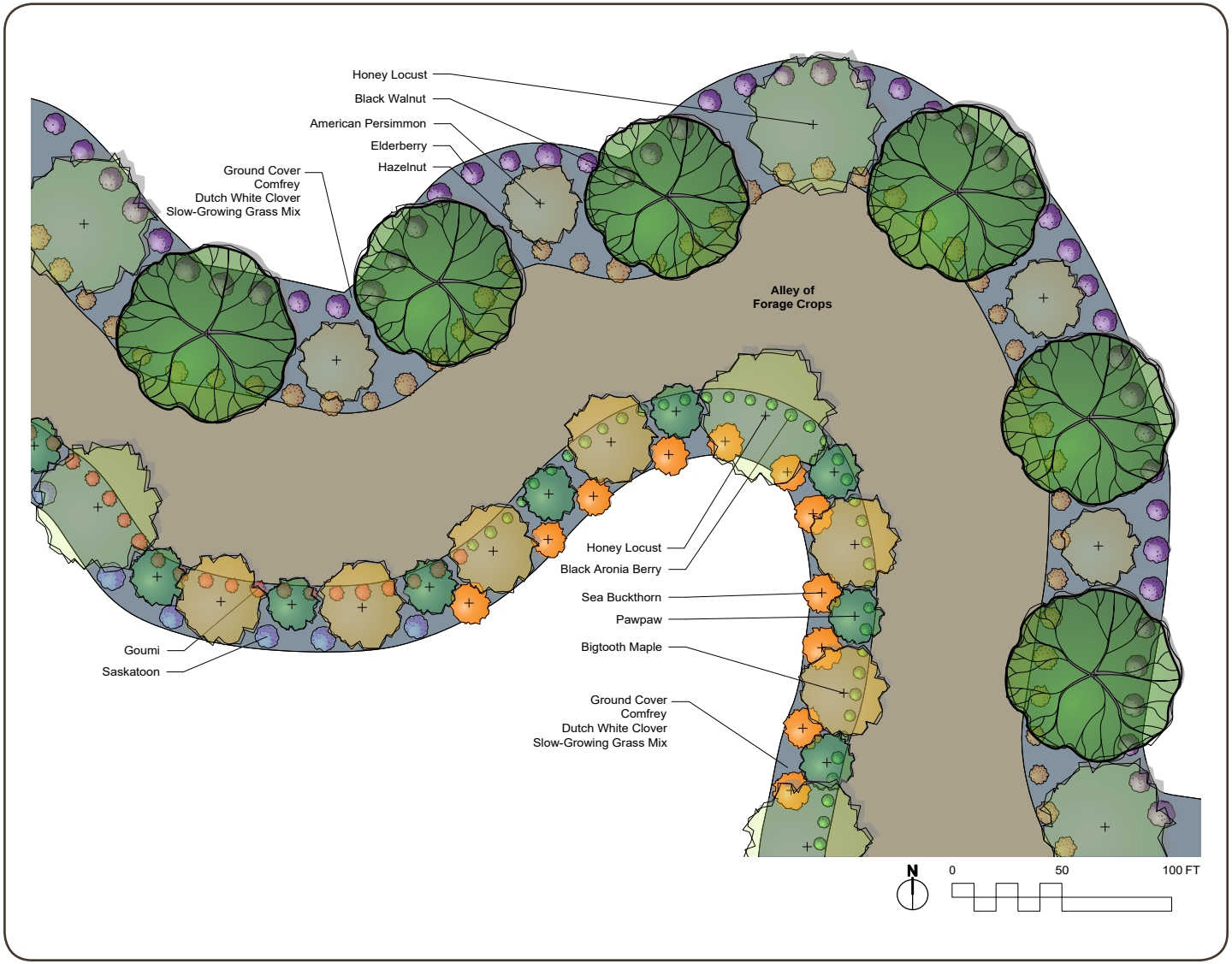

Figure 26. Alley Crop Orchard Conceptual Site Plan

ESTABLISHMENT AND MANAGEMENT

For tree rows, weeds must be minimized for the first 3-5 years in a band about 3 feet on each side of the trees. Nothing will improve the growth of trees and shrubs like the control of competing grasses.

Properly thinning trees within rows can maintain semi-open crowns. Maintained through regular thinning, these openings can help continue the vigorous growth of shade intolerant companion crops. Pruning basal branches before they reach 1” in diameter improves future wood quality and thins the depth of the canopy permitting more sunlight to reach understory crops.

If trees are shallow rooted, roots can be severed using a Ripper, Coulter, or Chisel Plow to decrease competition with annual crops. Begin when trees are young and annually or biennially rip lateral roots to decrease their presence in the plow zone. Remaining roots will be active deeper in the soil profile.[32]

As tree crops mature, less of the alley crop will thrive due to shading. Perennial alley crops could be replaced with shade-tolerant perennials.

As a system matures, it begins to propagate itself and expand. Consider allowing volunteer mulberries, raspberries, and grapes to thrive and provide yields provided they do not interfere with the rest of the system.

Figure 27. Tree Planting
A tractor-pulled tree planter can greatly increase planting efficiency and speed for large areas.
Photo by Fred Meyer

8 EDIBLE FOREST EDGE

Shady forests in the Mountain West often end abruptly when meeting steep, dry slopes. Orchard crops, beneficial insects, and wildlife can thrive in this sunny and partially protected environment while creating a beautiful and natural-looking transition of open woodland to dense forest.

Bees are important pollinators for many agriculture crops, but cultivated plants rarely provide their required nectar year round. Forest edges with large diversities of flowering plants can help support pollinators. In addition, the increased number of birds in forest edges help manage agricultural pests.[33]

Figure 28. Extending a Forest Edge
The edge of this forest is extended with newly planted fruit trees on the contour of the landscape.
Photo by Paul Trieu

INVENTORY AND ASSESSMENT

The forest edge design assessed existing tree canopy, sun exposure, soil type, and the slope of the land. Sun exposure is a major factor in determining species location in the forest edge habitat. The more deeply shaded forest areas share organic matter, shade, protective cover, and a fungal-driven soil. The sunnier grassland areas share sun, wind, openness, and bacterial-driven soil.[34]

Existing native species are desired for propagation.

The slope of the land does not require supplemental irrigation needs.

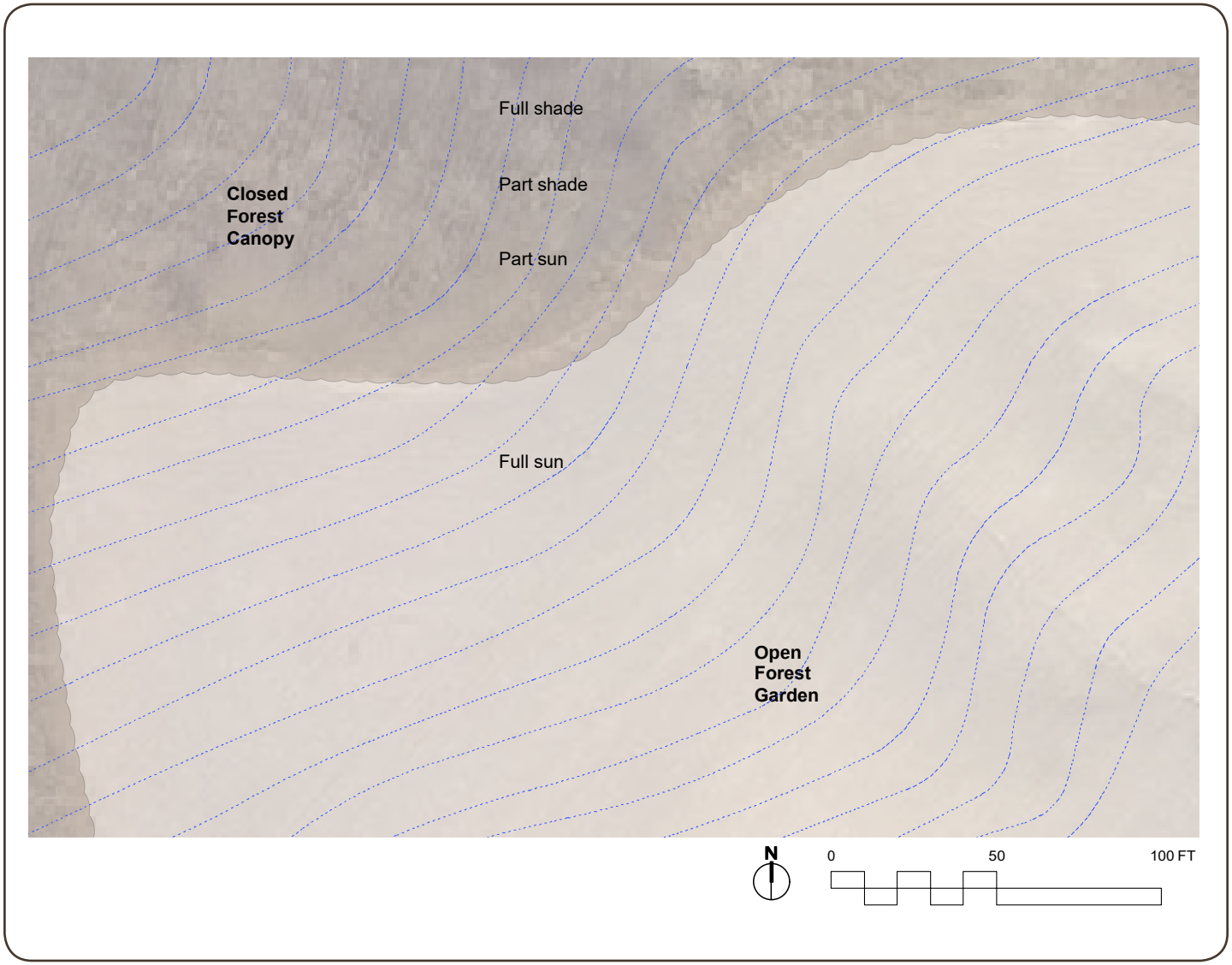

Figure 29. Edible Forest Edge Base Map
Contour lines help form the foundation for the design.

CONCEPT DESIGN

Carefully planning of paths to crops for ease of maintenance and harvesting was considered . using keyhole, sinuous, suntrap, crenellated, and gently curved designs.[35]

Livestock were also considered in placing and designing the forest edge planting. Enriching of the fodder base is incorporated with fruits, leaves, and branches by including forest edge planting near grazing areas.[36]

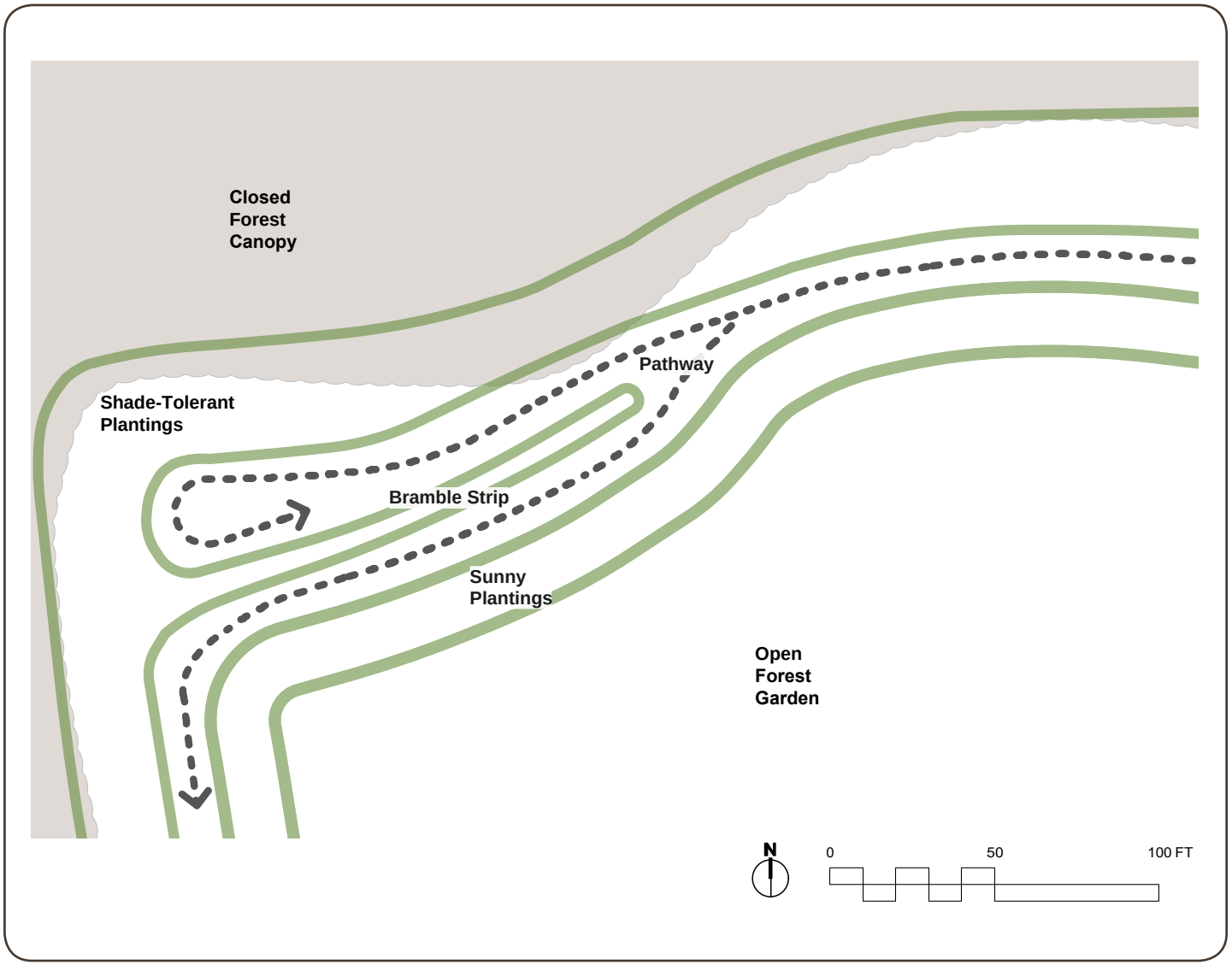

Figure 30. Edible Forest Edge Concept Design
Pathways extend through the forest edge to ease maintenance and harvesting.

PLANT SELECTION

Edible forest edge designs favor canes, shrubs, and small to mid-sized trees.[37]

Herbs also appreciate the fungal dominated soils of the forest edge. Marketable herbs such as thyme, lavender, and marjoram can be grown beneath the light shade of trees.[38]

Form	Common Name	Genus / Species	Hardiness Zones	Height	Width	Light	Water	Crops	Materials	Nitrogen Fixer	Nutrient Accumulator	Ground Cover	Nectary	Medicine
Tree	Crabapple, Siberian	Malus baccata	3	30'	25'	Full Sun	Mesic	Fruit			K			
Tree	Dogwood, Cornelian Cherry	Cornus mas	4-8	20'	20'	Full Sun - Part Shade	Mesic	Berries						
Tree	Pawpaw	Asimina triloba	4-8	20-30'	20-30'	Full Sun - Part Shade	Mesic	Fruit						
Tree	Pear, Asian	Pyrus pyrifolia	4-9	25-30'	25'	Full Sun	Mesic	Fruit					G	
Tree	Persimmon, American	Disospiros virginiana	5-9	15-75'	15-50'	Full Sun	Xeric - Mesic	Fruit					G	
Shrub	Elderberry	Sambucus canadensis	3-10	6-12'	6-12'	Full Sun - Part Shade	Xeric - Hydric	Berries					GS	
Shrub	Gooseberry	Ribes uva-crispa	3-8	3-5'	3-5'	Full Sun - Part Shade	Xeric - Mesic	Berries						
Shrub	Hazelnut	Corylus americana	4-9	12-20'	12-15'	Full Sun	Mesic	Nuts						
Shrub	Jostaberry	Ribes x culverwellii	4-7	4-8'	4-8'	Full Sun - Part Shade	Xeric - Mesic	Berries					x	
Shrub	Raspberry	Rubus idaeus	4-8	4-6'	Indef.	Full Sun	Mesic	Berries						
Herb	Blackberry, Thornless	Rubus fruticosus	5-8	4-5'	3-4'	Full Sun	Mesic	Berries						
Herb	Clover, Dutch White	Trifolium repens	4-8	4-10"	6-36"	Full Sun - Part Shade	Xeric - Mesic			x		x		
Herb	Clover, Miniclover	Trifolium repens	4-8	4"	6-36"	Full Sun - Part Shade	Xeric - Mesic			x		x		
Herb	Comfrey	Symphytum x uplandicum	4-9	3-5'	3-5'	Full Sun - Full Shade	Xeric - Mesic				K, P, Ca, Cu, Fe, Mg			x
Herb	Daffodil	Narcissus	4-8	3-5'	1-3'	Full Sun - Part Shade	Mesic						x	
Herb	Jerusalem Artichoke	Helianthus tuberosus	2-10	6-12'	Indef.	Full Sun - Part Shade	Mesic	Tubers						
Herb	Squash, Winter	Cucurbita moschata	2-11	18"	Indef.	Full Sun	Mesic	Vegetable						
Herb	Strawberry, Wild	Fragaria virginiana	3-8	4-12"	Indef.	Full Sun - Part Shade	Xeric - Mesic	Berries			Fe	x		
Herb	Yarrow, Dwarf Wolly	Achillea tomentosa	4-9	6-18"	Indef.	Full Sun - Part Shade	Xeric	Leaves (Tea)			K, P, Cu	x	GS	

Figure 31. Edible Forest Edge Plant List

Figure 32. Gooseberries
Many varieties of gooseberries produce high yields of sweet berries.
Photo by Fred Meyer

CONCEPTUAL SITE PLAN

This design depicts pawpaws (*Asimina triloba*) and persimmons (*Diospiros virginiana*) at the existing tree line with an understory planting organized by harvest times.

Design Strategy

In the southernmost row, berries tolerant of part-shade are planted on the north side of fruit trees. Daffodils (*Narcissus*) and chives (*Allium* spp.) planted around the trees confuse pests and provide a crop. Bulbs planted at the drip line of trees also help keep spreading grasses from competing with tree roots. Dutch white clover (*Trifolium repens*) and wild strawberries (*Fragaria virginiana*) complete the ground cover polyculture. The hedge of raspberries (*Rubus idaeus*) is surrounded by mowed pathways to contain their spread.

Harvest Strategy

Persimmons are harvested late in October into November. Pawpaws are harvested by hand in mid-September after elderberries (*Sambucus canadensis*) are harvested in late August.

ESTABLISHMENT AND MANAGEMENT IDEAS

Brush-hogs, tractors, winches, chainsaws, and other hand tools will be needed to initially clear trees and brush before planting the forest edge.

Animals contained within movable electric mesh fencing may also be incorporated to help prepare the forest edge. Goats can clear vegetation ahead of chickens, relying on the poultry to spread the manure and disrupt parasite cycles. The rooting behavior of pigs can remove deeply rooted woody weeds. Movable pig tractors can prepare a new area or can be rotated seasonally to clean up crop wastes or fallen fruit.

Elderberries grown for market are cut to the ground after the ground freezes to prevent mites from overwintering in the buds.[39]

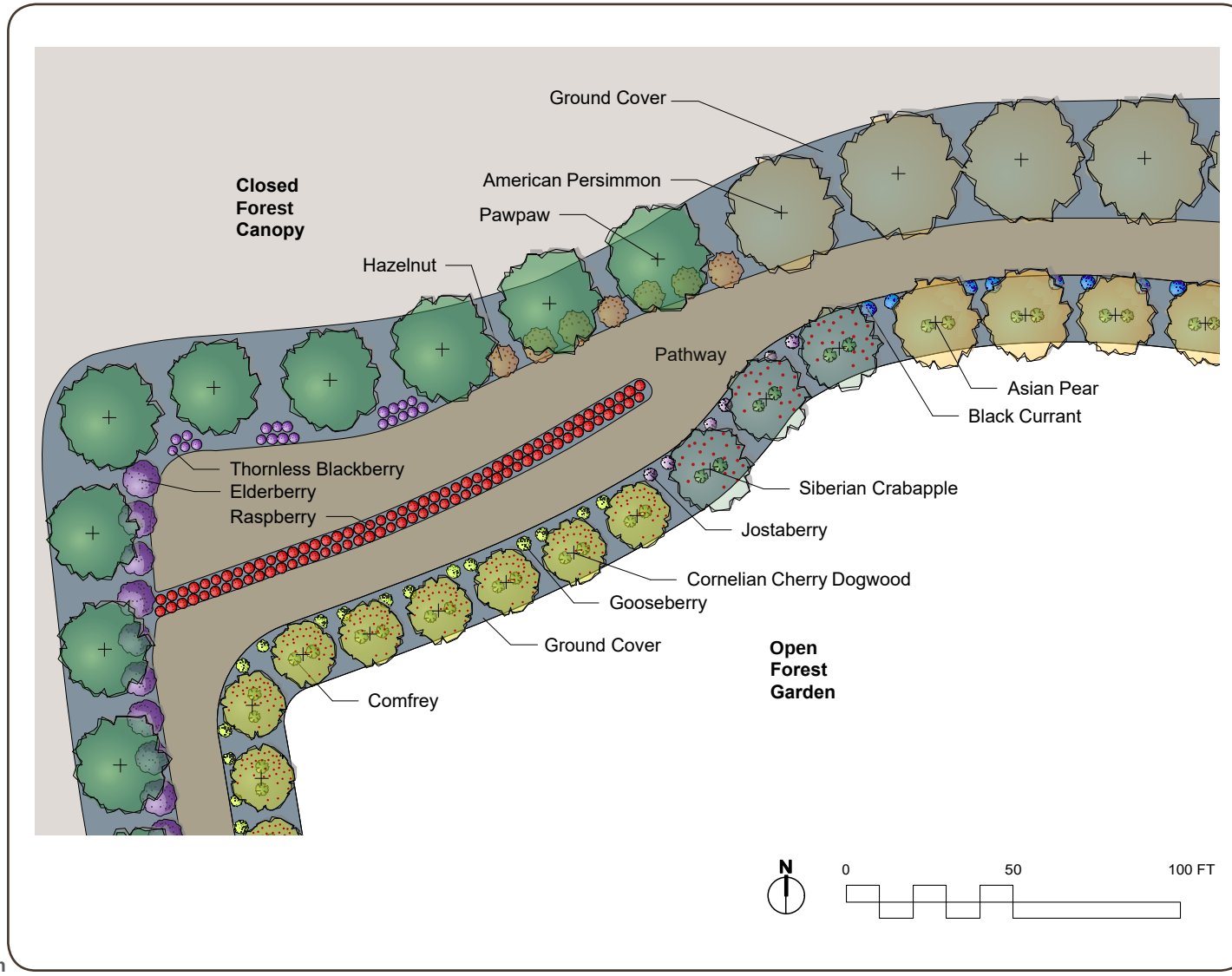

Figure 33. Edible Forest Edge Conceptual Site Plan

9 SHADY EDIBLE FOREST

Forest farming is the cultivation of high-value specialty crops under the protection of a forest canopy that has been modified to provide the correct shade level.[40]

Most shade-loving plants benefit from consistently moist soil and some direct or dappled sunlight. Thinning the upper canopy, removing underbrush, and removing entire trees may be required to provide the correct environment for forest crops to thrive.

Figure 34. Medicinal Herbs
Cultivated medicinal herbs can contribute to the health of a forest.
Photo by Forest Farming / CC BY ND

INVENTORY AND ASSESSMENT

This site was selected for ideal sunlight and soil moisture. Sunlight levels were carefully observed throughout the day: Most forest plants thrive only in part shade to full shade environments. These areas provide soil that is consistently moist, but well-drained.

Direct Sunlight Levels
Full Sun: 6 or more hours
Part Sun: 2-6 hours
Part Shade: 2-4 hours
Full Shade: Less than 2 hours

Vegetation Layers
Shrubs, ground covers, vines, or herbs can provide an opportunity for opportunistic weeds to gain a foothold. Saplings of desired canopy trees will be hand planted—these important young trees are the next generation in the stand awaiting a disturbance to fill in canopy gaps.

Mushrooms
Logs and woodchips inoculated with mushroom spawn are a popular medium because fungi requires almost no sunlight. A flat, protected area where logs could be stacked or leaned between trees has been identified for mushroom production.

When mushrooms are fruiting, daily misting and harvesting may be necessary to ensure freshness and prevent damage from insects. For this reason, growing mushrooms may only be practical when water rights are acquired and access allows the site to be visited frequently.

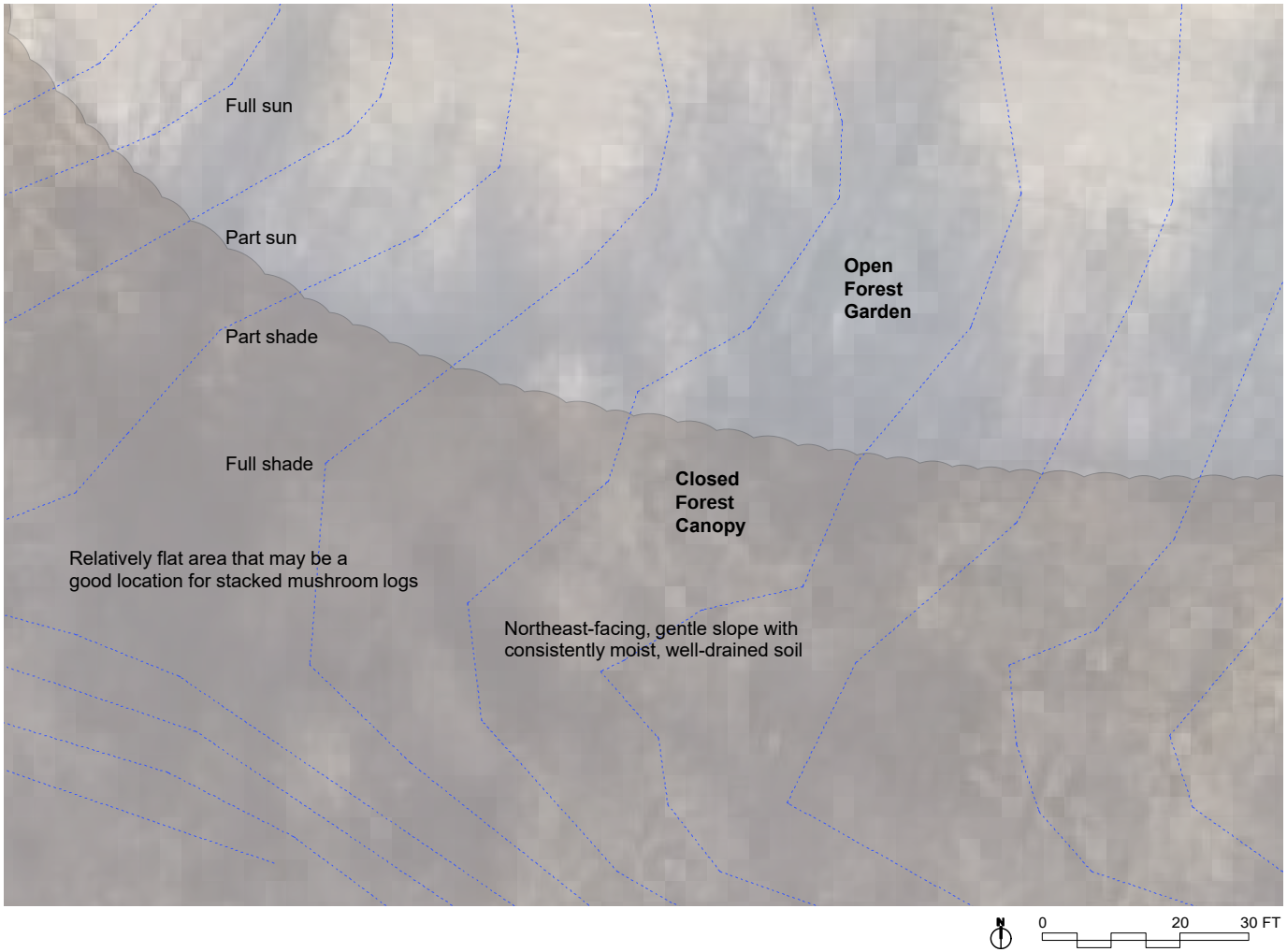

Figure 35. Shady Edible Forest Base Map
Contour lines help form the foundation for the design.

CONCEPT DESIGN

Sunlight is the greatest limiting factor in a forest design: too much or too little sun and plants will wither. Sunlight levels were used to identify planting areas then group plants based upon desired harvesting periods and growing conditions. For example, tall plants are used to fully shade mushroom logs and protect them from drying winds.

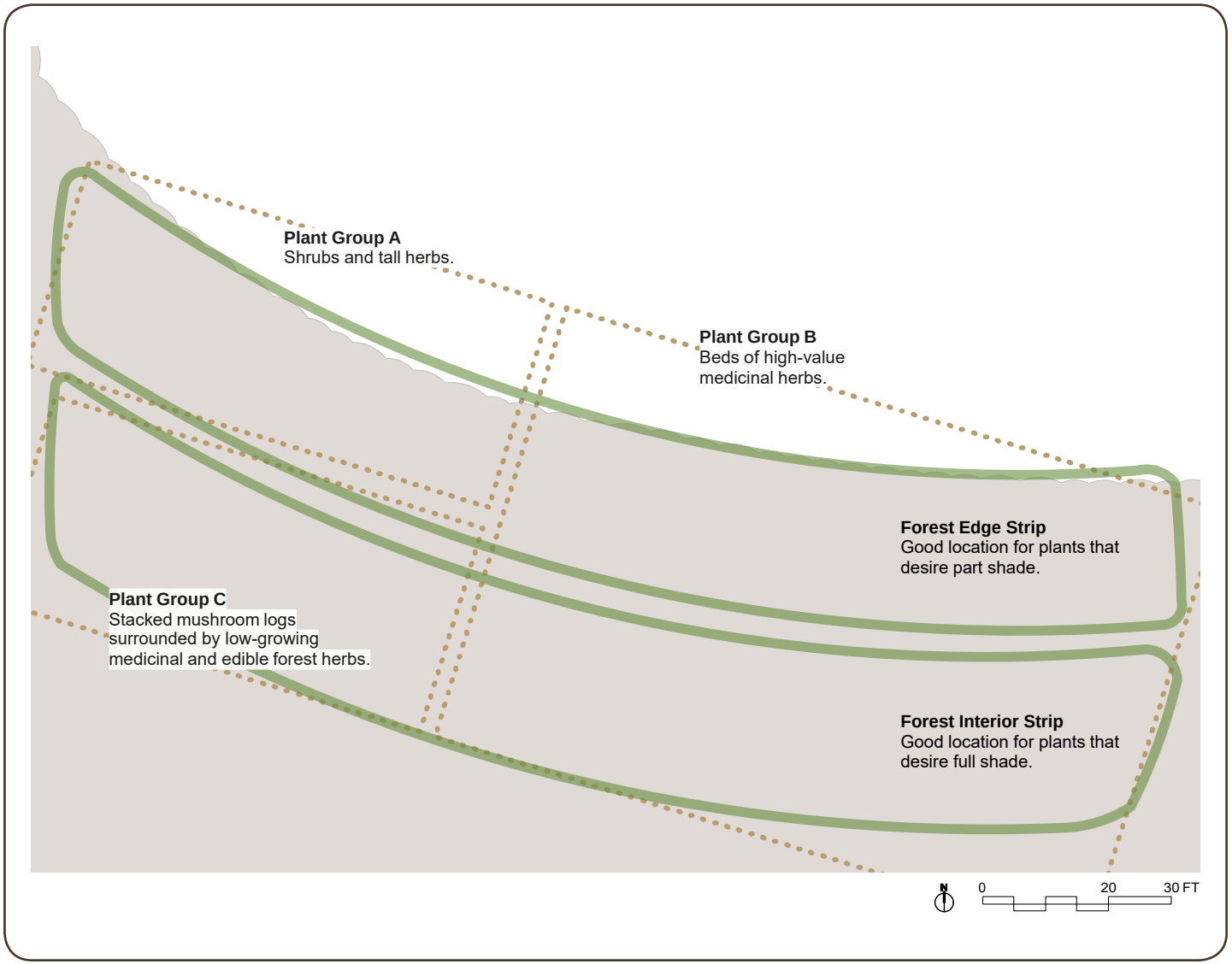

Figure 36. Shady Edible Forest Concept Design
Three plant groups are defined, each performing different functions.

PLANT SELECTION

Plants were selected and organized based upon their desired sunlight needs and moisture require-ments. Trees and stall shrubs help modify sunlight conditions and block wind.

Form	Common Name	Genus / Species	Hardiness	Height	Width	Light	Water	Crops	Materials	Nitrogen	Nutrient	Ground	Nectary	Medicine
Tree	Pawpaw	Asimina triloba	4-8	20-30'	20-30'	Full Sun - Part Shade	Mesic	Fruit						
Tree	Walnut, Black	Juglans nigra	4-7	50-70'	30-50'	Full Sun	Xeric - Mesic	Nuts	Lumber		K, P, Ca			
Shrub	Elderberry	Sambucus canadensis	3-10	6-12'	6-12'	Full Sun - Part Shade	Xeric - Hydric	Berries					GS	
Shrub	Gooseberry	Ribes uva-crispa	3-8	3-5'	3-5'	Full Sun - Part Shade	Xeric - Mesic	Berries						
Shrub	Oregon Grape Holly	Mahonia aquifolium	5	3-6'	3-6'	Full Sun - Full Shade	Xeric - Hydric	Berries					G	
Herb	Bloodroot	Sanguinaria canadensis	3-8	6"	Indef.	Part Shade	Mesic					x	G	
Herb	Cohosh, Black	Actaea racemosa	3-8	4-6'	2-4'	Part Shade - Full Shade	Mesic	Root						x
Herb	Cohosh, Blue	Caulophyllum thalictroides	3-8	1-2'	6-12"	Part Shade - Full Shade	Mesic	Root						x
Herb	Comfrey	Symphytum x uplandicum	4-9	3-5'	3-5'	Full Sun - Full Shade	Xeric - Mesic				K, P, Ca, Cu, Fe, Mg			x
Herb	Fern, Ostrich	Matteuccia struthiopteris	2-8	2-6'	Indef.	Part Shade - Full Shade	Mesic - Hydric	Shoots						
Herb	Ginseng	Panax quinquefolius	4-7	18"	18"	Full Shade	Mesic	Root						x
Herb	Goldenseal	Hydrastis canadensis	3-8	1'	1'	Part Shade	Mesic	Root						x
Herb	Mayapple	Podophyllum peltatum	3-8	12-18"	Indef.	Part Shade - Full Shade	Mesic	Fruit				x		
Herb	Ramps	Allium tricoccum	4-8	6-10"	Indef.	Part Shade - Full Shade	Mesic	Shoots, Root					G	
Herb	Solomon's Seal	Polygonatum biflorum	3-7	2-4'	2'	Part Shade - Full Shade	Xeric - Mesic	Shoots						
Herb	Trillium	Trillium grandiflorum	4-8	12-18"	Indef.	Part Shade - Full Shade	Mesic						G	x
Herb	Wild Ginger	Asarum canadense	3-8	4-8"	Indef.	Part Shade - Full Shade	Mesic	Root				x		
Fungi	Mushroom, Garden Giant	Stropharia rugoso annulata		6-18"	1-2'	Full Shade	Hydric	Fruiting body						
Fungi	Mushroom, Oyster	Pleurotus ostreatus		6"	4-10"	Full Shade	Hydric	Fruiting body						
Fungi	Mushroom, Shiitake	Lentinula edodes		6"	4-10"	Full Shade	Hydric	Fruiting body						

Figure 37. Shady Edible Forest Plant List

Figure 38. Stacked Mushroom Logs
The “log cabin” stacking style is a common method of managing logs inoculated with mushrooms.
Photo by Catherine Bukowski / CC BY ND

CONCEPTUAL SITE PLAN

This design depicts two rows of plantings: Plants in the row at the forest edge desire part shade while plants further inside the forest desire full shade. Pawpaws (*Asimina triloba*) provide fruit while shading beds of goldenseal (*Hydrastis canadensis*). Medicinal herb beds are aligned slightly off-contour to capture rain water, but stay well-drained.

A large amount of woodchip mulch inoculated with mushrooms will provide a harvest while suppressing weeds, retaining moisture, and enriching soil. Once fruiting begins, constant vigilance and daily harvests may be necessary to ensure freshness and prevent insect and rodent damage.

An edible forest ground cover grows through stacked logs that are inoculated with mushrooms. The plants help logs retain moisture and are short enough to not interfere with the mushroom harvest.

ESTABLISHMENT AND MANAGEMENT IDEAS

Several popular understory medicinal plants—ginseng (*Panax quinquefolius*), goldenseal (*Hydrastis canadensis*), black cohosh (*Actaea racemosa*), bloodroot (*Sanguinaria canadensis*)—require 3-6 years of growth before they are usable or marketable. Interplanting these areas with fast-yielding mushrooms, gooseberries (*Ribes uva-crispa*), and elderberries (*Sambucus canadensis*) will provide crops and build soil while the roots of these plants mature.

Oftentimes, thinning the canopy improves the health of the forest by allowing dappled sunlight to reach the forest floor. The resulting woody debris will be used to outline beds, cultivate mushrooms, and create woodchips for use around plants and for pathways. For more information about canopy thinning, see the Iowa State University Extension publication *Woodland Improvement and Crop Trees in Iowa*.[41]

Once mushroom fruiting begins, constant vigilance and daily harvests may be necessary to ensure freshness and prevent insect and rodent damage. Logs can be moved to a location that is frequently visited with ideal conditions, such a protected and shady area near access trails. Woodchip pathways inoculated with mushrooms will likely need to be remulched every year to remain productive. Visit the Cornell University *Forest Mushroom Cultivation* website[42] for research and best-practices for mushroom cultivation.

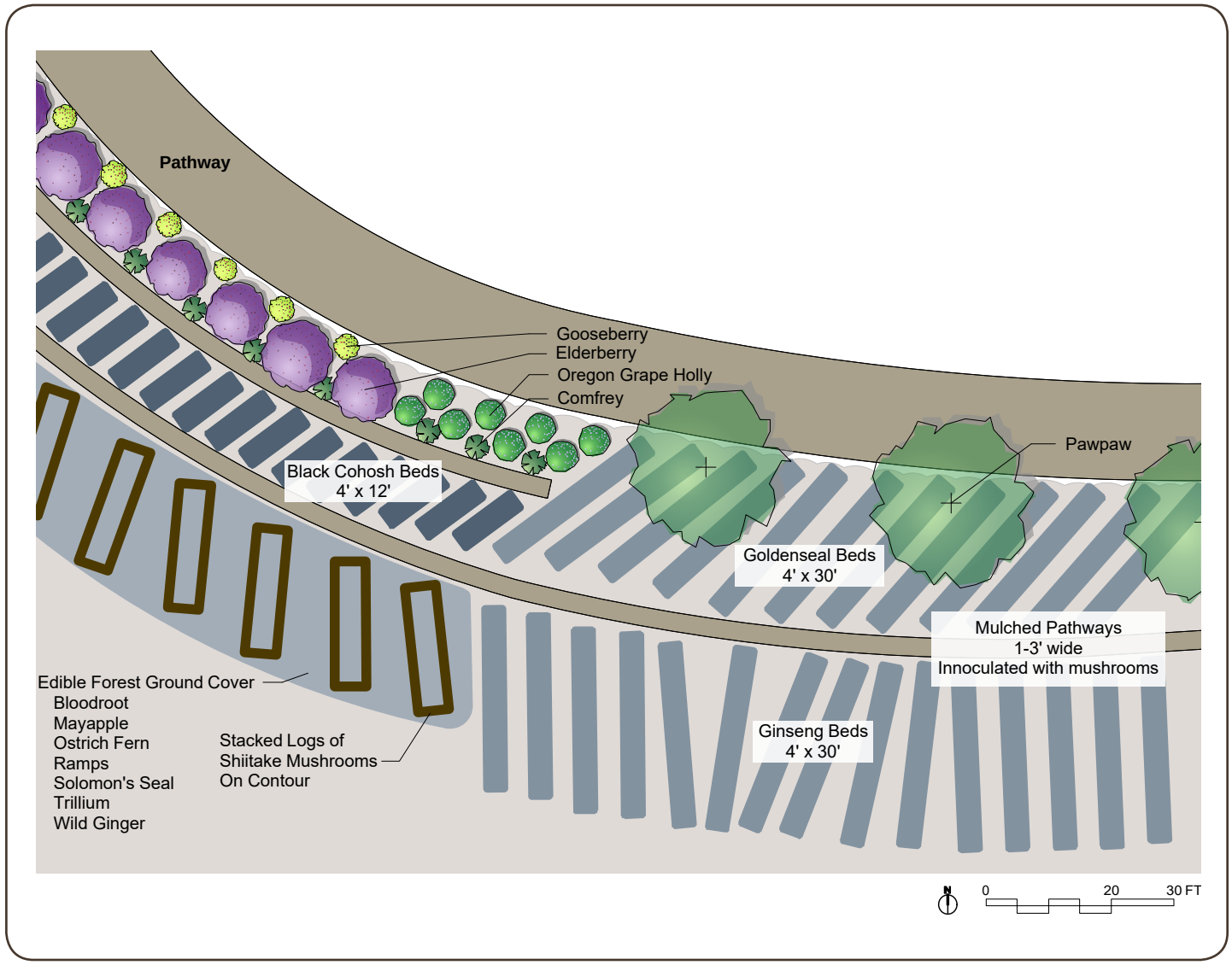

Figure 39. Shady Edible Forest Conceptual Site Plan

10 EDIBLE RIPARIAN BUFFER

Riparian forest buffers are ecosystems made up of tree, shrub, and grass plantings adjacent to watercourses and within floodplains. They buffer watercourses from pollution, stabilize stream banks against erosion, protect sensitive aquatic environments, enhance wildlife habitat, trap sediments, recharge groundwater, reduce flooding, and increase biodiversity.[43]

Few food crops tolerate the wet conditions along watercourses and in floodplains, but many ornamental and biomass plants thrive in this lowland environment.

Figure 40. Bear Creek
Multiple rows of trees and shrubs, as well as a native grass strip, combine in a riparian buffer to protect Bear Creek in Story County, Iowa. Few (if any) plants are edible at Bear Creek, but it still serves as an excellent example of a properly designed buffer.
Photo by Lynn Betts, USDA NRCS

INVENTORY AND ASSESSMENT

The conditions of watercourses and flood-plains are heavily influenced by weather and climate fluctuations. Rigorous observation over many years will continue to be required to thoroughly understand an area.

General flow patterns for the entire watershed have been observed to understand sources of water flowing through the landscape. Identifying sources of pollution that may need to be mitigated is a top priority.

The landscapes and stream has evolved to rapidly move water off property. This often causes further erosion and degrades the health of watercourses.

Contours and detailed water flow patterns for the area have been mapped.

Surface runoff, and stream flow during light showers, heavy rains, and spring-time snow melt were observed to identify areas of erosion, scouring, deep sediment, flooding, stream blockages, and bank undercutting.

Areas where soil is frequently scoured by fast-moving water and/or covered by sediment will be mitigated by soil and water erosion projects. The USDA Natural Resources Conservation Service (NRCS) funded EQIP 2018 748D43220U0 and CSP 2018 818D43220XG contracts in September 2022 to implement and/or maintain specific conservation practices, as set forth in the Conservation Plan Schedule of Operations attached in the appendix on the full 40-acre property (USDA Farm ID 1179, Tract ID 10780) through December 31, 2028.

Holes were dug in several areas to carefully document water table depths throughout the seasons. Areas of steep slopes are very dry during summer months which have informed plant selections.

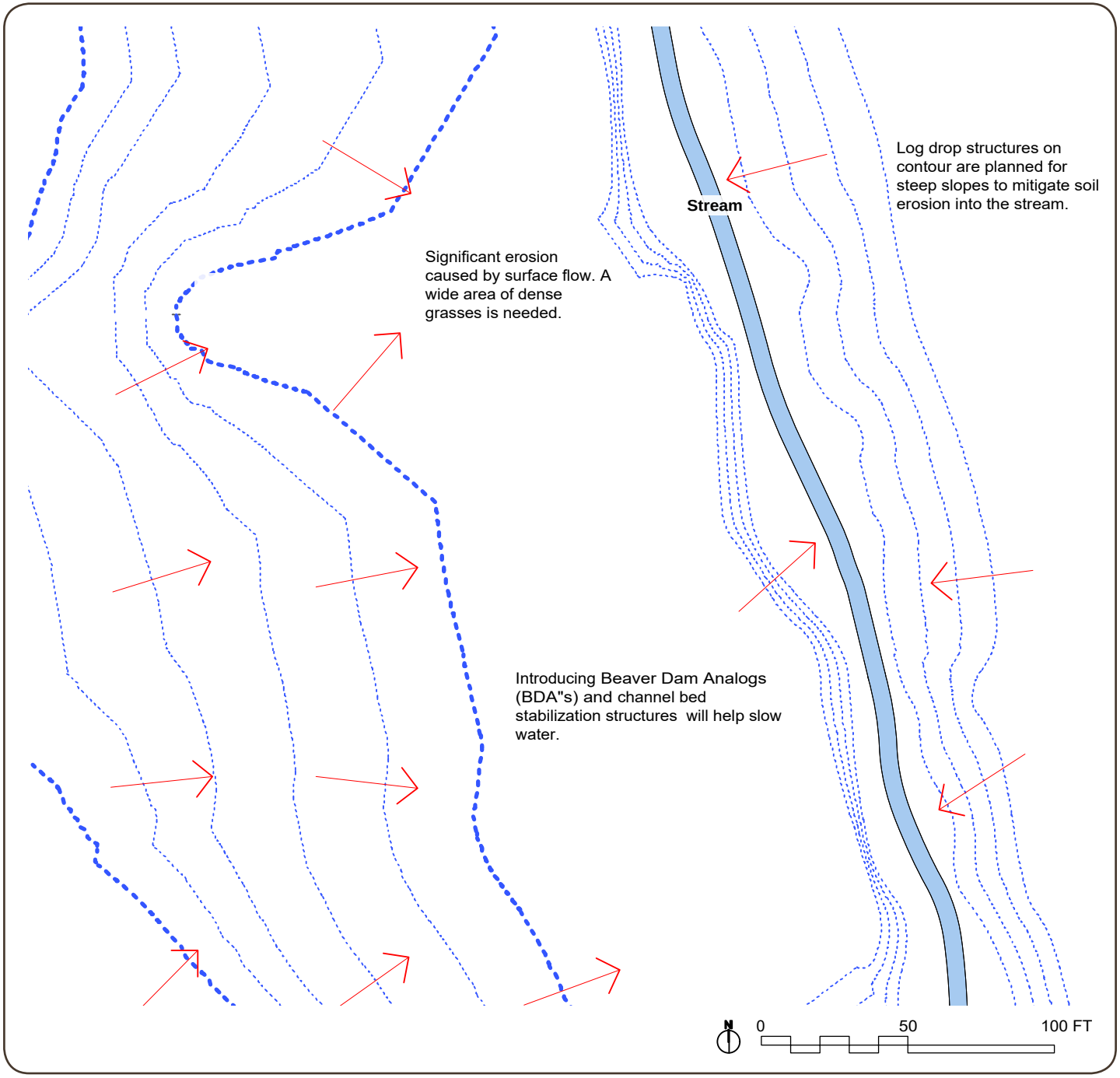

Figure 41. Edible Riparian Buffer Base Map
Contour lines help form the foundation for the design.

CONCEPT DESIGN

Three zones are typically defined in a riparian buffer, each with a specific width, function and design.[44] A total buffer width of 50 to 100 feet is recommended for the topographical features and goals. Width guidelines are provided here from the USDA *Conservation Buffers* publication based on detailed specifications for determining buffer widths.[45]

Riparian Buffer Zone Functions

Functions	Plant Characteristics	Management and Crops
Zone 1: Bank Stabilization - 20' strip along stream bank edge		
• Bank stabilization • Shade to moderate water temperature • Enhance aquatic habitat with organic matter • Reduce velocity of flood waters	• Fast-growing • Full sun to full shade • Water loving • Resprout when cut • Along the bank, herbaceous rushes and sedges have flexible stems and creeping roots[48] • Trees and shrubs have deep and wide roots	• Relatively unmanaged • Biomass and woodworking crops
Zone 2: Infiltration - 30' strip next to Zone 1		
• Maximize infiltration • Uptake, storage, and breakdown of nutrients and pollution • Reduce velocity of flood waters • Trap flood debris to keep it out of nearby crops	• Mixed growth rates • Full sun to part shade • Water loving or flood tolerant	• Actively managed • Avoid soil compaction • Cut flowers, fruits, nuts, herbs
Zone 3: Flow Control - 20' strip next to Zone 2		
• Slow surface runoff • Trap sediment and debris from surface runoff • Uptake of nutrients and pollution	• Fast-growing • Full sun • Warm season grasses and forbs • Tolerate wet soil	• Actively managed for vigorous growth by removing biomass through mowing or grazing • Avoid soil compaction • Cut flowers, forage

A buffer strip of undulating widths along the length of the stream will be required, with wider areas mitigating concentrated surface runoff due to high slopes.[46]

Zones have been widened beyond recommended minimums to mitigate higher flow rates in specific areas. Pathways and zones were identified to ensure convenient harvesting of crop plants located where their edible parts will not be submerged.

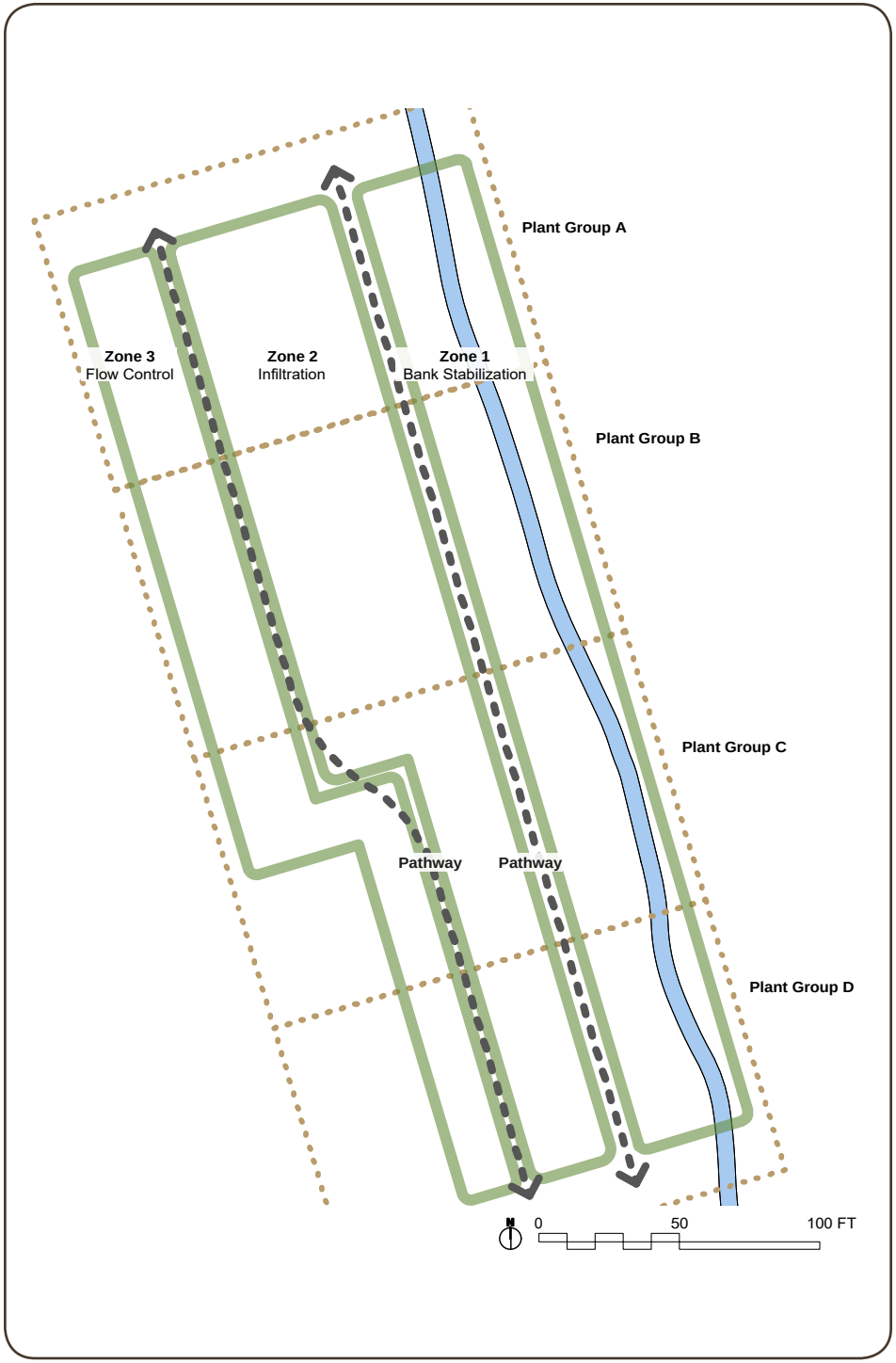

Figure 42. Edible Riparian Buffer Concept Design
Four plant groups and three riparian zones create a matrix of plant blocks with different harvesting times.

PLANT SELECTION

Buffers on both sides of the stream are composed of diverse woody and herbaceous plants that have stiff stems, are tolerant of wet soils and high nutrient levels, and have high root biomass to maximize effectiveness.[47] [48] Plants were identified for the desired zones and then grouped based upon harvesting strategies.

Tips

- To maximize sunlight in zone 2, select medium-sized or short trees and shrubs for planting next to watercourses. Large bottomland trees such as bigtooth maple, cottonwood, and box elder are typically recommended for streamside riparian plantings. Once established, debris from these fast-growing trees can contribute to aquatic habitat, but without significant and frequent pruning, their deep shade will greatly reduce food and ornamental crop yields.
- Some willow species may rapidly expand from zone 1 into crops located in zone 2. Carefully research willows and their growth habits. A wide, mowed pathway between zone 1 and 2 may help contain expansive willow growth.
- Seed mixes can be purchased that accommodate specific soil and sunlight conditions in each zone. Additional seed for desired cut flower species can augment mixes.
- Avoid nitrogen-fixing plants, such as clovers and legumes, which could contribute to water nitrification.
- Watercourses can quickly distribute plants and seeds. Use native plants and avoid plants with highly dispersive or expansive characteristics.
- If soil is dry during summer months or droughts, ensure plants can tolerate these conditions; do not simply select water-loving plants.
- Avoid cool-season grasses (brome and fescue): their flexible stems will not trap sediment.
- To decrease the amount of bare soil exposed between plants, consider overseeding a rhizomatous native perennial herb in zone 2 and 3, such as slender mountain mint (*Pycnanthemum tenuifolium*).
- Always include 3 or more grasses in zone 3 to utilize their soil-stabilizing, fibrous roots and to increase diversity. Switchgrass (*Panicum virgatum*) is an exception: it is an excellent choice for highly erodible soil, but mixing it with other grasses is not recommended as it will eventually out compete them.
- Kernza wheatgrass (*Thinopyrum intermedium*) is an edible, perennial grain under development at The Land Institute.[49] By 2022, the wheat may be suitable for planting in zone 3 in areas without pollution.

Figure 43. Native Prairie

Native prairie plants in zone 3 of a riparian buffer can help slow surface runoff and trap sediment. Emphasize plants with deep, fibrous root systems. Selecting beautiful flowers that can be used for cuttings may provide additional income.

Photo by Fred Meyer

Riparian Zone	Form	Common Name	Genus / Species	Hardiness Zones	Height	Width	Light	Water	Crops	Materials	Nitrogen Fixer	Nutrient Accumulator	Ground Cover	Nectary	Medicine
Stream Bank	Herb	Baltic rush	Juncus balticus	3-7	1-3'	Indef.	Full Sun	Hydric							
Stream Bank	Herb	Bottlebrush sedge	Carex comosa	3-9	1-2'	6"	Full Sun	Hydric							
Stream Bank	Herb	Dark green bulrush	Scirpus atrovirens	3-9	3-5'	3-4'	Full Sun	Hydric							
Stream Bank	Herb	Fringed sedge	Carex crinita	3-8	2-5'	Indef.	Full Sun - Full Shade	Hydric							
Stream Bank	Herb	Hop sedge	Carex lupulina	3-8	1-4'	1-2'	Full Sun - Part Shade	Hydric							
Stream Bank	Herb	Lurid sedge	Carex lurida	3-8	1-3'	1-2'	Full Sun	Hydric							
Stream Bank	Herb	Prairie cordgrass	Spartina pectinata	4-9	3-8'	Indef.	Full Sun	Hydric							
Stream Bank	Herb	Wild Rye, Riverbank	Elymus riparius	3-8	3-4'	1-2'	Part Shade	Hydric							
Stream Bank	Herb	Wool grass	Scirpus cyperinus	4-8	3-5'	Indef.	Full Sun	Hydric							
Stream Bank, Zone 1-2	Herb	Wild Rye, Virginia	Elymus virginicus	3-8	2-4'	2'	Full Sun - Part Shade	Xeric - Hydric							
Zone 1	Shrub	Dogwood, Red-Osier	Cornus sericea	3-8	9'	9'	Full Sun - Part Shade	Mesic - Hydric		Woody Florals					
Zone 1	Shrub	Dogwood, Yellow Twig	Cornus sericea	3-8	6'	6'	Full Sun - Part Shade	Mesic - Hydric		Woody Florals					
Zone 1	Shrub	Willow, Basket	Salix viminalis	4-8	8-10'	4-6'	Full Sun - Full Shade	Mesic - Hydric		Woody Florals					
Zone 1	Shrub	Willow, Bebb	Salix bebbiana	3-7	25'	20'	Full Sun - Part Shade	Mesic - Hydric		Biomass					
Zone 1	Shrub	Willow, Black	Salix nigra	4-9	50'		Full Sun - Part Shade	Mesic - Hydric		Biomass					
Zone 1	Shrub	Willow, Corkscrew	Salix matsudana	5-8	25'	20'	Full Sun - Part Shade	Mesic - Hydric		Woody Florals					
Zone 1	Shrub	Willow, Pussy	Salix discolor	4-8	15'	12'	Full Sun - Part Shade	Mesic - Hydric		Woody Florals					
Zone 1	Shrub	Willow, Sandbar	Salix interior	2-8	30'	20'	Full Sun - Part Shade	Mesic - Hydric		Biomass					
Zone 1	Shrub	Willow, Shining	Salix lucida	5-9	25'	20'	Full Sun - Part Shade	Mesic - Hydric		Biomass					
Zone 1-2	Herb	Aster, New England	Aster novae-angliae	4-8	5'	3'	Full Sun	Mesic - Hydric							
Zone 1-2	Herb	Culver's Root	Veronicastrum virginicum	3-8	4-7'	2-4'	Full Sun	Mesic - Hydric							
Zone 1-2	Herb	Golden Alexanders	Zizia aurea	3-8	3'	2'	Full Sun	Mesic - Hydric							
Zone 1-2	Herb	Goldenrod, Grass-Leaved	Solidago graminifolia	3-8	2'	2'	Full Sun	Mesic - Hydric							
Zone 1-2	Herb	Goldenrod, Riddell's	Solidago riddellii	3-7	3'	2'	Full Sun	Mesic - Hydric							
Zone 1-2	Herb	Goldenrod, Zig Zag	Solidago flexicaulis	3-8	1-3'	1-3'	Full Sun - Full Shade	Mesic - Hydric							
Zone 1-2	Herb	Hyssop, Purple Giant	Agastache scrophulariaefolia	4-6	6'	3'	Full Sun	Mesic - Hydric							
Zone 1-2	Herb	Ironweed	Vernonia fasciculata	4-9	6'	4'	Full Sun	Mesic - Hydric							
Zone 1-2	Herb	Prairie Blazing Star	Liatris pycnostachya	3-9	4'	3'	Full Sun	Mesic - Hydric							
Zone 1-2	Herb	Slender Mountain Mint	Pycnanthemum tenuifolium	4-8	2'	Indef.	Full Sun	Mesic - Hydric						G	
Zone 1-2	Herb	Vervain, Blue	Verbena hastata	3-8	2-5'	2'	Full Sun - Part Shade	Xeric - Hydric						G	
Zone 1-2	Herb	Wild Rye, Canada	Elymus canadensis	3-8	5'	2'	Full Sun	Xeric - Hydric							
Zone 2	Herb	Blackberry, Thornless	Rubus fruticosus	5-8	4-5'	3-4'	Full Sun	Mesic	Berries						
Zone 2	Herb	St. John's Wort	Hypericum perforatum	3-8	1-3'	Indef.	Full Sun - Part Shade	Mesic - Xeric					x	G	x
Zone 2	Shrub	Aronia Berry, Black	Aronia melanocarpa	3-9	5-6'	5-6'	Full Sun - Part Shade	Mesic - Hydric	Berries						
Zone 2	Shrub	Elderberry	Sambucus canadensis	3-10	6-12'	6-12'	Full Sun - Part Shade	Xeric - Hydric	Berries					GS	
Zone 2	Shrub	Gooseberry	Ribes uva-crispa	3-8	3-5'	3-5'	Full Sun - Part Shade	Xeric - Mesic	Berries						
Zone 2	Shrub	Hazelnut	Corylus americana	4-9	12-20'	12-15'	Full Sun	Mesic	Nuts						
Zone 2	Shrub	Saskatoon	Amelanchier alnifolia	2-7	5-15'	5-15'	Full Sun	Mesic	Berries						
Zone 2	Tree	Serviceberry, Downy	Amelanchier arborea	4-9	15-25'	15-25'	Full Sun - Part Shade	Mesic	Berries						
Zone 2	Tree	Walnut, Black	Juglans nigra	4-7	50-70'	30-50'	Full Sun	Xeric - Mesic	Nuts	Lumber		K, P, Ca			
Zone 3	Herb	Bee Balm	Monarda fistulosa	3-10	3-4'	2-6'	Full Sun - Part Shade	Xeric - Mesic	Leaves (Tea)					G	
Zone 3	Herb	Big Bluestem	Andropogon gerardii	4-9	7'	4'	Full Sun	Xeric - Hydric							
Zone 3	Herb	Black-Eyed Susan	Rudbeckia hirta	3-7	2'	2'	Full Sun	Xeric - Hydric							
Zone 3	Herb	Blanket Flower	Gaillardia aristata	3-10	8-12"	1'	Full Sun	Mesic							
Zone 3	Herb	Boneset	Eupatorium perfoliatum	3-8	4-6'	3-4'	Full Sun	Mesic - Hydric							x
Zone 3	Herb	Hyssop, Anise	Agastache foeniculum	4-9	2-4'	1-2'	Full Sun - Part Shade	Xeric - Mesic							
Zone 3	Herb	Indian Grass	Sorghastrum nutans	4-9	6'	3'	Full Sun	Xeric - Mesic							
Zone 3	Herb	Joe Pye Weed	Eupatorium maculatum	4-9	5'	3'	Full Sun	Mesic - Hydric							
Zone 3	Herb	Joe Pyeweed, Sweet	Eupatorium purpureum	4-9	4-7'	3'	Full Sun	Mesic - Hydric							
Zone 3	Herb	Little Bluestem	Schizachyrium scoparium	3-9	3'	3'	Full Sun	Xeric - Mesic							
Zone 3	Herb	Prairie Wild Rose	Rosa arkansana	4-8	2'	Indef.	Full Sun	Xeric - Hydric	Hips						x
Zone 3	Herb	Purple Coneflower	Echinacea purpurea	3-8	3-4'	1-2'	Full Sun - Part Shade	Xeric - Mesic						G	x
Zone 3	Herb	Side-Oats Grama	Bouteloua curtipendula	4-9	2'	1-2'	Full Sun	Xeric - Mesic						S	
Zone 3	Herb	Switchgrass	Panicum virgatum	5-9	4'	3-4'	Full Sun	Mesic - Hydric							
Zone 3	Herb	Yarrow	Achillea millefolium	3-9	2-3'	Indef.	Full Sun - Part Shade	Xeric	Leaves (Tea)			K, P, Cu	x	GS	
Zone 3	Tree	Plum, European Semi-Dwarf	Prunus domestica	4-8	12-15'	10-15'	Full Sun	Mesic	Fruit					G	

Figure 44. Edible Riparian Buffer Plant List

Plants are grouped by riparian zone and form.

CONCEPTUAL SITE PLAN

This design accommodates the fast-moving stream and areas with high surface runoff. These conditions require an open, woodland canopy so sunlight can stimulate low-growing herbaceous plants that will stabilize soil. The open canopy can be created by thinly planting trees and shrubs or through frequent cutting of dense plantings. If the area had slower moving water, such as floodplain, the canopy could have 100% cover.

Elderberries (*Sambucus canadensis*) are interplanted with walnuts due to their ability to thrive in part shade and tolerate juglone.

In zone 1, next to the stream, willows and dogwoods with beautiful branches are planted near the pathway to ease harvesting access. Less ornamental species that will not be harvested are planted near the stream. The pathway will help contain the expansive growth of willows.

In zone 2, plant groups A and B are shown with and without blackberries to demonstrate two different planting patterns.

ESTABLISHMENT AND MANAGEMENT IDEAS

For streambank bioengineering and extensive planting details, see *Developing Water Trails in Iowa, Chapter 4: Land and Stream Management* by the Iowa Department of Natural Resources.[50]

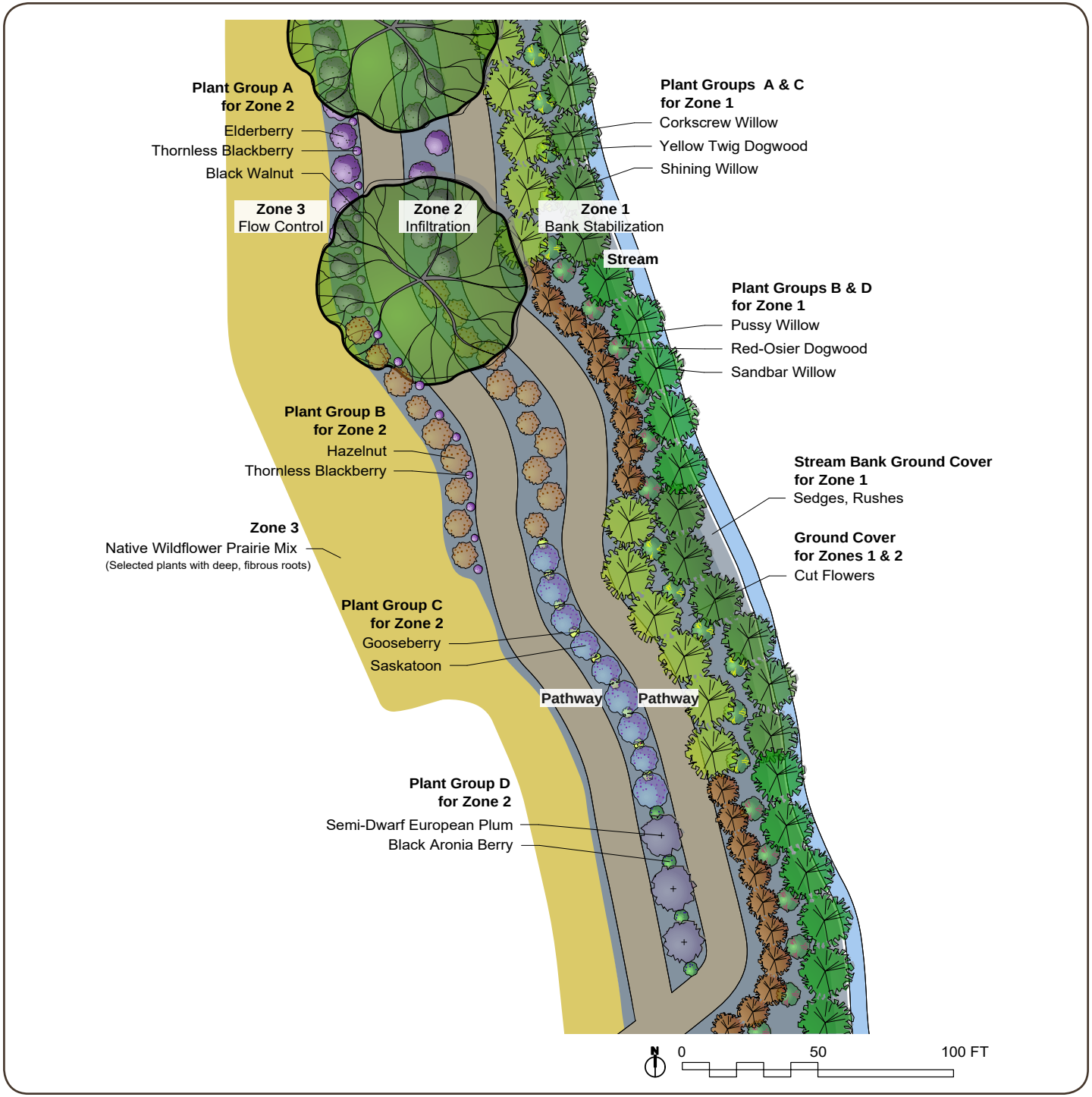

Figure 45. Edible Riparian Buffer Conceptual Site Plan

11 EDIBLE WINDBREAK

Windbreaks are planned and managed as part of a crop and/or livestock operation to enhance production, shelter livestock, protect buildings, provide wildlife habitat, and control soil erosion.[51] A thoughtfully designed windbreak that incorporates crop-bearing plants can provide a primary or secondary income while increasing property value.

Field windbreaks protect a variety of wind-sensitive row, forage, orchard and vine crops, control wind erosion, and increase bee pollination.[52]

Livestock windbreaks help reduce animal stress and mortality, reduce feed consumption, and help reduce visual impacts and odors.[53] Livestock protected by a windbreak will use more feed for weight gain and less to maintain body heat. Windbreaks also can provide protection for feedlots, pastures, calving areas, and confinement buildings. An outdoor “living barn” strategically located in open pasture can be helpful during calving and lambing season.[54] Primary windbreaks around farmsteads with secondary windbreaks around livestock facilities may provide optimum benefits.[55]

Living snowfences keep trails clean of drifting snow and increase driving safety. They can also shade snow across alleys, preserving snowpack and increasing spring soil moisture.[56]

Building windbreaks can reduce heating and cooling bills by decreasing the speed of summer and winter winds.[57]

Figure 46. Windbreak
This multi-row farmstead windbreak in Pocahontas County, Iowa, includes shrubs, conifers, and deciduous trees. Few (if any) plants are edible, but it still serves as an excellent example of a properly designed windbreak.
Photo by Lynn Betts, USDA NRCS

INVENTORY AND ASSESSMENT

These properties were assessed on the site:

- Area of desired protection, the desired wind speed in the area, and its distance from the future windbreak
- Prevailing wind direction and speed throughout all seasons
- Existing and future locations of plantings, roads, livestock grazing areas, and all buildings
- Soil types and drainage
- Sunlight
- Topography
- Property lines
- Existing wildlife habitat
- Beneficial insects, birds, native pollinators that need support
- Alternate host plants for diseases, such as cedar-apple rust

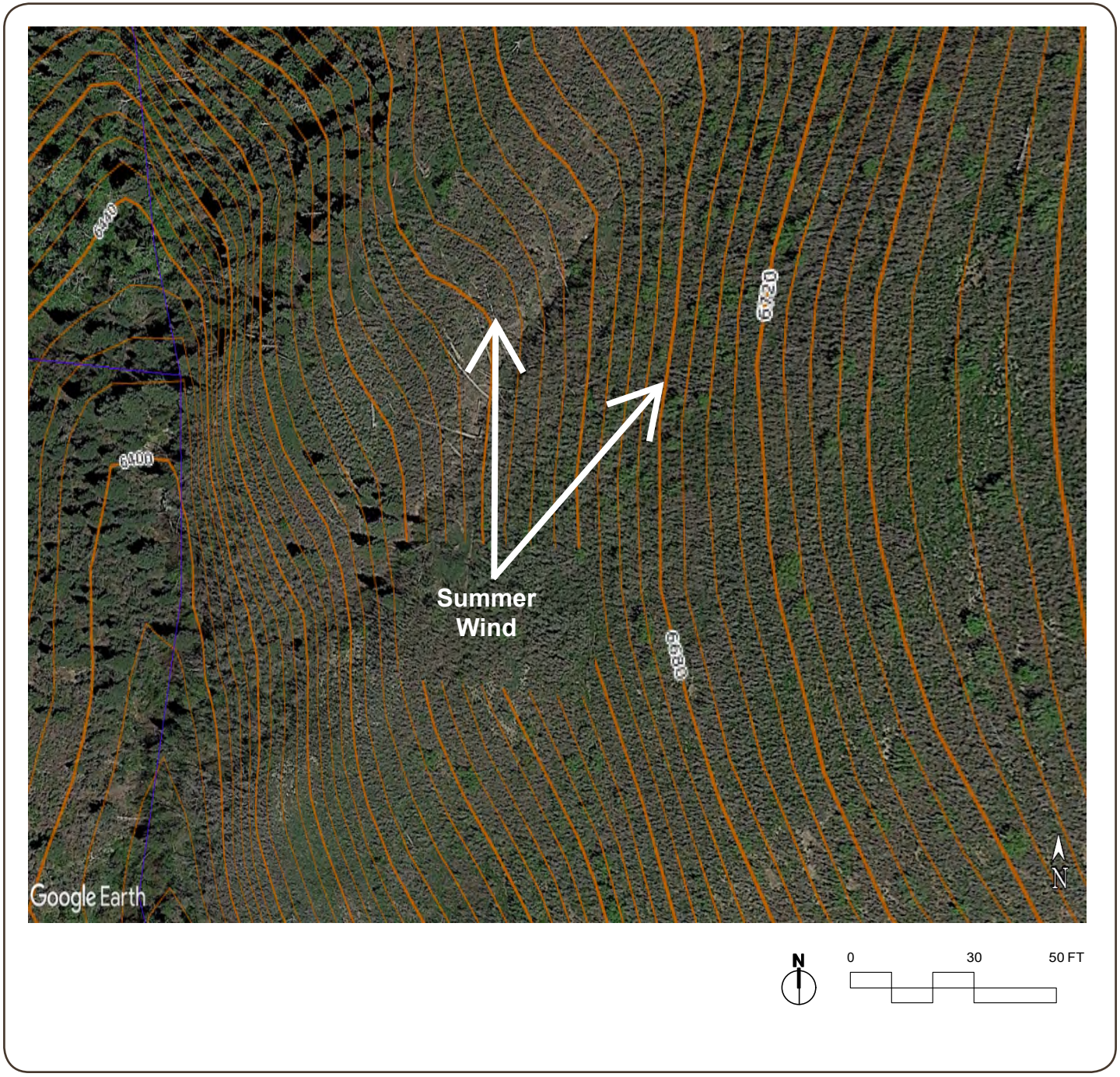

Figure 47. Edible Windbreak Base Map
Wind direction and the desired area of protection help form a foundation for the design.

CONCEPT DESIGN

Several factors must be simultaneously considered to design an effective windbreak.

Height

The windbreak height primarily determines the amount of protection received downwind; the taller the windbreak the greater zone of protection. Use the distance between the middle of the windbreak and the end of the area of protection to determine the windbreak height. Also consider the reduction of wind speed desired. For example, wind speed is reduced by 78% at a distance of 5 times the windbreak height. In this design, the distance between the middle of the windbreak and the end of the protected area is 200 feet. To achieve an 78% reduction in wind speed, the tallest trees must reach at least 40 feet (40 feet tall x 5 = 200 feet). See the Iowa State University Extension publication *Farmstead Windbreaks: Planning* for additional calculations for wind speed reductions.[58]

Length

Extend the planting beyond the protected area by at least 10 times the height of the windbreak to reduce turbulence at the ends. In this example, the 40 foot tall windbreak must extend at least 400 feet north and east.

Density

Allowing some air to pass through a windbreak reduces wind speed over the greatest distance. The most effective windbreaks are 50% permeable. With a permeable windbreak, some wind slips through to form layers of air. This blanket of layered air helps to keep blustery winds aloft after passing over the top of the windbreak. Very little protection from wind is provided with windbreaks below 30% density.

Windbreak Density[59]

60-80%	Winter protection of structures, livestock, farmsteads, and roads as well as noise and visual screens.
40-60%	Crop and soil protection.
25-30%	Snow distribution.

To achieve a density of 60% or more, plant at least three rows of trees and shrubs with at least one row being conifers. The standard arrangement is a row of shrubs with two rows of conifers. The function, durability, and longevity of a windbreak improves with each additional row up to 10 rows.[60]

Tips

- Windbreaks are most effective when oriented at right angles to prevailing or troublesome winds.
- Eliminate all gaps. Breaks in a windbreak become funnels that concentrate and accelerate wind velocity.
- Establish crop plants on the downwind side of a windbreak to increase yields.

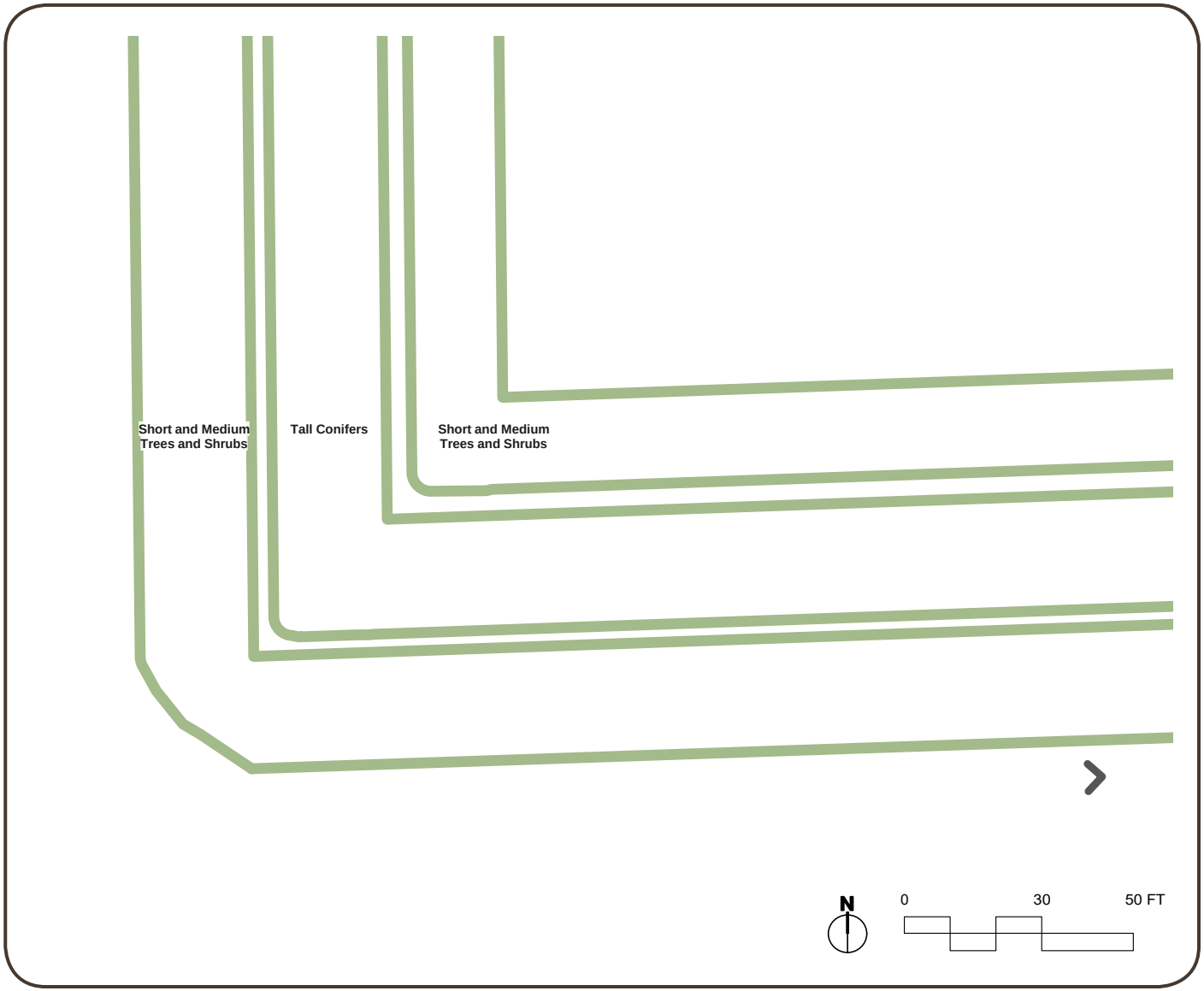

Figure 48. Edible Windbreak Concept Design
Each windbreak row contains specific plant types.

PLANT SELECTION

Windbreaks can increase the biological control of crop insect pests by incorporating specific plants that provide habitat for beneficial wildlife. Identify desired insects and birds and then choose plant species that support that wildlife. Larger windbreaks will support more wildlife.

Forage tree legumes can be planted as “fodder banks” along tree lines. Foliage from these trees is usually harvested under a cut-and-carry system and can be a principal source of high quality fodder to supplement lower quality crop residue fodder.[61]

Avoid alternate plant hosts of diseases, such as cedar-apple rust.

Evergreen trees and shrubs are valuable in the windbreak for their winter function. Consider species of conifers that yield crops, other than their value as lumber trees, such as pine nuts and medicinal oils.

Form	Common Name	Genus / Species	Hardiness Zones	Height	Width	Light	Water	Crops	Materials	Nitrogen Fixer	Nutrient Accumulator	Ground Cover	Nectary	Medicine
Tree	Crabapple, Siberian	Malus baccata	3	30'	25'	Full Sun	Mesic	Fruit			K			
Tree	Dogwood, Cornelian Cherry	Cornus mas	4-8	20'	20'	Full Sun - Part Shade	Mesic	Berries						
Tree	Fir, White	Abies concolor	3-7	40-70'	20-30'	Full Sun - Part Shade	Mesic							
Tree	Serviceberry, Downy	Amelanchier arborea	4-9	15-25'	15-25'	Full Sun - Part Shade	Mesic	Berries						
Tree	Spruce, Black Hills	Picea glauca	2-6	20-40'	10-15'	Full Sun	Mesic							
Shrub	Aronia Berry, Black	Aronia melanocarpa	3-9	5-6’	5-6’	Full Sun - Part Shade	Mesic - Hydric	Berries						
Shrub	Juniper, Common	Juniperus communis	2-7	2-4'	3-5'	Full Sun	Xeric - Mesic							
Shrub	Nanking Cherry	Prunus tomentosa	3-7	6-10'	6-8'	Full Sun	Xeric - Mesic	Fruit						
Shrub	Peashrub, Siberian	Caragana arborescens	2-7	8-20'	12-18'	Full Sun	Xeric - Mesic			x				
Shrub	Saskatoon	Amelanchier alnifolia	2-7	5-15'	5-15'	Full Sun	Mesic	Berries						
Herb	Clover, Dutch White	Trifolium repens	4-8	4-10"	6-36"	Full Sun - Part Shade	Xeric - Mesic			x		x		
Herb	Clover, Miniclover	Trifolium repens	4-8	4"	6-36"	Full Sun - Part Shade	Xeric - Mesic			x		x		
Herb	Comfrey	Symphytum x uplandicum	4-9	3-5’	3-5’	Full Sun - Full Shade	Xeric - Mesic				K, P, Ca, Cu, Fe, Mg			x
Herb	Goldenseal	Hydrastis canadensis	3-8	1'	1'	Part Shade	Mesic	Root						x
Herb	Purple Coneflower	Echinacea purpurea	3-8	3-4'	1-2'	Full Sun - Part Shade	Xeric - Mesic						G	x
Herb	Strawberry, Wild	Fragaria virginiana	3-8	4-12"	Indef.	Full Sun - Part Shade	Xeric - Mesic	Berries			Fe	x		

Figure 49. Edible Windbreak Plant List

Figure 50. Purple Coneflower
The stiff, upright stems of purple coneflower (*Echinacea purpurea*) can decrease wind speed and accumulate snow in a windbreak. The flowers, leaves and roots can be sold as medicinals.
Photo by Fred Meyer

CONCEPTUAL SITE PLAN

This design depicts 3 offset rows of conifer and fruit trees with an understory of shrubs and herbs that can provide marketable products.[62]

- Douglas fir (*Pseudotsuga menziesii*) provides needles that can be sold for medicine and brewing.
- White fir (*Abies concolor*) yields lumber and medicinal essential oil.
- Juniper (*Juniperus communis*) berries are used to flavor gin.
- Siberian peashrub (*Caragana arborescens*) fixes nitrogen and has edible seeds.
- Siberian crabapple (*Malus baccata*), saskatoon (*Amelanchier alnifolia*), Nanking cherry (*Prunus tomentosa*), cornelian cherry (*Cornus mas*) and aronia berry (*Aronia melanocarpa*) can be used for fruit preserves and juice in addition to being a nectar source for beneficial insects.
- Purple coneflower (*Echinacea purpurea*) can be harvested for seed, mulch, floral arrangements, and medicine while also providing nectar and building soil with its deep roots.
- Goldenseal (*Hydrastis canadensis*) is harvested for medicine, serves as a ground cover, and thrives under the shade of trees.
- Comfrey (*Symphytum x uplandicum*) serves many ecological functions: nectar source, ground cover, mulch, nutrient accumulator, and invertebrate shelter.

ESTABLISHMENT AND MANAGEMENT IDEAS

The first 1-3 years of growth are very important to the long-term vitality of the windbreak. Plants will require weed and grass control, replanting, animal protection, pest and disease control, pruning, and fertilization.

Planting conifers too closely is a common mistake which causes their lifespan to be reduced as they grow into on one another. Trees will be over-planting and then thinning as plants mature. White fir are a Christmas tree species, providing a holiday income for a few years in the large windbreaks.

See the *Producing Marketable Products from Living Snow Fences* publication from the University of Minnesota Extension Service for detailed lists of per-acre establishment costs and revenue for selected windbreak plants.[63]

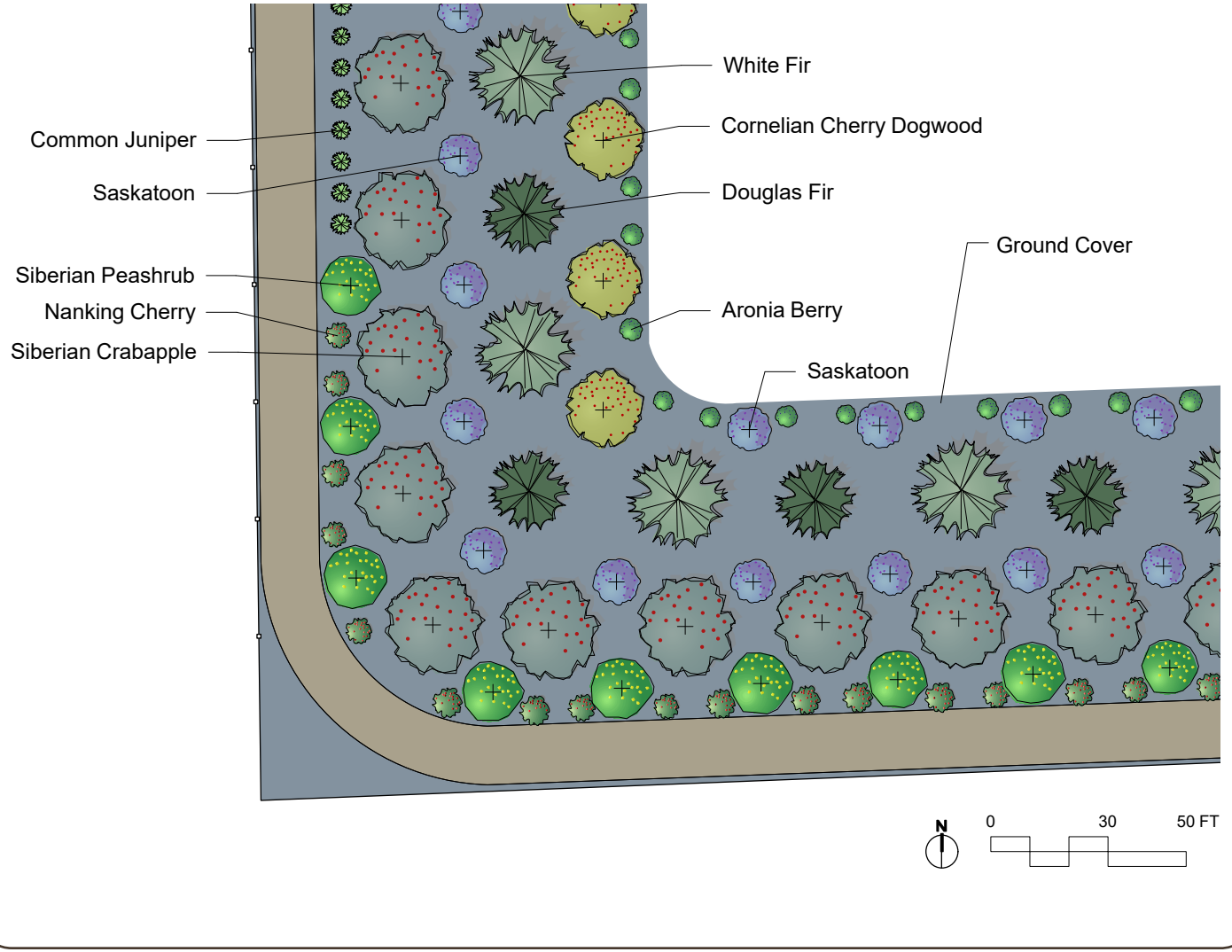

Figure 51. Edible Windbreak Conceptual Site Plan
The middle row of conifers will eventually grow up to 40 feet high which will decrease wind speed 200 feet away by 78% .

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The high-yielding heartnut tree (*Juglans ailantifolia var. cordiformis*) yields nuts that are easy to crack.
Photo by Fred Meyer

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Exhibit 9

Freeze Creek Forest - Conceptual Site Plan - 20250808

SITE IMPROVEMENTS

FREEZE CREEK FOREST

SALT LAKE COUNTY, UTAH

SHEET INDEX

SITE DATA

PARCEL AREA:	40.0 ± AC
ZONING DISTRICT:	FCOZ OVERLAY
USE:	FOREST IMPROVEMENT & PRESERVATION
WATER SYSTEM:	PRIVATE WELL
SEWER SYSTEM:	PRIVATE ON-SITE WASTEWATER SYSTEM

PREFACE

1. THIS DOCUMENT IS INTENDED AS AN INTEGRATED SET OF DRAWING SHEETS THAT TOGETHER DESCRIBE THE WORK. SHEET NUMBER AND TOTAL NUMBER OF SHEETS ARE SHOWN AT LOWER RIGHT CORNER ON EVERY SHEET. REQUIREMENTS ARE SHOWN IN MULTIPLE VIEWS, DETAILS, TABLES AND VIA TEXT THROUGHOUT THE DRAWING SET. AS SUCH, NO ONE SHEET MAY BE CONSIDERED ALONE. FOR CLARITY, EVERY EFFORT HAS BEEN MADE TO AVOID REPETITIVE CALLS. READ AND UNDERSTAND THE ENTIRE DRAWING SET BEFORE PROVIDING BIDS, APPLYING FOR PERMITS, OR COMMENCING CONSTRUCTION.

2. BOUNDARY LINES SHOWN HEREON ARE APPROXIMATE ONLY. A FULL BOUNDARY AND ACCESS ALIGNMENT SURVEY WILL BE REQUIRED PRIOR TO FINAL ACCESS DESIGN.

3. SITE IMPROVEMENTS DEPICTED HEREON DO NOT INCLUDE ANY BUILDING CONSTRUCTION.

4. BAR SCALE SHOWN ON GOOGLE EARTH IMAGES IS APPROXIMATE ONLY.

REGULATORY

1. AT LEAST TWO FULL BUSINESS DAYS PRIOR TO COMMENCEMENT OF ANY WORK, CALL 8 1 1 FOR UNDERGROUND UTILITY MARKING. ALSO, PROVIDE AT LEAST TWO FULL BUSINESS DAYS NOTICE TO PERTINENT COUNTY DEPARTMENTS BEFORE COMMENCING ANY WORK IN THE FIELD.

2. COORDINATE AND OBTAIN ALL CONSTRUCTION PERMITS REQUIRED BY REGULATORY AUTHORITIES.

3. PRIOR TO COMMENCEMENT OF ANY WORK, REVIEW AND FULLY UNDERSTAND ALL CONSTRUCTION REQUIREMENTS, CONDITIONS, AND LIMITATIONS IMPOSED BY PERMITS AND APPROVALS ISSUED BY REGULATORY AUTHORITIES.

4. THE SUBJECT PROPERTY IS NOT LOCATED WITHIN A SPECIAL FLOOD HAZARD AREA. SEE FEMA FLOOD INSURANCE RATE MAP, COMMUNITY PANEL NO. 49035C 0166, EFFECTIVE DATE SEPTEMBER 25, 2009.

SITE

N TWIN CREEK CIRCLE

E PIONEER FORK ROAD

NORTH

VICINITY MAP

ABBREVIATIONS

ACP	ASPHALT CONCRETE PAVEMENT
BLDG	BUILDING
CB	CATCH BASIN
CFS	CUBIC FEET PER SECOND
CIP	CAST-IN-PLACE
CL	CENTERLINE
CMH	COMMUNICATIONS MANHOLE
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNIT
CO	CLEANOUT
COMM	COMMUNICATIONS
DIA	DIAMETER
DMH	DRAIN MANHOLE
EG	EXISTING GRADE
EL	ELEVATION
EMH	ELECTRIC MANHOLE
ESHGW	ESTIMATED SEASONAL HIGH GROUNDWATER
EX	EXISTING
FDN	FOUNDATION
FE	FLARED END
FG	FINISH GRADE
FRP	FIBERGLASS REINFORCED PLASTIC
GPM	GALLONS PER MINUTE
GW	GROUNDWATER
HDCI	HEAVY DUTY CAST IRON
HDPE	HIGH DENSITY POLYETHYLENE
HP	HIGH POINT
ID	INSIDE DIAMETER
INT	INTERSECTION
INV	INVERT
LD	LONGEST DIMENSION
LF	LINEAR FEET
LOD	LIMIT OF DISTURBANCE
LP	LOW POINT
MDD	MAXIMUM DRY DENSITY
MEG	MATCH EXISTING GRADE
MUTCD	MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES
OD	OUTSIDE DIAMETER
PC	POINT OF CURVATURE
PCC	PORTLAND CEMENT CONCRETE
PJDI	PUSH-ON JOINT DUCTILE IRON
PRC	PRECAST REINFORCED CONCRETE
PVC	POLYVINYL CHLORIDE; POINT OF VERTICAL CURVATURE
PVI	POINT OF VERTICAL INTERSECTION
PVT	POINT OF VERTICAL TANGENCY
RCP	REINFORCED CONCRETE PIPE
S	SLOPE
SBED	STREAM BED
SD	STORM DRAIN
SMH	SEWER MANHOLE
SS	SANITARY SEWER; STAINLESS STEEL
TBA	TO BE ABANDONED
TBC	TOP BACK OF CURB
TBD	TO BE DETERMINED
TC	TOP OF CONCRETE
TO	TOP OF
TP	TOP OF PAVEMENT
TYP	TYPICAL
UD	UNDERDRAIN
UP	UTILITY POLE
WMH	WATER MANHOLE
WS	WATER SURFACE

ABBREVIATIONS - AGENCY

COE	US ARMY CORPS OF ENGINEERS
FEMA	FEDERAL EMERGENCY MANAGEMENT AGENCY
RMP	ROCKY MOUNTAIN POWER
SLCPU	SALT LAKE CITY PUBLIC UTILITIES
SLCO	SALT LAKE COUNTY
SLCOEH	SALT LAKE COUNTY ENVIRONMENTAL HEALTH
UDEQ	UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY
UDOT	UTAH DEPARTMENT OF TRANSPORTATION

REFERENCES

1. TOPOGRAPHY DEPICTED HEREON PROVIDED BY USGS.

2. AERIAL PHOTO BASE ON TITLE SHEET FROM GOOGLE EARTH.

DRAWING ISSUED FOR

- ☐ PLANNING
- ☐ CONSTRUCTION
- ■ PERMIT
- ☐ CONSTRUCTION RECORD

THIS DRAWING MAY NOT SHOW CONSTRUCTION DETAILS AND SPECIFICATIONS FOR ALL PROPOSED IMPROVEMENTS, AND MAY NOT IDENTIFY ALL CONSTRUCTION WORK ITEMS AND AREAS OF CONTRACTOR JURISDICTION.

NO.	DATE	BY	CHK	REVISION DESCRIPTION
1	07.24.25	APS	APS	ADD DRIVE CROSS SECTIONS AND GRADING

CANYON ENGINEERING
SOLUTIONS FOR LAND

CIVIL ENGINEERING
LAND PLANNING
PERMITTING

PO BOX 982131
PARK CITY, UTAH 84098

VOICE: 435.640.7373 EMAIL: GUS@CANYONENG.COM
WWW.CANYONENG.COM

SITE IMPROVEMENTS

CONCEPT EXHIBITS
TITLE SHEET

FREEZE CREEK FOREST
PARCEL ID NO. 10-20-400-002-0000
SALT LAKE COUNTY, UTAH

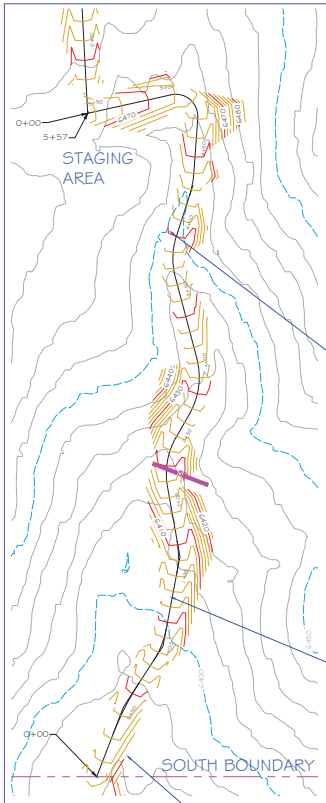
PREPARED FOR:
RYAN LEICK
SANDY, UTAH

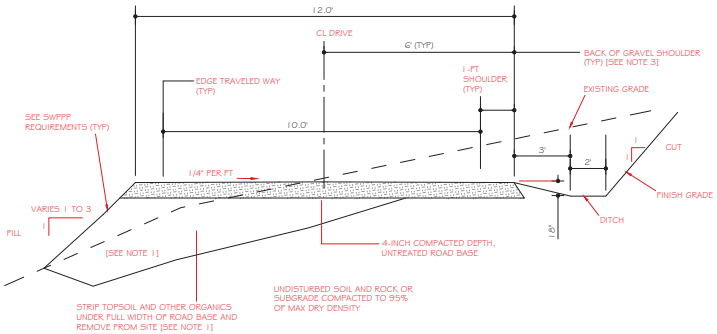
PLSS GRID LOCATION:
SEC 20 T1N R2E
SLBMU

DES. BY: APS
CHK. BY: APS

DATE: NOVEMBER 2024

JOB 2405





NOTES:
[1] PLACE 6-INCH-MINUS GRANULAR BORROW AND MECHANICALLY COMPACT; MAX COMPACTED LIFT THICKNESS = 12 INCHES. OBTAIN ENGINEER APPROVAL FOR USE OF ON-SITE EXCAVATED MATERIALS. WHETHER IMPORT OR ON-SITE EXCAVATED, PROVIDE GRANULAR BORROW COMPRISED OF UNIFIED CLASSIFICATION GROUPS LISTED IN TABLE AT RIGHT. TARGET ROCK PORTION OF FILL = 20 TO 30%.
[2] FINE GRADE AND MECHANICALLY COMPACT SHOULDERS
[3] CONSTRUCT DRIVEWAY TO SMOOTH LINE AND GRADE.
[4] WIDTHS SHOWN ARE MINIMUM. GREATER WIDTHS REQUIRED AT TRANSITION RADII AND TAPERS.

GW	WELL-GRADED GRAVEL; GRAVEL-SAND MIXTURE
GM	SILTY GRAVELS; GRAVEL-SAND-SILT MIXTURE
GC	CLAYEY GRAVELS; GRAVEL-SAND-CLAY MIXTURE
SW	WELL-GRADED SANDS; GRAVELLY SANDS
SM	SILTY SANDS; SAND-SILT MIXTURE
SC	CLAYEY SANDS; CLAY-SAND MIXTURE

DRIVEWAY
TYPICAL CROSS SECTION
NOT TO SCALE

LEGEND

EXISTING SURFACE RUNOFF DIRECTION
PROPOSED SURFACE RUNOFF DIRECTION
EXISTING SPOT GRADE & SURFACE CONTOUR (x 7208.00 TBG; 7290 7292)
FINISH SPOT GRADE & SURFACE CONTOUR (6400.0 FG; 7270 7276)
FINISH GRADE AT TOP & BOTTOM OF WALL (50.0 FGTW 46.8 FGBW)
SOIL EVALUATION TEST PIT (1012-2)
PERC TEST (1012-A)
PROPERTY LINE
SETBACK LINE
EASEMENT LIMIT
EX UNDERGROUND GAS LINE (G)
EX UNDERGROUND POWER LINE (E)
EX OVERHEAD WIRE (OHW)
EX UNDERGROUND COMMUNICATIONS (CO)
EX UNDERGROUND WATER LINE (W)
EX SANITARY SEWER LINE (SS)
CONCEPTUAL CULVERT LOCATION (CP)

ELEVATION DATUM

NAVD 88 ELEVATIONS IN FEET

PREFACE

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ABBREVIATIONS

ACP	ASPHALT CONCRETE PAVEMENT
BLDG	BUILDING
CB	CATCH BASIN
CFS	CUBIC FEET PER SECOND
CIP	CAST-IN-PLACE
CL	CENTERLINE
CMH	COMMUNICATIONS MANHOLE
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNIT
CO	CLEANOUT
COMM	COMMUNICATIONS
DIA	DIAMETER
DMH	DRAIN MANHOLE
EG	EXISTING GRADE
EL	ELEVATION
EMH	ELECTRIC MANHOLE
ESHGW	ESTIMATED SEASONAL HIGH GROUNDWATER
EX	EXISTING
FDN	FOUNDATION
FE	FLARED END
FG	FINISH GRADE
FRP	FIBERGLASS REINFORCED PLASTIC
GPM	GALLONS PER MINUTE
GW	GROUNDWATER
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HDPE	HIGH DENSITY POLYETHYLENE
HP	HIGH POINT
ID	INSIDE DIAMETER
INT	INTERSECTION
INV	INVERT
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LF	LINEAR FEET
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MDD	MAXIMUM DRY DENSITY
MEG	MATCH EXISTING GRADE
MUTCD	MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES
OD	OUTSIDE DIAMETER
PC	POINT OF CURVATURE
PCC	PORTLAND CEMENT CONCRETE
PJDI	PUSH-ON JOINT DUCTILE IRON
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PVT	POINT OF VERTICAL TANGENCY
RCP	REINFORCED CONCRETE PIPE
S	SLOPE
SBED	STREAM BED
SD	STORM DRAIN
SMH	SEWER MANHOLE
SS	SANITARY SEWER, STAINLESS STEEL
TBA	TO BE ABANDONED
TBC	TOP BACK OF CURB
TBD	TO BE DETERMINED
TC	TOP OF CONCRETE
TO	TOP OF
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TYP	TYPICAL
UD	UNDERDRAIN
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WMH	WATER MANHOLE
WS	WATER SURFACE

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COE	US ARMY CORPS OF ENGINEERS
FEMA	FEDERAL EMERGENCY MANAGEMENT AGENCY
RMP	ROCKY MOUNTAIN POWER
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UDEQ	UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY
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REFERENCES

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A.F. SHARPP, III 10703 07.24.25 STATE OF UTAH REGISTERED PROFESSIONAL ENGINEER

NO.	DATE	BY	CHK	REVISION DESCRIPTION
1	07.24.25	AFS	AFS	ADD DRIVE CROSS SECTIONS AND GRADING

CANYON ENGINEERING
SOLUTIONS FOR LAND
CIVIL ENGINEERING
LAND PLANNING
PERMITTING
PO BOX 982131
PARK CITY, UTAH 84098
VOICE: 435.640.7373 EMAIL: GUS@CANYONENG.COM
WWW.CANYONENG.COM

SITE IMPROVEMENTS

ACCESS - FROM SOUTH BOUNDARY PLAN & PROFILE

FREEZE CREEK FOREST
PARCEL ID NO. 10-20-400-002-0000
SALT LAKE COUNTY, UTAH

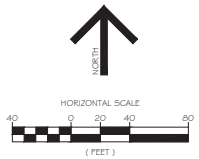
PREPARED FOR:
RYAN LECK
SANDY, UTAH

PLSS GRID LOCATION:
SEC 20 T1N R2E
SLBAM

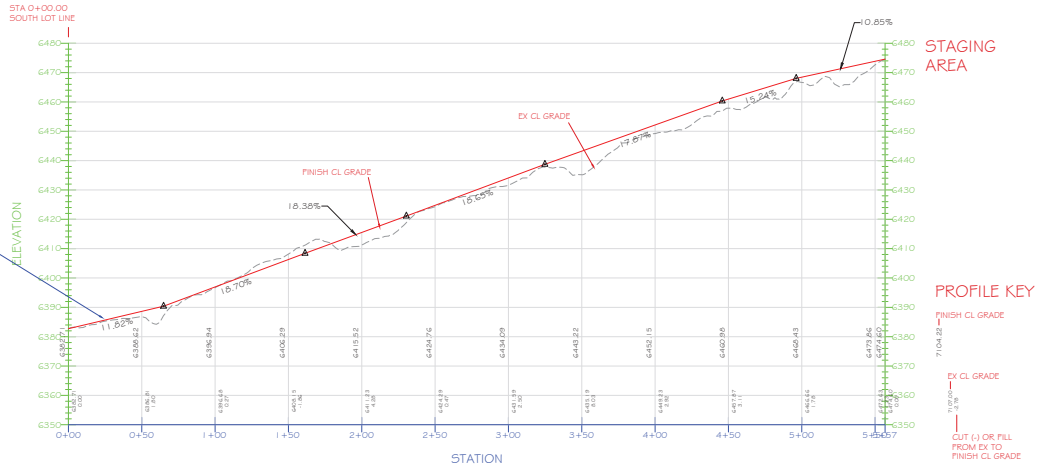
DES. BY: AFS
CHK. BY: AFS

DATE: NOVEMBER 2024
JOB 2405

PLAN VIEW

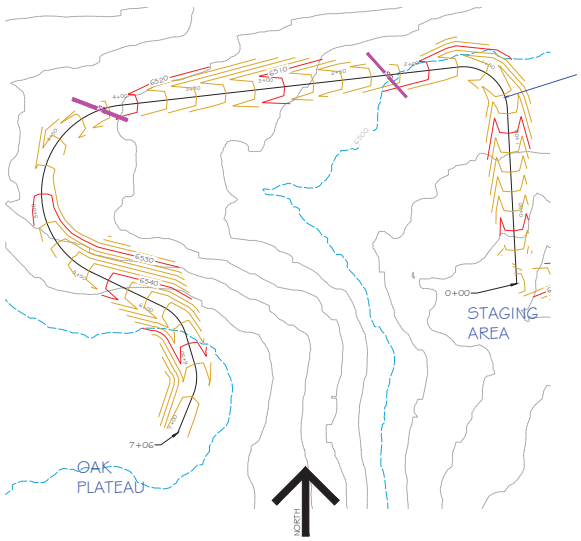


PROPOSED PARKING AREA



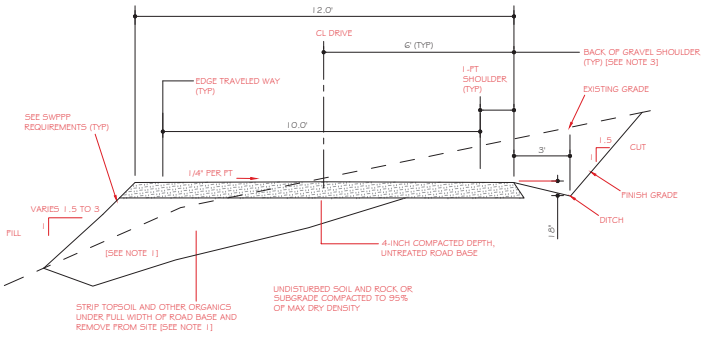
PROFILE VIEW

PROFILE KEY
FINISH CL GRADE
EX CL GRADE
CUT (-) OR FILL FROM EX TO FINISH CL GRADE



PLAN VIEW

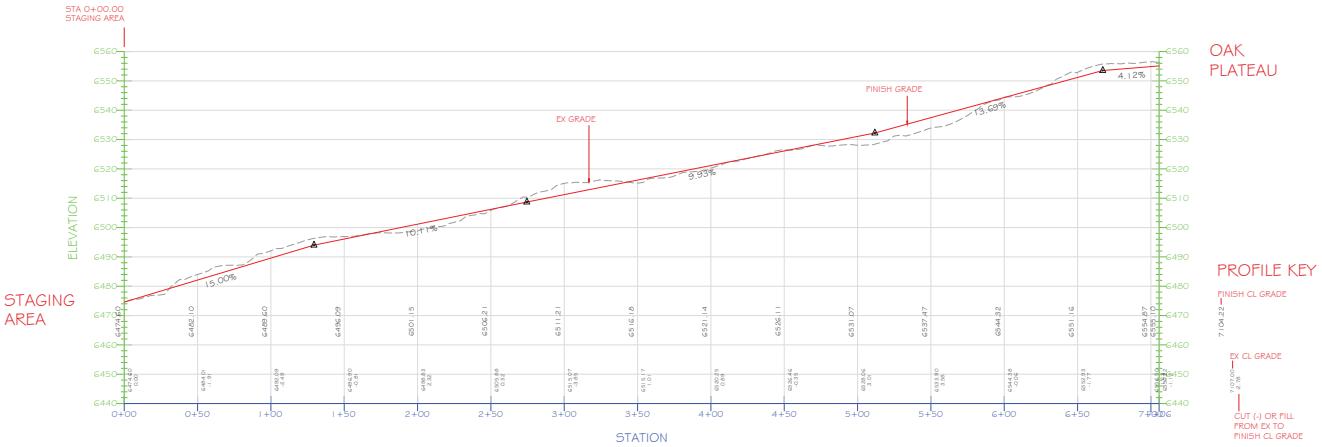
HORIZONTAL SCALE
40 0 20 40 80
(FEET)



NOTES:
[1] PLACE 6-INCH-MINUS GRANULAR BORROW AND MECHANICALLY COMPACT; MAX COMPACTED LIFT THICKNESS = 12 INCHES. OBTAIN ENGINEER APPROVAL FOR USE OF ON-SITE EXCAVATED MATERIALS. WHETHER IMPORT OR ON-SITE EXCAVATED, PROVIDE GRANULAR BORROW COMPRISED OF UNIFIED CLASSIFICATION GROUPS LISTED IN TABLE AT RIGHT. TARGET ROCK PORTION OF FILL = 20 TO 30%.
[2] FINE GRADE AND MECHANICALLY COMPACT SHOULDERS
[3] CONSTRUCT DRIVEWAY TO SMOOTH LINE AND GRADE.
[4] WIDTHS SHOWN ARE MINIMUM. GREATER WIDTHS REQUIRED AT TRANSITION RADII AND TAPERS.

GW WELL-GRADED GRAVEL; GRAVEL-SAND MIXTURE
GM SILTY GRAVELS; GRAVEL-SAND-SILT MIXTURE
GC CLAYEY GRAVELS; GRAVEL-SAND-CLAY MIXTURE
SW WELL-GRADED SANDS; GRAVELLY SANDS
SM SILTY SANDS; SAND-SILT MIXTURE
SC CLAYEY SANDS; CLAY-SAND MIXTURE

DRIVEWAY
TYPICAL CROSS SECTION
NOT TO SCALE



PROFILE VIEW

LEGEND

EXISTING SURFACE RUNOFF DIRECTION	·····▷
PROPOSED SURFACE RUNOFF DIRECTION	▶▶▶▶
EXISTING SPOT GRADE & SURFACE CONTOUR	x 7208.00 — 7290 / TBG — 7292
FINISH SPOT GRADE & SURFACE CONTOUR	←6400.0 — 7270 / FG — 7276
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PERC TEST	PT 101 2-A
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EX UNDERGROUND COMMUNICATIONS	CO
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STATE OF UTAH

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SITE IMPROVEMENTS

ACCESS - FROM STAGING AREA PLAN & PROFILE

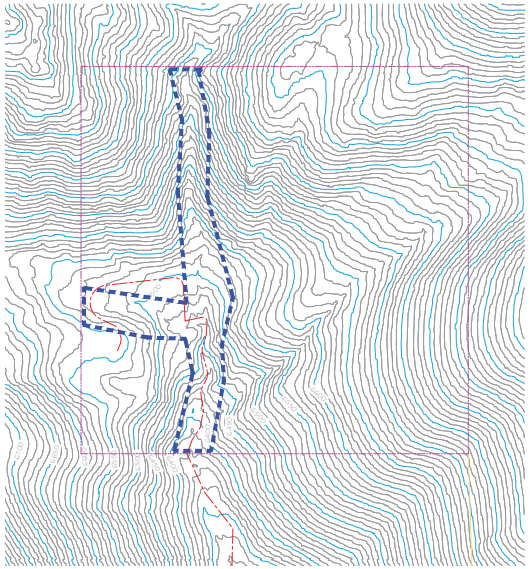
FREEZE CREEK FOREST
PARCEL ID NO. 10-20-400-002-0000
SALT LAKE COUNTY, UTAH

PREPARED FOR:
RYAN LESCK
SANDY, UTAH

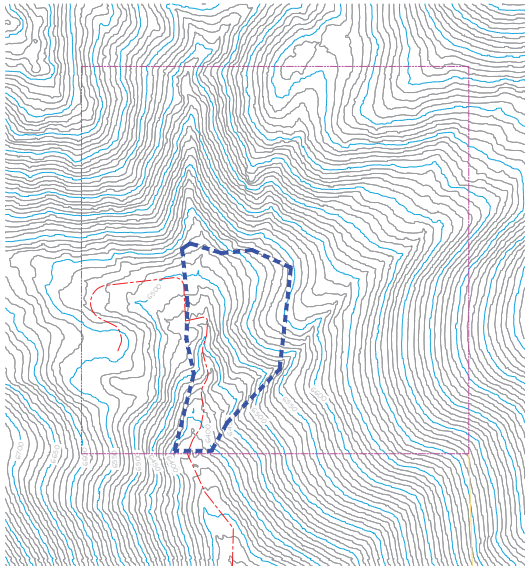
PLSS GRID LOCATION:
SEC 20 T1N R2E
SLBAM

DES. BY: AFS
CHK. BY: AFS

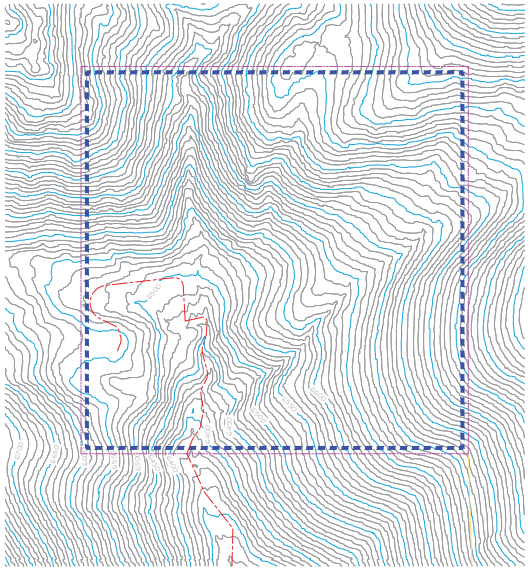
DATE: NOVEMBER 2024
JOB 2405
3 OF 6



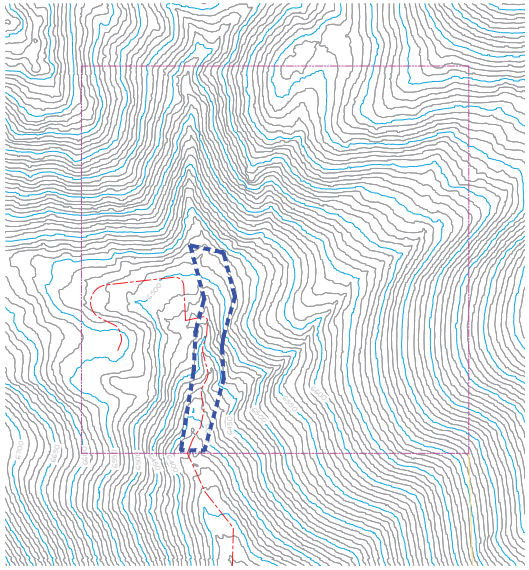
CPS 391 - RIPARIAN FOREST BUFFER



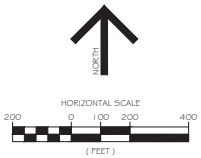
CPS 410 - GRADE STABILIZATION STRUCTURES



CPS 490 - TREE AND SHRUB SITE PREP



CPS 580 - STREAMBANK AND SHORELINE PROTECTION



ELEVATION DATUM

NAVD 88 ELEVATIONS IN FEET

LEGEND

EXISTING SPOT GRADE x 7208.00 7210
& SURFACE CONTOUR TBG 7212

APPROXIMATE PROPERTY LINE

PROPOSED CSP BMP LIMIT

PROPOSED ACCESS CENTERLINE

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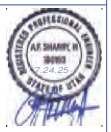

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SITE IMPROVEMENTS

CONSERVATION STEWARDSHIP MANAGEMENT PRACTICES

FREEZE CREEK FOREST
PARCEL ID NO. 10-20-400-002-0000
SALT LAKE COUNTY, UTAH

PREPARED FOR:
RYAN LECK
SANDY, UTAH

PLSS GRID LOCATION:
SEC 20 T1N R2E
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DES. BY: AFS
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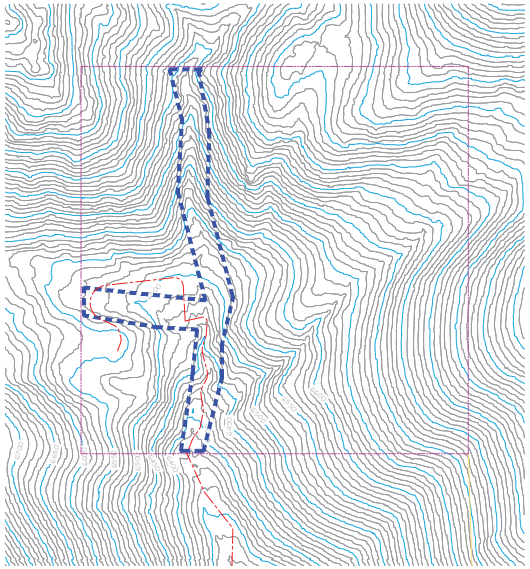
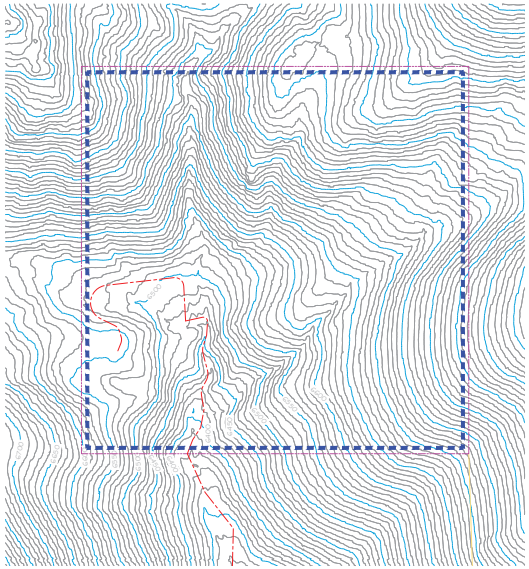
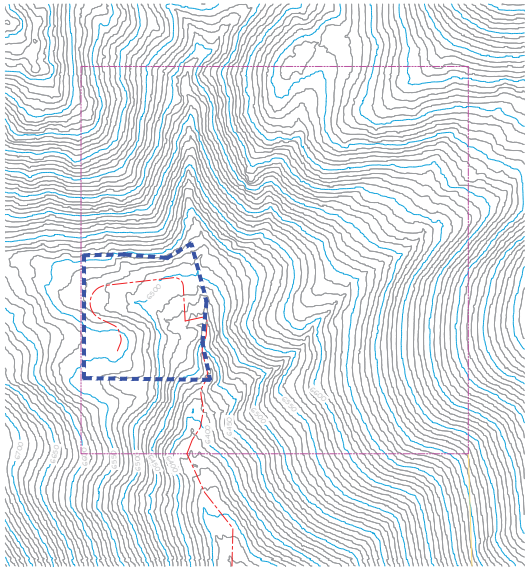


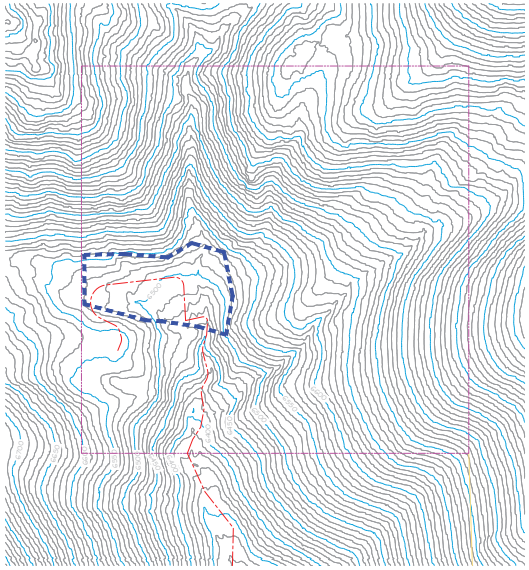
CPS 584 - CHANNEL BED STABILIZATION



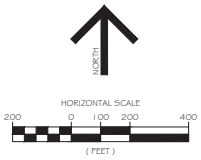
CPS 612 - TREE AND SHRUB ESTABLISHMENT



CPS E384A - BIOCHAR PRODUCTION FROM WOODY RESIDUE



CPS E612D - ADDING FRUIT-PRODUCING TREES AND SHRUBS



ELEVATION DATUM

NAVD 88 ELEVATIONS IN FEET

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EXISTING SPOT GRADE x 7208.00
EXISTING SURFACE CONTOUR TBG 7292
APPROXIMATE PROPERTY LINE
PROPOSED CSP BMP LIMIT
PROPOSED ACCESS CENTERLINE

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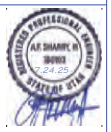
2. AERIAL PHOTO BASE ON TITLE SHEET FROM GOOGLE EARTH.

DRAWING ISSUED FOR

- ☐ PLANNING
- ☐ CONSTRUCTION
- ■ PERMIT
- ☐ CONSTRUCTION RECORD

THIS DRAWING MAY NOT SHOW CONSTRUCTION DETAILS AND SPECIFICATIONS FOR ALL PROPOSED IMPROVEMENTS, AND MAY NOT IDENTIFY ALL CONSTRUCTION WORK, ITEMS AND AREAS OF CONTRACTOR JURISDICTION.



NO.	DATE	BY	CHK	REVISION DESCRIPTION

CANYON ENGINEERING
SOLUTIONS FOR LAND
CIVIL ENGINEERING
LAND PLANNING
PERMITTING
PO BOX 982131
PARK CITY, UTAH 84098
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SITE IMPROVEMENTS

CONSERVATION STEWARDSHIP MANAGEMENT PRACTICES

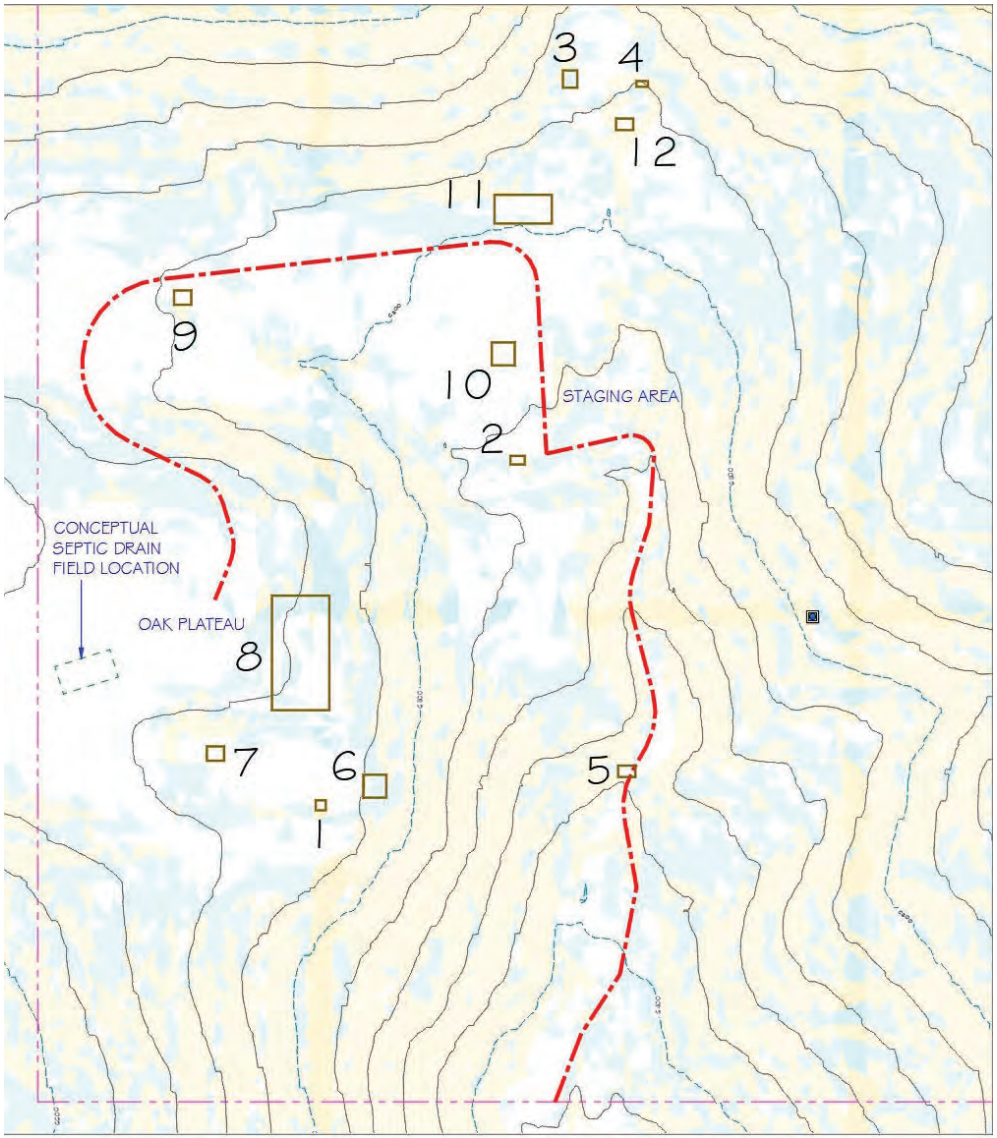
FREEZE CREEK FOREST
PARCEL ID NO. 10-20-400-002-0000
SALT LAKE COUNTY, UTAH

PREPARED FOR:
RYAN LEICK
SANDY, UTAH

PLSS GRID LOCATION:
SEC 20 T1N R2E
SLBAM

DES. BY: AFS
CHK. BY: AFS

DATE: NOVEMBER 2024
JOB 2405



NORTH

HORIZONTAL SCALE

40 0 20 40 80

(FEET)

SLOPE KEY

0 TO 30%

30 TO 50%

OVER 50%

NOTE: SLOPE SHADING IS BASED ON AN EXISTING SURFACE CONTOUR INTERVAL OF 10 FEET. AS SUCH, DEPICTED SLOPE RANGES ARE APPROXIMATE AND WILL CONTAIN SMALLER AREAS WITHIN THAT ARE EITHER MORE OR LESS STEEP.

ELEVATION DATUM

NAVD 88 ELEVATIONS IN FEET

LEGEND

EXISTING SPOT GRADE x 7208.00
& SURFACE CONTOUR TBG 7290 7292

APPROXIMATE PROPERTY LINE

PROPOSED CSP BMP LIMIT

PROPOSED ACCESS CENTERLINE

STRUCTURE AND ID NO. 7

PREFACE

1. BOUNDARY LINES SHOWN HEREON ARE APPROXIMATE ONLY. A FULL BOUNDARY AND ACCESS ALIGNMENT SURVEY WILL BE REQUIRED PRIOR TO FINAL ACCESS DESIGN.

STRUCTURES

ID NO.	USE	DIMENSIONS
1	SHED (EX)	7' X 7'
2	PICNIC TABLE (EX)	6' X 10'
3	TREEHOUSE (EX)	10' X 12'
4	SOLAR ARRAY (EX)	4' X 8'
5	BRIDGE	8' X 12'
6	OBSERVATION DECK	16' X 16'
7	SLOVENIA BEE HOUSE	10' X 12'
8	WEST HOMESTEAD BARN BUILDING PAD	40' X 80'
9	SLOVENIA BEE HOUSE	10' X 12'
10	GREENHOUSE BUILDING PAD	16' X 16'
11	LUMBER MILL BUILDING PAD	20' X 40'
12	BRIDGE	8' X 12'

NOTES:

1. STRUCTURES 1 - 4 ARE EXISTING. ALL OTHERS ARE PROPOSED. STRUCTURES 7 - 11 ARE PROPOSED AGRICULTURAL ACCESSORY STRUCTURES.

2. UPON COMPLETION OF CONSTRUCTION, STRUCTURES TO BE LOCATED AND DEPICTED ON AN AS-BUILT PLAN.

ABBREVIATIONS

ACP	ASPHALT CONCRETE PAVEMENT
BLDG	BUILDING
CB	CATCH BASIN
CFS	CUBIC FEET PER SECOND
CIP	CAST-IN-PLACE
CL	CENTERLINE
CMH	COMMUNICATIONS MANHOLE
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNIT
CO	CLEANOUT
COMM	COMMUNICATIONS
DIA	DIAMETER
DMH	DRAIN MANHOLE
EG	EXISTING GRADE
EL	ELEVATION
EMH	ELECTRIC MANHOLE
ESHGW	ESTIMATED SEASONAL HIGH GROUNDWATER
EX	EXISTING
FDN	FOUNDATION
FE	FLARED END
FG	FINISH GRADE
FRP	FIBERGLASS REINFORCED PLASTIC
GPM	GALLONS PER MINUTE
GW	GROUNDWATER
HDCI	HEAVY DUTY CAST IRON
HDPE	HIGH DENSITY POLYETHYLENE
HP	HIGH POINT
ID	INSIDE DIAMETER
INT	INTERSECTION
INV	INVERT
LD	LONGEST DIMENSION
LF	LINEAR FEET
LOD	LIMIT OF DISTURBANCE
LP	LOW POINT
MDD	MAXIMUM DRY DENSITY
MEG	MATCH EXISTING GRADE
MUTCD	MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES
OD	OUTSIDE DIAMETER
PC	POINT OF CURVATURE
PCC	PORTLAND CEMENT CONCRETE
PJDI	PUSH-ON JOINT DUCTILE IRON
PRC	PRECAST REINFORCED CONCRETE
PVC	POLYVINYL CHLORIDE, POINT OF VERTICAL CURVATURE
PVI	POINT OF VERTICAL INTERSECTION
PVT	POINT OF VERTICAL TANGENCY
RCP	REINFORCED CONCRETE PIPE
S	SLOPE
SBED	STREAM BED
SD	STORM DRAIN
SMH	SEWER MANHOLE
SS	SANITARY SEWER, STAINLESS STEEL
TBA	TO BE ABANDONED
TBC	TOP BACK OF CURB
TBD	TO BE DETERMINED
TC	TOP OF CONCRETE
TO	TOP OF
TP	TOP OF PAVEMENT
TYP	TYPICAL
UD	UNDERDRAIN
UP	UTILITY POLE
WMH	WATER MANHOLE
WS	WATER SURFACE

ABBREVIATIONS - AGENCY

COE	US ARMY CORPS OF ENGINEERS
FEMA	FEDERAL EMERGENCY MANAGEMENT AGENCY
RMP	ROCKY MOUNTAIN POWER
SLCPU	SALT LAKE CITY PUBLIC UTILITIES
SLCO	SALT LAKE COUNTY
SLCOEH	SALT LAKE COUNTY ENVIRONMENTAL HEALTH
UDEQ	UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY
UDOT	UTAH DEPARTMENT OF TRANSPORTATION

REFERENCES

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A.F. SHARPP, III 10703 8.8.25 REGISTERED PROFESSIONAL ENGINEER STATE OF UTAH

NO.	DATE	BY	CHK	REVISION DESCRIPTION
1	08.08.25	AFS	AFS	ADD SLOPE SHADING AND KEY

CANYON ENGINEERING
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SITE IMPROVEMENTS

STRUCTURES OVERVIEW PLAN

FREEZE CREEK FOREST
PARCEL ID NO. 10-20-400-002-0000
SALT LAKE COUNTY, UTAH

PREPARED FOR:
RYAN LECK
SANDY, UTAH

PLSS GRID LOCATION:
SEC 20 T1N R2E
SLB&M

DES. BY: AFS
CHK. BY: AFS

DATE: NOVEMBER 2024

JOB 2405

Exhibit 10

FCOZ Site Plan Application Narrative – 20250207

Application Date: March 31, 2021
Application #: PER2021-000287
Applicant Name: Ryan Leick
Parcel ID: 10-20-400-002
Current Zone: FR-20
Property Address: 1475 Pinecrest Canyon Road, Emigration Canyon, UT 84108
Request: Permitted Use / FCOZ Site Plan

PROJECT DESCRIPTION

The owner of A.P.N. 10-20-400-002, which is known as 1475 Pinecrest Canyon Road, is requesting approval of a Foothills and Canyons Overlay Zone (FCOZ) site plan required by Emigration Canyon Code 19.72.030 for development related to a permitted Agricultural use allowed under 19.02.090 and 19.12.020(B) and accessory structures allowed under 19.12.020(A).

EXECUTIVE SUMMARY

The application appears to meet the provisions stated in Section 19.72.030 – FCOZ Development Approval Procedures.

The following uses are permitted in the FR zones subject to compliance with all applicable requirements set forth in this chapter including those relating to site and lot dimensions, development standards, and other regulations:

A. Agriculture, as defined in Section 19.04.020;

SITE & VICINITY DESCRIPTION

The site is a 40-acre parcel zoned Forest & Recreation, FR-20, and considered a Lot of Record under Emigration Canyon municipal ordinance 19.72 Foothills and Canyons Overlay Zone (FCOZ). The city of Emigration Canyon issued a quasi-judicial determination through the Greater Salt Lake Municipal Services District appeal hearing officer (SLCORO Entry 14287206, Book, 11517, Page 5974) that the Subject Parcel is a lot of record because it had frontage on a public road across land in the public domain at the time of lot creation in 1888. U.C.A. 72-5-302(3)(a) states “Acceptance of a right-of-way for the construction of a highway over public lands, not reserved for public uses, is presumed if the state or a political subdivision of the state makes a finding that the highway was constructed and the right-of-way was accepted prior to October 21, 1976.”

The surrounding properties are also zoned FR-20 and FCOZ. The only existing structures in the immediate neighborhood are Emigration Improvement District well facilities approximately ½ mile south of the property.

General Plan Considerations

There are no identified negative impacts to the current General Plan with the approval of this application.

Neighborhood Response

There is no requirement to notify adjacent property owners for permitted use applications.

Reviewing Agency Conditions

MSD Grading:

SLCO Hydrology:

SLCO Geology:

SLCO Traffic:

SLCO Health Offices:

MSD Planning:

SLCO Surveyor:

Unified Fire Authority:

MSD Building:

SLCO Operations:

Emigration Improvement District:

Location and Topography

The location and topography of the parcel in the Freeze Creek drainage of Emigration Canyon pose significant challenges. The property is not located within the Salt Lake City Watershed Area as defined in Salt Lake City Ordinance 17.04.010, but the entire parcel is located within the Ground Water Source Protection Management Area of Emigration Improvement District's Upper Freeze Creek wells as defined in Salt Lake County Ordinance Section 9.25 – Water Source Protection.

Proposed Use

The applicant is proposing development that includes disturbance related to agricultural conservation projects, accessory structures for a permitted Agricultural use, and grading for an on-site private access road. The private access road is required to meet EC Code 19.72.080(A) stating, “Motor vehicle access to a building or development site shall be [within reasonable proximity of a] road (including private access road), street, alley, or driveway."

Agriculture is currently practiced on the entire 40-acre parcel as permitted under ECMT Code 19.02.090. The site is managed for perennial organic crops and livestock forage. Site disturbance and development will be limited to those structures and areas depicted on the FCOZ site plan. Conservation projects will adhere to US Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) Conservation Practice Standards (CPS). The applicant will receive Stream Alteration Permits from the Utah Division of Water Rights as may be required. All accessory structures will meet the requirements of the International Wildland-Urban Interface Code Class 1 ignition-resistant construction. The necessity of building permits will be reviewed by the MSD Building department for exemption of agricultural structures under U.C.A. § 15A-1-204(11)(a). No proposed structure is within 100’ of a property line.

Project phasing will be as follows:

Phase 1 (2025): CPS 584 – Channel Bed Stabilization (Part 1/2)
CPS 643 – Restoration of Rare or Declining Natural Communities (Part 1/2)
CPS 391 – Riparian Forest Buffer
CPS E384A – Biochar production from woody residue
CPS E612D – Adding fruit producing trees and shrubs to existing plantings
Bridge (ID NO. 5)
Slovenian Bee House 1/2 (ID NO. 9)
Greenhouse Building Pad (ID NO. 10)
Phase 2 (2026): CPS 584 – Channel Bed Stabilization (Part 2/2)
CPS 643 – Restoration of Rare or Declining Natural Communities (Part 2/2)
CPS 410 – Grade Stabilization Structures
CPS 612 – Tree/Shrub Site Preparation
CPS 612 – Tree/Shrub Site Establishment
Slovenian Bee House (ID NO. 7)
Lumber Mill Building Pad (ID NO. 11)
Phase 3 (2027): CPS 575 – Trails and Walkways
CPS 294 – Firebreak
Observation Deck (ID NO. 6)
Bridge (ID NO. 12)
West Homestead Barn Building Pad (ID NO. 8)

Disturbance from the 1,263 linear feet of access road and 5,205 square feet of structures will depend on Unified Fire Authority input, but will likely be under the one acre requiring a Storm Water Construction Permit and Storm Water Pollution Prevention Plan (SWPPP). A Sediment and Erosion Control Plan incorporating Best Management Practices will be provided at a later stage in the review process. No approvals in the form of variances and waivers are required or requested for this application.

Exhibit 11

E.C.C. 19.12.020 Permitted Uses

19.12.020 Permitted Uses

The following uses are permitted in the FR zones subject to compliance with all applicable requirements set forth in this chapter including those relating to site and lot dimensions, development standards, and other regulations:

A. Accessory uses and structures customarily incidental to a permitted use;

B. Agriculture, as defined in Section 19.04.020;

C. Home business, subject to Chapter 19.85;

D. Home day care/preschool for six or fewer children subject to the conditions set forth in Section 19.04.293;

E. Household pets, provided the area proposed for animals is not in a watershed area, primary water supply recharge area, or drinking water source protection area, as determined by the Salt Lake Valley health department or Utah Department of Environmental Quality;

F. Minor ski resort improvements, provided:

1. That the privately owned land areas on which such improvements are permitted constitute less than ten percent of the total land area utilized for the ski resort that the improvements support, and

2. That at least ninety percent of the land area on which the improvements are developed, operated, and maintained is on public lands, and

3. That the public agency responsible for the management and administration of such lands has previously approved a special use permit or similar regulatory authorization, and has assumed long-term administrative and enforcement responsibilities for such approvals, and

4. That opportunities for public notice, review, and comment on the proposed improvements have been provided through a finalized National Environmental Policy Act (NEPA) or other comprehensive public review and comment process, and

5. That such improvements are either:

    a. Essential to public safety, or

    b. Required in association with the reasonable repair or maintenance of existing legally established facilities and improvements, or

    c. Essential to the continuation or extension of improvements approved under the terms of a governmental land lease or use permit or by final action of the federal or state governmental agency with jurisdiction over the lands on which the improvements are located;

G. Residential facility for persons with a disability;

H. Single-family dwellings;

I. Wireless telecommunication facilities; provided:

1. The wireless telecommunication facility is a wall-mounted or roof-mounted facility, and

2. The facility is mounted on a nonresidential building, and

3. A computer-generated visual simulation of the proposed structure is submitted as part of the required site plan, and
4. All other applicable requirements set forth in Chapter 19.83, "Wireless Telecommunications Facilities," are satisfied.

(Ord. No. 1753, § III, 8-6-2013; Ord. 1597, § 3, 2006; Ord. 1535, § 4 (part), 2004; Ord. 1473 (part), 2001; Ord. 1454, § 3 (part), 1999; Ord. 1452, § 5, 1999; Ord. 1417, § 5 (part), 1998)

HISTORY
Adopted by Ord. 18-06-02 on 6/28/2018

19.04.020 Agriculture

"Agriculture" means the tilling of the soil, the raising of crops, horticulture and gardening, but not including the keeping or raising of domestic animals or fowl, except household pets, and not including any agricultural industry or business such as fruit-packing plants, fur farms, animal hospitals or similar uses.

(Prior code § 22-1-6(2))

HISTORY
Adopted by Ord. 18-06-02 on 6/28/2018

Exhibit 12

E.C.C. 19.02.020 Purpose of Provisions

19.02.020 Purpose Of Provisions

This title is designed and enacted for the purpose of promoting the health, safety, morals, conveniences, order, prosperity and welfare of the present and future inhabitants of Emigration Canyon Metro Township, including, among other things, the lessening of congestion in the streets or roads, securing safety from fire and other dangers, providing adequate light and air, classification of land uses and distribution of land development and utilization, protection of the tax base, securing economy in governmental expenditures, fostering the Metro Township's agricultural and other industries, and the protection of both urban and non-urban development.

(Prior code § 22-1-2)

HISTORY
Adopted by Ord. 18-06-02 on 6/28/2018