

Village Micropark Place Design and Development Plan

For The Town of Gray, Maine



Route #115/ 5 Yarmouth Rd/ Greenleaf St/Hancock Block/Gray Corner

Tax Map 43, Lot #405.23

Latitude: 43.885358° (43°53'7.28792"N)

Longitude: -70.329746° (70°19'47.08415"W)

Elevation: +308 ft

Magnetic Declination: -15.12°

Prepared by:

Rachel Lyn Rumson
207Permaculture.com
8 George Perley Rd
Gray, Maine 04039
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Introduction	5
Background	5
Design Goals	5
Motivations	5
Document Review	6
Site Analysis & Assessment	7
Site History	7
Climate	8
Water	12
Vegetation and Wildlife	13
Sun	14
Assets & Challenges Summary	14
Essential Strategies	14
Water in the Landscape	15
Soil Building	15
Design Options and Considerations	18
Built Environment	18
Plant Communities	20
Suggested Design Implementation Sequence	21
Project Management Tables	25
APPENDIX A: A Sample of Survey Data	29
APPENDIX B: Soil and Paste Report	31
APPENDIX C: Rain Barrel Specifications & Ordering Details	33
APPENDIX D : Organic & Biological Material Sourcing	35
Organic Material Sources	35
Plant and Seed Sources	35
APPENDIX E: Sheet Mulch Recipe	37
APPENDIX F: Sheet Mulch & Tillage Comparison	38
APPENDIX G: Conceptual Plan	39
APPENDIX H: Permaculture Principles	40
APPENDIX I: Storm Brick & Edge Restraint Specs	42

APPENDIX J: Earthworks Plan	43
APPENDIX K: Detailed Budget Estimates for Key Built Features	44
APPENDIX L: Design Plant List	46
APPENDIX M: General Maintenance Plan	49

Introduction

Background

In Fall of 2019, members of the Gray Community and Economic Development Committee (CEDC) included this site in their village beautification targets. They sought immediate restriction of passthrough traffic on the site and a conceptual plan. The Town Planner led the first site walk in October 2019. Members of the CEDC and community stakeholders from The Congregational Church and Gray Historical Society were in attendance. Ideas for the site that emerged then were: green space, public seating, parking, pollinator gardens, a pantry garden, edible landscape, tree canopy, and hedgerows for screening traffic, wind and dust.

Subsequently, we reviewed documents including those of plans drawn up by other developers for the location, the Project Village Canopy, the Comprehensive Plan, and the property's history and consulted with the Public Works Director. Passthrough traffic at the location was causing a debris hazard on 115 West/Yarmouth Rd and the fencing was being considered as a solution.

An initial draft conceptual plan was presented to The Town Council in December. With their feedback on features in the park, the conceptual plan was approved to proceed, with public engagement, and grant applications. The project was funded through a Community Development Block Grant awarded in February of 2020.

Design Goals

The design goals for this site are to create a place of natural and local interest. A common gathering place for the community and travelers alike where people can convene. It provides a positive outdoor space with shelter in the middle of Gray. It is a vegetative buffer from the traffic and asphalt. Birds forage and people picnic there. Visitors grab a stretch, take a stroll, or have a conversation.

The CEDC's original goal statement was a prominent spot in the village center, it should be a positive outdoor space, beautiful, welcoming, accessible, sheltered from traffic, safe, shaded from the sun and sheltered from the traffic. In the context of trends in the region, it should have edible landscape features, restore the tree canopy, and retain all stormwater, provide pollinators with a diverse supply of nectar, and encourage community engagement through implementation, maintenance and enrichment activities.

Motivations

This conceptual plan and narrative attempts to achieve our design goals by using a dynamic ecological design process known as Permaculture Design. This approach allows for participatory design in refining the goals, connecting with stakeholders in the community, choosing an aesthetic for various features, and integrating public safety measures.

The chief motivation for this permaculture design was to beautify the Village Area, starting with the abandoned lot. It is more than a beautification effort; it is about building soil together and building community.

Document Review

There were several documents reviewed in the pre-work stages of design. In 2013, there was a conceptual plan drawn up for the Hancock Block, where this site is located. One of the notable themes presented was that the property owners on the block wanted more parking and green spaces. Project Village Canopy, done in 2009 also was reviewed. It established a goal to increase the canopy trees in the village, and maintain others. Adding to the Village Area tree canopy is desirable as is engaging more people in municipal forestry projects. Finally the Comprehensive Plan highlights improvements to the Village Area including investments in public spaces.

Public Engagement & Participation

Public process has included three publicly announced site walks, one public participatory public design workshop, stakeholder interviews, and a survey. (*See Appendix A for A Sample of Survey Data.*) At site walks, several abutters attended, as well as council members and planning board members. The Town Planner sent notice broadly in the surrounding community. After the pandemic lock-down, the CEDC launched Gray Birdhouse Project and decided to add the community art installation and bird habitat into the plan, raising public engagement greatly.

There were four Planning Board meetings attended for the project and two engineer Peer Reviews on initial conceptual plan. Conditional approval was granted on basis of an engineer's stamp on the stormwater retention plan. (The plan was stamped in March 2021.) Site work begins in April of 2021. There were also four consultations with the Public Works Director. Many volunteers and departments in the Town are engaged as well.

In May, CEDC volunteers are hosting a community hands-on educational and community-building event to transform the site in a day with the assistance of regional interest groups. Collaboration between The Planning Department, Gray Historical Society, Public Works, Solid Waste Management, Gray Rec, Gray Fire and Rescue, The Resilience Hub and Cumberland County Soil & Water Conservation District informs this development plan. In kind donations were also received from Machino's Lumber, Whitney Tree Service, Cumberland County Soil and Water District and private citizens. Implementation of Phase one and Two of the plan would not happen without these partners.

Site Summary



The site is a 0.3-acre lot in Gray, Maine. It is one-quarter of a mile from the Maine Turnpike I95 and is surrounded by traffic, parking lots, and businesses. The plot was formerly a residence that was raised, however; all foundations and vegetation have since been removed. The parcel of land is situated in the Hancock Block in the Village Historic District. It is in a census designated area where 56% of the 803 residents in the tract are low/moderate income households.

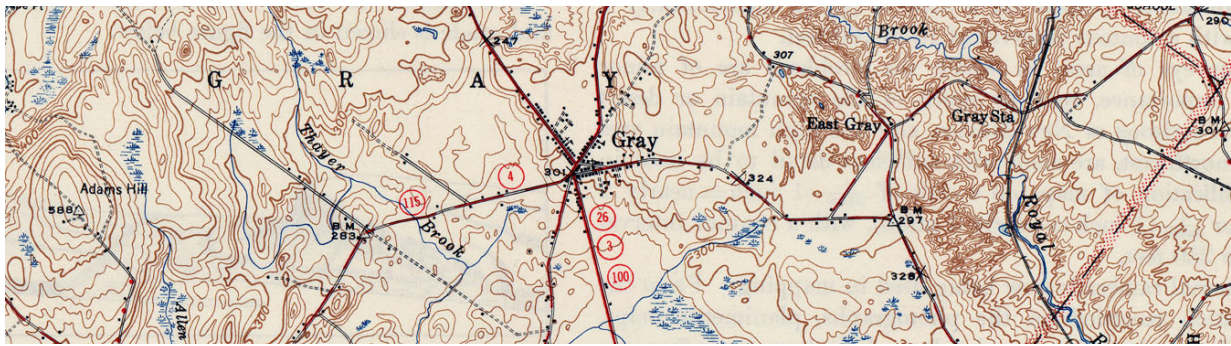
The site is situated approximately 300 feet above sea level and was cleared and graded within the past decade. It is relatively level today, with pits from erosion and vehicle pass-through. The lot is exposed to heavy solar loads, weight loads, and strong winds. The ground is compacted and desertified. Airborne dust is a nuisance to neighbors and road debris, a hazard to drivers on 115.

Site Analysis & Assessment

Planning a permaculture design requires that we learn to “read the land.” Reading the land for this design took a year and many different people’s observations and knowledge. Permaculture is said to be information and imagination intense. This section will cover the information-intense part. Initial recommendations are included however, the imagination-intense part will follow; practical ideas for how to transform this abandoned lot into a community treasure, and a regenerative place that are vetted by various approaches to public engagement.

Site History

Located on land indigenous to the Abinaki people. Colonial speculators were granted land on March 27, 1736 by the Massachusetts General Court to a group from Boston. The first settlers arrived in the spring of 1738. The settlement was attacked in the spring of 1745 by Indians and resettled again in 1751. The town had been without a name until about 1756, when it began to be called New Boston. On June 19, 1778, New Boston Plantation was incorporated as Gray after Thomas Gray, a proprietor.



This area, commonly known as Gray Corner, is located in that center of Gray, and is zoned as the Gray Village Area District. Gray Corner has been a hub for regional traffic for 200 years. The spokes of that hub are Route 26 and Route 100 corridors running north and south, and intersection with Route 202 and Route 115, east and west. In the 19 Century the village was a staging area with amenities abundant for commercial parties. Trucking has outmoded horse and oxen, but transport of forestry, sand and gravel products though Gray has stood the test of time.

There was a narrow gauge railway connecting Portland and Lewiston/Auburn called the Interurban that sat running a quarter of a mile from the corner. The site was home to Gray's first retail store and first U.S. Post Office and survived the great fire of 1921.

Climate

Average Annual Precipitation: Average annual precipitation is 48 inches/year and the average monthly precipitation is at least 3.5 inches/month throughout the growing season. On average, there is a lull from July to August ranging from 3.31 to 3.15 inches each month (All of which can fall in a single rain event, and more).¹ [1]

Each year there is more than 244,236 gallons of rainfall on the site, not including the impervious services up-slope that may drain into it. In a 100 year storm of 6 inches of rain, which we have seen twice in two years in Gray, 54,254 gallons of rainwater can fall. More rain over less time is the precipitation trend forecasted by Maine Climatologists.

Initial recommendations and considerations for the site include:

- Irrigation will be necessary in average years to establish plantings. Both increasing water storage in the soil and adding rain barrels will benefit installation and maintenance. Harvesting rainwater during warmer months will support plantings with minimal cost.
- It is necessary to plan for the likelihood of increased variation in precipitation conditions given forecasted climate chaos. Stronger and more intense rainstorms in shoulder

¹ From <https://www.usclimatedata.com/climate/brunswick/maine/united-states/usme0056>, accessed Sept 31, 2019.

seasons, as well as longer and deeper droughts in the middle of the growing season, are both likely in this region. This site must be designed for increased holding capacity, drought tolerance, and erosion control. Earthworks such as swales, cut slightly off contour, are recommended as well as improving organic matter content in soils and using layers of organic mulch.

- Design for increased runoff retention/purification/infiltration on this site.

USDA Plant Hardiness Zone: 5b (-15 to -10F).²

Arbor Day Plant Hardiness Zone: 5 and 6 (0 to -20F).³

The site is close to a solid, consistent zone 6. The design must be prepared for a general warming trend in the future with punctuated cold events. As Casco Bay warms, the zone will become a 6b-6a.

Average Annual Wind Speed: 7 mph.⁴ Peak wind gusts in the spring months of March and April are 6 mph prevailing north-northwest (337 degrees^[AE1]) on average.

Prevailing Winds: A nearby data source indicates prevailing winds are north-northwest.⁵ Strongest wind gusts are from the northwest from December through March. However, in October 2019, the site saw the sixth strongest wind gust since records began. Warm summer winds tend to be southerly during the growing season.⁶

- Current windbreak protection for this site consists of the building on the northwest. The north is unprotected. This is a concern for fruiting trees in the winter. While being established, trees will need support. Wind speeds may accelerate through and around the buildings.
- Area topography suggests no significant elevation changes are nearby to protect this site from strong gusts. Wind-sensitive crops, especially fruits, should be carefully placed and not left unprotected.
- The site contributes greatly to excessive dust in the surrounding environment. Design for soil wind erosion protection is urgent. Cover crops, and a seven-layer forest system are recommended.
- The site is not well protected from strong summer winds either.
- Traffic is intense at rush hours, and throughout the business day. Air flow is good coming from forested parts of Gray and fields at Pennell, mitigating the collection of fumes on site. Dense vegetation, berms and tall hedges will further protect inhabitants from traffic gases.

² From <http://planthardiness.ars.usda.gov/PHZMWeb/#>, accessed Sept 31, 2019.

³ From <https://shop.arborday.org/LookUp.aspx?nursery=false&zipcode=04093>, accessed Sept 31, 2019.

⁴ From <https://www.timeanddate.com/weather/usa/portland-me/climate>

⁵ From <https://www.erh.noaa.gov/avnclimo/index.php?tab=State>, accessed Sept 31, 2019.

⁶ From <https://www.wcc.nrcs.usda.gov/ftpref/downloads/climate/windrose/maine/portland/>, accessed Sept 31, 2019.

Landform and Boundary

Ecoregion: The site sits in an urban environment. The tree canopy has been significantly reduced by development, to the north of the site. Gently rolling irregular plains and a scattering of shallow lakes, hills and forest stands nearby (and throughout central Maine) have an average elevation of 300 feet. They are formed by Maine sedimentary rock,⁷ and an extensive covering of glacial till and outwash plain deposits.⁸

Parent material is mostly sand; Glacial Flattop. To the south coastal marine forest, clay flats, and flood plains in lower elevation, and is Casco Bay. Underlying bedrock and sand play a role in the character of the region with ledge poking out of topsoil and vast sand deposits that are currently mined.

Elevation: According to historical USGS maps (1898, 1913, 1927) the site elevation is 300 feet. The land rises toward Collier Hill, a 400 foot elevation, one half mile northeast of the site. The range of elevation in the area is 200 to 560 feet above sea level.

Plot Slope Aspects: Relatively flat field topography on the plot area however, there are two trends influencing the flow of water in the space. The dominant trend is a .6% grade rising to the west toward the Town of Gray Municipal Parking. The run is 65 feet and the rise is 13 inches. (Impervious surfaces there drain away from the plot to storm drain.) There is a secondary trend rising to the northeast corner of .3%, where the run is 40 feet and the rise is 7 inches above the lowest.

Plot Soils: Initial research showed that soil surveys in the past ruled the site favorable for septic construction. A pit test was performed by Geologist, Mark Cenci in March of 2021. The soil type is silty sand. The water table was not found at 10 feet. Percolation rates in that soil type are sufficient at 1/10 inch/hour.

The soil is severely compacted, without a compaction meter reading, it is estimated to be between 200 and 300 psi.

- Drilling through the compaction is strongly recommended, avoiding the foundation zone.

The plot soil has extremely low fertility. There is visibly no organic matter in the soil to support plant life. Wind erosion and rain are visible. There is marginally better biology in the soil around the silver and sugar maples near the site where mature canopy trees and understory sapling and shrubs exist to feed the soil biology there. The species of Black Locust and Autumn Olive

⁷ From <http://www.maine.gov/dacf/mgs/explore/bedrock/faq.htm#q3>, accessed Sept 31, 2019.

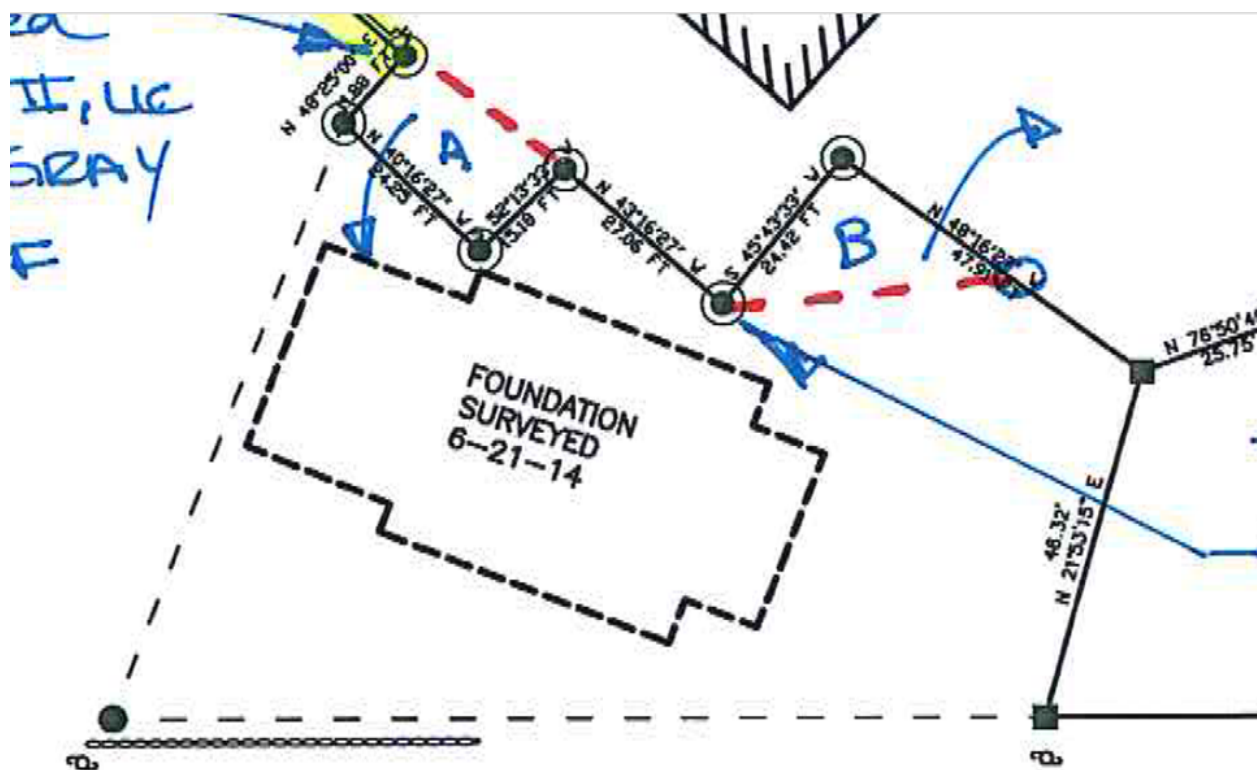
⁸ From <http://www.landscape.org/>, accessed Sept 31, 2019.

provide nitrogen fixation to the nutrient cycle in one of these corners. A biological soil testing was not conducted.

BioNutrient Assessment: A soil test was performed by Logan Labs, LLC (See Appendix B for the Soil and Paste Reports). Findings reveal the following:

- There is lead in the soil. Edibles should be limited to fruiting crops. Leaf crops may contain lead if grown here. Fruit and nuts will not uptake the type of lead in this soil.
- There are low levels of exchangeable cations, for calcium and magnesium, which is expected with the level of compaction on the site. Potassium is also reading very low but that will change with biological activity.
- The soil is slightly too acidic for aerobic bacteria to thrive; ideal for anaerobic bacteria and disease causing fungus. Soil priming is a good idea in the early Spring, just as soils start to warm and soil prep is being done. Another time to consider soil priming would be during the growing season when plants need more nutritional support from the native soil microbial community. A fall application is also recommended. Soil biological priming can be a combination of a carbon source, an inoculant, and biostimulants.
- Nutrient cycling is impeded by a lack of carbon and active bacterial, fungi and plants that use it. Adding significant amounts of organic matter in the form of compost and a biochar is recommended. Thick mulch layers (sheet mulch) are recommended to enliven the soil and increase its productive capacity. Leave no earth surface uncovered.
- When planting, the holes should be dug 3-5x bigger than usual for amendments to be added with the root ball. Bare-root plant material should be used, as much as possible to avoid root binding in the planting holes.

Boundary: The north boundary line for this plot was uncertain in a search of deeds. Abutter, Advantage Realty, Inc met with the town to propose drawing a new line equitably as possible. The proposal was accepted by the Town Council in 2020. Red lines below show the new boundary. The abutter is hiring a surveyor to reset the markers in 2021.



This image also reveals the subsurface foundation at the site. This structure presents some challenges to planting trees.

Water

Watershed: This site is part of Gray Water District's Wellhead One zone, and it drains into the Presumpscot River watershed and Casco Bay, ultimately and the Thayer Brook more locally. Thayer Brook is documented to have low oxygen as of 2020 (Cumberland County Soil & Water District reported this to the Town Council October of 2019).

- The land is very dry; desertified. It sits unprotected from the sun and wind all day. Moisture will evaporate and or percolate rapidly.

On-Site Water Resources: There is not a well on site nor a water meter presently. The design should maximize the slight trend of the plot for maximum spread of rain water collection, sending none as run off to Thayer Brook. Rainwater harvesting, permeable structures and heavy mulches are suggested.

Initial recommendations and considerations for the site include:

- In the near term, place a 275 water tank on site for installation and maintenance in the short term. Have it filled by Gray Fire and Rescue.
- In the long term, place rain barrels to support irrigation and plant stewardship.
- Earthworks are needed to break up compaction on the site.

- Mulches with high carbon content will increase the capacity of soils to hold moisture for drought resistance and increase exchange capacity.
- Three secure 200-gallon rain barrels 6 - 12 inches off the ground in the shade, are recommended to establish and maintain vegetation.

Vegetation and Wildlife

Potential Natural Vegetation: This region was historically dominated by a combination of Central Interior and Appalachian, Laurentian-Acadian Floodplain Forest. There is some combination of silver, red and sugar maples, green ash, American elm, black willow, pines, aspens, spruces, balsam fir, eastern hemlock, alder, and transition hardwoods. Due to climate change, this region will transition to a hardwood forest of predominantly hickory and oak. Pines and maples will suffer due to changes in climate and precipitation.

Existing Vegetation

There is largely no existing vegetation on the site. However, there is an existing single senescent silver maple standing over the West property line. Two sugar maples to the Northwest canopy the site from an adjacent lot and one Norway maple on the East^[AE2], with aspen, beech, autumn olive, and black Locust in the understory. There is an active fungal layer. Nearby properties feature black locust, linen, mountain ash, some conifers, lilacs, and rhododendrons to the south. Rosa rugosa shrubs are also in the neighborhood.

Next steps and thoughts include:

- Add plantings in all seven layers of the forest garden. Canopy and understory trees, shrubs, herbaceous plants, vines, and groundcovers will transform this site into a sanctuary for humans, pollinators, and wildlife.
- Using vegetation that is already present in the landscape nearby would create some continuity with the surroundings.
- The site could make use of the locust that is there for a natural visual screen for traffic. Locusts can also be managed to yield very rot resistant pole material on a 5-year cycle as well (Locust has the highest BTU rating as well and is under utilized regionally due to the hardness after it has been cut). Using vegetative screening from traffic will improve seating as well.

Pests/Varmints: We did not observe any pests or varmints, however there are rat traps set on the nearby property. The resident hawk is a notable predator in the area. Also, as urban as it is groundhogs, foxes, sea birds, squirrels, mice and voles may live in the area too. Protection from these animals will ensure plants are established. Protections from humans is also a consideration. Anaerobic bacteria and fungi are likely to be present as well, which could threaten the establishment of new plants.

- Make every effort to aerate and inoculate and feed aerobic soil bacteria and fungi. M
- Add mycorrhizal spores to all new plantings.

- Wrap new trees in the fall to protect them from mice that would girdle them.

Sun

There is good sun exposure during the summer – approximately 10 hours. Throughout the winter months, there is 6-7 hours of sun exposure. In the fall and spring, eight hours of direct sunlight hits the plot. From early morning to late afternoon, the site is in full sun and has a hot and dry microclimate.

Initial considerations regarding sun on this site include the following:

- Watering needs to occur in the morning or evening during the summer.
- Provide shady options for seating applications.
- Install photovoltaics for lighting, and for a electric vehicle charging station

Assets & Challenges Summary

Site Assets

- Solar window of 10 hours of sun in the summer
- 47 - 50 inches of rain each year
- Low water table; good drainage
- Existing Canopy Tree (Silver Maple)
- Integral Village location
- Historical significance

Site Challenges

- Soil compaction
- Lack of vegetation, Low fertility; no nutrients cycling
- Bare Earth + quick drainage = Wind erosion
- Minimal topographical variation
- No irrigation sources on site
- Demolished house foundation 24 inches below the surface.

Essential Strategies

In our assessment, the challenges pose a significant barrier to ecological restoration of this site. Essential strategies to restart the ecological capacity of the site so it can sustain a revegetation effort are: 1) restoring a hydrological cycle 2) Surfacing bare Earth with organic matter, such as compost and woodchips but also layers of mulch that will decompose in place, and 3) injecting aerobic liquid, biologically-complete, soil amendments to rebuild the soil structure, and make the nutrient cycle possible 4) plant for biodiversity, 5) inspire the public to support this work and to learn how to replicate it until it is a development imperative for the town.

Water in the Landscape

Earthworks: This is landwork, to change the local topography to support hydrologics that will support life.

- Carve shallow swales in the compacted soil in a “rib” pattern, on contour with the .6 grade slope, running east to west. This will spread out the flow of rainwater, and allow it to slowly sink rather than rushing to the lowest point in the landscape. This will increase the chances of success in re-vegetation.
- Excavate planting holes 3’ deep and fill with compost to over-winter before planting in the spring. Use displaced Earth to build a berm that will retain all rainwater on site, and protect the place from road salts and particulates. Plant it densely with diverse perennial forest layers in the spring.
- Construct a permeable structure for subsurface rainwater storage in the event of a 6” rain event. Add this displaced material to the berm as well.
- Drill holes every 12 - 18” in planting areas, inject with compost and aerobic biology to increase the capacity of the ground to hold water.

Rain Barrels: Harvest rainwater for use in drier times, especially during the establishment years. Use the impervious surface of a shelter to direct the water to the barrels. Rain barrels are essential to the irrigation system, where humans can steward the place and serve the commons. (See *Appendix C for Rain Barrel Specifications.*)

Revegetation: This is the term that is common to municipal planning. It is used to describe the process of making an abandoned lot into green space, or a lot cleared by development into a landscaped space. This is not a term commonly used in permaculture design. To revegetate does not capture the regenerative ethics of permaculture but the closest translation is to transform a highly disturbed ecological system into a healthy socio-biome. That is a fancy word for increasing plant and soil biodiversity and cycling nutrients in a way that is grounded in awareness of a human dependence on having these living systems intact.

Soil Building

Organic Materials Depot: Locations must be designated for a material depot for community-build events. Ideally, this location will be strategically placed to avoid moving materials before they can be used. The material depot will accumulate piles of bulk organic materials such as wood chips, compost, seaweed, leaves, cut grass, manure, coffee grounds. (See *Appendix D for Organic and Biological Material sourcing.*) Ongoing material storage can be compost bins.

Sheet mulching: Increase organic matter with the sheet mulching method. This can be done in 28 to 32 inch thickness in patches. Layer materials directly on the ground, and cut into it to plant, adding compost and mycorrhizae to the planting holes. (See *Appendix E for Sheet Mulch Recipe and Appendix F for Sheet Mulch & Tillage Comparison.*) Done in the fall, you can plant into it in the spring directly. Done in the spring, add at least 4 inches of compost to the sheet mulch.

Biostimulants: Apply 4 inches of mixed compost and straw to all uncovered areas. Seed these areas with a diverse, inoculated cover crop. Red and White clover, Lacy Phacelia, Buckwheat, Mustard, Sea Oats.\ and Sudangrass.

- Injections of Bio-Complete Liquid Amendments (Compost tea) into the planting holes once a month for three months in the Spring and again in the Fall are recommended.
 - Foliar sprays are also recommended for trees and shrubs, on the same schedule.

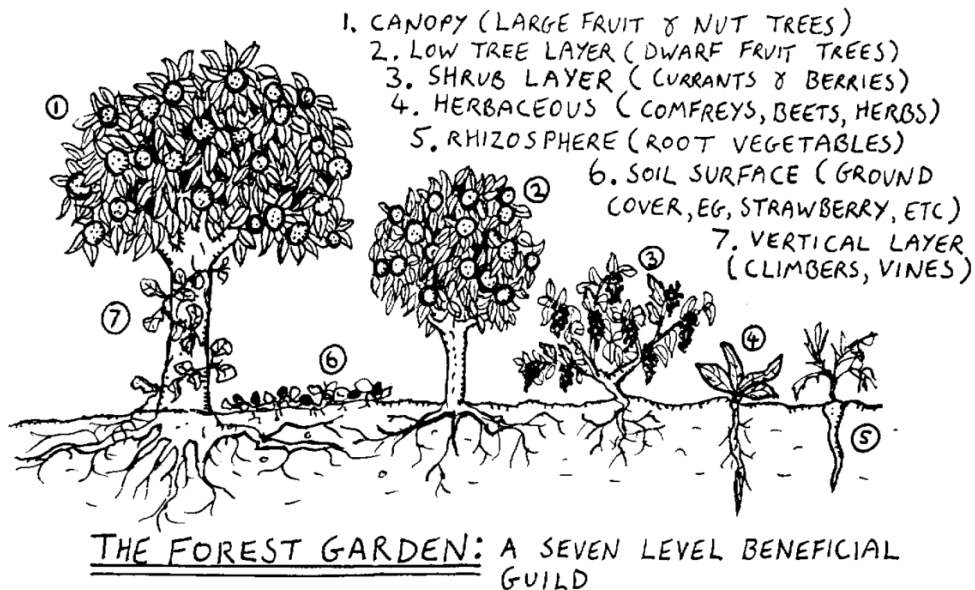
Soil Amendments: The site is approximately 13,100 square feet. Some soil mineralization will occur naturally with the introduction of organic matter and addition of a diversity of densely-planted plantings. Compost, seaweed, coffee grounds, goat manure, wood chips and cardboard are suggested. Apply these using sheet mulch method for all growing areas. (See *Appendix I for Sheet Mulch & Tillage Comparison*). *Additional strategies are as follows:*

- Add compost to planting holes and sheet mulches except the road side of the berm.
- Injections of Bio-Complete Liquid Amendments (Compost tea) into the planting holes once a month for three months in the Spring and again in the Fall are recommended.
 - Foliar sprays are also recommended for trees and shrubs, on the same schedule.
- Thick mulch layers are recommended to enliven the soil and increase its productive capacity, through increasing carbon rich biomass and organic matter.
 - Apply sheet mulch around all tree areas, and garden beds, except the road side of the berm. On the berm thick compost and dense plantings, and liquid biological amendments.
 - Apply 4 inches of mixed wood chips on all uncovered areas that are not garden beds such as seating areas and access paths. Apply low cover crop seed such as white clover, creeping thyme and low-mow grass to paths. Red clover and buckwheat to the edges.
 - Add compost to and planting holes, and sheet mulches.
- Apply 15 to 20 gallons of diluted compost extract or EM1 to the site in the spring and apply bio-complete compost to the space in the fall.
 - Inoculating all municipal compost with these products as well as anaerobic bacteria will be dominant in this compost product.
- Avoid all water soluble fertilizers as they will turn to salt and result in anaerobic conditions in the soil.
- The following dry mineral amendments are recommended. Blend these with 100-200 pounds (25-30 gallons) compost. Broadcast evenly over the 6500ft. This application can be applied again in the fall or lightly as a side dress during the season. :
 - 70 lb gypsum
 - 5 pounds epsom salt
 - 1 pound solubor or borax
 - 25-50 pounds basalt
 - 25-50 pounds carbonatite
 - 15 humates

Polycultures: Group plants into polycultures that will include Nitrogen-Fixing plants, Dynamic Accumulators and fast growing Green mulches.

- “Nitrogen-fixing” (Nx) plants use a biological process to capture Nitrogen (N₂) from the air deposit in roots in a mutualistic relationship with a species of bacteria that make it available to the soil-food web. Consider Pea shrub, lupines, seaberry, red clover, black locust and birdsfoot trefoil. Nature will tend to fill this niche with vetch, field pea, sweet fern, locust and clover. There are black locust and autumn olive volunteers on site now. Maintain these trees and shrubs for their mutualistic relationship with soil bacteria.
- “Dynamic accumulator” (DA) plants have deep roots and draw trace minerals from the subsoil to the surface for nutrient cycling. They also can push through moderate compaction. Comfrey, dandelion, and daikon radish are considered. Nature will tend to fill this niche with docks, dandelions, plantain, and wild carrot. It is recommended to leave the leaf drop from these plants on the ground to assist in soil development. There is queen anne’s lace on site, that is a dynamic accumulator as well.
- Fast-growing “green mulch” plants are recommended as ground cover in early succession while other plants are being established, to provide simple carbohydrates to the microbiome of the soil. They can also be added to thermophilic (hot) compost to feed microbiology in the pile. Buckwheat, rye, oats, bulbs, and alliums grow fast in Zone 5. Green mulch may also fill in areas between plantings.
- “Pest Confusers” is another category to include in your polycultures. The allium family, fennel, dill and daffodils are all in this group.

Layers of the Forest Garden: Develop a plan for revegetation that will include the seven layers of the Forest Garden to maximize space for biodiversity. *(Image credit: Wikimedia Commons).*



Design Options and Considerations

Outlined below are several design options and considerations. These options are informed first by the permaculture ethics: Care of Earth, Care of People, and Fair Share. The first two are straight forward but the third ethic can be better understood as sharing the surplus and knowing the limits. All the ethics are in play in these design ideas. (See *Appendix G for the Conceptual Plan.*)

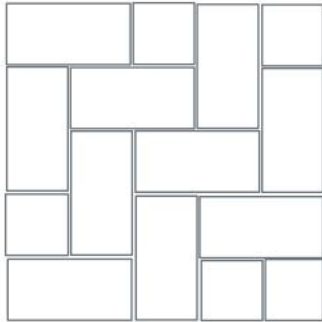
Biomimicry is another lens used to inform this design. Biomimicry is a principle of design in the permaculture approach where the designer works from patterns to details; noticing patterns in nature and setting up systems to reflect those patterns. In this way Nature is the teacher, the designer is the learner. There are many principles in permaculture design that stem from the protracted observation of nature, and the ethical imperatives. The principles that are expressed in this design are: 1) Integrate Rather than Segregate, 2) Manage the Edges, 3) Harmonize with Nature, 4) Strive for Diversity, 5) Stack Functions, and 6) Produce No Waste. (See *Appendix H for The Permaculture Principles.*)

Built Environment

Permeable Parking/Patio: This entire site is a rain garden. Like a traditional rain garden, this site will hold excessive rain water on site to passively irrigate plants. What is different is that there is a hardscape instead of trenched Earth. This design feature keeps the space habitable, and not muddy, or impassable. With capacity for 2 cars to park side-by-side and a picnic table, this

design stacks the functions of a rain garden to eliminate runoff, and provide drought resistance, this design also functions as an access point on 115, parking for two cars with room to turn around, and a resting spot for humans.

This design is built for a 6" rain event; or the "100 year storm", according to the Federal Emergency Management Agency. This structure is level to grade and 30' x 30'. Aroma Joe's has donated a picnic table for it (and one for the pavilion). The subsurface area reaches 13"



below grade and is 40% void. Base materials are selected for the least amount of fine particles as possible. The surface pavers are locally-manufactured paver called "stormbrick", designed for this application. Bricks are laid in a herringbone pattern on a 1" bed of Aqua Rock, with Aqua Rock filling the cracks. There is an apron that rises 1% above grade to keep road water from entering the system. Use an aluminum edge restraint to separate wood ship and stone work (See Appendix I for specifications on Stormbricks and Edging.)

This feature of the design was a sticking point for the Town's Planning Board. Even after Peer Review and a letter from Cumberland County Soil and Water Conservation District saying it was state of the art, a model design, there was scepticism. Fortunately, the Planning Board accepted the design contingent on an engineer stamping it. Terradyne Consultants provided that stamp in March 2020. (See Appendix J for the Earthworks Plan with Engineers Stamp.)

Roadside Berm: The addition of a constructed berm is the feature that, integrated with the Silver Maple Polyculture, begins to define a 'positive outdoor space' at the center of the site. Area buildings on the block add to this feel of an outdoor "room" for this commons.

The berm runs east to west and as such will have a cooler, moist north side inside the park, and a dryer, hotter south side facing the road. The berm is planted on the moist side with a long, living Willow fence, shade tolerant ground covers, like Creeping Thyme, and Red Clover. On the top there are Munstead Lavender, Common Sage, and Heathers, and on the down slope of the outside of the berm are Rosa Rugosa, Lupin (Nx), Daylily, Narcissus. Inter-planted among them are low-habit flowers like Calendula, Forget Me Not, Borage and Yarrow (Nx). The berm will both insulate the area from traffic, and invite the public passing by into the place.

Pollinator Pavillion: This timber-frame structure has a shed roof with cedar-shingles. There are Kolomikta Kiwi vines climbing it on the sunniest side, and rain barrels, on the back to harvest rainwater. This sheltered area is a rest-stop. It



has seating underneath and faces the diverse Pollinator Garden.

On one side is the mini-orchard and on the other the main entrance with a scattering of boulders facing into the structure. The area underneath is covered with a heavy mulch of wood chips seeded with White Clover and Red Buckwheat. There is no hardscape for the pavilion in this design as the pavilion is not located on a site suitable for performances. There is a low-mow grass blend seeded between the pavilion and the pollinator garden as well.

In the future if there is a source for electricity, a conduit can be run under the main access path to the back post of the timber frame, where a secure outlet could be installed.

Plant Communities

Revegetation is a term that is commonly used in municipal planning. It is used to describe the process of making an abandoned lot into green space, or a lot cleared by development into a landscaped space. This is not a term commonly used in permaculture design. To revegetate does not capture the regenerative ethics of permaculture but the closest translation is to transform a highly disturbed ecological system into a healthy socio-biome. That is a fancy word for increasing plant and soil biodiversity and cycling nutrients in a way that is grounded in awareness of a human dependence on having these living systems intact. For a complete plant list, see Appendix L: Design Plant List.

Silver Maple Polyculture: The area of ground surrounding an existing Silver Maple, on the southwest corner of the plot, includes parts of the berm structure and the main entrance to the commons. The area to the south of the tree will be a densely-planted edge with a wildness to it. Careless foot traffic will be discouraged by the thorns on the black locust. The area north of the tree will have a welcome sign, at the head of an access path into the commons, a small “four-door” tool shed, and a Gray Historical Society marker.

In addition to the 250 year old Silver Maple, that has seen all of Gray’s history, there are several Black Locust (Nx), two Autumn Olives (Nx), a pine sapling, a senestant alder and grasses existing in this intact polyculture. We are adding a mix of Serviceberry, Beach Plum, Sea Kale, Rosa Rugosa, Lupins and Asters to this in this polyculture.

- In the future, if either a water meter or a gridded electrical drop is sought, this area will need to be disturbed so plantings are placed in consideration of that potential.
- To make space for the berm construction, we have removed a few of the Black Locust.

Shagbark Hickory Polyculture: A slow-growing, nut-bearing canopy tree, this Shagbark is meant to serve as a future shade provider, in the new climate reality. This polyculture, located in the central area of the southern boundary, includes a large section of the built berm in the south section of the tree’s drip edge, and the mini orchard and built pavilion/shelter on the north edge. We are adding this tree to the landscape and the understory plants including Kolomikta Kiwi, Asian Pears, a Peach, a living Willow Fence, many heat tolerant pollinators plants, cover crops, dynamic accumulators, fast growing allium and bother herbaceous-layer plants. There will be seating in the pavilion.

Pollinator Garden: Covering the north edge of the main access path through the park and stretching to the north boundary, there is a large pollinator bed, with all seven layers of the forest garden. We are adding Serviceberry, Hawthorn, Peach, Chokecherry, Tansy, Blue Vervain, Dill, Coriander, Coneflower, Hyssop, Camomile, various Allium, Red Yarrow, Beebalm, Daylilies, Poppies, Red Clover and LemonBalm. Bulbs of Dahlia, Tulip and Daffodil will also grace this garden. On the West end of it is an ADA accessible landing pad for the Gray Historical Society with some seating. On the east side there is a small chess table and two chairs, flanked by a low hedge of Lingonberry. Eventually, if there is a path connected to a Brown Street Crosswalk at McDonalds, this lingonberry alley-area will access that connection for foot traffic.

Edible hedges: There are hedges flanking the parking area featuring Blueberries, Seaberries and Nannyberries, in addition to the fruit trees in the mini-orchard.

Historical Markers: Gray Historical Society has a history-walk project and will place several podium-style markers in the park. These markers will feature some history about The Fire of 1921, The McLellan House, The homes of Greenleaf, and the First Parish House. There is also a seating area that has American's with Disabilities Act compliant access and an adjacent handicapped parking space in the Municipal Parking Lot that is adjacent.

Gray Birdhouse Project: The Gray Birdhouse Project is a community art installation and social permaculture feature in this design. A colorful birdhouses village will be located in space. The place-making project, organized by the Community and Economic Development Committee celebrates community connection and promotes wellness in Covid-times. Community-members are decorating unfinished birdhouses to be included in the installation.



"Many community activities were brought to a halt in 2020. The Gray Birdhouse Project recognizes that something was lost that is hard to describe. Friends we only saw at community events were missed. We miss cheering at sports events together, joining crowds at festivals together, going out to eat and worshipping together. The time of social distancing has been hard but the community will make their inextricable connection to one another visible with the Gray Birdhouse Project." - Gray Birdhouse Project

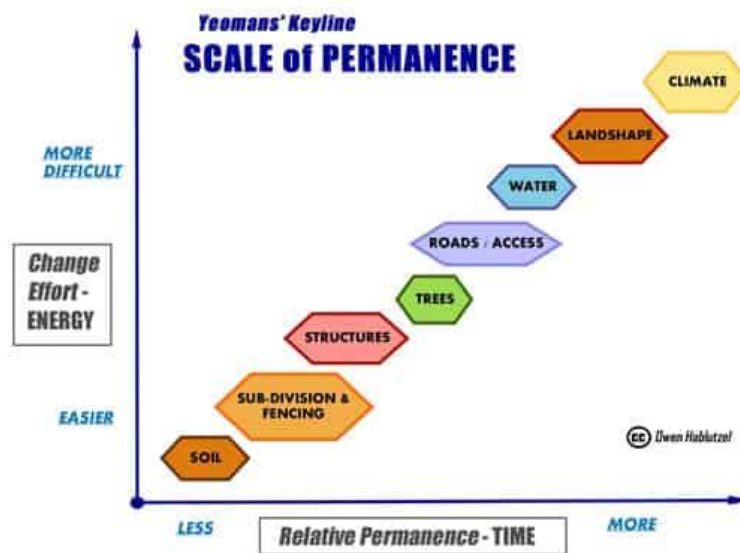
Suggested Design Implementation Sequence

This implementation plan is a five phase trajectory, and should proceed as time, money, and energy allow. In addition to the project management tables in this section. (See Appendix K for Detailed Budget Estimates for Key Built Features.)

The sequence for this plan is based on the Scale of Permanence. The Scale of Permanence is a tool for reading the land that was used in the site analysis phase of this design to inform the build phases of this design.

All design details relate to each other along the lines of permanence. Permanence is defined by the time and effort needed for us to make a change in the system. If something takes a lot of time or effort to make a change you work with it. Climate and landform/geography are two of those things. Although there are microclimates that can be changed, locally, the regional climate is what it is. Climate instability is a growing concern for many and an accepted reality for permaculture designers. It seems to be out of the sphere of our individual influence, but together we can make a difference, especially where soil is the focus of change and development. In this way soil is the workhorse of resiliency planning in the face of climate change.

On the other end of the scale are things that are easy to change and take little time. Solar energy is one of those things. Photosynthesis and photovoltaics are two great examples of harvesting the sun. It happens at the speed of light! Human ingenuity is easy and quick as well, as seen in market economics, home economics, enterprise start-ups of all kinds. Even the enterprise of learning happens at light-speed, where there is attention, and emotional capacity.



Phase 1: Earthworks

Earthworks will involve cutting, breaking up compaction with shallow swales, excavating a permeable structure and building a berm.

- 1) Swales on contour are cut to reduce compaction and distribute water in the landscape. This step involves digging three shallow swales (4" deep) slightly off contour in a "rib" pattern. This was completed with an excavator in October of 2020. The cuts are 20 inches wide at a depth of 8-10 inches and the soil was not disturbed but not displaced. These "ribs" should be recut with hand tools before covering with 4 inches of woodchip mulch and ground cover seed.
- 2) Earth is excavated for 33' x 33' square to 13 inches from grade. Fill it with screened rock to specifications and compress it. (See Appendix I for Surface material and Edging Specifications). Use displaced Earth to build the berm to specifications.
- 3) A 65' berm is constructed to create a sense of place and some separation from traffic. (See Appendix C for construction specifications.) Existing punky wood on the site will be buried in the berm on the widest end. Berms will be topped off with compost and up to 28 inches of sheet mulch methods in places.
- 4) Predig major tree planting holes to 36 inches where possible and filled with compost. These are the primary focus of soil biology injections.
- 5) Barriers. Boulders were applied to the site in 2020. Some boulders will remain to flank the parking lot and snow storage area.
- 6) Materials need to be stored on site ahead of the park build. Truck in woodships and compost, water, pavers, stone, lumber and plants.
- 7) Build the Pavilion.
- 8) Request power access from abutting businesses for building day.
- 9) Order plants available on the plant list in the Spring.

Phase 2: Permablitz

This project is approved for collaboration with the Resilience Hub in Portland which organizes permablitzes. Cumberland County Soil & Water Conservation District is also assisting with outreach for the first event.

A permablitz is a formal organized work party hosted by members of a community of interest. A project coordinator gathers materials, tools, safety and snacks. The designer identifies projects and works with the host, in the case Gray CEDC, to find project leaders with skills and experience to help the team of volunteers at the event. Here are the steps for this permablitz, scheduled for May 8, 2021.

- 1) Collect seaweed straw, grass clippings, leaves, coffee grounds, manure. Avoid material that could have pesticides in it. Store in piles on site or in compost bays.
- 2) Gather flagging tape and sturdy stakes, mark out garden beds and pathways.

- 3) Hammer drill every 12 inches for growing areas to 3 feet. Fill with Bio-Complete Compost and inject dirt with Liquid Soil Amendments. Define beds, hedges and pathways.
- 4) Sheet mulch Pollinator Bed, Berm and orchard areas.
 - a) Mulch with at least a 4 inch thick top layer of wood chips on bare Earth.
 - b) On the berm, use cover crops, don't let soil be hollow. Sow Winter Rye, Oats or Buckwheat in the fall.
- 5) Plant trees according to planting schemes.
 - a) All trees should be bare root for the best chance of survival, care in planting method, staking, and varmint protection must be taken.
 - b) When placing plants in the landscape, placing taller trees in the north of the others benefits all the plants in the system by maximizing solar resources and creating beneficial microclimates. After planting the canopy tree crops, and building supports and protection for them there is room to make adjustments to the planting scheme. Plantings should be placed to fill ecological niches.
 - c) Inoculate roots with Mycorrhizae before planting
 - d) Add any recommended soil amendments in the Spring or Fall when plants are dormant (March or November).
- 6) Plant gardens and understory vegetation according to the planting scheme for: Orchard, Pollinator Bed and Hedge, Berm, including the living willow fence.
 - a) Add compost liberally to planting holes when planting.
- 7) Install Living Willow Fence
- 8) Install stakes and protection for young trees
- 9) Outline beds with stones from site.
- 10) Install information kiosk.
 - a) Post information about the park in this structure.

Phase 3: Establishment and Maintenance

- 1) Water plants daily in the first season.
- 2) See Appendix M for General Maintenance Schedule
- 3) Educational Events are a great way to engage the public in maintenance.
 - a) Invite local skilled gardeners, landscape designers and permaculture educators to share their skills and knowledge. List their offerings in the Community and Adult Education catalogue and coordinate with the Recreation Department.
 - b) Take an intergenerational approach. Design on the fly.
 - c) Paying people for their time can help them commit to the engagement, but there are Master Gardeners too that offer community service education too.
 - d) Hands on activities can move implementation along and maintenance.
 - e) It helps to include food and refreshments.
 - f) Consider having community organizations sponsor a piece of the maintenance as a community building program within their organizations.

Phase 4: As Time Money and Energy Allows

- 1) Gray Historical Society to install 3-4 podium style markers and a 10' x 10' seating area.
- 2) Build a platform off the back of the pavilion and install 3 200 Gallon Rain barrels.

- 3) Add limestone to access paths.
- 4) Build Four-Door Shed for community tools and communications
- 5) Install Photovoltaic Phone Charging station
- 6) Install Benches and games, like the chess board table and chairs

Phase 5: Harvest and Community Stewardship

Establish a third party entity with an educational mission to oversee the public's on-going engagement and maintenance. This organization will also serve as a participatory development corporation to develop more greenscapes in alignment with the Comprehensive Plan and the Community Agriculture Goals for the town. They will help raise awareness of the development process and environmental goals of the town.

Project Management Tables

Phase 1: Site Preparation

Description	Notes	Budget/Financial
Earthworks (See Appendix J.)	Public Works	In kind
Early soil development: mulching and cover crops	We Compost it (compost) Transfer Station (compost) - While supplies last Whitney Tree (wood chips) Fungi Perfecti (mycorrhizae) Fedco Seeds	\$900 n/a In-kind \$99 \$20
Build Pavilion	Got three bids: E.L.K Construction was awarded the bid based on availability	\$12,000
Order plants and seeds (See Appendix L for plant list.)	HORT Resource Sy's Trees Fedco Living Willow Farm	\$1500 \$200 \$600 \$1200

Phase 2: Permablitz

Coordinate Community Build	Resilience Hub 207Permaculture Cumberland County Soil &	In-kind In-kind In-kind + 1500 for materials
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	Water District Edgewood Nursery Community Volunteers	In-kind
Stake out planting areas and paths	Ace or True Value (if not volunteer has it)	\$20
Collect Sheet Mulch Materials:	Maine Coast (Seaweed) Community source or grounds and maintenance (leaves, grass) Ten Apple Farm (goat manure)	\$150 for delivered seaweed
Hand Dig Holes and Plant trees	Shagbark Polyculture Silver Maple Polyculture Pollinator Hedge	n/a
Gathering divisions from other gardens, neighbors and community swaps.	Be sure they are on the plant list and free of disease and invasive weed fragments and pesticides.	n/a
Surface Permeable structure	Genest (pavers, bedding stone and edge restraint) Home Depot (rebar)	\$5900 \$547 - edging In-kind (\$219)
Install Birdhouses	Birdhouses from Maine (houses, poles, labor) Gray Birdhouse Project Home Depot (poles)	\$1371 \$1706 In-kind (\$350 value)

Phase 3: Establishment and Maintenance

Irrigation	Passive irrigation is built in. Rain barrels would ensure resilience in a drought month.	200-500 gallons \$200-500
Soil Amendments	Topping up beds with compost and sheet mulch each year.	Subsequent soil testing and modest soil amendments
Pruning	Each plant can be pruned for better habit and control.	Local Food Group

Phase 4: As Time, Money and Energy Allow

Install Rain Barrels	Tank and Barrel Desert Plastics Villa Series Speckled Light Abobe 200 gallon x 3 @ \$540.49ea freight shipping	\$2510
	Machinos Lumber for staging them...	\$320
Historical Markers and Seating area	Galan Morrison	n/a
Four-Door tool Shed	Estimate needed	n/a
Signage	Estimate needed chris@bsdmaine.com https://bsdmaine.com/work/	n/a
Photovoltaics	Estimate needed. Meant to power a sting of lights for the pavilion or that plus and EV charging station.	n/a

Phase 5: Harvest and Stewardship

Harvest for nut trees, shrubs, will be in 5 years	Tarp method for catching fruit and nuts is best. Call on Gleaners Society and Gray Local Food Rules for harvesting appropriately and plant care.	
Most perennial vegetables will be harvestable and able to split within 2-3 years	Adage for perennial veg is “first they sleep. then they creep, then they leap”! Varieties recommended are for spring, summer, and fall harvest.	Again gleaners can help maintain the plants.
Pruning fruit trees and edible hedges layers	Most pruning needs to occur when trees and shrubs are	Holding a pruning skills class on site would be a great way

	dormant; winter and early spring.	to get your community involved. Again, gleaners can help maintain the plants.
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APPENDIX A: A Sample of Survey Data

13 Participants

General Goals:

The park at 5 Yarmouth Rd in Gray is grant-funded. What would YOU like to see as "tangible outcomes" of implementing a permaculture design at this location over the next two years?

Intentional beautifying green space at the busiest intersection in gray will be great!
Something that would beautify the area and allow residents to enjoy a nice spot.
A space for families and residents to come and enjoy
I would love to see an urban garden here for the community! I would hope that it could be something sustainable within the community to help our community out. Fruit trees would be perfect because it is a long lasting source of food and can also serve as a place to educate others in the community and possibly help them learn more about gardening and doing it for themselves.
Would love a more walkable downtown area and more places to bring kids. Would also be nice to have more appealing areas in town.
A place to sit and relax in gray center! We live close and would definitely want to walk over (me and the 2 kids) and visit the little park so plenty of area to sit or swing, or hammock?
Our family would like to build and donate a little free library. I have 4 children and we have been looking for a space to do this.
Food for our community and to teach kids to grow their food
Create an attraction tied to walking trails
Would like to see the gardens flourish to provide fresh fruit/veggies for the food pantry. A space for socializing or reading. Maybe include sidewalks and crosswalks to/from the library, and extend the walking pathways from Pennell to this space and the library. (And even the path beyond the library that connects to Gray Plaza--people can circle back around up rt 100, using the existing sidewalks.) Maybe include a water spicket for dogs. Trash can and pet waste disposal cans. Like the idea of a bulletin board with periodic updating information about the community and history of Gray. Perhaps a Geocaching site? Festive lighting. No smoking/alcohol/drugs. Keep the big shade trees!
Improving the appearance and functionality of the site
Useable space for humans, birds and insects.
A finished product within the 2 years / Collaboration between town, school & businesses.

Modivations

Please give some specific reasons WHY this goal or set of outcomes is important to you. What are the underlying reasons for this goal to have risen to the surface for you? How might this link to the town's comprehensive plan?

Permaculture is good for communities, spaces like this offer learning opportunities, food and health benefits like stress reduction.

I think the downtown area is very unappealing and needs a bit of an upgrade. Along with beautification I feel like a nice area that families can be proud of and be useful.

This is an important space for the residents of Gray because we do not have a lot of public parks in the area and this would give families a place to spend outside. Which is especially important right now as we navigate through COVID. Also this will give Gray Center a nicer look, which is always great.

I have been food insecure in my life and it has made me very passionate about food security and the importance of gardening and growing my own food as well as teaching myself how to preserve some of it. My own kids and I have a large garden we grow every year and we also have worked with Maine Foodscapes in the past and could be a good connection for this project.

Improving the town as a whole while improving the value of property

There's not a lot of incentive to go to gray center with so little parking so walking there would be easy for us but we'd like to hang for a while before heading back home.

our family wants to contribute to the community, we always have fun finding little free libraries. While people are using the space they can look at a book.

Just moved to Gray and started my own veggie garden

create an actual village

Need more safe space for gathering/socializing/exercise for people and pets. Extending pathways also brings people around Gray center to support area businesses. Information about the history and community of Gray is always interesting and gives another reason to stop by. Geocaching is fun, especially with kids and would be a great destination for it (could also place sites along the walking paths.) Would be a nice spot to sit and have lunch.

This could be the first domino... It would be wonderful to see this project serve as a catalyst for other initiatives to improve the esthetic environment of Gray Village.

Use is as much of a tangible outcome as we could all hope.

That location has been an eyesore for many years.

APPENDIX B: Soil and Paste Report

Saturated Paste Report

<i>Job Name</i>	Town of Gray	<i>Date</i>	11/5/2020		
<i>Company</i>	Town of Gray	<i>Submitted By</i>			

<i>Sample Location</i>			Local	Tree			
<i>Sample ID</i>							
<i>Lab Number</i>			154929	154930			
<i>Water Used</i>			DI	DI			
<i>pH</i>			5.1	6.0			
<i>Soluble Salts</i> ppm			62	51			
<i>Chloride (Cl)</i> ppm			5	5			
<i>Bicarbonate (HCO₃)</i> ppm			46	52			
ANIONS	SULFUR	ppm	0.21	0.21			
	PHOSPHORUS	ppm	0.09	0.1			
SOLUBLE CATIONS	CALCIUM	ppm	3.42	3.71			
		meq/l	0.17	0.19			
	MAGNESIUM	ppm	1.81	1.78			
		meq/l	0.15	0.15			
	POTASSIUM:	ppm	3.67	12.24			
		meq/l	0.10	0.32			
	SODIUM	ppm	12.76	2.88			
		meq/l	0.55	0.13			
PERCENT	Calcium		17.58	23.87			
	Magnesium		15.49	19.09			
	Potassium		9.82	40.91			
	Sodium		57.11	16.13			
TRACE ELEMENTS	Boron (p.p.m.)		0.03	0.04			
	Iron (p.p.m.)		0.39	0.48			
	Manganese (p.p.m.)		0.04	0.03			
	Copper (p.p.m.)		< 0.02	< 0.02			
	Zinc (p.p.m.)		< 0.02	< 0.02			
	Aluminum (p.p.m.)		0.37	0.59			
OTHER							

Logan Labs, LLC

Soil Report

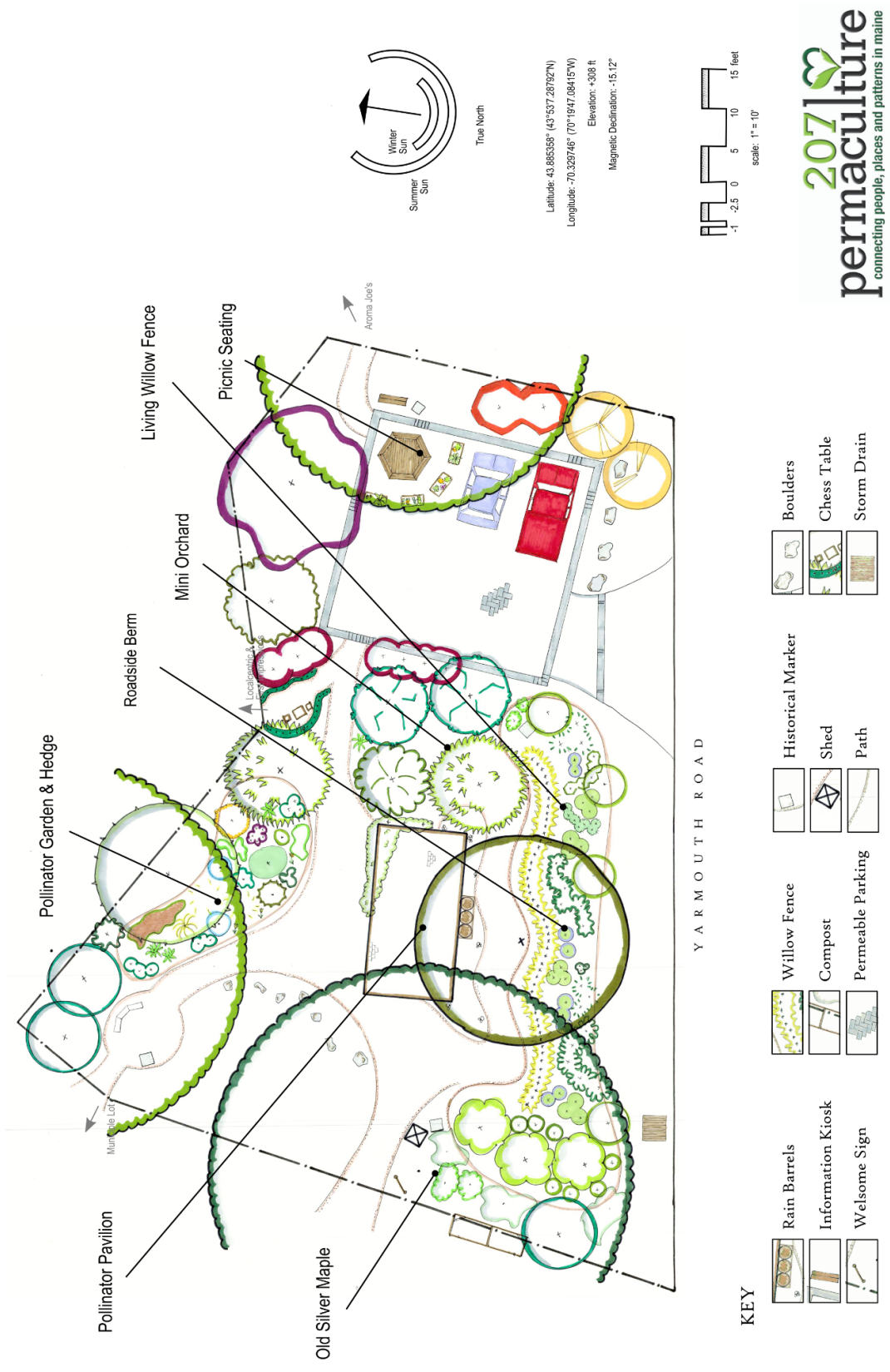
Job Name Town of Gray Date 11/5/2020
 Company Town of Gray Submitted By _____

Sample Location			Local	Tree		
Sample ID						
Lab Number			66	67		
Sample Depth in inches			12	12		
Total Exchange Capacity (M. E.)			3.55	2.18		
pH of Soil Sample			5.1	6.0		
Organic Matter, Percent			3.79	0.64		
ANIONS	SULFUR:	p.p.m.	13	6		
	Mehlich III Phosphorous:	as (P ₂ O ₅) lbs / acre	871	915		
EXCHANGEABLE CATIONS	CALCIUM:	Desired Value	1931	1188		
	lbs / acre	Value Found	870	778		
		Deficit	-1061	-410		
	MAGNESIUM:	Desired Value	204	200		
	lbs / acre	Value Found	117	123		
		Deficit	-87	-77		
	POTASSIUM:	Desired Value	221	200		
	lbs / acre	Value Found	376	645		
		Deficit				
	SODIUM:	lbs / acre	213	90		
BASE SATURATION %	Calcium (80 to 70 %)		30.63	44.51		
	Magnesium (10 to 20 %)		6.86	11.73		
	Potassium (2 to 5 %)		6.79	18.92		
	Sodium (.5 to 3 %)		6.51	4.46		
	Other Bases (Variable)		7.20	5.40		
	Exchangeable Hydrogen (10 to 15 %)		42.00	15.00		
TRACE ELEMENTS	Boron (p.p.m.)		0.31	0.32		
	Iron (p.p.m.)		102	77		
	Manganese (p.p.m.)		5	13		
	Copper (p.p.m.)		1.98	1.38		
	Zinc (p.p.m.)		5.55	2		
	Aluminum (p.p.m.)		1554	1317		
OTHER	Cobalt ppm		0.213	0.547		
	Molybdenum ppm		<0.02	<0.02		
	Ammonium (p.p.m.)		0.9	0.7		
	Nitrate (p.p.m.)		46.9	28.9		
	Selenium ppm		0.98	<0.02		
	Silicon ppm		3.3	6.1		
	Estimated Nitrogen Release #N/Acre		88	26		
	EC mmhos/cm		0.19	0.09		
	Lead (Pb) MB Extractable		269	59		

Logan Labs, LLC

APPENDIX C: Rain Barrel Specifications & Ordering Details

Conceptual Plan for The Town of Gray
for a public commons area and greenspace at
Yarmouth Road/ / Route 115/ Greenleaf Street



3 units of Model: VILLA-200PLUS

Manufacturer: [Desert Plastics](#)

Material cost: \$1178.73

Freight Shipping Estimate: \$768.86

Source: Tank and Barrel

Website:

https://www.tankandbarrel.com/rain-barrels-villa-200plus-desert-plastics-villa-200-gallon-rain-barrel-p-1247.html#tabs2_1

The Desert Plastics Villa 200 Gallon Rain Barrel is a Tijeras Rain Barrels. Tijeras Rain Barrels are made from recyclable virgin resin, FDA approved for contact with potable water. Valves and fittings are professional grade, and all fittings are welded into place. There are no gaskets, which means "no gaskets - no leaks". Custom fittings locations are available at no additional charge.

Villa Rain Barrel Features

- 200gallon version, or 2360
- Speckled Light Abobe
- 17" Stainless Steel Basket
- Large 1-1/2" External Overflow
- Brass Ball Drain Valve with Garden Hose Threads
- Animal / Child Resistant
- Full UV protection; Completely Recyclable
- Food-Grade Virgin Polyethylene
- Seamless Construction
- All fittings welded to tank - No gaskets
- Consider draining in freezing temps

Dimensions:

Capacity (gallons)	Diameter (inches)	Height (inches)	Weight empty	Weight full
200	35.5	47	50	1750
360	48	51.5	125	3130

APPENDIX D : Organic & Biological Material Sourcing

Organic Material Sources

Item	Sources	Contact info.	Cost
EM1 Seen Inoculant	Fedco		\$100
Woodchips	Whitney Tree Service	David McDonald (207) 3294539.	donation
Finished Compost	We Compost It Gray Transfer Station Garbage to Garden	207} 786-0600 (207) 657-2343	\$43/yard Free while supplies last
Cardboard (large sheets)	Transfer Station	(207) 657-2343	free
Coffee grounds and/or chaff	Aroma Joes	Next door	Free; give them clean and empty buckets
Straw Bales	Ames/ Blue Seal	(207) 829-5417	\$8-12/bale
Seaweed	Falmouth Town Landing, Maine	n/a	Harvest at low tide after a storm or a full moon
Rock Dust (paramagnetics) A.k.a slurry	Any garden store, or rock quarry		
Soil tests	Logan Labs, UMaine Co-op Extension	(888) 494-7645	Co-op Ext - \$8-\$12 Logan Labs - \$65-\$80
Leaves	Community Donation Gray Transfer Station	(207) 657-2343	n/a
Bio-Complete Liquid Amendments	Living Soil Network Gray-New Gloucester High School	Spero Latchis 207 299 2738	\$1000 for 3 applications

Plant and Seed Sources

Source	Location/Contact	Notes
Edgewood Nursery	Aaron Parker of Edgewood Nursery 653-2065	West Falmouth, Maine, source for many unique

		perennial vegetables, shrubs, vines, and seeds. Bare roots
Fedco	www.fedcoseeds.com	Source for veg, seeds, grain seed, perennials, cover crop seed, shrubs and trees. (Great Tree Sale in May)
Sy's Nursery	Jesse Stevens 207 595 9723	Unique edibles, fruiting trees and shrubs, vines, bareroot
HORT Resource	Jeff Horton MCN 207-252-9525	Balled roots, mature trees, good variety.
Stark Bros	800.325.4180	Good variety, asian pear, harty peaches, berries. Bare root.
Eden Brothers	https://www.edenbrothers.com/	Some hard to find seeds
Johnny's Seeds	www.johnnyseeds.com	Herbs, flowers, annual veg seed, cover crop seed
Food Forest Farm	http://www.foodforestfarm.com/	Unique selection of perennial vegetables, shrubs and fruit trees
Amanda's Native Plants	http://www.amandasnativeplants.com/	Native woodland species, pollinator plants
Pinetree Garden Seeds	https://www.superseeds.com/ 1-207-926-3400	Pollinator plants, vegetables, ground covers
Concentrates, Inc	https://concentratesnw.com/ Phone: 503.234.7501	Cover Seed, Ag Products

APPENDIX E: Sheet Mulch Recipe

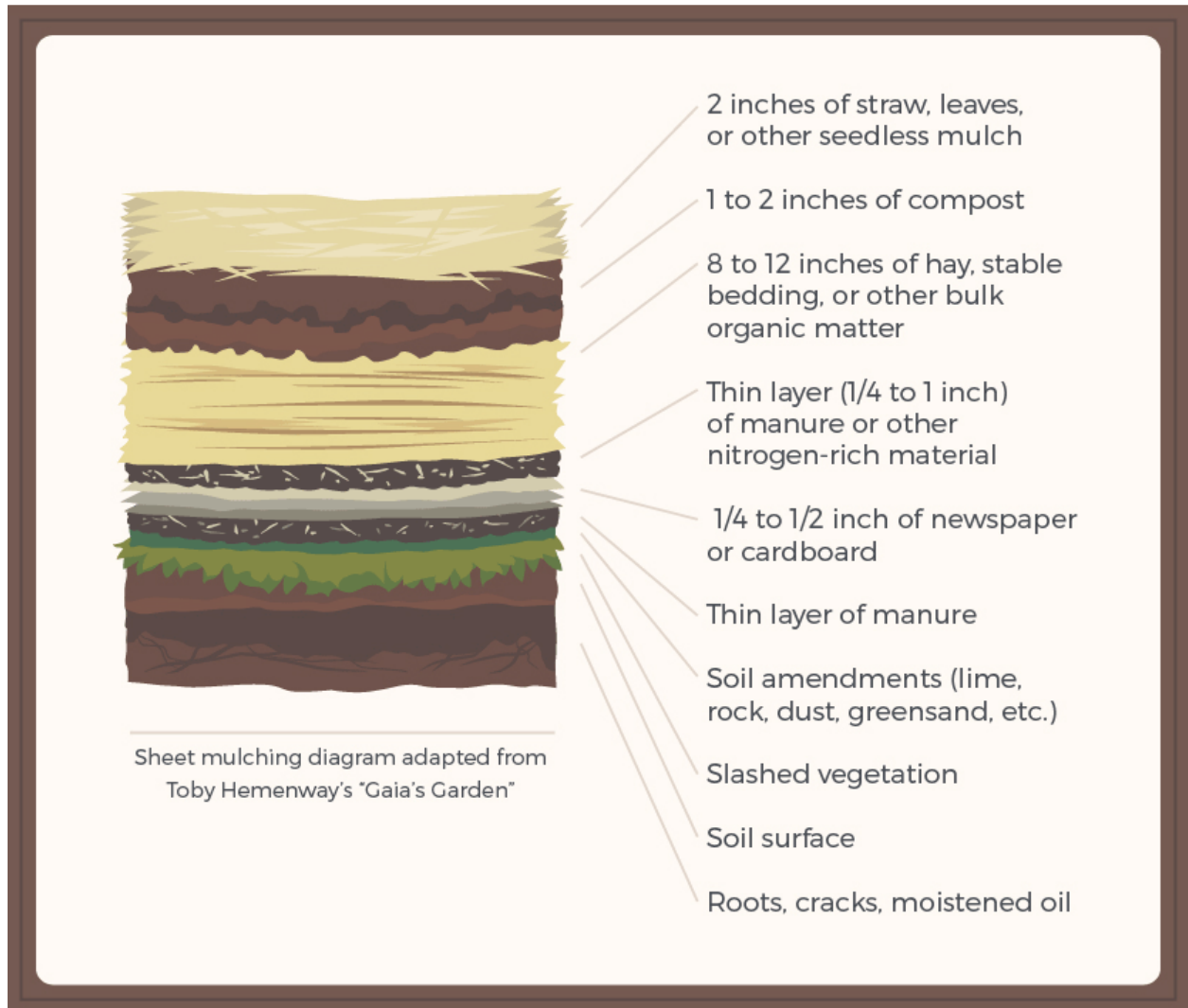


Image credit: Fix.com

APPENDIX F: Sheet Mulch & Tillage Comparison

SHEET MULCHING

- **Relatively easy way** to transform lawn to garden
- Kills weeds **without poison** and prevents them from growing
- Creates **nutrition** for the soil
- Uses materials available on-site or available for free or low-cost; **saves materials from landfills**
- Helps **earthworms** proliferate to aerate the soil
- Protects garden soil from **winter rain and snow**
- Mulched soil retains **30 percent more water**



 **30%⁺**

TILLING

- Overturning sod can be **labor- and time-intensive**
- Weeds must be **removed manually or chemically**
- Soil is more likely to **need fertilizer and amendments** to improve aeration, moisture retention, drainage, and pH of the soil.
- Disrupts the **soil structure and microbiome**
- Bare soil is subject to **erosion**
- Garden requires **more water**



Image credit: Fix.com

Conceptual Plan for The Town of Gray for a public commons area and greenspace at Yarmouth Road / Route 115/ Greenleaf Street



APPENDIX G: Conceptual Plan

APPENDIX H: Permaculture Principles

Permaculture Ethics



Care of the Earth



Care of People



Fair Share

& Design Principles



1. Observe & Interact



2. Catch & Store Energy



3. Obtain a Yield



4. Apply self-regulation & accept feedback



5. Use & value renewable resources & services



6. Produce no waste



7. Design from patterns to details



8. Integrate rather than segregate



9. Use small & slow solutions



10. Use & value diversity



11. Use edges & value the marginal



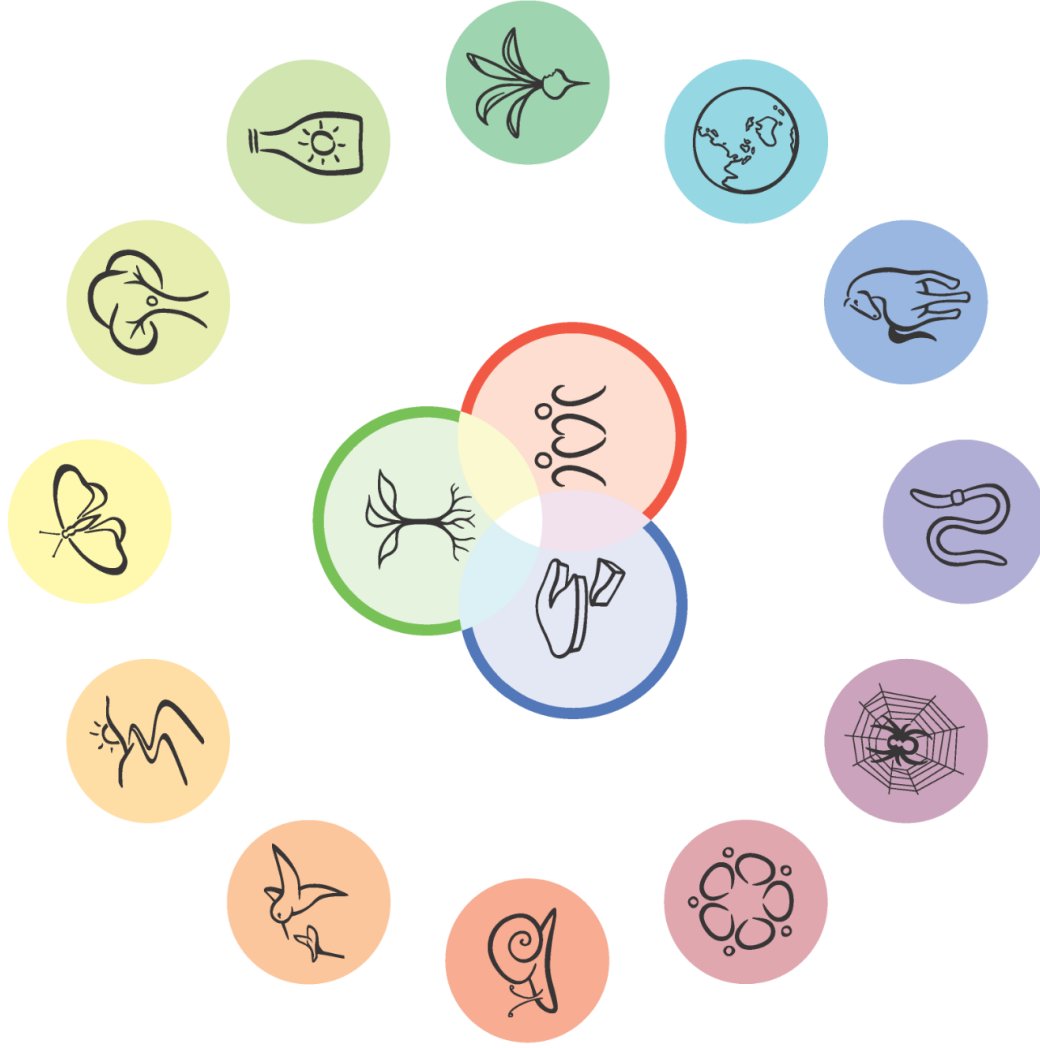
12. Creatively use & respond to change



permacultureprinciples.com



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APPENDIX I: Storm Brick & Edge Restraint Specs

Stormwater Brick®

4" x 8"

The Stormwater Brick used as part of a permeable pavement system is an excellent way to control runoff water. The aggregate base used in the system helps to filter and reduce pollutants. The ground water is recharged because the water is not running off the pavement. Not only does it collect and properly handle storm water, but provides a functional and attractive paving solution.

Packaging

- 78.24 sq. ft. per pallet
- 4.5 pieces per sq. ft.



Stormwater Brick® 4" x 8"
Cumberland Blend (shown wet)

Standard Colors



StructurEdge™

RECOMMENDED ANCHORING GUIDELINES:

Patios & Walkways	12" - 24" on center (30.5cm - 61cm)
Driveways	4" - 12" on center (10cm - 30.5cm)
Heavy Vehicular Loads	4" on center (10cm)

INSTALLATION PROCEDURE

- 1.) Remove excess soils and all unstable subbase materials. Compact subgrade to 95% proctor density test.
- 2.) Backfill excavated area with appropriate depth aggregate material.* The base needs to be compacted in 2"-3" lifts to achieve proper density. The base needs to extend 6" to 12" beyond the edge of the paver installation.
- 3.) Screed concrete sand* over the base to a uniform thickness of not less than 1" and not more than 1-1/4".
- 4.) Install StructurEdge with the base resting on the aggregate and facing away from the paver. (**Diagram A**)
- 5.) Connections to be made using the 4" sliding connectors. (**Diagram B**)
- 6.) Install the pavers making sure that the pavers are 1/4" higher than the desired final grade. Sweep fine sand* into the joints.
- 7.) Make several passes with a plate compactor with no less than 3,000-5,000 lbs centrifugal force and operates at 80 to 90 hertz. Continue sweeping sand into the joints. Make several passes alternating the direction of the compactor each time.
- 8.) Remove excess sand from paver installation.

RESTRAINT UNDER PAVER: Same as above except place StructurEdge under the paver. Be sure that StructurEdge is restraining both the paver and the concrete sand.*

*Please refer to ICPI standards or architect's specifications

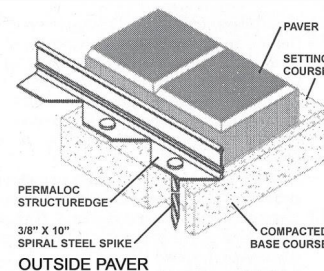


DIAGRAM A

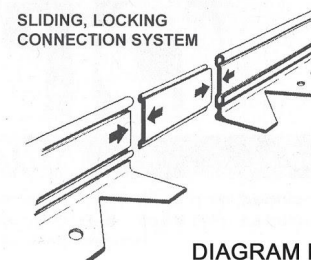
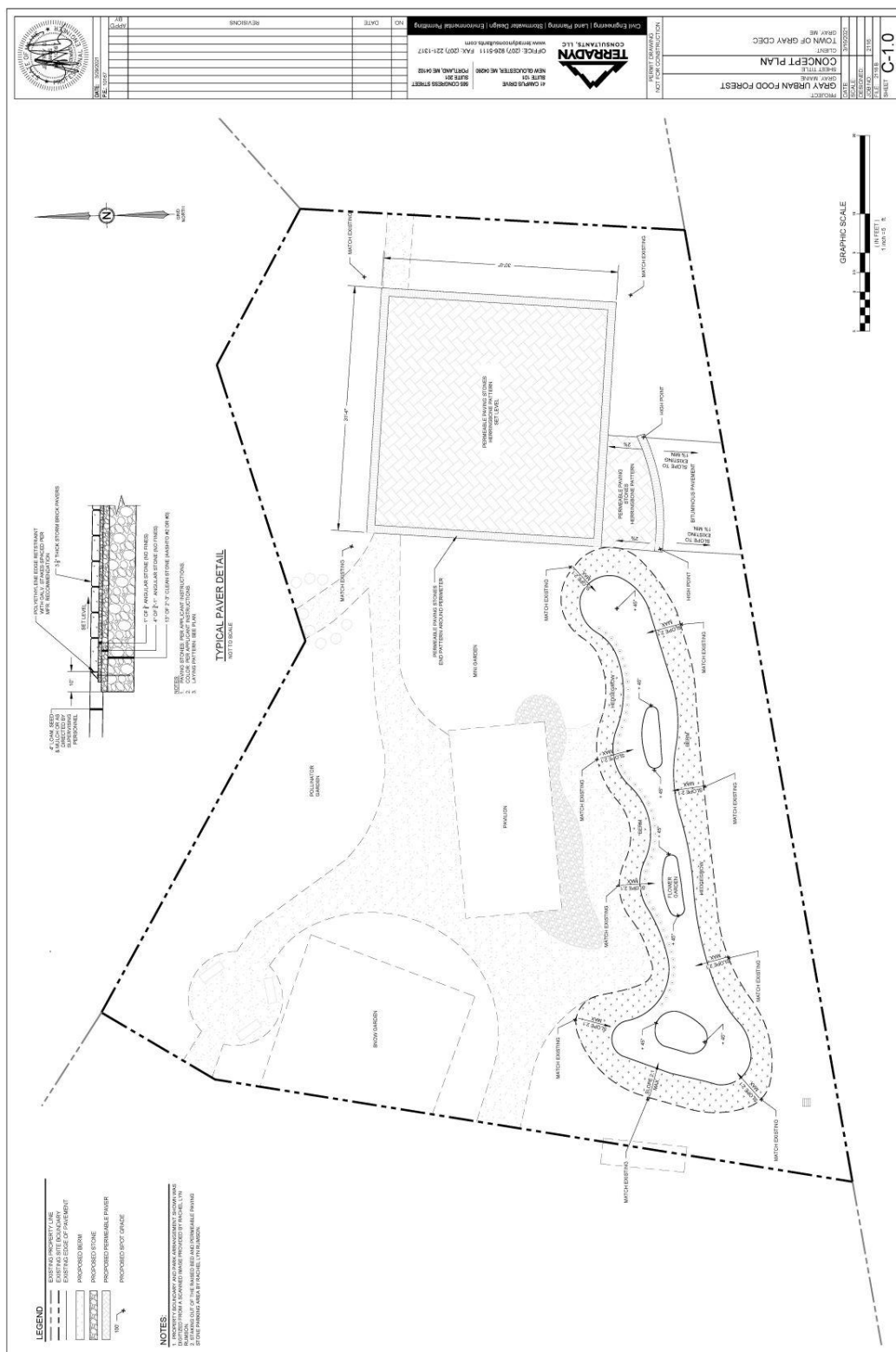


DIAGRAM B



APPENDIX K: Detailed Budget Estimates for Key Built Features

Element/Feature	Estimate Budget	Notes
Metal Orchard Planters		Bradbury Mountain Metalworks, LLC
Post and Beam Shed Roof Pavilion 24' x 12'	\$16,600	Machinos Lumber \$717 Bids: Colin Doughty, Mike Joyce, Dan Crowley
Path materials Limestone eventually, wood chips phase one	\$1000	Confirm estimate and determine source with Grounds and Maintenance Director
Town Square/Permeable Staging	\$6000	Special order Storm Brick from Genest, delivered. 900 sq.ft. (11 Pallets) plus 30-40 bags #9 Stone (3/8") Scree at 1.5 inches depth.
Permeable base and subbase	\$ 1020	47 cubic yards of 1 1/2 inch clean rock (no fines) 12-13 cubic yards of 3/4 inch clean rock (no fines) AH Grover \$17/cu.yr.
L-Edge Restraint	\$549	120 sq.ft total
Solar Generator Conduit and locked outlet on Pavilion post and phone charging station.	\$882	1100W (600W On Grid + 500W Off Grid) Hybrid Solar Generator Powerhouse MPPT and Pure Sine Battery Box, USB, 12V (23V DC Max PV Input), 100W Standard Solar Panel, 100Ah Interstate AGM Battery, AC Wall Charger: 96W Wall Charger (+68.97), 90W Car Charger, : Car Charger (+\$52.97) CuttingEdgePower.com

Rain Barrels	\$2131	Desert Plastics Villa Series Speckled Light Abobe 200 gallon x 3 @ \$540.49ea freight shipping lumber for staging \$300
Raised Beds and Planters		

APPENDIX L: Design Plant List

Canopy Trees

Phase	Latin Name	Common Name	Guild	#	Size
1	Carya Ovata	Shagbark Hickory	Shagbark Poly	1	60' - 80'

Understory Trees

Phase	Latin Name	Common Name	Guild	#	Size
1	Salix Sp	Willow	berm	100	12' x 3'
1	Carya Ovata	Shagbark Hickory	Shagbark Poly	1	60' - 80'
3	Cercis canadensis	Redbud	parking hedge s	1	20' x 20'
1	Prunus persica	Peach	Peach Polyculture	2	12'- 15' x 12'-15'
1	Pyrus pyrifolia	Asian Pear	Pear Polyculture	2	12 - 15' x 9 - 11'
1	Pyrus Pyrifolia	Semi Dwarf Asian Pear	Pear Polyculture	2	12-15' x 9 - 11'
1	Crataegus Laevigata	Hawthorn	pollinator beds	1	15-20'/12-20'
2	Pseudotsuga menziesii	Douglas Fir	windbreak		

Shrub Layer

Phase	Latin Name	Common Name	Guild	#	Size
1	Prunus maritima	Beach Plum	Beach plum Poly	3	6' x 6'
1	rosa rugosa	Sea rose	Beach Plum Polyculture	3	4-6'/same
3	Hippophae Rhamnoides	Seaberry "buckthorn"	Beach Plum Polyculture	3	8' /8'
1	Salvia Officinalis	Common Sage	berm	1	18 in / 30 in
2	Calluna vulgaris Con Brio	Heather	Berm	6	12" - 14"/ 16"-18"
2	Calluna vulgaris Jan Dekker	Heather	Berm	6	4-6"/ 10-12"
1	Lavandula	Lavender	berm	4	12-24 in / 12-18 in

	angustifolia	"Munstead"			
3	Cornus Sericea	red osier	parking	3	7-9' x 10'
1	Amelanchier Canadensis	Service Berry/Shad	GHS/ Maple Poly	2	15' x 15'
1	Aronia	Choke cherry	Pollinator beds	1	flag iris
2	Vaccinium corymbosum	Highbush blueberry	parking hedge W	8	6' / 6'
2	Caragana arborescens	Siberian Tree Shrub	Pear Polyculture	2	15' - 20'
2	Viburnum Lentago	Nanny Berry	pollinator beds	1	15-20'/10-12'
3	Vaccinium vitis-idaea	Lingonberry	Searing area	21	12" x 12"
3	Lonicera Caerulea	Honey berry "Aurora"	Sunny understory	3	5' -6' / 5'

Herbaceous and Ground Cover

Phase	Latin Name	Common Name	Guild	#	Size
1	Cambre Maritima	Sea Kale	Beach Plum Polyculture	3	2-3' / 1-2'
1	Hylotelephium	Sedum	Beach Plum Polyculture	5	6" x 12"
2	Perovskia atriplicifolia or Salvia Officinalis	Blue Spires Russian Sage	berm	5	9 in / 8 in
1	Lupinus perennis	Lupins	berm	20	10" x 24"
1	Hemerocallidoideae	Day Lily	berm and borders		
1	Symphyotrichum Novae-angliae starwort	Aster	Berm/Pollinator bed	10	30-36"
1	taxaxacum off.	Dandelion	maple/borders		
1	Symphyum Officinale	Comfry	Pear Polyculture	5	24-48"
1	Echinacea purpurea	Echinacea	Pear Polyculture	8	3' / 2'
1	Allium tuberosum	Garlic chives	Pear Polyculture	3	
1		Mouse Garlic	Pear Polyculture		12" x 20"
1	Monarda didyma	Bee balm	pollinator beds	1	

1	<i>Rudbeckia hirta</i>	Black-eyed Susan	pollinator beds	8	
5	<i>Verbena hastata</i>	Blue Vervain	pollinator beds		4' x 1'
1	<i>Matricaria recutina</i>	Camomile	pollinator beds	20	18" x 3"
1	<i>Stachys hyssopifolia</i>	Hyssop	pollinator beds	1	12"-20"
1	<i>Melissa officinalis</i>	Lemon balm	pollinator beds	2	2' x 2'
1	<i>Arnica montana</i>	Red Yarrow	pollinator beds	3	
	<i>Eriogonum grande</i> var. <i>rubescens</i>	Rosy Buckwheat	pollinator beds	20	12" - 46" / same
1	<i>Tanacetum vulgare</i>	Tansy	pollinator beds		4 -5' /same
3	<i>Fragaria ananassa</i>	Strawberrys	windbreak	10	5" x 12"
3	<i>Schizanthus litoralis</i>	Little Blue Stem	berm	3	2-4' x 2'
	<i>Chasmanthium latifolium</i>	Sea Oats	cover crop	1/4 lbs	
	<i>Phacelia tanacetifolia</i>	Lacy Phacelia	cover crop	1 lbs	
	<i>Trifolium Repens</i>	White Clover	cover crop	1 lbs	
	<i>Sorghum x drummondii</i>	Sudan Grass	cover crop		
	<i>Gallium falvum</i>	Mustard	cover	1 lbs	

APPENDIX M: General Maintenance Plan

Winter

- Protect young tree's stems from mice with tubing.
- Protect young foliage from deer with caging.
- Review implementation plan and order seeds.
- Late winter – prune trees and shrubs before they break dormancy.
- Store snow only in designated contaminated snow areas.
- Close permeable parking lot. Do not plough them.

Spring

- Early spring – put rain barrels in place, or open them.
- Run drip irrigation, if using.
- Plant seeds and seedlings according to their needs.
- Top up any beds that need additional sheet mulching.
- Solarize patches of goutweed to suppress.
- Plant spring greens.

Summer

- Enjoy the harvest! Freeze, can, dry, gift or otherwise consume the bounty.
- Minimal weeding and watering due to heavy sheet mulching.
- Irrigate trees and shrubs.
- Any time – “top up” mulch with additional wood chips or shavings at your discretion.
- Chop and drop dynamic accumulators.

Fall

- Continue harvest.
- Remove dead plant material at bed surfaces (leaving roots intact unless diseased) and compost plant material. Leave some plants to go to seed and naturalize if desired.
- “Top up” or patch sheet mulched beds with additional organic matter or compost if needed, especially for beds that will house heavy feeders next year.
- Late fall – drain and store rain barrels for winter.
- Gather and store leaves as your carbon source to mix with green plant cuttings and food waste in the compost bin.

Throughout the year

- Secure compost bins with lock and key
- Secure rain barrel with lock and key
- Patrol

