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Reclamation - An Eco-Industrial Park in Greenfield, Massachusetts

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Reclamation

Prepared for Greenfield Massachusetts
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Special Thanks

A special thanks to Eric Twarog, AICP, Director of Planning and Development In Greenfield, for introducing me to this project. Also thank you to Mayor William F. Martin, Robert W. Pyers Assistant to the Mayor for Economic Development and Marketing, and the other town officials for assisting me in understanding the site and gathering information required for the successful completion of this project.

My professors:
Elizabeth Thompson for the design guidance and inspiration, as well as encouraging me to pursue my business concept. Dr. Peter Kumble and Elizabeth Brabec for helping me understand graphic design and giving me graphic guidance.
Contents

Introduction .................................................... 7

What is an Eco Industrial Park? ......................... 8

Sustainable Design Guidelines ......................... 10

Site Analysis .................................................. 12

  Site Location ............................................. 13
  History ................................................... 14
  Zoning ..................................................... 18
  Land use .................................................. 19
  Topography ............................................... 20
  Water ....................................................... 21
  Impervious surfaces .................................... 22
  Structure .................................................. 23
  Circulation ............................................... 26
  Views ....................................................... 27
  Winds ....................................................... 28
  Vegetation ............................................... 29
  Sun ........................................................ 30
  Shade Analysis .......................................... 31

The Design .................................................... 32

  Concept .................................................... 32
  Master Plan ............................................... 33
  Diagrams and Systems .................................. 34
  Sections .................................................... 36
  Perspectives .............................................. 38

A Business Concept ........................................ 44

  Why Food & Why Greenfield ......................... 45
  Case Studies ............................................. 47

Conclusion ................................................... 49

Works Cited .................................................. 50
Abstract

Sustainable Industrial Design
Reclaiming a Brownfield in Greenfield, Massachusetts

Abstract:

For the senior capstone project at the University of Massachusetts, this student completed a conceptual site design project for the City of Greenfield. The City of Greenfield wishes to redevelop the Brownfield site, currently known as the Bendix Property, into an eco-industrial park. Working closely with the City’s officials, the student created a realistic vision for the site. After twenty years of soil and groundwater treatment, the site is ready to come back to life. The student investigated what an eco-industrial park is, and how the businesses cooperate with each other to achieve greater efficiencies. To do this, the student looked into case studies of successful eco-industrial parks to use as a model for the project in Greenfield. The student also researched sustainable technologies that can be incorporated, such as Photovoltaic panels and groundwater infiltration. The student created a site analysis of the property looking at aspects such as: vegetation, circulation, sun, shade, drainage, and the effect this project will have on the surrounding community. The student created a site plan of the area, using the data from the site analysis. The plan is supplemented with sections, perspectives, and diagrams to explain the design. The site plan will generate interest in the area and help Greenfield attain its vision of an eco-industrial park. With the property going out to bid in the spring of 2011, the conceptual design by this student will excite developers into action.
Introduction

Sustainability is not a trend. This word can be skewed and abused as to confuse people into misunderstanding what it really is: Meeting the needs of the present without compromising the future to meet their needs. Critical examination is necessary to fulfill this requirement.

An Eco Industrial Park is a facet of sustainability. This report will explore not only the design of the park, but also a business model which will take the concept of sustainability to the next level by incorporating it into the community.

Sustainable Technologies are a major component of this design concept. Depletion of resources, particularly energy resources, as well as the Climate Change theory, are driving factors in our society’s interest in preserving our world for future generations. Reducing energy use and receiving energy from renewable resources such as the sun, has to be seriously considered.
What is an Eco Industrial Park?

Eco Industry is:

- Cooperation
- Reduction of waste and pollution
- Sharing resources
- Sustainable development
- Increased economic gains
- Improving environmental quality

Cooperation

The businesses within an eco-industrial park cooperate with each other and the local community. Sometimes this includes opening their financial records to each other, or sharing Human Resources.

Reduction of Waste And Pollution

Reduction of waste and pollution can be accomplished through cooperation among businesses. This diagram shows the relationship between the different options. Prevention should be the first step.

Sharing Resources

Everyone in the park is a part of the puzzle; by putting the pieces together, many of the goals will be accomplished in an economically and environmentally conscious manner.
Sustainable Development

This is a broad concept combining and balancing the aspects that make up life. In this project, using renewable energies and developing on a brownfield are key contributions to making this a successful sustainable development.

Increased Economic Gains

By following these principles, increased economic gains are a natural result. There is also the possibility of increased regulations as society adapts to the sustainability model. These business would already be prepared.

Improved Environmental Quality

This is a concept that should be incorporated into all aspects of business. By following the previous concepts, environmental quality will be greatly improved.
Sustainability Guidelines

Passive Solar Design

The sun is our most abundant source of energy. We can make electricity from it, but we also can capture its heat with passive solar design. This will reduce in heating costs considerably.

Roof Systems

The roof of the buildings should not be wasted space. Solar panels and be added to create an alternate form of electricity by arranging the buildings and rooftops to gain southern exposure.

Flat roofs provide the opportunity for green roofs which aid in cooling the building and reducing impervious surfaces which aids in rainwater management. This also provides habitat for wildlife. The most desired option would be a combination of both.

Building Model

The Butler Buildings were used in this design. They have LEED Certification specialists on their team, and can be built efficiently both in cost and labor.
LEED is the most widely accepted and known design and building guidelines. This site is a prime candidate for LEED certification, and the design was developed with these in mind.

www.usgbc.org

The Sustainable Sites initiative is a newer certification system that looks at the outdoor systems closely. The LEED certification system will most likely adopt its principles. The various elements of this are:

- Site Selection
- Pre-Design Assessment and Planning
- Site Design—Water
- Site Design—Soil and Vegetation
- Site Design—Materials Selection
- Site Design—Human Health and Well-Being
- Construction
- Operations and Maintenance
- Monitoring and Innovation

Again, this site is a prime candidate for this certification, and the design was developed with these principles in mind.

www.sustainablesites.org/
Site Analysis

Understanding the site is the first step in making a successful design. This section was developed using Geographic Information Systems, frequent site visits, and town records. The site is broken up into various different elements to illustrate the systems separately so they can be easily understood. All of these elements were considered carefully in developing the design.

The site is approximately seventeen acres located east of I91, on Laurel Street.
Some key neighborhood elements in the region are:

- Close proximity to the highway, the five minute drive from the rotary makes access to this site easy and is an asset to potential developers.
- This Site is also within close proximity to New England Naturals, (a granola manufacturing company) Buckly Healthcare Centre, The Fairgrounds, Wisdom Way Solar Village, (a net-zero housing development)
- A capped landfill which will be developed for electricity generation with photovoltaic panels.

Overall the community in this area is mixed, and an eco-industrial park will fit in with the character.
Location and Surrounding Neighbourhood

Map created using Arc GIS Version 10
History And Cleanup

The history of the site as taken from the Parsons Report Immediate Response Action Plan:

“The former Besly/Bendix Facility was built in 1961 by Treadwell Tool co., an extension added in 1965. Honeywell International Inc, successor to Allied Signal, Inc, purchased the property in 1982, and then in 1984, sold the property and building to BC Acquisition, a subsidiary of Besly Products, Inc (Besly). Honeywell retained the existing environmental obligations at the time of the 1984 sale of the property. Besly operated the property from 1984-1990, and sold the property in 1998 to Repal, Inc. The primary manufacturing activity at the former plant was metalworking, including the milling and grinding of steel drill bits and taps. Cutting oil and degreaser fluid were used at the individual milling and grinding locations within the former plant. Currently, Repal, Inc uses the property to store and process wood pallets. The property encompasses approximately seventeen acres.

The former Besly/Bendix products property was the location of a former drywell, which was used for the disposal of cutting oils and trichloroethylene in and around an outdoor aboveground storage tank in the vicinity of the drywell resulted in localized spills and releases. The tank, drywell, and surrounding soils were removed in 1984. The total mass of soil removed was approximately 742 tons.

Following a series of site investigations, a groundwater recovery and treatment system was installed at the hydraulically downgradient property boundary in 1991. A Class C Response Action Outcome (RAO) Statement for the Site was filed on April 3, 2000 (ERM, 2000a). A Remedial Action Plan for the site was also filed on April 3, 2000 (ERM2000b). The Remedial Action Plan included operation of the groundwater recovery and treatment system, as well as semi-annual sampling of the following monitoring wells and surface water sample locations for volatile organic compounds.”

The chart below illustrates the level of TCE Degreaser that was used on the property from 1988 to 2004.
The extent of the groundwater monitoring wells extended down Laurel Street as far as Newton School across Main Street, Greenfield.
The photograph below is one in a series that labels where the groundwater monitoring wells are on the site. Each of the wells are less than a foot wide and are approximately one to three feet tall.

The letter on the next page details the current state of the cleanup. The agency is asking to be discharged of the continued monitoring of the site.
February 17, 2011

U.S. Environmental Protection Agency
5 Post Office Square, Suite 100
Mail Code OEP06-4
Boston, MA 02109-3912
ATTN: Remediation General Permit NOI Processing
(via electronic mail: NPDES_GeneralPermits@epa.gov)

RE: Notice of Intent for Remediation General Permit
NPDES RGP #MAG910138
Former Besley-Bendix Products Site
180 Laurel Street
Greenfield, MA 01301-3109

Dear Sir/Madam:

MACTEC Engineering and Consulting, Inc. (MACTEC), on behalf of Honeywell, is submitting this National Pollution Discharge Elimination System (NPDES) Remediation General Permit (RGP) Notice of Intent (NOI) for the discharge of treated groundwater originating from Massachusetts Contingency Plan (MCP) remediation activities at the above referenced Site. Authorization to discharge for the Site has been granted under an existing RGP #MAG910138. As required by the U.S. Environmental Protection Agency (USEPA), Honeywell is reapplying for coverage under the 2010 RGP. Attached please find the following documents.

- Remediation General Permit Notice of Intent
- Figure 1 – Site Location
- Figure 2 – Site Plan Showing Location of Outfall(s)
- Figure 3 – Treatment System Layout
- Attachment A: Dwarf Wedge Mussel information
- Attachment B: Correspondence with National Fish and Wildlife Services

Please note that although the endangered Dwarf Wedge Mussel is located within Franklin County, it is not located proximal to the facility or its discharge location. Refer to the attached information for the Dwarf Wedge Mussel including excerpts from the Dwarf Mussel Recovery Plan, February 8, 1993 by G. Andrew Moser, Annapolis Field Office, U.S. Fish and Wildlife Service, Annapolis, Maryland and information from the Natural Heritage & Endangered Species Program, Massachusetts Division or Fisheries & Wildlife, 1 Rabbit Hill Road, Westborough, MA updated November 1, 2009.
The property is zoned mostly industrial (purple) with residential zoning (gold) to the north and west. In order to utilize the full potential of the site, I propose industry occurring on the western section of the site. In order for this to occur, a rezoning would have to be implemented. The surrounding zoning is predominantly residential with transportation to the west and a cemetery which has been zoned industry to the south.
Land Use

The land uses illustrate the low density mosaic of the area. Here the forested path (dark green) along interstate 91 can be seen and the Bendix property makes up part of this corridor. The industry (purple) to the north of the site could also become incorporated into the eco-industrial park. There is also a lot of community space in the area, such as cemeteries and the fairgrounds. The cemeteries (olive green hatched) act like public parks where people can walk. Allowing the public to walk through the Bendix property will facilitate the community connections between Laurel Street and Wisdom Way.
Topography

The ten-foot contour lines were all that were available for this area from Mass GIS. Nevertheless, the site is very flat with the high point in the middle of the site and the low point occurring in the northwest corner.
The site is also a high point in the community and slopes down along Laurel Street.
The water follows the topography of the site, and the blue arrows approximate where the water moves across the site. There is an existing drainage swale directing water to the northwest of the site. Because this northwest section of the site is predominantly low ground, development is not a good idea for this section. This notch is a good space to accommodate water overflow.
The site is currently 30% impervious surfaces indicated by black. In this design, the development was mostly contained to this impervious area to minimize disturbance.
The dominant feature on the site is the main building. This building is planned for demolition. Some of the materials in this building such as brick pavers or concrete blocks for a walk may be useful and could be reused.
The site is divided by a power line right of way indicated in brown, although the actual lines follow the perimeter of the property, indicated by a double black line. There are also many wells spread out across the site and a well monitoring station.
The town records of underground piping show the pipes along Laurel Street. The records end at the #7 Bendix property boundary.
The site is currently surrounded by a chain link fence. This element degrades the aesthetics and community support of the site. Once the site is developed I recommend the fence be removed.
The current entrance to the site is at the end of Laurel Street. The property extends to Wisdom Way, but this sliver of land is too narrow for another vehicular entrance. Wisdom Way does carry the bus route and a pathway for bicyclists and pedestrians would connect the site with public transportation. Interstate 91 to the west is a good opportunity for aesthetic advertisement, generating interest from the public driving by. The interstate does produce noise, but the constant hum of cars is not overly disruptive.
Views

The good view across the interstate into the mountain ranges beyond is an asset to the site. The highway due to landform cannot be seen from the center of the site.

The site has been known for its piles of pallets in the former parking lot. It has been an eyesore for the community.
Understanding the winds is essential to creating outdoor spaces which are enjoyable all year long. Blocking the cold winds and allowing the prevailing winds through is the objective.
The vegetation on the site is dominated by a forest of Ponderosa pines. This forest is a major asset to the site, offering a sense of tranquility within the forest. The north and west of the site is a mixed young forest of predominantly deciduous trees.

To the south of the site, on the property of the abutting cemetery, is a row of tall Norwegian pines. These pose a challenge for photovoltaic and passive solar design.
The path of the sun occurs to the south of the site, rising in the east and setting in the west.
Shade Analysis

Fig 1. Shade in the winter at noon

Fig 1. b. Shade in the winter at 8 am

Fig 2 Shade in the winter at 8 am

The shade created by the tall pines to the south required a shade analysis. Using Google Sketchup I was able to predict where the sun would be at different times of the year. In the design, the buildings are placed away from the shadows, so there would be successful rooftop solar systems and passive solar design.
The design seeks to reincorporate the land with nature and the program with people. The site has a bad reputation in the community due to sitting vacant for over twenty years, along with the environmental hazards. Thus, it was vital to make a holistic design which supports both people and natural processes. Specific challenges to designing an industrial park was the accessibility for semi-tractor trailer trucks, which require a lot of turning room and could result in a road dominated site.

**Concept Diagram**

The concept is based on the existing site assets and the elements of sustainability by designing to take advantage of solar aspect. The buildings alternate along a central axis which is organized east to west, taking advantage of the forest and good views to terminate the line. Alternating with the buildings to the north the forest is extended. Alternating with the buildings to the south are meadows. Thus the design is a contrast of enclosure and openness, light and dark, along a central connecting axis.
The master plan for the site is overlayed on the orthophoto, with the main uses labelled. The business concept explaining these uses is outlined on page 44.
The Design

Water

The water on the site is made an amenity. Following the central axis of the pedestrian pathway are a series of rain gardens which will accommodate the overflow water from the rooftops. Overflow water from the entire site will be directed to the low point on the site into a detention pond. This pond hopefully will accommodate a hundred year flood event.

Vegetation

The evergreen forest extending to the north of the site will block the cold winter winds and reduce heating costs for the buildings as well as creating a more comfortable outdoor space for people.

Meadow

The meadow to the south is a low maintenance habitat planting area which will not shade the southern area of the buildings to accommodate passive solar design and PV on the roofs.

Pedestrian Paths

The path system makes a loop around the site and follows the central axis in a serpentine manner to mimic the flow of water. Rain gardens eco this path system.

Buildings

The buildings alternate along the central axis as to not crowd or shade each other. The central building at the western point would house community incorporation programs and shared resource offices.

Roads

The roads are kept to the exterior of the building to leave the center for people to facilitate communication and cooperation on a person-to-person scale.

Diagrams

Water

Vegetation

Meadow

Pedestrian Paths

Buildings

Roads
Section Through the Axis
The pathway is bordered with a rain garden. Where the pathway curves, the rain garden would connect to the next rain garden under the path. The earthen berms help define the central connecting garden and offer a place to rest.
3D Overview Perspectives
The South Side

This perspective shows the shadows during the summer at noon. The building windows are shaded with the extended roofline.

This perspective shows the shadows during the winter. The tall Norwegian Pines in the south of the site do not cast a shadow on the buildings. The architecture of the building allows sunlight to penetrate the windows, creating passive solar heat gain.
The alternating buildings looking north.

The front entrance from Laurel Street.
Central Axis looking east, birds eye view.

Central Axis looking east, first person view.
Central Axis looking west, birds eye view.

Central Axis looking west, first person view.
Woodland gathering space, looking west.
A Business Concept

In reviewing case studies of other models of eco-industry, (page 47-48), a business concept for this site became apparent. Many of the benefits of eco-industry depend on the business working together and creating synergy. In order to make this proposal truly sustainable, a business model was necessary that incorporates the community within the larger vision of “sustainable”.

This concept bridges the gaps in the local food system in Greenfield. Using the park to house food system industries would create a common theme and ‘food hub’ for Greenfield. After concerns of depleting resources and global warming, the logical next concern is local and healthy food. Raising concern for our economic stability results in the desire to localize our most fundamental need: food.

Greenfield is home to the only licensed kitchen facility, owned and operated by the Community Development Cooperation. At this facility, small food production places can start up, providing a wonderful start-up opportunity. These businesses grow out of the CDC kitchen, and the eco-industrial park is a space where they could keep production local. Special Projects Director at the CISA, Margaret Christie, confirmed there are industry gaps in our local food system. In working with local food producers, she has noted there is a need for distribution, a grain mill, and a slaughterhouse.

Synergy between these industries is possible. A slaughterhouse would place its waste into an underground biogas chamber which would create methane that would be used for energy for the Park. Other food waste would also be placed in this chamber. A distribution company would serve the industries in the park to get the product to the people. The businesses would also share resources between each other and the surrounding community, such as day care, human resources, outdoor recreational walkways, classes, and collaborated promotion.
Greenfield

Why Greenfield?
Greenfield is the hub of Franklin County. With agricultural roots and assets, it is fitting the City sponsor a local food system.

- The City is on the forefront of energy conservation and sustainability projects.
- Designated a Green Community by the Commonwealth.
- Conservation projects have saved the city thousands of dollars.
- A 2.0 MW Solar Farm on the city’s capped landfill is planned. To date, this will be the largest solar installation in New England.

Greenfield is an up-and-coming model for other rural communities. Staying ahead of the curb will distinguish Greenfield as a progressive place to work and live.
Partners for Greenfield’s Food System

Greenfield already has a strong base of community, sustainability and food programs. Listed below are a few possible partners for the proposed Eco-Industrial Park.

Greening Greenfield

“We are a group of concerned citizens working with residents, businesses and town government to make Greenfield, MA a more sustainable and vibrant place to live.”

Franklin County Community Development Cooperation

“The FCCDC provides an opportunity for business owners to build their capacity to make sound decisions that will launch or grow their businesses.”

Greenfield Community College

“GCC is the smallest of the 15 community colleges in the Massachusetts higher education system, known for the caring and supportive attitude of the faculty and staff, and for the broad support it enjoys from the surrounding community.”

Community Involved in Sustaining Agriculture

“Farmers. Families. Restaurants. Grocery stores. We’re all working to keep local agriculture in western Massachusetts strong.”
Case Study~ The Intervale Center

The Intervale Center provides a solid model to follow in terms of practices and engagement with the community.

“For 23 years, the Intervale Center has been dedicated to preserving agricultural resources in Vermont. We help farmers bring their products to market, build and sustain their businesses, and maintain Vermont’s working landscape; we promote land use that protects Vermont’s water quality; we sustain Burlington’s treasured Intervale; and we share our innovative work and knowledge with communities around the world. Our work has helped to build a community food system that honours producers, values good food, and enhances the quality of life.”

-Intervale Centre | Burlington, VT

The Intervale Center also has a myriad of programs that would benefit Greenfield business owners if they were implemented here.

The following excerpt is from the Intervale Food Center Project update which provides a good overview of the eco-industrial park being planned:

“The Intervale Food Center is a sustainable agricultural-based project emerging from discussions between an ad hoc group of citizens and City officials who recognized the potential of an eco-park as a model of sustainable development. This eco-park has been conceived as a partnership of the public, private, and non-profit sectors. It exemplifies sustainable development through emphasis on the principles of cooperative industrial ecology - waste products from one industry become the raw materials for another.

The vision for the Intervale Food Center is the integration of sustainable agriculture with cutting-edge technology. This is accomplished with a firm commitment to the facility's relationship with the community as an employer, good neighbour, and incubator for new business. A bedrock principle of the eco-park is to be a model of environmentally sound and equitable economic development. This four-acre parcel utilizing the existing McNeil Generating Plant is being developed to improve both Burlington's economy and quality of life.

It will consist of a complex of greenhouses and buildings utilizing “waste” heat (steam), a by-product from burning wood chips (renewable bio-mass fuel technologies) at the McNeil Plant. The McNeil Plant has also taken an innovative step in renewable energy production with the biomass gasification project. The wood gasification process has the potential to generate electricity more efficiently and at a lower cost by converting wood or other organic materials into a gaseous, energy-intensive fuel source that can be used in high efficiency gas turbines.

The facility will be comprised of 10,000 square feet of business space and 50,000 square feet of bioshelter (greenhouse) space. Ideal tenants are those who can then utilize the low-grade heat produced at the McNeil Plant to complete the energy-waste-energy cycle through a symbiotic closed loop. The eco-park currently has community gardens, citywide composting, wind power, and a Living Machine demonstration project.”

For more information:
Contact: Nick Warner, Community & Economic Development Office, City Hall Room 32
Phone: (802) 865-7173 E-mail: nwarner@together.net
Case Study ~ Hardwick, Vermont

Hardwick is a small Vermont town that has a strong agriculture base. Through the help of the Center for an Agricultural Economy, the town is now moving towards creating an eco-industrial park. They are currently still in the planning phase, but watching what happens in this community could offer a model to follow.

The Center for an Agricultural Economy writes about an agriculturally-based eco-park:

“Hardwick Area Eco-Industrial Park

An agriculturally-based EIP is a relatively untried concept. Because the Center seeks to develop a cutting-edge facility as a model to be replicated in other rural areas, it is critical that the current planning phase is comprehensive and strategic. With solid planning as a foundation, the Center will move to the second phase, design and construction, with support that is likely to include federal, state and private investment.

The concept of an Eco-Industrial Park is fairly new and there are very few examples worldwide of businesses cooperating in this way. There are even fewer examples of an EIP’s focus on agricultural enterprises. The conventional model for the creation of an industrial park is to bring jobs into the area, regardless of the type of jobs. They are usually initiated and owned by a region’s local economic development group. In an EIP, on the other hand, it is important that the businesses work well together – as different parts of an ecosystem work together. In addition, to take advantage of as many overlapping needs and synergies as possible, it will be valuable to focus the development of the park in a conscientious, intentional and purposeful way. These two facts as well as others make it important that this EIP is developed by the businesses, for the businesses, rather than for an outside agency.”

The Center for an Agricultural Economy is a great third party program to organize the collaboration between the local food systems. Creating a program like this in Greenfield would make this eco-industrial park reach across the community.
Conclusion

This project was integration between program, community, and design. Working with the Town of Greenfield was an extraordinary opportunity to create something innovative for my local community. Looking into the business aspect of an eco-industrial park was a refreshing change of pace and it inspired me to interact with the community of Greenfield in a new way.

To make a place where people would enjoy working was a major element which coincided beautifully with a sustainable model, as well as capitalizing on the existing assets of the site. Overall the result of the site being developed along these guidelines would result in a well-functioning and sustainable asset to the Community.
Works Cited


“Intervale Food Centre, Burlington, Vermont.” 5/2/2011 <http://www.usc.edu/schools/sppd/research/NCEID/Profiles/Mini_Sites/Intervale_Food_Center.html>.


