Heritage Community Environment

Re-imagining Barry Docks

Thaddeous Allan Holland | Fall 2011 | Barry Waterfront, Wales
A Land Use Alternatives Study
Barry, Wales

Thaddeous Allan Holland
Advisor: Emanuel Carter

State University of New York College of Environmental Science and Forestry
Centre for Regeneration Excellence Wales (CREW)

Fall 2011
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Location</td>
</tr>
<tr>
<td>2</td>
<td>East Quay Current Conditions</td>
</tr>
<tr>
<td>3</td>
<td>East Quay Current Conditions Cont.</td>
</tr>
<tr>
<td>4</td>
<td>South Quay Current Conditions</td>
</tr>
<tr>
<td>5</td>
<td>South Quay Current Conditions Cont.</td>
</tr>
<tr>
<td>6</td>
<td>Remediation Master Plan</td>
</tr>
<tr>
<td>7</td>
<td>Willow Growth Cycle</td>
</tr>
<tr>
<td>8</td>
<td>Remediation Materials Palette</td>
</tr>
<tr>
<td>9</td>
<td>Remediation Environmental Performance Summary</td>
</tr>
<tr>
<td>10</td>
<td>Production Expansion Master Plan</td>
</tr>
<tr>
<td>11</td>
<td>Promenade Blow up Plan</td>
</tr>
<tr>
<td>12</td>
<td>Section Elevation A-A'</td>
</tr>
<tr>
<td>13</td>
<td>Production Expansion Materials Palette</td>
</tr>
<tr>
<td>14</td>
<td>Production Expansion Environmental Performance Summary</td>
</tr>
<tr>
<td>15</td>
<td>Housing Master Plan</td>
</tr>
<tr>
<td>16</td>
<td>Eco-Village Plan</td>
</tr>
<tr>
<td>17</td>
<td>Housing Materials Palette</td>
</tr>
<tr>
<td>18</td>
<td>Housing Environmental Performance Summary</td>
</tr>
<tr>
<td>19</td>
<td>Conservation and Open Space Master Plan</td>
</tr>
<tr>
<td>20</td>
<td>Remediation Gardens</td>
</tr>
<tr>
<td>21</td>
<td>Section Elevation B-B'</td>
</tr>
<tr>
<td>22</td>
<td>Heritage Trail Materials Palette</td>
</tr>
<tr>
<td>23</td>
<td>Conservation and Open Space Environmental Performance Summary</td>
</tr>
<tr>
<td>24</td>
<td>Bird's Eye Perspective of Locks Crossing</td>
</tr>
<tr>
<td>25</td>
<td>Alternatives Balance Chart</td>
</tr>
<tr>
<td>26</td>
<td>Conclusions / Recommendations</td>
</tr>
</tbody>
</table>
The Location

Road
Barry Docks is located off of the A4055 on Ffordd Y Mileniwm which connects to the A48 to Cardiff and the A4232 leading to the M4. Swansea is roughly 40 minutes away while both London and the Midlands are around 2.5 hours away.

Rail
Barry Docks Rail Station is the first of three stops in the town of Barry. Cardiff is a short 20 minute train ride from here. London and the Midlands can again be reached within 2.5 hours.

Air
Cardiff International Airport is a mere 10 minutes from the docks. Services include flights to all major cities within the UK and throughout Europe.
East Quay Site Inventory
Contamination and Current Conditions

East Quay is located to the east of Barry No. 1 Dock and west of Barry No. 2 Dock. The site is roughly 4.7 hectares. Previously, the Cadoxton river channel ran through the site. This site was later used for engineering works, ship yard and railway sidings. The site was subjected to remedial works in the mid 1990’s.

The backfilled graving dock comprises an engineered HDPE liner having been backfilled with contaminated soils from within the Barry Docks complex. Wastes were only deposited within the graving dock. The waste management license was surrendered to the Environment Agency on 16th of January 2006. This part of the site is to remain undeveloped. A perfect place for willow plots!

Prior Tenants

<table>
<thead>
<tr>
<th>Name</th>
<th>Business</th>
</tr>
</thead>
<tbody>
<tr>
<td>T &amp; C Engineering</td>
<td>Engineering – Shot Blasting</td>
</tr>
<tr>
<td>Alembic</td>
<td>Chemical Manufacturer (aluminum chlorohydrate)</td>
</tr>
<tr>
<td>Penarth Boat Building</td>
<td>Small boat repair and restoration</td>
</tr>
<tr>
<td>C J Harding/Barry VW</td>
<td>Car repair/restoration</td>
</tr>
</tbody>
</table>

Figure 1: Previous site use
Shallow and deep obstructions are present. Shallow obstructions consist of hard standings at the surface, abandoned services and the foundations to many of the original buildings. Deep obstructions consist of the pump house chamber walls, chimney base and the grouted up culverts.

**Defining Contaminated Soils**

Type 1 - Fill containing mobile contaminants at such a level that they were unsuitable for anywhere in the remediated site and were moved off site.

Type 2/3 - Fill contaminated with heavy metals suitable to remain on site under capping layers.

Type 3 - Fill suitable for the capping of areas to be used for retail, leisure and highways.

Type 4 - Fill suitable for the capping of areas to be used for domestic housing.

**Metals:**
- Arsenic
- Boron
- Cadmium
- Chromium
- Copper
- Lead
- Mercury
- Nickel
- Tin
- Vanadium
- Zinc

**In organics:**
- Cyanides
- Nitrates
- Sulphates
- Sulphides

**Organics:**
- Oil/fuel hydrocarbons
- Aliphatic and aromatic hydrocarbons
- Chlorinated aliphatic hydrocarbons
- Acetone
- Phenols
- PCB’s

**Others:**
- PAH’s
- Oranotin compounds, Ethylene glycol, creosote, herbicides

The above contaminants may be present in both soil and most of them in groundwater. Therefore, soil and groundwater chemical testing should be carried out together with soil leaching tests. In addition, due to the presence of made ground there is a possibility for presence of ground gases, therefore adequate testing should also be performed. The backfill of timber ponds might have resulted in ground gas (methane and carbon dioxide contamination). It is recommended that additional site investigation be carried out in order to confirm the findings of the previous contamination validation testing, to test for substances not included in the previous investigations and to assess areas not previously investigated. Although the evidence to date does not indicate large areas of heavy contamination, soil will have to be treated.

**Credits:** Ove Arup & Partners Ltd. Issue 15. 15 January 2008. Barry Waterfront East Quay Desk Study
South Quay Site Inventory

Contamination and Current Conditions

South Quay is located to the south of Barry No. 1 Dock. The plot is rectangular in shape and consists of 12.5 hectares of land partially covered in concrete, formally occupied by a number of bulk storage containers, an ancillary plant and about 20 buildings of varying size and type. The plot is bounded to the north by Dock No. 1 and to the north-west by the West Pond area, to the south by a slope cut into the hillside, above which is a neighborhood, to the west by a railway line, and to the east by a commercial graving dock.

South Quay was used as a tank farm and for railway sidings, whereas the West Pond area was originally used as a port entry and was generally backfilled. The eastern part of the West Pond was also used as a tank farm. In the mid 1990’s parts of West Pond were subjected to remedial works in order to prepare the site for future development. No remedial works have taken place on South Quay.

Development of the site included construction of tanks and buildings to handle storage of fuel and other hydrocarbons (diesel oil, jet fuel, kerosene, lube oil, mineral oils, carbon tetrachloride, phenol, benzene, solvents) and other chemical substances (sodium hydroxide solution, methanol, silicone). By the early 2000’s all the tanks had been demolished or removed and may have caused wider spread contamination of soil.

Ground Conditions

Shallow bedrock is present in the south while rock head is significantly deeper in the north. Alluvial clays, silts, sands and gravels were encountered. The alluvial materials are generally thickest close to the dock wall and gradually pinch out to the south. These are overlain by made ground materials. Significant soil and groundwater contamination by hydrocarbons and heavy metals on the south dock site and their impact on a housing development needs to be considered. Since the 1880’s the site was used as railway sidings (low level railway) and coal loading areas and since the 1960’s as a tank farm. Two spillages were reported by the former site personnel.

- Jet Fuel (FFO 3000g) in the western part of the site
- Phenol in the eastern part of the tank farm.
The following contaminates are likely to be found within the South Quay Area.

**Metals:**
- Cadmium
- Chromium
- Copper
- Lead
- Nickel
- Vanadium

**Organics:**
- Hydrocarbons (speciated)
- Fuels/Oils
- Phenols
- Solvents
- PCB’s
- PAH’s
- Benzene

**Others:**
- Toluene
- Carbon tetrachloride
- Ethylene glycol

**In organics:**
- Creosote
- Herbicides (atrazine, simazine, 2,4,5-trichlorophenoxyacetic acid)
- sodium chlorate, dalapon, diuron, borax,
- paraquat, picloram, 2,4- dichlorophenoxyacetic acid)

The above contaminants may be present in both soil and most of them in groundwater, therefore the soil and ground water chemical testing should be carried out together with soil leaching tests. In addition, due to the presence of made ground there is a possibility for presence of ground gases, therefore adequate testing should also be performed.

Prior to redevelopment, it will be necessary to carry out site preparations to address the issues of obstructions and ground contamination. In order to develop a greater understanding of the site and issues relating to its development, the following detailed information should be obtained.

- The depth and distribution of shallow obstructions (hard standings, disused foundations)
- Nature and extent of chemical contamination within the soil, ground and surface water.
- Depth and nature of the bedrock.
- Consistency and strength of the fill and alluvium.

It is likely that much of the site will need to be raised by at least 1m above the existing level to mitigate a flood risk.

**Credits:** Ove Arup & Partners Ltd. Issue 29. February 2008. Barry Waterfront, South Quay Desk Study
South Quay Remediation Plan

1. Grid of Hybrid Poplar Trees
2. Development of the Heritage Trail
3. Shrub Willow Plots (Varied Cultivars)
4. Native Woodland Establishment
Willow Growth Cycle

- In one month’s time, the willow will sprout from the planted shoot.

- By the end of the first year, the willow will typically grow to 10’.

- If allowed to grow, the willow shrub can reach 30’ by the 3rd year. This marks the optimal time for harvesting.

- Willow is diverse and can be used as natural screens while being visually pleasing at the human scale.

*Note: Willow requires maintenance in the form of pruning at least once every season to maintain its vertical growing form.

Scale: 1/4" = 1'-0"
Remediation Plan
Environmental Performance Summary

This plan incorporates the planting of shrub willow as means to cleanse the contaminants that are in the soil due to the sites previous use as fuel tank storage farm. Willow speaks to concerns about global warming, air pollution and rural development. Willow biomass is an environmentally sound, locally produced, renewable source of energy and bio-products. Some of the benefits of using this shrub are:

- Willows are easily propagated from un-rooted cuttings.
- High yields can be obtained in a few years.
- Willow’s genetic diversity / short breeding cycle can be utilized to produce improved varieties.
- Willows vigorously re-sprout after each harvest.
- The amount of heat in a dry ton of willow is similar to other hardwoods. 
  An array of bark and foliage colors creates opportunities for visually stunning landscapes.

Production of Willow Biomass

Willow biomass crops increase habitat diversity. They are planted on open land, not on cleared forest land. A crop can be harvested six to seven times before replanting is required. Willow cultivation uses significantly fewer pesticides than traditional agriculture. Willow biomass products reduce the need for fossil fuels and petroleum products. The willow planted at the docks has potential to be converted into a variety of sustainable environmentally friendly resources at a smaller scale, including:

- Heat and electricity by direct combustion, co-firing with coal, and gasification
- Biodegradable plastics and other polymers
- Bio-fuels

Willow crops are ideal for other applications besides bio-energy and bio-products. The application necessary for the South Quay site is Phytoremediation. The willows, poplar trees and miscanthus grasses clean toxins from the contaminated areas through their uptake process.

Lastly, willow promotes rural development and the environment. The willow crops are carbon dioxide neutral which helps to reduce global warming. They reduce the need for fossil fuels for energy, chemicals, products, and fuels. Willow crops reduce soil erosion and nonpoint source pollution as well as generating income for local landowners and create jobs within the local community.

Credits:
USDA
NYSERDA
USDOE
Niagara Mohawk
Antares
NRG Energy
Office of Congressman Walsh
NYS EG
States of Delaware, Maryland, New Jersey and Pennsylvania
East Quay Remediation and Production Plan

1. Swing Bridge Connection to South Quay
2. Greenhouse Growing and Production Expansion
3. Parterre Garden
4. Terraced Planting Beds, Paths, Seat Walls and Lawn
5. Willow plots remediating contaminated envelope
6. Pedestrian Corridor
A tomato’s sweetness and flavor is largely dependent on light and temperature.

Thinning, or pinching off young buds, flowers or fruit can increase the yield of pepper plants.

A pH value between 5.5 and 7.5 should be maintained for growing cucumbers.

What makes up the greenhouse?
The greenhouses are an astonishing construction of white steel and glass. In the greenhouse, every inch of metal is painted white to reflect as much light as possible. The floor is covered with white plastic to reflect sunlight. Conditions will be monitored and controlled by computers. The greenhouses are centrally heated and in winter, the greenhouses are warmed and illuminated artificially. In summer, shades block out the sun if temperatures get too high.

Plants will be grown year round, suspended in vast rows from the 26ft-high ceiling. The beds will then be placed in a system of guttering suspended from the greenhouse ceiling on metal cables and hanging at waist height to allow easy harvesting. A cable drip will feed each plant with water, and nitrogen, phosphate, potassium and magnesium.

Site Specifics
The lighting features will remain consistent with the new installations of the mast and sail that are seen around the docks. Hybrid poplar trees, shrub willow and heather grass will be the dominant vegetation. Other grasses and ornamental displays will be planted. Display gardens will showcase what is being grown inside the greenhouses. Keeping the rail theme intact, the fencing will be spike and spear with any railing along the water’s edge to have a contemporary curve away from the water. Seat walls will be made of slate and shall be brought in locally.
Production Expansion Plan

Environmental Performance Summary

Willow on the Envelope

The backfilled graving dock has been deemed unsuitable for development. This creates an opportunity for willow plots to be introduced amidst the entirety of the footprint of the landfill. Willow is functional and will create an aesthetically pleasing backdrop to the terrace gardens that surround the other graving dock. That dock is disused but has not been filled in so it will be utilized as the focal point of the site. The willow can treat the soil while servicing some of the runoff from the hill of the communities behind the project site. This plan is based on movement and efficiently gets people through while offering paths that off shoot into more passive recreational activities.

Hydroponics...How it Works

Vegetables will be grown exclusively using hydroponics which is a method that uses nutrient rich water rather than soil. The plants will be grown in beds on mats of rock wool which is described as a natural, absorbent fiber that is made by melting rock and blowing air through it, a process much like making candy floss. The crop will be suspended from the eight meter high ceiling in rows which will make picking far easier. Critically, the computer controlled greenhouses will be able to produce crops all year round. Liquid feed is dripped onto the roots from a network of pipes. This contains nitrogen, phosphorus, pentoxide, potassium oxide and magnesium. Given the right conditions, the produce grows two to four times faster than normal.

The advantage is that it is a clean growing medium. There are no soil born diseases and you can control exactly the amount of nutrients, light and temperature the plants get. The greenhouses are lit during the winter from midnight to late afternoon to mimic the summer months. The plants receive the same amount of light and are kept at 28C throughout the year.

Worker bees are released to pollinate plants. Natural predators like spiders are also released during the initial process as a means to control pests.

This system is very efficient and it is a very sustainable model. Each greenhouse complex will have combined heat and power to heat the greenhouses and potentially provide electricity to supply homes in close proximity to the site. This will also help offset some of the construction costs. With the soaring price of fuel, pressure is on growers to cut overheads and they are encouraged to look at these larger scaled sites.

Lastly, this site is an expansion of the initial phasing on the opposite side of the docks water. The larger system being proposed adjacent to the pump house is acting as a catalyst for future development. Keep in mind this is one alternative, an expansion of that production process. These greenhouses could also be growing greenhouses for plants or herbs for medicinal purposes. The system allows flexibility, another advantage.
South Quay Housing Plan

1. Initial Implementation of Park
2. Continue Development of Heritage Trail
3. New Road
4. Eco-Village
5. Vegetable Garden Plots
6. Connection to the East Quay
Eco-Village Plan
1 Photovoltaic Panels capture the winter sun even on a cloudy day.

2 Solar water panels are optional but can be used to provide a hot water system.

3 Super Insulation in the walls and roof keeps warmth inside the house.

4 That warm air is heated by the sun through Triple pane double low-e glazed windows. When tightly closed the house is completely draught free.

5 Low cost and low energy LED Lighting for inside and out.

The Larch House is more of a classic Passive House and is UK’s first zero-carbon Passive House. It shares Passivhaus principals with the houses designed in Germany, but it is adapted for the more temperate Vale climate.

The linear shape of the house is based on the long houses found on farms and the house is built almost entirely from sustainable components and products developed in Wales, many with a proud heritage.

The closed-panel timber frame has been designed using draught-minimizing details developed from Austria, but is constructed from Welsh timber. How those timber frame panels fit together and their joints sealed is crucial for draught-fitting.

The locally made triple-glazed windows, super-insulation and the draught-free fit components ensure that most of the heat generated inside the house remains inside. As well as adding warmth, the extra glazing makes for a brighter living environment.

Photovoltaic panels on the roof collect solar energy and their contribution reduces the house’s overall carbon footprint to zero.
Housing Plan

Environmental Performance Summary

The Passive House

These homes have no need for a conventional, gas fired heating system. In winter, the air is circulated and kept fresh by a low energy ventilation system that saves 10 times more energy than it uses. It draws air in from outside and passes it over the heat in the stale air that it extracts from the bathrooms and kitchen. In the winter, this reclaimed heat helps to keep the house comfortably warm. The result is a light, bright, well ventilated house that is kept warm in the winter and cool in the summer with hardly any use of gas or other fossil fuels. This house responds to the energy challenge and to the climate of South Wales.

Benefits of Eco-Villages

The villages can provide affordable living alternatives as opposed to the high rise apartments and flats. They are generally small, compact and integrate well with the landscape. These villages can be interwoven into the existing willow fabric. Because the willow is always growing, the villages have the benefit of being surrounded yearly by a changing landscape.

The Eco-village displays a closed circuit road network, which improves pedestrian circulation and improves the air quality by lowering fuel emissions. Parking sheds are located on the perimeter of the villages to further the previous notion of improved pedestrian movement and air quality.

Even though our plans call for a large farmers market and production greenhouses, each village will be equipped with vegetable gardens. People will be able to grow their own food and care for their gardens.

This plan integrates a housing scheme while also conserving the majority of the site as public green space. Now is as good a time as any to begin transitioning to energy efficient housing rather than the usual high rise flats and apartments that only impede ones experience of the place, both physically and visually.
South Quay Land Conservation Plan

1. Remediation Gardens
2. Completion of Heritage Trail
3. Willow Plots
4. Heritage Overhead Structure
5. Open Lawn
6. Native Woodland with Trails
7. Meadow Walk
8. Connection to East Quay
Heritage Trail Paving Detail

The main feature for this set of plans is the conservation of the traces of heritage and identity along the water’s edge. The original coal rail tracks (pictured right) run the length of the water. These can be highlighted into the path system as shown to the left.

Heritage Trail Overhead Structure

The hoists were once significant structures towering over the docks. This growing structure reflects the signature of the docks industrial past. The frame reminds the form of the hoists and each structure is located in their original positions along the water’s edge.

Suspended soil beds at approximately 2m are planted with different varieties of climbing plants that transform the tall steel structures into lush green chimneys.

Clemantis - A fast growing flowering plant that could transform the chimneys depending on the color of the flower planted.

Honeysuckle - A colourfull richly scented climber that can tolerate a wide range of conditions throughout the seasons.

Akebia Quinata - A hardy fast growing, semi-evergreen climber with fragrant cup-shaped purple flowers.

Ivy - English Ivy is a versatile and easy plant to grow that stays green all year round. This would ensure the lush green appearance of the chimneys throughout the seasons.

Virginia Creeper - A vigorous self clinging plant with a vivid red color in the autumn.
Conservation and Open Space Plan
Environmental Performance Summary

High end residential complexes are the death of waterfronts. The ideas and concepts from this plan offer the most beneficial land use to this site and play the role of public green space in the overall master plan. Since the site is in need of remediation, some of the areas can be preserved once remediation is complete in the form of remediation gardens. These gardens will include the shrub willow, hybrid poplar trees and various grasses including miscanthus that were planted during the initial implementation. Nodes or pocket parks can be enjoyed by the public and the employees of the market and greenhouses alike.

A trail along the water has huge potential largely due to the fact that some of the original pieces are already in place. There are 3-4 sets of low level rail tracks from the olden days of coal and timber transport for exporting at the docks. In collaboration with the tracks, large coal hoists and cranes towered over the water. The living structures resemble that form with its steel frame and the living greenery can represent a new sense of direction for a place and a nation.

Conservation of land is never a negative. The impacts can be measured in various ways from:

- Protecting wildlife and re-establishing habitats
- Improving the public’s quality of life
- Increased property values
- Active and Passive recreation spaces

Strategic use of the vegetation and the conservation of the land can offer the public and employees a 3rd place to spend their time. People’s 3rd places are sometimes overlooked. This strategy provides a place for all to play after they have spent the day at the places they work and the places they live. It is related to the concept of forest bathing which was developed in Japan. This idea has also been proven successful in Germany among other places. A person’s stress levels are lowered, their mood improves and their immune system strengthens. The idea is to enjoy the forest through the five senses: the murmurings of the water, bird’s singing, green color, fragrance of the flowers, eat some nuts or berries and just touching the trees. The scale of this site may be smaller, but the impact is direct due to the proximity of the adjacent communities and potential work force.
This plan embraces the operations of the locks. The pedestrian corridor presents opportunities to enjoy the surroundings of the water and the historical sliding gate, while efficiently moving people between the East and South Quay areas.
Finding A Balance
Comparision of land uses with the 5 project elements

Note: Squares that are filled meet that project element.
Squares that are not filled do not completely meet that project element.

This graphic compares the land use alternatives with the main project elements. The remediation is a given and must be done. The graphic shows all alternatives are aesthetically pleasing. Production has potential for economic development and a strong level of community development. Housing has strong community development but is weak in other important elements. The graphic shows that Land Conservation as an alternative fulfills all the important elements and is integrated holistically for this particular project. The conclusion is that this is the best fit alternative following the implementation of the remediation.
Conclusions / Recommendations

Over the course of this project, my process continually changed. What remained consistent were the numerous representatives and their interest and support in our ideas and concepts. Valuable experience has been gained with the site visits, meetings and interactions with people that matter, and presentations to elected members of the Welsh government and members of town councils. The decision to study the South Quay site in depth was a good one. In addition to the pump house and the mole, it is carrying the most immediate interest. The current proposals offer an exhaustive amount of two to three level homes with high rise apartments and flats on the South Quay site. The site has yet to be remediated and the potential of shrub willow and its numerous benefits has sparked interest as a temporary solution while the housing market is down. However, the goal is for that plot of land to be conserved as open green space for the public to interact with. Realistically, housing seems to be inevitable, but their approach could be more delicate towards the environment and the surrounding communities.

Instead of filling the majority of that plot of land with housing and limited conserved land or open space, the value of that property will quickly diminish after the wave of first tenants. Contrast that with a plot of land that is shared by housing and large conserved land and green space. The property values will raise and the area will become quite the destination to live and play. Yes, housing is important, but establishing more of the same in a community that statistically has not increased in quite some time is not the strongest solution. A shift in focus is necessary. Create opportunities for tourism that will bring people to Barry and re-establish the waterfront as a destination. Focus also on retaining the existing population and bringing a percentage of the unemployment to work closer to home while offering the closest public green space in town.

In addition, as part of the green space and conserved land, the idea of a heritage trail that speaks of the stories of the docks is another strong recommendation. The proposals for the pump house and waterfront museum were big hits, and incorporating a heritage trail along the water’s edge would be an excellent way of conserving that land. The existing rail tracks should be implemented into the paving design, and the living overhead structures that resemble the large coal hoists that use to defend and protect the water can serve as a significant meaning of transition between the past and the future.

Barry has an excellent opportunity to create spaces for economic and community development, that improves transportation and circulation, is aesthetically pleasing while being sustainable and environmentally sound. Having made numerous trips to the docks site, I made a connection to the waterfront and envision a place buzzing with people, enjoying great food and the creativity of local artisans as well as activities on the water. I see a place that will embrace the landscape while retaining and showcasing a town’s local heritage, pride and identity.

-Thaddeous A. Holland

5th year Landscape Architecture Student
SUNY College of Environmental Science and Forestry