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RESIDENTIAL DEVELOPMENT UNDER M.G.L. CHAPTER 40B:

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RESIDENTIAL DEVELOPMENT UNDER M.G.L. CHAPTER 40B:
DESIGNING AN ALTERNATIVE STORM RUNOFF SYSTEM BASED ON THE
CASE STUDY “OCEAN SHORES”

A Master Qualifying Project

Submitted to the faculty of

Worcester Polytechnic Institute

to partially fulfill one requirement for the

Degree of Bachelor of Science

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Date: 5-31-2007

This Major Qualifying Project Report is submitted in partial fulfillment of the degree requirements of Worcester Polytechnic Institute. The views and opinions expressed herein are those of the author and do not necessarily reflect the opinions of Worcester Polytechnic Institute.

This report is the product of an education program and is intended to serve as partial documentation for the evaluation of academic achievement. The report should not be construed as a working document by the reader.
Abstract

This project reviews Ocean Shores, a 90 condominium site development built in Marshfield MA under M.G.L. Chapter 40B regulations. Data about the project was collected to produce a timeline documenting the steps the developer took while applying for a building permit. The application process required the developer to redesign the site plans. The author proposes an alternative an innovative more environmentally friendly system storm runoff design for this project using low impact development techniques and rain gardens instead of a retention basin
Capstone Design Statement

The replacement of the sediment basin and the retention basin for a Low Impact Development System as an innovative approach to storm water runoff is not widely used in the north eastern US. The higher cost of porous asphalt and concrete and the breaking of tradition deter developers from attempting to implicate these simple procedures that are better for the environment then miles of piping below the ground.

The initial approach was to research the case study “Ocean Shores”, then a problem was recognized and research was done on how fix it afterward the design was incorporated to the development’s storm runoff system. The most common use of the rain garden is for individual home use, so the most detailed information found was on an individual building basis. Thus the rain gardens were applied to the individual buildings for storm water runoff treatment of those areas. The other source of impervious material was the asphalt parking lot and paved sidewalks. To reduce runoff the design changed that material porous asphalt and concrete. French drains, and grass buffers were included in the design to help slow water thus keeping erosion to a minimum, and filter out pollutants.

There are very specific guidelines about how to design a rain garden that best suits an individual’s needs. These rain gardens and LID techniques are pretty self sustainable, they only need minor maintenance by a landscaper to keep them in good repair. The bright flowers and relaxing atmosphere of a rain garden promotes health and wellbeing to all in the neighborhood. This design first came about as being a way to help citizens compromise with the politics of incorporating a new development into their area.
Acknowledgements

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Chapter 1. Introduction

The production of residential developments under Massachusetts General Law (M.G.L.) Chapter 40B is a state program that seeks to increase affordable housing opportunities for citizens who are below the median income of the area. Each Massachusetts city or town must possess at least ten percent of units deemed affordable. For a development to be recognized as a Chapter 40B project it has to have 25 percent of its residential units affordable to families that earn less than 80 percent of the median income or the project must consider 20 percent of the units available at the ‘affordable’ rate for people with an income below 50 percent of the median.

(Applicable for this type of development are both for-sale and rental units. Also the profit of the development can not exceed 20 percent of cost. Any profits exceeding this calculated value are given to municipality to minimize the impact caused by the development in that area. The development of ‘Ocean Shores’ in Marshfield MA was determined to be in compliance with the Chapter 40B requirements and was given permission by the Conservation Commission to build on March 10, 2005.

The citizens of Marshfield objected to the construction of ‘Ocean Shores’ and formed a Ten Citizen’s Appeal which has delayed construction. During the five years of debate since the first proposal was submitted to the town many concerns were raised by the citizens of the Marshfield. One such concern was the destruction of the Eastern Box Turtle, a species of special concern’s habitat. Others concerns were related to the
aesthetics of the proposed project, cost of maintenance and general safety of having a retention basin in the vicinity of the Eastern Box Turtle habitat and the inquisitive young children of the development.

Retention basins are used to contain and filter storm water runoff and to stop pollution from getting into the immediate environment. Ironically the filtration system of the retention basin while trying to help protect the environment, requires miles of piping to transport the water wasting valuable resources. Also because throughout the site there are so few locations for the water to enter the system the water has long distances to travel eroding the land from constant use. This erosion caused by the trails of water leading to the piping system scars the earth with a permanent change.

The installation of Rain Gardens solves that problem by being more numerous and close to the point of origin of storm water run off throughout the site. The installation of natural filtration systems, which are environmentally friendly and innovative techniques have not been fully explored in the north eastern U.S.. At one time believed to be unreliable with the constantly fluctuating environmental changes of the region, these filtration systems are usually only applied to individual home use. Through new research and the use of these systems in more north eastern environments most well known in Maryland, there was enough information to apply the technology in Massachusetts. The research into Low Impact Development (LID) strategies and rain gardens shows that these applications can be used together as effective storm runoff systems. Pervious
asphalt and pavement two important LID techniques are not usually applied to projects of this magnitude because the cost of is higher then regular asphalt and concrete mix.

These higher prices may increase construction costs however I have found them negligible compared to the amount of good the rain gardens and LID systems will do the environment. This project implements the LID aspects and incorporates it with the rain gardens for a complete storm runoff design for a 90 condominium project.

Ocean Shores is a development built under Chapter 40B regulation. The removal of the retention basin was theorized as a way to halt destruction of the Eastern Box Turtle habitat and smooth over disputes between the citizen’s of the town who object to the construction and the developer. The implementation of LID strategies and Rain Gardens were utilized to maintain a storm water runoff system that fulfilled the original goals.
Chapter 2. Background

2.1 A Description of M.G.L. Chapter 40B

Enacted in 1969 M.G.L. (Massachusetts General Law) Chapter 40B designated ‘The Regional Planning Law’ (http://www.mass.gov/legis/laws/mgl/gl-40b-toc.htm) and also known as the ‘anti-snob’ law, Chapter 40B was intended to encourage non-government sponsorship of low-income housing throughout Massachusetts (Http://www.dwpm.com/content/main/Affordable_Housing.php3). This sponsorship would increase affordable housing developments, with the intention to help developers avoid ‘not in my back yard’ (NIMBY) complications (Http://www.masschc.org/story_opin.php?id=61). These types of complications are brought about when citizen’s fight to keep developers from building because the citizens objections to a new development in their neighborhood. The law says that the purpose of M.G.L. Chapter 40B (hereinafter referred to as Chapter 40B) is to facilitate the cooperation between cities and/or towns of a quick, well organized and cost-effective movement toward the common goal of coordinating the developmental expansion within their areas of jurisdiction (http://www.mass.gov/legis/laws/mgl/gl-40b-toc.htm). The M.G.L. Chapter 40B law was meant to make it easier to develop in a city or town and increase housing for the low to moderate income families, especially in communities that do not meet the 10 percent required low-income housing as mandated by the state. This law which was amended in 1969 gives developers the right to appeal the decision of the Zoning Board of Appeals (ZBA) if the restrictions put upon the proposed project are deemed to be ‘uneconomical’ (Http://www.chapa.org/40b_fact.html). By suing the local
ZBA, the 40B developers can then override town zoning laws and other restrictions that would normally be put in place against project developments (Http://www.chapa.org/40b_fact.html). While this helps to accommodate the developer and promotes the development of low income housing there is controversy concerning whether projects built under the 40B law are beneficial to the towns and their people. Projects that are applicable for the 40B law, must have at least 20 to 25 percent of the units designated low to moderate income affordable housing (Http://www.chapa.org/40b_fact.html). The affordable housing units go toward a towns goal percentage of affordable housing units (Http://www.chapa.org/40b_fact.html). Towns are required by the state to have 10 percent or more of their housing affordable. There are many benefits allotted to the towns that are able to reach the 10 percent goal.

2.2 M.G.L. Chapter 40B Benefits and Challenges

One of the benefits of the Chapter 40B program is that it provides towns with a reward based encouragement to increase affordable housing units in a particular area. Achieving the 10 percent affordable housing goal in a town then grants the ZBA the right to be more selective when considering future proposed 40B projects (Http://www.chapa.org/40b_fact.html). This increase in lower priced housing helps citizens that “make less than 80 percent of median household income for the area” have a place to live (Http://www.chapa.org/40b_fact.html). Median household income means that if you line up all of the incomes in a given area from most to least whichever number is in the middle is the median income in that area. Eighty percent of that household income sets the price for the affordable units being developed. Developers have the
advantage of applying for a low-interest loan from the state that covers partial or complete costs of the construction for the developer (McConville, 2006). Town governments often want to oppose Chapter 40B developments because their constituents tell them to, but if the town reaches the 10 percent affordable housing goal they may be permitted to deny additional 40B developments and applicants are not permitted to circumvent the by-laws (Department of Housing and Community Development, 2002). Also a developer is only permitted a maximum profit of 20 percent on any project developed under the Chapter 40B law. Any profits over that amount are given to the town. There are many challenges within target communities because they are concerned that the benefits of such a development maybe exceeded by the negative impact it could have in their neighborhoods. Often new school capacity has to be developed to handle the number of new school-age children developments bring into a town (Center For Policy Analysis University of Massachusetts Dartmouth, 2002). Other aspects of controversy include developers using 40B to increase their net profit more then helping the affordable housing industry (McConville, 2006). Many deceptions have been documented including hiring their own crews for the construction but not claiming that as profit and inflating the cost of the land purchase on their pro-forma (McConville, 2006). Another complaint people have toward 40B developments is the definition of ‘affordable housing’. Affordable housing means the purchase price must be affordable to 80 percent of the median income of the area and by this very definition over a third of the population will not be able to afford renting or purchasing at such a price (Http://www.masschc.org/story_opin.php?id=61; Marshfield ZBA, 2002).
Chapter 3. Case Study

A description of the project Ocean Shores including a timeline from proposal of the project in Marshfield MA to the current lawsuit that has halted construction. Throughout the proposal process there were issues that arose and after the developers were given permission to build there were regulations that the development was exempt from.

3.1 Project Description

On December 5, 2001 Beacon Ocean Shore Limited Partnership c/o Beacon Residential Properties applied for a Comprehensive Permit (See Appendix H for definition) from the Marshfield ZBA for a 198 Apartment Project to be known as Marshfield Commons located at 1209 Ocean Street in Marshfield (Marshfield ZBA, 2002). The apartment complex was intended to have seven 3-story buildings with one, two, and three bedroom units (see Appendix G for more detail concerning unit layout) (Horsley & Witten, Inc., 2001). A total of 20 percent of those units would be classified as affordable as mandated by the state. They proposed this plan to the town’s ZBA and were told to decrease their units to 180 as a compromise for the citizens. The proposal for the 180 unit project was the same general type with a decreased number of units that affected all single, double and triple bedroom apartments. After the ZBA approved the permit the town Selectmen filed a lawsuit and Beacon Residential Properties settled with a new project proposal of 90 condominiums. This development proposal passed both the ZBA and the Conservation Commission with little alteration and is currently in litigation filed by town citizens.
3.2 Full outline/timeline

On December 5, 2001 Beacon filed for a comprehensive permit through Marshfield’s Zoning Board of Appeals for 198 apartments (Marshfield ZBA, 2002). Throughout the process many documents were filed by both public and private organizations in regards to objections or topics of consideration for the Beacon Proposal. Some public groups that were involved included the Massachusetts Division of Fisheries and Wildlife, Marshfield’s Airport Commission, Marshfield’s Conservation Commission, Marshfield’s Selectmen, and Marshfield’s Zoning Board of Appeals. (see Appendix E for detailed timeline) Some private groups involved were Beacon, Daylor Consultation Group, Inc., and Marshfield Action, Inc. (see Appendix E for detailed timeline) Objections were made about the density of the project and Beacon showing its desire to accommodate changes altered their design for Marshfield Commons from 198 apartments to 180 apartments (Nixon Peabody, LLP., 2002). They also complied with requests that they change the name from Marshfield Commons to Ocean Shores (Baker, 2004). Most of the complaints that were brought to Beacon’s attention were discredited by experts Beacon hired who ascertained that the project would not adversely affect traffic (Glenn D. Cannon, P. E. and C. Engineering, 2002), airport noise (Horsley & Witten, Inc., 2002), species of special concern habitats (McPhail Associates, Inc., 2001) and wetland boundaries (Horsley & Witten, Inc., 2002). The Selectmen and Zoning Board of Appeals hired their own experts who said that Ocean Shores would indeed be adversely affected by the airport noise (Senzig Engineering, 2005) and the flood plane boundary (SGC Engineering, LLC., 2005) of 10.3 feet if they built for five feet which was the original ground water table measurement, and the population of the new development itself would
adversely affect the traffic (Horsley & Witten, Inc., 2002) and species of special concern (Massachusetts Division of Fisheries & Wildlife, 2004), eastern box turtle habitat. These experts proposed ways to modify the design of the project to help with the above issues and from current designs it is obvious that not all of those alternatives were put into affect. However the ZBA felt that Beacon had compromised to an extent that was acceptable and granted the Comprehensive Permit on 8-27-2002 (Marshfield ZBA, 2002).

The Selectmen of Marshfield were motivated by their constituents to sue the ZBA and Beacon concerning the validity of the Comprehensive permit (James B. Lamplke, 2002). Two other unsatisfied parties sued after the ZBA’s decision, Diane and Stephen Schieb sued the ZBA(Drohan 2002), while Marianne McCabe sued Beacon Ocean Shores Limited Partnership etal. (Commonwealth of Massachusetts Department of the Trial Court Plymouth Superior Court, 2002). The Selectmen of Marshfield settled with Beacon concerning the proposed project (Baker, 2004). Beacon modified their project from 180 apartments to a dual proposal of 150 apartments or 90 Condos (Baker, 2004).

Beacon again brought their proposal before the ZBA and while Marshfield Action, Inc. still claimed their objections were valid toward this revised proposal the ZBA felt that Beacon’s concessions during settlement were adequate and they approved the revised proposal on 4-20-2005 (Marshfield ZBA, 2005). This revised proposal had to also be approved by the Conservation Commission and after deliberations, the Conservation Commission found that the changes made by Beacon to protect the Vernal Pools on the property to be appropriate, and the elevation of Beacon’s ground floors at 11ft to be safe from the 100 year storm (10.3feet). Upon reviewing Beacon’s application the
Conservation Commission granted Beacon their permit (Conservation Commission, 2005).

After the ZBA and the Conservation Commission granted Beacon their respective permits Laurie Hannah sued Marshfield’s ZBA (Commonwealth of Massachusetts Land Court, 2005) and Marshfield Action, Inc. formed a group of citizen’s to file a Ten Citizen’s Appeal which is still ongoing today. (See Appendix E for complete Primavera timeline)

3.3 Projects Constraints

Throughout the proposal process the constraints remained the same, even as the project changed size and style the concerns of the public remained the same. The most important of those issues are discussed here below.

3.3.1 Environmental

In this instance the site location, 1209 Ocean Street, Marshfield, MA 02050 intersects Business Highway zoning, Airport zoning, and Residential Waterfront Zoning (Marshfield ZBA, 2005). Also on the site there are three certified vernal pools and an acknowledged special species the Eastern Box Turtle, making the 31 acre plot its home. Due to the vernal pools Beacon is not allowed to build within 100 feet of the basin and 22.7 acres of the property is being preserved for the Eastern Box Turtles.

3.3.2 Traffic

Traffic is an issue concerning the amount of congestion that the development will be bringing to already poor quality roads (Marshfield Action, Inc., 2002). The Level-of-
Service (LOS) predictions for the surrounding roads if more congestion is added on them are LOS D and LOS F (see Appendix H for definition).

Pedestrians are also to be considered for this near beach community. Sidewalks are a necessity and required for safety measures due to the high volume of pedestrians both inside the development and outside of the development.

3.3.3 Safety & Noise

There was an original concern on the part of the citizens of Marshfield was that the height of the largest building in the 198 unit proposal would be too tall. However with the change to 90 condos the height became irrelevant.

The next concern was airport noise and how aircraft noise would impact the residents in the building. According to Dufresne-Henry, Inc. the safety and quality of life of Beacon’s residents is not in jeopardy. However the Marshfield Airport Commission disagrees, Ann Pollard the Airport Manager states “…we are certain that the duration and level of noise generated by aircraft at the Marshfield Airport will cause significant disruption to residents of Marshfield Commons should … <the> project be developed on the proposed site”(Pollard, 2002).

3.3.4 Site Drainage

The site drainage is setup so that the storm water runoff will travel to set spots that will drain the water and its pollutants into the underground piping that transfers it to the sediment pond and then to the retention basin. Both of these facilities are drainage systems that maintain water purity while re entering it into the environment. In this particular situation the retention basin is set at a 8.5feet level which means “In effect, the
flood elevation has been set at the elevation 8.5’ with this design” (Daylor Consulting Group, Inc., 2004). Originally this would have been acceptable when it was thought that the flood elevation was 5 feet however with the new flood elevation being at 10.3’ the retention basin is not designed to handle the amount of storm water runoff.

The water table was measured in the peak of winter through the measuring of the certified vernal pools on site. The elevation of the vernal pool on January 19 is 4.38 feet (ENSR International, Jan 19, 2003). In the retention basins a water pocket is designed that is kept constantly wet, forming a type of pond, that in this case will hold up to 5’ of standing water which is greater then the calculated water table, based on the vernal pool study (Daylor Consulting Group, Inc., 2004).

There are many discrepancies about this storm runoff set up. The location of the retention basin in the middle of the Eastern Box Turtle habitat:
Figure 3.1: Site Plan Diagram

Ocean Shores site plan with Eastern Box Turtle habitat, Certified Vernal Pools and the retention basin all explicitly pointed out. This figure shows that the Retention Basin is being built in the middle of the Eastern Box Turtle habitat.
Chapter 4. Low Impact Development Drainage System

4.1 Capstone Design

While seemingly effective the retention basin is an eye sore and it requires significant maintenance. Also at this particular site it interferes with Eastern Box Turtles nesting grounds. My intent to design a more inconspicuous and effective means to handle storm water runoff would hopefully in turn help to alleviate some of the controversy existing between the towns citizen’s and the developer. I have designed a rain garden system which is better for the environment then the standard pipes leading from the drains to a retention basin. There are pipes emptying off of roofs out onto gravel paths that are easily maintained and lead to small drainage gardens. In the following example the yellow lines represent the french drains that lead the water away from the rain gutters to the rain gardens that are strategically placed.
Rain Gardens and Pervious Concrete/Popcorn Asphalt as well as Low Impact Development (LID) are new and innovative ways to try and decrease storm runoff with minimal negative affects on the surrounding environment. The rain gardens are both aesthetically pleasing and useful in their function of rainwater runoff infiltration. The pervious asphalt and concrete while used for some road construction is not widely utilized as an efficient means of filtering storm water runoff. The other LID methods applied are french drains and grass filtering strips. Alone these mechanisms...
can be applied to personal homes or landscaping areas, but together they can handle the runoff of a 90 condominium development. (see Appendix A for Proposed Alternative Storm water Runoff Design)

Figure 4.2 : Edge of Ground Meets Parking Lot

A diagram showing the usage of LID strategies in the site. The edge of ground meets porous asphalt diagram showing crushed rock/french drain layer, grass buffer strip and porous concrete all working together to filter storm water runoff back into the ground.
4.2 Redesigned Plan

After researching the most effective way to alter the storm water runoff system it was decided that rain gardens and LID would be a modern approach that could be used as an alternative solution for such a large development.

Figure 4.3: Rain Garden Cross-Section

A diagram showing the cross-section of a basic rain garden. Labeling the layers in the cross-section as suggested by Bannerman & Considine (2003).

The Rain Garden Manual provided a formula that calculated the volume and quantity of the rain gardens necessary to cope with the runoff from the roof of each building (Bannerman & Considine, 2003). Bannerman and Considine (2003) also gave limitations as to a rain garden’s size and how far away it should be from the building. Taking all of that into consideration the design of a runoff system was soon underway on the hardcopies of the site plans. The first step toward making the design most accurate was to input it and the site plan into AutoCAD. This started very simply with scanning the hardcopies into an electronic format. Then uploading the file into AutoCAD it was
copied into the drawing file. Next the traced and uploaded designs were rescaled to fit actual size in the program. This introduced some precision error because upon scaling the largest value was used of the two choices.

The site plans scanned into the computer at 2263.62in X 2541.18in. The first step was to make the drawing as close to the original size as possible 36in X 42in to do that I had to down scale it by 0.01855435099. Then I scaled it the 1in = 50feet as it said on the original drawing.

After scaling the drawing, the storm water runoff system was implemented with measurements and direction of water flow, showing how the rain gardens would individually collect the storm water from the roof tops.

GENERAL EQUATION:
Area*Percent_Roof_Runoff*0.15(depth of 6") = volume of necessary rain gardens

BUILDING 1
Area=2987.5 sqft
Rain Gardens=6

Minimum Rain Garden Volume=2987.5*(1/6)*0.15=74.6875 sqft

2F=8’x16’=128 sqft
2G=8’x16’=128 sqft
2H=8’x16’=128 sqft
2I=8’x16’=128 sqft
2J=8’x16’=128 sqft
2K=8’x16’=128 sqft
(see Appendix B for more results)

Table 4.1 : Example Rain Garden Calculations

Example Calculations for the rain garden volumes around Building 1.

Also copied into the AutoCAD file was the topographic map which shows the original layout of the land before construction and the newly designed ‘double rain garden’ (see Appendix C for AutoCAD topographic maps). The Rain Garden Manual specifically
dictates that the volume of a rain garden should be no more than 300sqft to avoid forming a puddle (Bannerman & Considine, 2003). The tight spaces in the area of this design required some creative design of the rain gardens shapes and sizes. So to keep to the restrictions of the manual and to take into account the small amount of space that was available I designed a double 300sqft rain garden. It is two rain gardens 300sqft each back to back, so that they can mainly function as individual units however they can overflow into each other if necessary. Their design was input into AutoCAD along with a cross-section of a rain garden (see Appendix D for LID diagrams).

4.3 Summary of work

The calculation of rain gardens for each of the twelve buildings was generally repetitive. The complications came into play when it came to finding space for the rain gardens. Singularly there wasn’t enough space surrounding most of the buildings to keep a 10 foot distance and still fit 6 decent sized rain gardens in really close proximity. To help compensate for this lack of space a single rain garden that might be a decent size, could retain the water from two of the gutters off of the roof. Thus consolidating the number of rain gardens and increasing the size. Another design liberty taken was the designing of a double rain garden: one rain garden that is made up of two separate but equal sized rain gardens. This honored the rule of only being allowed to have a garden that is 300sqft because each garden was individually only 300sqft and unless there is a down poor and overflow, each garden is only expected to act individually of each other.

The building that caused the most problem space wise was the Garage/Building 12. Its vast impervious surface area caused problems because three sides of the building are
surrounded by either mostly asphalt or just very little soil. Luckily there was enough room on the back of the building to squeeze in a bunch of small rain gardens. Altogether it took 37 rain gardens to filter the storm runoff from that building.

Rain Gardens and LID strategies are environmentally friendly. They filter the water right back into the water table and they do not require constant maintenance, they are attractive and do not form pools of water at the bottom. In the case of Ocean Shores they also remove the threat to the Species of Special Concern the Eastern Box Turtle habitat. These solve key problems that the citizens were objecting to. However there are also some draw backs, this type of storm water runoff is not often used in the eastern US so it is not well tested under the weathering conditions for such a large development. Also although The combination of both LID technologies and Rain Gardens on one site are best served to help protect against large storms like the 10 year or the 100 year flood (http://www.lid-stormwater.net/intro/background.htm). The goal to prove that it could handle a 100 year storm by summing the rain gardens areas and seeing if it were comparable to the retention basins area went astray when it was realized that those calculations left out the sidewalks and the parking lot that while handled by the porous asphalts and concrete were calculated largely into the retention basin. Attempts were made to deduce how to incorporate the other aspects however no solution was found. Most information says that LID combined with other sources like Rain Gardens or even some piping if necessary can automatically handle a 10 to 100 year storm (http://www.lid-stormwater.net/intro/background.htm; http://www.iamu.org/main/Stormwater/Stormwater%20Management/Stormwater%20Mgmt%20BMPs.pdf). The most important part for the environment is that the LID system
be able to take care of the small day to day storms so as not to over strain the environment by trying to over compensate for a 100 year flood (http://www.lid-stormwater.net/intro/background.htm).

Site Plan with Rain Gardens
Chapter 5. Conclusions

With a total of 88 Rain Gardens required in this one development they come in different shapes and sizes. Including the LID strategies especially porous asphalt and concrete this storm water runoff system is designed to handle all but the strongest storm. Ocean Shores is a Chapter 40B development. Upon proposal in Marshfield MA it came in expecting little resistance with the citizens. Marshfield surprised them and caught them unawares. The citizens found vernal pools on the construction site and an Eastern Box Turtle Habitat as well in the same area. The citizen’s other complaints, included the lack of aesthetics of the retention basin, the placement of it in the middle of the turtle habitat, and the constant maintenance and upkeep required of that storm water runoff system.

This LID and Rain Garden system removes all of those complaints surrounding that one topic. It removes the retention basin from the middle of the turtle habitat, the rain gardens do not require any more maintenance then just general landscaping costs and they are very pretty to look at. On top of which Rain Gardens do not have a permanent pond nor are they a curiosity to the youth in the area who must be kept out with high fences.

These Rain Gardens could be used more locally. Even without it being a huge development. If peoples start putting them in communities and spreading the use of rain gardens and LID strategies then the north eastern US will have some more information on how well they work and hopefully that will encourage developers to look at these innovative strategies and see potential.
If so then maybe the cost of the porous asphalt and concrete will decrease enough for developers to really take an interest in making their projects more environmental friendly. Then maybe the towns people and developers can have a smoother transition when proposing a new project.
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Appendices

Appendix A – Proposed Alternative Plan with Rain Garden
Appendix B – Calculations and Notes
Appendix C – Project Topographic Maps
Appendix D – Rain Gardens and LID Diagrams
Appendix E - Attached outline produced by PRIMAVERA™
Appendix F – Allowed Exemptions/Exceptions to Local Bylaws and Codes & Specific Exemptions/Exceptions to the Applicable Town of Marshfield Conservation Commission Regulations (2005)
Appendix G – Developer’s building details
Appendix H – Definitions
Appendix A – Proposed Alternative Plan with Rain Garden

Site Plan Overlay
Drawn Original Site Plan With Key

Changed Site Plan with 10’ Boundary
Site Plan with Rain Gardens

Building 1 and Surrounding Rain Gardens
Building 2 and Surrounding Rain Gardens

Building 3 and Surrounding Rain Gardens
Building 4 and Surrounding Rain Gardens

Building 5 and Surrounding Rain Gardens
Building 6 and Surrounding Rain Gardens

Building 7 and Surrounding Rain Gardens
Building 8 and Surrounding Rain Gardens

Building 9 and Surrounding Rain Gardens
Building 10 and Surrounding Rain Gardens

Building 11 and Surrounding Rain Gardens
Garage with Rain Gardens Including 7 closest in the Park Area

Park Area with Rain Gardens
Appendix B – Calculations and Notes
Calculation Results

Area*Percent_Roof_Runoff*0.15(depth of 6”) = volume of necessary rain gardens

**Area** = Area of the roof the runoff is going to be collected off of

**Percent_Roof_Runoff** = the percent of the runoff water that was going to be accumulated by that specific rain gutter to drain to that specific rain garden

**0.15** = a set value to be used when the depth of the rain garden is 6 inches

**Volume of necessary rain garden** = the volume of the rain garden that will absorb the storm runoff water from that part of the roof

**BUILDING 1**
Area=2987.5 sqft
Rain Gardens=6

Minimum Rain Garden Volume=2987.5*(1/6)*0.15=74.6875 sqft

- 2F=8’x16’=128 sqft
- 2G=8’x16’=128 sqft
- 2H=8’x16’=128 sqft
- 2I=8’x16’=128 sqft
- 2J=8’x16’=128 sqft
- 2K=8’x16’=128 sqft

**BUILDING 2**
Area=2343.75 sqft
Rain Gardens=5

Minimum Rain Garden Volume=2343.75*(1/5)*0.15=70.3125 sqft

- 2A=20’x10’=200 sqft
- 2B=8’x16’=128 sqft
- 2C=8’x16’=128 sqft
- 2D=8’x16’=128 sqft
- 2E=8’x16’=128 sqft

**BUILDING 3**
Area=2987.5 sqft
Rain Gardens=6

Minimum Rain Garden Volume=2987.5*(1/6)*0.15=74.6875 sqft

- V=12.5’x18.75’= 234.375 sqft/2=117.1875 sqft (double sided garden)
- W=25’x6.25’=156.25 sqft
X=17.5’x8.75’=153.125 sqft  
Y=17.5’x8.75’=153.125 sqft  
Z=17.5’x8.75’=153.125 sqft  
2A=20’x10’=200 sqft

BUILDING 4
Area=2987.5 sqft
Rain Gardens= 6

Minimum Rain Garden Volume=2987.5*(1/6)*0.15=74.6875 sqft

R=12.5’x18.75’= 234.375 sqft/2=117.1875 sqft (double sided garden)  
Q=25’x6.25’=156.25 sqft  
S=12.5’x6.25’=78.125 sqft  
T=12.5’x6.25’=78.125 sqft  
U=12.5’x6.25’=78.125 sqft  
V=12.5’x18.75’= 234.375 sqft/2=117.1875 sqft (double sided garden)

BUILDING 5
Area=2343.75 sqft
Rain Gardens= 5

Minimum Rain Garden Volume=2343.75*(1/5)*0.15=70.3125 sqft

M=12.5’x6.25’=78.125 sqft  
N=12.5’x6.25’=78.125 sqft  
O=12.5’x6.25’=78.125 sqft  
P=18.75’x6.25’=117.1875 sqft  
R=12.5’x18.75’= 234.375 sqft/2=117.1875 sqft (double sided garden)

BUILDING 6
Area=2343.75 sqft
Rain Gardens= 5

Minimum Rain Garden Volume=2343.75*(1/5)*0.15=70.3125 sqft

2L=16’x8’=128 sqft  
2M=16’x8’=128 sqft  
2N=16’x8’=128 sqft  
2O=16’x8’=128 sqft  
2P=16’x8’=128 sqft

BUILDING 7
Area=3018.75 sqft
Rain Gardens= 5
Minimum Rain Garden Volume = 3018.75 \times \frac{1}{5} \times 0.15 = 90.5625 \text{ sqft}

2Q = 16' \times 8' = 128 \text{ sqft}
2R = 16' \times 8' = 128 \text{ sqft}
2S = 16' \times 8' = 128 \text{ sqft}
2T = 16' \times 8' = 128 \text{ sqft}
2U = 16' \times 8' = 128 \text{ sqft}

BUILDING 8
Area = 5100 \text{ sqft}
Rain Gardens = 6

Minimum Rain Garden Volume = 5100 \times \frac{1}{6} \times 0.15 = 127.5 \text{ sqft}
(2 drains 255 sqft)

A = 16' \times 8' = 128 \text{ sqft}
B = \frac{(24' \times 24')}{2} = 288 \text{ sqft (triangle)}
C = 10' \times 30' = 300 \text{ sqft (double sided)}
D = 15' \times 10' = 150 \text{ sqft}

BUILDING 9
Area = 5100 \text{ sqft}
Rain Gardens = 6

Minimum Rain Garden Volume = 5100 \times \frac{1}{6} \times 0.15 = 127.5 \text{ sqft}

C = 10' \times 30' = 300 \text{ sqft (double sided)}
E = 10' \times 30' = 300 \text{ sqft}
F = 10' \times 30' = 300 \text{ sqft (double sided)}

BUILDING 10
Area = 5100 \text{ sqft}
Rain Gardens = 6

Minimum Rain Garden Volume = 5100 \times \frac{1}{6} \times 0.15 = 127.5 \text{ sqft}

F = 10' \times 30' = 300 \text{ sqft (double sided)}
G = 16' \times 8' = 128 \text{ sqft}
H = 10' \times 30' = 300 \text{ sqft (double sided)}
I = 16' \times 8' = 128 \text{ sqft}

BUILDING 11
Area = 5100 \text{ sqft}
Rain Gardens = 6
Minimum Rain Garden Volume = 5100 \times (1/6) \times 0.15 = 127.5 \text{ sqft} \\
(2 \text{ drains approx} = 276 \text{ sqft})

H = 10' \times 30' = 300 \text{ sqft (double sided)} – 2 \text{ drains}
J = 10' \times 20' = 200 \text{ sqft} – 1 \text{ drain}
K = 12' \times 24' = 288 \text{ sqft} – 1 \text{ drain}
L = 12' \times 24' = 288 \text{ sqft} – 2 \text{ drains}

GARAGE
Area = 72521 \text{ sqft}
Rain Gardens = 37

Minimum Rain Garden Volume = 72521 \times (1/37) \times 0.15 = 294 \text{ sqft}

2V -> 3G = 30' \times 10' = 300 \text{ sqft}
3H -> 3P = 17.32' \times 17.32' = 300 \text{ sqft}
3Q -> 3Z = 30' \times 10' = 300 \text{ sqft}
4A -> 4I = 24.49' \times 24.49' = 600 \text{ sqft/2 = 300 sqft (Triangle)}
4J -> 4R = 30' \times 10' = 300 \text{ sqft}

**TOTAL: 88 Rain Gardens**

**NOTES:**

Percentage Page

Capstone Design

AutoCAD:

Map with rain gardens
Rain Garden Dimensions
  Volume
  Placement
  Sliced View
  Soil Details
  Plant Layout
Calculations to find rain garden volumes
Large basin volume
Site specs to be dictated

Other Low Impact Development Processes
  Culvert
French Drains
Grass Boundaries
Pervious Pavement

Page 1

Reference: *Rain Garden Manuel*
Specs for Rain Garden Depths

SET SLOPE: 6 percent
SET SOIL: Merrimac Sandy Loam
Grade A (very good filtration)
DEPTH: 6”

Cross Section (top layer to bottom layer)
20 percent topsoil
30 percent compost
50 percent aggregate (crushed stone)

Rain Garden Dimensions
If <30’ from downspout then:
Roof Area * percent of water to downspout * # of downspouts fed to rain garden =
pervious surface area rain garden is filtering

Page 2

Reference: *Rain Garden Manuel*
Equation for Recommended Rain Garden Area:

pervious surface area (rain garden is filtering) * size factor = recommended area of rain garden necessary

size factor according to set slope = 0.15

If more then 30’ from downspout then must included existing surface area of uphill lawn
Although not applicable in this site:

Size factor = 0.03

Page 3

Pervious Asphalt (93,500 sqft)

Parking lot
Poured in place pervious asphalt
Large aggregate only
Quality of tar is reduced
Sealants for waterproofing not applied

Sidewalks—walk ways
Poured in place pervious concrete
Large pea sized gravel used
Low water/cement ratio
Pebbly surface, compacted with a roller

French Drain Diagram (see AutoCAD file for visual)
(from grass area to parking lot)
Gravel tract
Grass barrier
Curb 2in higher then grass level

Page 4

Large double sided 600sqft rain gardens: (see Appendix D for visual)
Two 300sq ft rain gardens

Page 5

Smaller Design of a Rain Garden (see Appendix D for cross-section)

Page 6

Smaller design with an interesting brick wall divider for aesthetics (discarded idea because adding more impervious material seems very counter productive)

Page 7

Rain Garden Areas (for complete and updated list see Appendix B above)

Page 8

Building 11

Area = (42.5*40)+(42.5*40)+(42.5*17.5)+(50*27.5)=5518.75 sqft

Buildings 8 to 10

Area = 3*(42.5*40) = 5100 sqft

Building 12 (Garage)
Area = 72521 sqft [as calculated by AutoCAD]

Page 9

Building 7
Area = (50*27.5)+(40*17.5)+(35*22.5)+(12.5*12.5) = 3018.75 sqft

Buildings 6, 5, & 2
Area = (40*17.5)+ (40*17.5)+(22.5*35) + (12.5*12.5) = 2343.75 sqft

Building 1, 3, & 4
Area = (40*17.5)+ (40*17.5)+(40*17.5)+(22.5*32.5) + (12.5*12.5) = 2987.5 sqft
Appendix C – Project Topographic Maps

Topographic Map of Construction Site

Topographic Map with Key
Layer 1:
Topographic Lines & Vernal Pools

Layer 2:
Topographic Lines/Vernal Pools/Boundary Lines
Appendix D – Rain Gardens and LID Diagrams

Rain Garden Cross-Section

- Grass & Plants
- Merrimac Sandy Loam Soil
- Crushed Rock
- Drainage Outlet
- Grade A Soil

Double Rain Garden

- French Drain
- Grass Buffer Strip
- Rain Garden w/Native Plants
- Inclined Area To Keep In Water
- Overflow Drains
Edge of Ground meets Parking Lot

- Pourous Concrete Curb
  2in taller then ground level

- Grass Buffer Strip

- French Drain Barrier
Appendix E - Attached outline Primavera
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Developed using Primavera
Appendix F – Allowed Exemptions/Exceptions to Local Bylaws and Codes & Specific Exemptions/Exceptions to the Applicable Town of Marshfield Conservation Commission Regulations (2005)
### Allowed Exemptions/Exceptions to Local Bylaws and Codes

#### A. Specific Exceptions/Exemptions from the Applicable Marshfield Zoning By-Law

<table>
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<th>Section and Provision</th>
<th>Allowed Exemption/Exception and Notes</th>
</tr>
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<tr>
<td><strong>1.</strong> Article II (Definitions) Parking Space</td>
<td>An off-street space at least 10 feet in width and 20 feet in length, having an area of not less than 200 square feet, plus 100 square feet of access and maneuvering space, whether inside or outside a structure for exclusive use as a parking stall for one motor vehicle. To allow perpendicular parking spaces to be 9' x 18', with maneuvering space of 90 sq. ft and parallel spaces to be 8' x 20'.</td>
</tr>
<tr>
<td><strong>2.</strong> §5.01 Use Regulations</td>
<td>Except as set forth in the Zoning Enabling Act (M.G.L. Chapter 40A) or in the Town of Marshfield Zoning Bylaw, no building, structure, or land shall be used except for the purposes permitted in the district as described in Section 5 of the Bylaw. Any use not listed shall be construed to be prohibited. To allow land in Business Highway, Airport, Residential Waterfront, Inland Wetlands and Flood Plain Zone Districts to be used for the construction of twelve (12) multifamily dwellings containing as few as three dwelling units and as many as forty-two units in each building and facilities ancillary thereto. 100% of the proposed buildings will be located within the B-2 District.</td>
</tr>
<tr>
<td><strong>3.</strong> §5.04 (Community Facilities - #5) Table of Use Regulations</td>
<td>Nonprofit recreational facility, not including a membership club, allowed by Special Permit in Residential Waterfront District and Airport District; not allowed in Business Highway District. To allow recreational facilities (which is an ancillary use only to the multifamily development and are not open to the public) to be constructed and operated for residents and guests of the developed Building #12.</td>
</tr>
<tr>
<td><strong>4.</strong> §5.04 (Retail and Service - #13) Table of Use Regulations</td>
<td>Membership Club allowed by Special Permit in Residential Waterfront District and Airport District; allowed as of right in Business Highway District. To allow recreational facilities (which is an ancillary use only to the multifamily development and are not open to the public) to be constructed and operated for residents and guests of the developed Building #12.</td>
</tr>
<tr>
<td><strong>5.</strong> §5.04 (Retail and Service - #18) Table of Use Regulations</td>
<td>Miscellaneous business repair not allowed in Residential Waterfront District or Airport District; allowed by Special Permit in Business Highway District. To allow shed for maintenance and/or storage to be constructed and operated at the site as shown on the plans. The maintenance building is in the B-2 Business Highway District.</td>
</tr>
<tr>
<td><strong>6.</strong> §5.04 (Retail and Service - #25) Table of Use Regulations</td>
<td>Filling of land or water area and construction of drainage facilities allowed by Special Permit in Residential Waterfront, Airport and Business Highway Districts. To allow filling of land generally as shown on the plans filed in connection herewith.</td>
</tr>
<tr>
<td><strong>7.</strong> §5.04 (Accessory Uses - #5) Table of Use Regulations</td>
<td>Accessory private garage for not more than three non-commercial motor vehicles, and not more than one-half ton rated or less in size commercial motor vehicle not allowed in Airport District; allowed as of right in Residential Waterfront and Business Highway Districts. To allow as many as 92 garage spaces to be constructed and operated at the site generally as shown on the plans.</td>
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<tr>
<td>Section</td>
<td>Provision</td>
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<td>17. §8.02 Minimum Off-Street Loading and Unloading Requirements</td>
<td>For every building hereafter erected for Retail and Service, Wholesale, Transportation and Industrial, and Community Facility use as specified in the Table of Use Regulations and for every such use hereinafter established in an existing building or area, the off-street loading and unloading requirements presented in the Table of Off-Street Loading Regulations shall apply.</td>
</tr>
<tr>
<td>18. §8.02 Minimum Off-Street Loading and Unloading Requirements – Table of Off-Street Loading Regulations</td>
<td>Business services, other services, community facility (school, church, town building recreation, etc.) or public utility establishment = one off-street loading space per 75,000 square feet or a fraction thereof of gross floor area up to two spaces; one additional space fraction thereof of gross floor area.</td>
</tr>
<tr>
<td>19. §8.08(7) – Parking and Loading Space Standards</td>
<td>Parking shall not be located within the required front yard area, between the lot line and the required setback in any district except residential; front yard in the Business Highway District is 40 feet.</td>
</tr>
<tr>
<td>20. §8.08(12) – Parking and Loading Space Standards</td>
<td>Any entrance or exit driveway shall not exceed 24 feet in width at the point of tangency of the curb radii except for fire stations, in which cases the widths may be increased to 40 feet.</td>
</tr>
<tr>
<td>21. §11.03 – Filling of Land or Water Area</td>
<td>Special Permit required for filling of land that exceeds 500 cubic yards or more or an area exceeding 10,000 square feet. See also, General Bylaws – Article 20 Earth Removal</td>
</tr>
<tr>
<td>22. §11.10(3)(d) Traffic Mitigation</td>
<td>Traffic Study shall include a plan to minimize traffic and safety impacts and an interior traffic and pedestrian circulation plan designed to minimize conflicts and safety problems. Measures shall be proposed to achieve post-development standard of LOS D or better at all streets and intersections to be impacted by the project.</td>
</tr>
<tr>
<td>23. §11.11(1) Curb Cut Bylaw – Applicability and Use</td>
<td>All driveway openings for special permit uses must be approved by the Special Permit Granting Authority (SPGA). The SPGA shall solicit from and consider any comments received by the Board of Public Works in approving or conditioning such a curb cut permit.</td>
</tr>
<tr>
<td>Section</td>
<td>Provision</td>
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| 24. §11.11(2) - Curb Cut Bylaw - Required Performance Standards | The following standards shall guide issuance of curb cut permits by the SPGA:  
  a. One curb cut shall be allowed per parcel. If frontage exceeds 600', one additional curb cut may be permitted where it will aid access to and circulation within the parcel. For the purpose of this provision, "parcel" shall mean the entire property subject to an application and any other contiguous land in common ownership or control on or after the date of the bylaw.  
  b. Curb cuts shall be no closer than 75 feet to existing curb cuts and 75 feet to intersecting roadways.  
  c. Wherever possible, access shall be provided onto side streets to avoid the need for a curb cut onto major roadways.  
  d. Curb cut widths shall be the minimum necessary for safe access and egress. The maximum width of curb cuts shall be 24 feet. Curb cuts shall be clearly defined with curbing. The SPGA may modify these width requirements where necessary to promote safe access to or circulation within the parcel.  
  e. The SPGA may restrict curb cuts to right turn in/right turn out only when, in the opinion of the SPGA, such restriction is necessary for public safety and to minimize traffic congestion. | To allow single entrance as shown on the plans, plus non-paved emergency access as shown on the plans. To allow entrance as shown on the plans. To allow curb cut on Ocean Street as shown on plans. To allow curb cut on Ocean Street as shown on the plans. To allow right and left turns in and out of the development. |
| 25. §12.02 Site Plan Approval | Any request for a permit for a non-residential use permitted by right or by special permit in any district shall not be granted until a site plan for such use has been submitted to and approved by the Board. | M.G.L. Chapter 40B consolidates all local permits into one Comprehensive Permit. |
| 26. §15.05 - Flood Plain Zoning - Standards | Areas of Special Flood Hazard - All permits granted under Section 3 above shall be subject to the following provisions:  
  1. All development and redevelopment, whether permitted by right or by special permit, shall be in accordance with the standards of the Massachusetts State Building Code, the Wetlands Protection Act (Chapter 131, Section 40) and regulations (310 CMR 10.00, 302 CMR 6.00, and 302 CMR 4.00), septic system regulations (310 CMR 15, Title 5), and all other applicable federal, state and local requirements. Any variance from the provisions and requirements of the above referenced state regulations may only be granted in accordance with the required variance procedures of these state regulations. | To allow construction as generally shown on the plans. |
<table>
<thead>
<tr>
<th>Section</th>
<th>Provision</th>
<th>Allowed Exemption/Exception and Notes</th>
</tr>
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</table>
| 27. §15.03 – Flood Plain Zoning – Floodplain Permits | Permits for development and uses of land within the Floodplain District shall be required for the following. Such applications shall be obtained prior to or in conjunction with building permits if necessary:  
1. new construction of residential and non-residential structures;  
2. ...  
4. alteration of topography (as defined). | According to the April 30, 2002 letter from the Building Inspector, the proposed development does not fall within the Inland Wetlands District as delineated on the Marshfield Zoning Map. However, to the extent any other determination is made that the proposed development lies within this district, the Board grants approval and/or relief from such provisions so that the proposed development can be constructed generally as shown on the plans. |
| 28. General | All rules, regulations, bylaws, etc. adopted by the Town or any of its Boards, agencies, or Commissions, including, without limitation, local wetland bylaws or regulations, subsequent to the date of filing of this Application (December 5, 2001). | To allow construction of the development generally as shown on the plans. According to 760 CMR 31.07(j), "The bylaws, regulations, and other local requirements which apply in determining whether a comprehensive permit should be granted are those in effect on the date of the application to the Board." See also Weston Development Group v. Hopkinton Zoning Board of Appeals, No. 00-05 (Housing Appeals Committee May 26, 2004), slip op. at 11 ("the Committee finds that any regulation not in effect at the time of the filing of the application will not be applied") (emphasis in original); Northern Middlesex Housing Associates v. Billerica Zoning Board of Appeals, No. 89-48, slip op. at 11 (Housing Appeals Committee Dec. 3, 1992). |
### B. SPECIFIC EXEMPTIONS/EXCEPTIONS TO THE APPLICABLE TOWN OF MARSHFIELD
CONSERVATION COMMISSION REGULATIONS

<table>
<thead>
<tr>
<th>Section</th>
<th>Provision</th>
<th>Allowed Exemption/Exception and Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Section III(A)(iii, iv, v and vi)</td>
<td>All land subject to tidal action, subject to coastal storm flowage, subject to flooding, and at or below elevation 11 feet above mean sea level considered an Area Subject to Protection</td>
<td>To allow construction and operation of the development generally as shown on the plans and to find construction is in compliance with applicable requirements.</td>
</tr>
<tr>
<td>2. Section III(B)(i)</td>
<td>Activities proposed within land described in Section III(A)(iii, iv, v and vi) (land at or below elevation 11) are subject to the local regulations.</td>
<td>Same as Section III(A)(iii, iv, v and vi) above.</td>
</tr>
<tr>
<td>3. Section III(B)(ii)</td>
<td>Activities outside of protected areas which in the opinion of the Conservation Commission will alter an area subject to the regulations will require an NOI.</td>
<td>To allow construction and operation of the development generally as shown on the plans, and to find that no NOI is required pursuant to Section III(B)(ii).</td>
</tr>
<tr>
<td>4. Section X(A)</td>
<td>No utilities shall be placed below elevation 11.0</td>
<td>To allow underground utility lines and vertical utility services into buildings to be below elevation 11.</td>
</tr>
<tr>
<td>5. Section X(C)</td>
<td>Pavement within 100 feet of an area subject to protection must be constructed with a surface approved by the Conservation Commission; every way in an area subject to protection must provide throughways accessible to wildlife for not less than 5% of the length.</td>
<td>To allow bituminous pavement for all roadways and bituminous pavement or concrete for all walkways; to allow no wildlife throughways for ways which are outside of areas described in Paragraph III(A)(i)-(v).</td>
</tr>
<tr>
<td>6. Section X(F)</td>
<td>No destruction or removal of woody vegetation, shrubs, trees, and the like within 100 feet of an area described in Section III(A)(i)-(iii) without permission of the Conservation Commission.</td>
<td>To allow clearing as necessary to construct the development generally as shown on the plans.</td>
</tr>
<tr>
<td>7. Section X(G)</td>
<td>Breakaway walls required in all structures built in areas subject to flooding or coastal storm flowage.</td>
<td>To waive requirement for breakaway walls for all structures shown on the plans.</td>
</tr>
<tr>
<td>8. Section X(H)</td>
<td>Any project which may discharge into area subject to protection will be subject to by-law.</td>
<td>To waive this provision and allow construction and operation of the development generally as shown on the plans.</td>
</tr>
<tr>
<td>9. Section X(I)</td>
<td>Adequate access to and egress from structure must be available during 100-year storm event.</td>
<td>To allow construction and operation of the development generally as shown on the plans.</td>
</tr>
<tr>
<td>10. General</td>
<td>All regulations adopted by the Conservation Commission subsequent to the date of filing of this Application (December 5, 2001), including without limitation, any increase in wetland setbacks or non-disturbance zones.</td>
<td>To allow construction of the development generally as shown on the submitted plans, specifically with setback of at least 100 feet from vernal pools and wetland setbacks as shown.</td>
</tr>
</tbody>
</table>
Appendix G – Developer’s building details
198 Apartments (Marshfield Commons) (Horsley & Witten 2001)
7 3-Story Buildings
  84 1-bedroom units
  96 2-bedroom units
  18 3-bedroom units
20 percent affordable units
1 single-story 3,750sf club house
1 1,050sf maintenance building
5 garages of 7 – 12 cars each total (359 parking spaces)
16 handicapped
45 garage spaces
93,760sf building area
149,220sf pavement
1,105,310sf open space

180 Apartments (Marshfield Commons) (Appeals 2002)
  75 1-bedroom units
  90 2-bedroom units
  15 3-bedroom units
20 percent affordable units
360 parking spaces

150 Apartments (Ocean Shores) (Partnership 2004)
5 buildings
  63 1-bedroom units
  75 2-bedroom units
  12 3-bedroom units
20 percent affordable units

90 Condos (Ocean Shores) (Appeals 2005) (Attached Appendix B)
  67 2-bedroom market rate units
  12 2-bedroom affordable units
  11 3-bedroom affordable units

OWNERSHIP
25 percent affordable units
minimum 201 parking spaces
Appendix H – Definitions
Definitions:

LOS: Level of Service is a rating given to roads grading the congestion of traffic on the road. D and F are the lowest grades available to be given to a road.

Comprehensive Permit: The Massachusetts Comprehensive Permit Law enacted in 1969 is intended to permit a restricted overruling of local policies when they are conflicting with affordable housing requirements. (http://www.mass.gov/dhcd/publications/fact_sheets/cpl.htm)

Median: An example is; In Ville the incomes are $100,000, $90,000, $80,000, $79,999, $6,000, $5,000, $1,000. That area’s median income would be $79,999. So medium income apartments are affordable to people who can pay 80 percent of that amount $63,999.20. Low income apartments are 50 percent, however a development chooses if they want their units to be priced for low or moderate income families.