The Process of and Barriers to Environmentally-Oriented Real Estate Development: Examining the Role of Organizational Structure, Project Delivery Methods and Contracts in Low Impact Development

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ABSTRACT

Low Impact Development (LID) is a site planning approach that limits the environmental impact of development on the local hydrological regime. By preserving and mimicking natural landscape features, LID introduces a new site planning and stormwater management paradigm to mainstream real estate development and represents a *product innovation* in the industry. Through the examination of three case studies, this thesis explores the sources of innovation and the risks of implementation. It then examines whether changes to delivery and contract structures might be necessary to redistribute risks and incentives among members of the development team in order to realize LID practices.

The investigation finds that the private sector plays an integral role in advancing LID. Often developers are the first adopters of this innovation. The success of their projects motivates municipalities to encourage the innovation through regulation and training. The projects that present the most innovative approach institute small, integrated, multi-disciplinary corporate and project team structures. Examining the process of implementing LID practices reveals that innovation does not introduce new sources of risk; rather it exacerbates existing sources of risk at each phase of development. Much of this increase in risk is related to the innovation's nascent stage of adoption and is related to informational or educational lags in the industry.

Incremental *process innovation* is crucial to proper implementation of LID practices. The design phase should incorporate environmental analysis, include a diverse in-house team with environmental backgrounds, and encourage collaboration between generalists and specialized consultants. Other process innovations should be structured to educate industry professionals about the principles and practices unique to LID. The appropriate project delivery and contract arrangement is dependant on the extent to which a project adopts the full suite of LID practices. In instances of moderate product innovation, developers focus on process innovation and seek unilateral control through the multiple primes delivery method and time & material contracts. These structures place the most risk and incentives with the developer, who is best-suited to lead the process. Conversely, in projects that focus on product innovation and adopt the breath of LID's technical practices, the developer relinquishes control of the process, assigning the risk (and associated incentives) of delivery to specialized consultants who are better able to realize the innovation.

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Chapter 1

The New Ecomony: Environmental Innovation & Risk in Master-Planned Communities

Increasingly sectors of today's economy are responding to consumer demand for environmentally-sensitive products. The growing presence of renewable energy generation and expanding consumption of alternative energy reflect the power of conservation and environmental awareness in defining a new economy. Wind farms are cropping up on agricultural farms, alongside highways and in oceans, supplementing traditional forms of energy generation. A recent controversial project in Massachusetts proposed a wind farm off the coast of Cape Cod capable of supplanting up to 130 million gallons a year in oil consumption and providing a third of the Cape and surrounding islands' energy needs.[1] The inclusion of the environment in capitalist markets represents an extraordinary shift in traditional market dynamics.

Historically, economic production has been at the cost of the environment, degrading resources through polluting our waterways and atmosphere with the toxic by-products of manufacturing. This cost to the environment was not borne by the companies that perpetuated it, never appearing in production budgets. Instead, environmental degradation came as a cost to society as a whole. Only when regulation mandated higher standards for effluent or discharge were companies forced to place a cost on protecting the environment (by investing in more rigorous post-production technology) and often passed that cost on to consumers. Regulations such as the Clean Air Act and Clean Water Act are staple controls that force industry to assume the cost of protecting public health and natural resources from the by-products of manufacturing.

Growing awareness of the health and environmental impacts of technology and production practices have motivated American consumers to increasingly demand "green" or environmentally-conscious products instead of waiting for governments to encourage such corporate responsibility through regulation. Corporations in every industry have recognized the power of this demand and have responded in a number of ways, ranging from "green washing" products so that they appear more environmentally-sensitive to truly changing their products and manufacturing practices to reduce their environmental impact. The real estate industry has slowly responded to consumer demand as well, introducing green building materials and construction practices as well as environmentally-sensitive development configurations.

MOTIVATING ENVIRONMENTALLY-SENSITIVE DEVELOPMENT

Master-planned communities provide a unique opportunity for environmentally-sensitive real estate development because of their large size (ranging upward of several hundred acres) and typical location in exurban greenfields, where large tracts of natural land are increasingly rare. Because of these characteristics, planned communities can greatly impact the environment by destroying ecologically significant land. As the real estate industry embraces environmentalism, developers are adopting site planning practices that diminish the environmental impact of master-planned community development. Incorporation of open space has been one of the leading methods of greening planned communities. The amenity package of a planned community is an integral component of the value of the homes and an important attraction to potential homeowners. Traditionally, new communities have included family-oriented recreation

1 Cape Wind: Energy for Life, "Project at a glance" *Capewind.org*, <http://www.capewind.org/article24.htm> (26 July 2006)

areas and golf courses to provide visual appeal and leisure opportunities for residents. As consumer demand evolves, developers of these communities are increasingly incorporating *open space* and *the environment* in the amenity package, seizing an opportunity to increase the value creation potential of master-planned communities. Through a variety of environmentally-sensitive site-planning techniques, developers provide a differentiated product that experiments with site preparation methods, stormwater management and site drainage, resource conservation, and the scale and type of open space.

The arrival of environmentally-sensitive master-planned communities may represent a response to market demand for residential communities that promote sustainable living as well as an evolving conception of the ideal living environment. A combination of recreation and natural space has been the most widely adopted practice perhaps because it is the most visibly obvious technique and satisfies the most clearly expressed market demand. Studies have found that "nearly 40% of people living in golf course developments do not even play the game", suggesting a strong desire on the part of residents to live near open space even if they don't use it.[2] These results are corroborated and expanded by the 1994 AmericanLIVES study that revealed that while 39.5% of respondents found golf courses to be very or extremely important, the other 60.5% thought natural, open space, gardens and walking paths, and wilderness areas were more important.[3] This behavior indicates that developers "should broaden the appeal of their developments by conserving more natural areas on their sites, such as woodland habitat and riverbanks …value as passive recreation and wildlife corridors."[4]

That consumers are re-imagining their ideal communities to include more open space- both recreational and natural- marks a new way in which developers are able to add value to master-planned community projects and, thus, secure marketability, increase price points, decrease sales times, and bolster value appreciation through embracing sustainability. Exploration, interpretation, and further development of the principles of sustainable site planning will allow developers to take advantage of this burgeoning market.

Low Impact Development (LID) is a recent concept in environmentally-sensitive site planning that is an extension of this trend in the master-planned community industry. LID concentrates on preserving the local hydrological regime. Development typically disrupts the water cycle by adding impermeable surface to an area, reducing the ability for rain water to be absorbed through the soil and vegetation. Instead runoff collects pollutants from paved surfaces and is directed to a centralized stormwater treatment area. Thereby, typical development patterns contaminate runoff and weaken the hydrological cycle, resulting in lower water table recharge rates, poorer water quality, and diminished water resources. Low Impact Development attempts to preserve the landscape and maintain its ability to absorb and treat runoff, protecting the integrity of local hydrological systems. Conserving open space is one method in a litany of techniques geared to reducing the impact of development on the environment.

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2 Randall Arendt, *Conservation Design for Subdivisions: A Practical Guide to Creating Open Space Networks* (Washington, D.C.: Island Press. 1996), 2.

3 Brooke Warrick, and Toni Alexander. "Changing Consumer Preferences" in *Trends and Innovations in Master-Planned Communities* (Washington: Urban Land Institute, 1998), 15

4 Ibid., 7.

Despite consumer interest in environmentally-conscious development and emerging green technology and practices, adoption has been slow and piecemeal. In an industry considered "change-resistant" the additional risk on new products and design forms adds a further barrier to adoption. Significant literature is devoted to understanding the real estate industry's averseness to change and innovation, revealing barriers at every step of the development process. Cost, regulation, liability, lack of information and consumer demand only outline some of the barriers to innovation.[5] Understanding new technologies and practices are integral to their dissemination and appropriate application; however, in order for practitioners to feel comfortable using new development techniques they must not only learn new practices but understand the optimal process with which to adopt and implement these practices. The process of real estate development is typically structured by *project delivery methods* and *contracts*. These mechanisms allocate design and construction responsibilities and distribute the inherent risks of each phase of development. They become particularly important in the context of a new product because the traditional delivery vehicles and contract types may not be ideally suited to a new development form with different design and construction needs and potentially different (or greater) associated risks.

A HYPOTHESIS & THESIS QUESTIONS

This thesis is founded on a broad interest in the process of and barriers to environmentally-oriented real estate development. It begins with a curiosity about whom and what motivates such product innovations in the industry. The inquiry also relies on the assumption that introducing innovation to the development process will increase risk, which can act as a barrier to adopting environmentally-sensitive practices. Therefore, the hypothesis that drives this investigation is that product innovations, such as Low Impact Development, can increase risk to the developer and may require a different process to execute the project. In particular, developers may manipulate project delivery methods and contracts to shift risk and incentives among parties of the development team.

Thus, given the barriers to innovation and associated risk, this thesis will seek to understand:

1. *Who motivates environmental innovation in the mainstream, market-driven real estate industry? What organizational structures promote innovation and its execution?* This thesis will consider the design and construction experiences of three projects to identify the process by which Low Impact Development was included in the project and the factors that allowed each development team to conceive and realize environmentally-oriented innovation. In particular, the examination will focus on the *organizational structure* of each development team and the extent to which they were able to foster a climate of creativity within the team.
2. *Does Low Impact Development introduce new risk to or exaggerate typical risks of the development process?* Real estate development inherently carries risk. Adding innovation, such as Low Impact Development, to the process inherently introduces risk to a project because of the uncertainty created by a new, unknown and/or untested product.

5 Justin T. Pauly, "Innovation and the Big Builders: Barriers to Integrating Sustainable Design Construction Practices into the Production Homebuilding Industry, The Case of Pulte Homes" (M.C.P. Thesis: Massachusetts Institute of Technology, 2005). 30.

3. *Who bares the risk of environmentally-oriented innovation in real estate development? Project delivery methods* and *contracts* are mechanisms that distribute responsibilities, risk and reward of development projects. An examination of these aspects of a project reveal who assumes the risk of innovative, environmentally-sensitive development.

To the extent that developers do perceive additional risk from environmentally-oriented development and are uncertain of the most appropriate process for development, significant barriers remain to the adoption of Low Impact Development and other ecologically-minded development forms. This thesis aims to address these concerns and illuminate appropriate organizational structures, development processes, and delivery and contract mechanisms to guide decision-making for developers and design and construction professionals.

ANSWERING THE QUESTIONS

Before addressing these questions this thesis must traverse a number of principles, processes, and theories to develop an understanding of the relevant concepts. Chapter 2 provides a brief description of Low Impact Development to orient the uninitiated to one of the more recent innovations in environmentally-oriented site planning. Chapter 3 explains the master-planned community model of development, describing the origins of the development form and the typical responsibilities of the master developer. The chapter goes on to discuss the mechanisms that structure the design and construction phases of a project, project delivery methods and contracts. Chapters 4 concludes the first half of the thesis by presenting theories of innovation and placing Low Impact Development practices and project delivery methods within that framework. This chapter also extends the theories of innovation to consider its implications for the organizational architecture of real estate development project teams.

The second half of the thesis presents three cases (Chapters 5-7): the Pinehills (Plymouth, MA), the Palisades (Charlotte, NC) and Haymount (Caroline County, VA). These cases form the field of investigation. Their analysis will aid in a better understanding of the origins of Low Impact Development in market-driven planned communities and the distribution of the risk resulting from the novelty of each project. Chapter 8 offers synthesis from the chapters before, striving to understand the impetus of innovation in each case and the influence of team organization in conceiving and executing innovative ideas. The chapter also examines the risks specific to LID projects and its distribution in each of the cases, leading to a discussion of whether the process of development and associated risk allocation demonstrated in the case studies is appropriate in Low Impact Development projects.

THREE MASTER-PLANNED COMMUNITIES

The Pinehills is a 3,000 acre community in Plymouth, MA, targeting the "empty-nester" population. The community features four private and public golf courses and other recreational amenities for residents. 70% of the parcel is recreational and natural open space. The Pinehills has taken a unique tack by pursuing a *design- by-view* development approach, resulting in innovative lot placement and road design. In addition, a Low Impact Development paradigm dominates the project's stormwater management plan and takes advantage of the naturally occurring sandy soils of the parcel. The LID approach supports the developer's mission of a natural-looking landscape that offers extraordinary views at every turn.

	PINEHILLS	PALISADES	HAYMOUNT
location	Plymouth, MA	Charlotte, NC	Caroline County, VA
total area (acres)	3,000 acres	1,500	1,808
residential (houses)	2,983	2,000	4,000
commercial (sf)	1.3 million	10,000	750,000
open space (% of parcel)	70% (includes 4 golf courses)	30% (includes 1 golf course)	45-50%

Figure 1.1: Summary of Case Study Characteristics

Along the Rappahannock River in Caroline County, a stone's throw from Fredericksburg, VA, developer John A. Clark will soon break ground on Haymount. Haymount- at 1,808 acres- is smaller than the Pinehills but its ambitions are more diverse if not greater, embracing the principles of New Urbanism and promoting a pedestrian-friendly and engaging community governed by a commitment to public infrastructure and environmental conscience. The project promises 8 churches and 3 schools. Site planning and construction is guided by a commitment to preserving the parcel's natural features, limiting the environmental impact of land development and vertical construction, and a desire to innovate. The New Urbanist design form establishes a dense, urban project that requires curb and gutter stormwater management which connects to Low Impact Development stormwater treatment areas that retain and treat runoff naturally.

The Palisades lies along the banks of Lake Wylie in southern Charlotte, NC. It is 1,500 acres with 2,000 homes at build-out, a golf course, a number of recreational amenities, and a commercial town square. It is currently completing its first phases of development and construction proceeds at a brisk clip. The project preserves a third of the parcel as open space in the form of golf courses and natural areas. The Palisades incorporates a number of LID practices as part of a contingent rezoning that mandated environmentally-sensitive stormwater management to mitigate the project's size, density and location in a hydrologically-sensitive area along Lake Wylie.

The similarities shared by the three projects provide an opportunity to compare the process of design and development. The differences provide a chance to explore the different motivations of environmentally-sensitive development and the methods to execute it. Most importantly, the comparison will reveal the differences to allocate the risk of a new, environmentally-oriented development form throughout the design and construction phases.

METHODOLOGY AND LIMITATIONS

This thesis strongly relies on and seeks to build upon the work of previous MIT theses on environmentally-responsible development. Jeffery Rapson's thesis *Private Wilderness Playgrounds: Understanding the Competitive Effects of Environmentally Oriented Master-Planned Communities* provides a detailed and thoughtful foundation of the role of environmentalism in the marketing and success of projects in the second home/master-planned community market. Justin Pauly's

thesis *Innovation and the Big Builders: Barriers to integrating Sustainable Design and Construction Practices into the Production Homebuilding Industry, The Case of Pulte Homes* focuses on green building and innovation, comparing the effectiveness of privately and publicly motivated green building innovation in the merchant home production industry. Most recently, Taylor Mammen's thesis *Between Hot Opposition and Lukewarm Support: Innovation and Community in Land Planning and Development*, through a study of master-planned communities in the American West, has identified characteristics that influence the inception of innovative land development and related barriers. Implicitly, each of these theses discusses conducive and oppositional forces that influence the inception of environmentally-conscious development in the real estate industry. This thesis will advance these arguments by further exploring the process by which such development is realized and focusing on the role of project delivery methods, contracts, and risk in erecting and dissembling major barriers to environmentally-oriented development.

Like its predecessors, this thesis relies on a case study model to answer the questions posed. The information and observations come largely from interviews with individuals involved in almost every part of the project. In each case study, you will notice comments and insights from the developer, his staff, design and engineering consultants, regulatory officials, subcontractors and homebuilders. This wide array of interviews allows this thesis to achieve its mission of broadly surveying the master-planned community industry to understand the sources and motivation of environmentally-oriented innovation, the types of risks such innovation introduces to the development process, and the distribution of those risks.

Despite extensive research and lofty ambitions to select cases based on controls for a myriad of characteristics, the primary selection criteria- market-driven, mainstream master-planned communities using LID techniques- was the most limiting criteria and curtailed the ability to ensure the cases shared any other similarities. Even the extent to which they adopt LID practices varies. Each project has different amenity packages and varies greatly in density. They target different, sometimes overlapping, demographic groups. They are each in a different phase of completion. Beyond these project differences, the developers and development teams also vary in size and experience. In short, the projects seem to have more variation than similarity. These broad differences make it difficult to draw extensive and conclusive lessons about the sources of innovation or the ideal allocation of risk to motivate environmentally-thoughtful development. However, it does provide an opportunity to broadly explore relationships between innovation and structures and processes to reveal unanticipated insights and avenues for more detailed study. Despite any shortcomings of the projects selected, they provide a significant basis from which to begin to derive current perceptions and practices to address risk as well as to surmise some optimal behavior.

Although large planned communities have been chosen for this study, it is important to note that the scale of the projects does not necessarily dictate the novelty of the land development. Indeed, countless examples exist of smaller projects that demonstrate LID form and practice more completely than the projects discussed here; however, this thesis focuses on larger projects because their size requires them to target mainstream markets. As such, these projects have the pressure of appealing to the masses and balancing a number of risks that are exacerbated by or unique to the scale of the project. Given the risks associated with large, market-driven projects, it is interesting to consider how environmentally-oriented practices

affect the inherent risk in development projects and stifle the incorporation of Low Impact Development practices.

A WORD ON VOCABULARY

As environmentalism has gained prominence in popular culture and the market, all products and activities that promote an environmental conscious have been branded as *sustainable*. This thesis avoids the use of this term because most of our endeavors as a society are still not truly sustainable. That is, they have a net negative impact on the planet. Instead, this thesis employs terms, such as environmentally-sensitive or ecologically-oriented to more accurately describe the products and processes discussed in upcoming chapters. This distinction serves as an important reminder that despite the efforts of developers, design and construction professionals, government agencies, citizens and organizations, the development industry must continue to evolve to reduce the impact of human settlement on the environment.

Chapter 2

Low Impact Development

THE ENVIRONMENT & SITE-PLANNING TECHNIQUES

The literature that describes environmentally sensitive, large-scale development owes much to Ian McHarg's *Design with Nature* and Randal Arendt's *Conservation Design for Subdivisions*. Together, their theories and recommendations established design principles that formed the framework for ecologically-driven site planning and developed a rationalized system for applying these practices to large planned communities. The techniques McHarg and Arendt propound are inspired by design found in nature and they advocate for the preservation and mimickery of these natural systems. Within this framework, human settlements must be sensitive to existing and ideal environmental functions and exist in a manner that compliment natural systems in order to maintain the synergy between human and natural systems.

Ian McHarg's *Design with Nature* is an outcry against the environmental ills of human settlement and seeks to inform a new development paradigm that reduces environmental impact. He describes a valuation and planning methodology that comprehensively considers economic and *non-economic* costs and benefits of development projects. Through considering costs and benefits from a variety of perspectives McHarg describes a synthesized approach to development that aims to not only minimize normative costs but also social and environmental costs. His theory is the conceptual foundation necessary to understand the interplay between the built and natural environment. Meanwhile, Randall Arendt's work describes a step-by-step methodology for *conservation design*, which implements the principles McHarg expounds. Whether developers adopt Arendt's precise methodology or not, the basic concepts espoused by McHarg and Arendt underpin today's model of the environmentally-oriented master-planned community.

These basic principles have inspired a number of conservation-oriented philosophies, including *conservation design*, *cluster development, open space communities, better site design, sustainable development, regenerative development, low impact development* and others. Although there are many names for environmentally-sensitive land planning and development, much of it stems from Arendt's more comprehensive model- *conservation development.* The following describes a collection of practices that together characterize an ecologically-minded approach to land planning and development.

Clustering Clustering homes on a smaller portion of the site is a fundamental tenet of *conservation design* and paramount feature of environmentally-sensitive master-planned communities. Ideally, development is concentrated on no more than half the site, placing homes on smaller lots. While development is limited to a particular site coverage ratio, the overall density is not reduced. Thereby, the same number of homes may be constructed as permitted under conventional zoning; they are simply developed more densely on one portion of the site. This clustering method seeks to reduce development impact by minimizing the destruction of the environment during the construction phase, reducing impermeable area by limiting roads and homes to half the site, and leaving a significant portion of the site for open space. Many landmark principle-driven conservation communities and market-driven projects have utilized this method. For instance, Prairie Crossing in Illinois, developed by a group of citizens dedicated to preserving the environment of the site, restricted the development of 36 condominiums

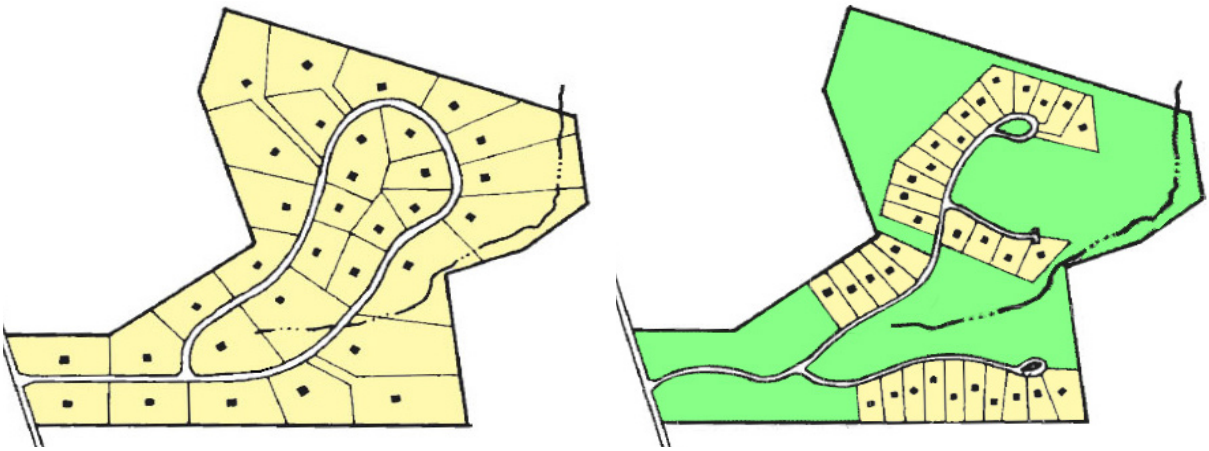


Figure 5.1: Clustering groups all development on select portions of the parcel and preserves the rest as open space without sacrifing density. (Source: Randall Arendt)

and 359 single family homes to 40% of the 667-acre site.[1] Market-oriented projects, such as the Woodlands and the Pinehills, have embraced this technique as well. The Woodlands, a project north of Houston, has concentrated the majority of development along major roads and intersections, reducing development in isolated natural areas.[2] At Pinehills in Plymouth, MA residential and commercial construction accounts for approximately 30% of the 3,064 acre site, leaving an aggregate 70% open for recreational and natural uses.

By limiting development to half the site or less, there are several multiplier effects for site ecology. First, constraining development greatly reduces impact during the construction period. With less area exposed to grading and site preparation, erosion from de-vegetation, habitat destruction and earth compaction is greatly mitigated. Second, such development reduces impermeable space on the site by reducing the size of house lots and shortening and narrowing roads.

Open Space One of the most dramatic and marketable elements of sustainable master-planned communities is the practice of retaining at least half the site as recreation and conservation area, as described in Arendt's *Conservation Design for Subdivision*. Many mainstream developments often adopt this practice even when they do not necessarily incorporate other methods discussed in this chapter because open space is a valued amenity to prospective residents. The extent to which open spaces can serve an ecological function depends on the scale, use, and quality of that space. For instance, golf course communities that became popular in the 1980s introduced the idea of open space as an amenity in planned communities. From an environmental standpoint, however, golf courses provide little ecological value beyond allowing open space for natural stormwater drainage. In fact, while cosmetically pleasing, golf courses are often environmentally harmful due to the fertilizers and pesticides necessary to maintain them.

1 Prairie Crossing, "Community Overview," http://www.prairiecrossing.com/pc/site/about-us.html (11 November 2005).

2 Michael Pawlukiewicz, "Environmentally Responsible Development" in *Trends and Innovations in Master-Planned Communities*., ed. (Washington: Urban Land Institute, 1998), 72.

Some communities preserve areas that have environmental value, deeding segments of the parcel conservation in perpetuity. These areas may be accessible by residents and act as a true community amenity and natural resource. Thus, these conservation areas are a valuable recreational outlet for residents and also serve as an important ecological function for the local environment. Because environmentally-sensitive new communities tend to put large parcels of contiguous land into conservation they can have significant ecological functions. Though even relatively small patches of land can have important ecological functions by "protecting certain elements…[such as] small animals, plants, fungi, and microorganisms," several contiguous acres of the correct habitat are necessary to enable "insect, arachnids, small vertebrates, and herbs and grasses … [to] reach population sizes that have long-term viability."[3] Master-planned communities provide a unique opportunity to preserve natural areas that play an important ecological role, allowing flora and fauna to achieve threshold populations and "can provide even greater ecological benefits to their human neighbors- ranging from watershed protection to food and fiber production to scenic enjoyment."[4]

Increasingly, new communities include several hundred acres of conservation in their amenity packages. Spring Island, a 3,000 acre second home planned community in South Carolina, preserved a third of the site to protect the unique and fragile island ecology of the area. This conservation area represents highly desirable development land. However, because of the commitment of developer Jim Chaffin to the local environment, conservation of the land provides an invaluable ecological resource and recreational amenity to residents. Prairie Crossing also pursued an objective of ecological restoration and preservation to mitigate the effects of human development. 350 acres are protected with 200 acres of restored prairie land and 150 acres of created wetland and farmland. This conservation area has re-established native habitat and natural stormwater management, as described above.

Resource Conservation Environmentally-sensitive development also seeks to reduce energy and resource consumption through strategic design, recycling, and siting of homes. One study conducted by the town of Concord, CA found that up to 40% of water use of households in the summer could be attributed to "outdoor" uses, largely lawn maintenance.[5] Landscaping can significantly lower irrigation needs, conserving water through drought tolerant plantings. Meanwhile, capturing greywater- "reclaimed household wastewater from sinks and showers… (and) effluent from sewage treatment plants"- for secondary uses such as irrigation can also significantly lower water usage.[6]

Renewable energy is another heavily used resource in the built environment. By orienting the most utilized living areas toward the south, households can markedly diminish lighting and heating needs. The traditional suburban cul-de-sac design only allows for 20% of lots to take advantage of passive solar energy. Slight layout changes can optimize design so that 70-80% of homes can take advantage of passive solar energy and greatly reduce energy usage.[7]

3 Dan L. Perlman and Jeffery Milder, *Practical Ecology for Planners, Developers, and Citizens* (Washington: Island Press, 2005), 152.
4 Perlman, 165.
5 Town of Concord, CA, "Water Usage," http://www.ci.concord.ca.us/living/recycle/env-water-use.htm (10 December 2005).
6 Pawlukiewicz, 73.
7 Ibid., 74.

Drainage Reducing the drainage and stormwater runoff impacts of development is an integral component of decreasing the environmental impact of development. The built environment necessarily increases water management demands of a site by introducing more impermeable space and reducing the area where water can percolate into the water table. Mimicking natural drainage systems can diminish demand on local infrastructure and replenish hydrological resources. This can be achieved through constructing streets and "embankments perpendicular to the slope of the site to delay flow over highly permeable soils and allowing time for maximum infiltration."[8] Such techniques coupled with minimizing impermeable space and maintaining natural drainage systems as much as possible can achieve critical environmental protection goals, such as "minimize[ing] degradation of water quality, prevent[ing] downstream erosion and flooding, and recharge[ing] groundwater reserves."[9]

When designing and preparing the Pinehills site, the Green Company took great care to design nature-mimicking landscapes with varying slopes, small hills, un-uniform landscaping and appropriate plantings. These elements act to reduce the velocity of runoff and erosion and increase percolation. The design has greatly reduced the need for man-made drainage infrastructure and facilitates recharge of the local hydrology table. Environmentally-oriented projects will often utilize natural drainage areas and mechanism such as lakes, wetlands, and drainage swales instead of culverts and pipes. For instance, Village Homes in Davis, CA developed a system of creeks and ponds to collect and absorb storm water. Several years into construction this system was tested during a severe storm and proved to be more effective than the city's system, which backed into and was absorbed by the Village Homes natural system.[10] Prairie Crossing harnessed and enhanced the natural systems of the site's wetlands "to purify runoff and allow it to infiltrate the ground naturally."[11] A series of swales, restored prairie lands, man-made wetlands and lakes capture 60-90% of suspended solids, metals, and excess nitrogen and phosphorous while creating natural and recreational amenities. [12]

The practices described above represent broad areas of innovation and environmental awareness in site planning and community design. When employed together, they take advantage of synergies that multiply their environmental benefit. This list is certainly not comprehensive of the many techniques that can minimize the impact of the development process and human communities on the environment. Nonetheless, they represent broad arenas of environmentally-sensitive design.

LOW IMPACT DEVELOPMENT

Conservation design has influenced the emergence of a number of other environmentally-oriented design forms. Low Impact Development (LID) borrows one tenet from conservation design - drainage- and expands the techniques for environmentally-sensitive surface runoff management practices. The application of Arendt's site planning process to LID and detailed descriptions of distributed IMP technologies are comprehensively discussed in *Low Impact*

8 Ibid., 72.
9 Ibid., 73.
10 Judy Corbett, *Designing Sustainable Communities: Learning from Village Homes* (Washington, D.C.: Island Press, 2000.), 25.
11 Pawlukiewicz, 73.
12 Ibid., 73.

Development Design Strategies: An Integrated Design Approach produced by Prince George's County, MD's Department of Environmental Resources, a leader in Low Impact Development. Under a conventional stormwater management regime, retention and treatment structures are called Best Management Practices (BMPs). Because the LID approach promotes an entirely different management paradigm, the following techniques are called Integrated Management Practices (IMPs). As the name suggests, runoff management techniques seek to integrate into the landscape and treat runoff at its source unlike conventional BMPs aimed at centralizing runoff retention and treatment. LID broadly includes many of the site planning techniques espoused by Arendt such as preserving open space and clustering homes with a focus on the importance of site planning and IMPs in supporting and mimicking the natural hydrological regime

In undisturbed areas, the water cycle acts to maintain and replenish local hydrological tables and the exchange of water between the atmospheric, terrestrial, and native water resources. As rain falls, water is absorbed back into the water table through the ground or into the atmosphere through evaporation or transpiration. The process of infiltration and absorption through soils and plants acts to treat water and maintain the water table and local water resources, such lakes and streams. Development greatly reduces the permeable area necessary for rain water infiltration and introduces pollutants to the water cycle. The loss of permeable area alone drastically alters the water cycle. However, traditional stormwater management systems further diminish the local cycle by removing water from its local hydrological regime.

Conventional stormwater management techniques focus on collecting runoff from the site quickly and conveying it through grading and pipes to a central storage area, such as a detention basin or pond, during a storm event.[13] Detention basins are designed to store runoff during peak flows, "such as 10 year, 24-hour storm[s]."[14] This conventional approach does not attempt to modify the site design, provide controls to reduce runoff from small, more frequent events, or reduce impervious ground cover imposed by the development. Rather the management paradigm seeks to accommodate any level of development and address stormwater consequences. Furthermore, these practices consume significant land in the form of large basins or a series of ponds. Conventional measures have evolved to effectively reduce runoff from development and remove pollutants but have little ability to reduce the hydrologic environmental impact of development. Lastly, conventional systems require significant infrastructure and are costly to install and maintain.

By contrast, low impact development practices seeks to preserve a "hydrologically functional landscape that mimics the natural hydrological regime" after development.[15] By detaining and storing runoff on site, IMPs allow water to evaporate back into the atmosphere and percolate into the water table. This approach seeks to integrate stormwater controls throughout the landscape rather than concentrating the management plan at the "end of the pipe". Therefore, the low impact development approach to stormwater management tends to stress micromanagement (a localized and distributed approach) and source control

13 Department of Environmental Resources, *Low-Impact Development Design Strategies: An Integrated Design Approach* (Prince George's County, MD: DER, 1999,), 1-4.
14 Whole Building Design Guide. "Low Impact Design Technologies" by Anne Guillette. <http://www.wbdg.org/design/lidtech.php> 14 June 2006.
15 DER, *Low-Impact Development*, ix.

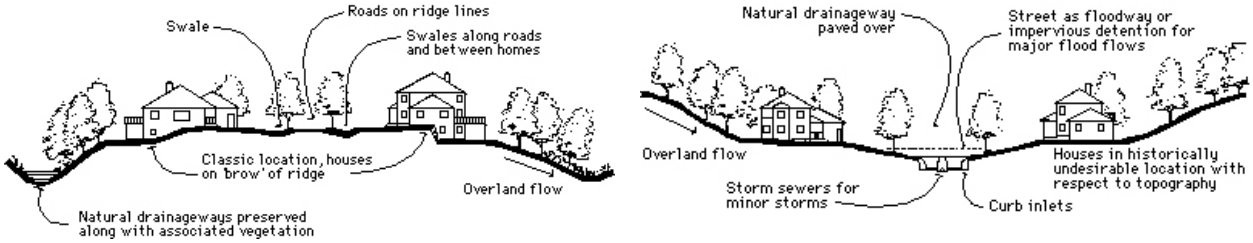


Figure 5.2: An comparison of hydrologically-sensitive placement of development compared to conventional site planning. (Source: University of Minnesota Extension Service)

rather than traditional pipe and pond stormwater management site solutions, which reduces the environmental impacts on groundwater recharge, water quality of runoff, and the water cycle. Such practices can significantly diminish the hydrologic and environmental impact of development and the cost of infrastructure maintenance as well as have a profound affect on site planning and aesthetics. It can also influence another form of development not only by promoting clustering, but also by placing development in areas that take advantage of natural topography to aid with drainage. Figure 5.2 illustrates how LID techniques can influence the placement of buildings. Of the cases discussed later, the Pinehills in particular embraces this approach, placing homes below the crest of hills to take advantage of views and natural drainage pathways while preserving the viewshed.

The following description of Integrated Management Practices often used by the LID approach better illustrate the methods that introduce a more ecologically-sensitive stormwater management regime. Generally, these methods seek to reduce runoff velocity, locally detain runoff, and maintain vegetation to minimize erosion, facilitate infiltration, and allow treatment. Although not a comprehensive summary of IMPs, the following treatment practices describe the philosophy and range of methods Low Impact Development utilizes.

Vegetated swales are open drainage ways designed to channel and hold runoff for short periods of time during storm events.[16] They are intended to supplement or replace traditional pipe networks that convey runoff to a storage area for later release. The vegetation acts to filter and treat pollutants and sediment in the runoff as well as encourage evaporation and infiltration.

Naturalized basins and dry ponds are large vegetated depressions that capture and detain runoff during storms.[17] As with vegetated swales, native plants address stormwater quality by filtering runoff before infiltration. The basins are designed to only hold water during storm events and are otherwise dry.

Bio-retention islands and rain gardens are similar to naturalized basins in that they are also vegetated depressions designed to capture and store runoff during storm events. However, they tend to be smaller (accommodating smaller drainage areas and smaller storm events) and more deliberately landscaped, often incorporated into parking lots, cul-de-sacs, or residential gardens.[18]

16 Managing Stormwater, " Vegetated Swales," <http://www.greenworks.tv/stormwater/vegetatedswales.htm> (24 June 2006)

17 Managing Stormwater, "Naturalized Basins," <http://www.greenworks.tv/stormwater/naturalizedBasins.htm> (24 June 2006)

18 Managing Stormwater, "Bio-retention Islands," <http://www.greenworks.tv/stormwater/bioretentionislands.htm> (24 June 2006)

Source: the Sanctuary, The Green Book: A Contractor's Guide to Sustainable Building

(from top left) Rain garden at the Sactuary (Charlotte, NC); Grass swale along the Parkway at the Palisdes (Charlotte, NC); Wet Wet Pond ; Porous pavement at the Sanctuary (Charlotte, NC)

Wet ponds are designed to permanently retain water and store runoff during and after storms.[19] Like naturalized basins, vegetation on the pond floor act to treat runoff and remove pollutants. The wet pond is a popular LID feature incorporated in master–planned communities because it provides residents with an amenity while addressing runoff and water quality needs.

Porous Pavement is a permeable surface that allows the infiltration of runoff during storms.[20] The runoff typically undergoes water quality treatment in the substrate underneath the pavement before infiltration into the water table. Traditional pavement is impermeable and prevents water from recharging the water table.

A number of these principles and management techniques have been implemented in each of the projects discussed in later chapters. Each case study utilizes several non-structural methods such as vegetated buffers and preserving open space and the natural topography. The Palisades and Haymount also are constructing vegetated swales, bio-retention basins, wet ponds, and constructed wetlands to mimic the hydrological cycle and offset the environmental impact of each project.

19 Managing Stormwater, "Wet Ponds," <http://www.greenworks.tv/stormwater/wetponds.htm> (24 June 2006)
20 Managing Stormwater, "Porous Pavement," <http://www.greenworks.tv/stormwater/porouspavement.htm> (24 June 2006)

Chapter 3

Developing Master-Planned Communities: A Process of Assigning Responsibility & Risk

MASTER-PLANNING THE SUBURBS

The 1950s and 1960s began a long trend of suburban growth, triggering a series of innovations in the residential development industry to accommodate the immense demand for suburban homes. The confluence of government subsidy for single family home ownership through the Federal Housing Redevelopment Acts of 1949 and 1954, the impetus of a national highway system in 1956, and race and income tensions in urban areas spurred an exodus of middle and high income populations to the suburbs. These populations inspired the bedroom communities of today as they left cities in pursuit of a particular lifestyle and home. Such factors and exploding suburban growth created an environment ripe for innovation in the housing industry. Developers responded by creating a spectrum of suburban residential products. The traditional subdivision method, although not imaginative, was indeed an innovation in the housing industry designed to meet the growing demand for suburban homes in an expedited, systematic and homogeneous manner. Meanwhile, other products responded to disenchantment with urban living by creating lifestyle communities that provide a more comprehensive living environment.

In the context of urban flight, master-planned communities located in the suburbs and exurbs quickly attracted residents looking for safety, better public schools and convenient amenities. This combination of amenities along with proximity to metropolitan areas has resulted in planned communities capturing a growing share of residential development. For instance, in 1987 "more than 10 percent of the new housing starts in this country [were] provided in master-planned communities."[1] During the same period in the mid-80s, "60% of home sales were in master-planned communities."[2]

Although there is no widely accepted definition, master-planned communities have a number of defining qualities that make them attractive to residents and towns alike as well as master developers. These communities are characterized by their large size, ranging from several hundred to several hundred thousand acres, and are typically owned by one developer. They often provide a variety of housing products at multiple price points organized into a number of neighborhoods for the primary and secondary residential markets, allowing the developer to appeal to a broader range of income groups and take advantage of different market demands. The master-planned community is a unique residential product because although it focuses on residential uses, these uses are complimented with recreational amenities and, often, retail and commercial uses. The extent of the amenity package depends on the size of the community and the income strata it targets. While these characteristics are typical of many new communities and differentiate planned communities from typical residential subdivisions, no clear definition exists, making it difficult to distinguish some master-planned communities from other planned residential products in the spectrum of suburban and exurban developments.

From a town's perspective, master-planned communities are often desirable because they provide an opportunity for coordinated, phased planning. Large-scale development controlled by a single developer assures a unity of design and an opportunity to provide a complimentary mix of uses. Also, such development is able to offer a number of amenities that are frequently neglected by incremental development, such as a comprehensive open space network and

1 Anne Vernez Moudon, "Introduction" in *Master-Planned Communities: Shaping Exurbs in the 1990s*, eds. Anne Vernez Moudon, Bill Wiseman, and Kwang-joong Kim. (University of Washington: Seattle. 1990), 9.
2 Ruth Eckdish Knack,. "Master Planned Lite" *Planning*; 61, no.10 (1995): 4

recreational and sports facilities. Such amenities are often not provided by the typical suburban developer because they do not generate a return. However, in the context of new communities they add significant value and can increase the master developer's returns. From the perspective of municipalities, these characteristics are highly desirable for new development as it relieves the strain on town's to provide the physical, economic and social infrastructure necessary for a growing and shifting population. In this way, new communities are able to address many of the traditional negative impacts of uncoordinated development by multiple developers. In fact, it is this comprehensive planning that provides security to prospective homeowners and increases the value of the community and home lots. The wide variety of housing products, price points, amenities and mix of uses coupled with relatively close proximity to urban centers creates an attractive housing option for many homebuyers.

In recent years, the planned communities industry has increasingly evolved to adopt environmentally-sensitive site planning techniques as a response to new demands in the market. Techniques include clustering homes on the site and preserving natural resources and landscape features. These changes represent not only innovations within the master-planned industry but also in the values and behavior of municipalities and consumers. Studies have found that "nearly 40% of people living in golf course developments do not even play the game", suggesting a strong desire on the part of residents to live near open space even if they don't use it.[3] Consumer behavior indicates that developers "should broaden the appeal of their developments by conserving more natural areas on their sites, such as woodland habitat and riverbanks …value[d] as passive recreation and wildlife corridors."[4] Further evidence comes from a focus group study conducted by CDS Research, Inc for the First Colony project in New Mexico where 43.5% of respondents indicated that parks were "absolutely essential/ very important" when selecting a neighborhood or community.[5]

Studies show that these consumer preferences also influence the marketability and value of homes in new communities that preserve open space as an amenity. A limited investigation conducted by the Center for Rural Massachusetts in 1990 compared market appreciation rates between homes in traditional residential subdivisions and cluster subdivisions that retained half the site as open space by placing homes on smaller lots. Repeat sales data from 1980-1988 comparing average sales found homes in the planned community sold at a premium $17,000 or 12.7% higher than their conventional counterparts.[6] Although the study is not extensive, it makes a strong argument that homes located on smaller lots (in this case, half the size) in proximity to protected open space had more value appreciation than their counterparts in traditional developments. That homes in open space communities offer a better investment certainly affords developers a marketing and sales advantage. Furthermore, anecdotal evidence states that homes in master-planned communities also enjoy faster selling times in slow economies and sell at a higher premium in strong economies. Finally, leveraging the open space amenity, developers are able to differentiate their product and, thus, garner attention and increase sales. For instance, a new community in Brookfield, Wisconsin advertises that "when

3 Randall Arendt, *Conservation Design for Subdivisions: A Practical Guide to Creating Open Space Networks*. (Washington, D.C.: Island Press. 1996), 2

4 Ibid., 7

5 Reid Ewing, *Developing Successful New Communities* (Washington: Urban Land Institute, 1991), 64.

6 Jeff Lacy, *An Examination of Market Appreciation for Clustered Housing with Permanent Open Space* http://www.umass.edu/larp/crm/Lacy/LacyMarket.html (Massachusetts: University of Massachusetts/Amherst, 1990).

[homeowners] buy a one-acre lot in one of their conservation subdivisions, they are actually receiving the use of more than 80 acres."[7]

BUILDING NEW COMMUNITIES

Broadly, new communities are developed in 2 phases: the land development and the vertical construction. The land development includes securing permitting, master planning, and provision of infrastructure and amenities. This phase is usually completed by the master developer. The vertical construction consists largely of homebuilding. In large planned communities, like those discussed in later chapters, the vertical construction is often executed by a number of merchant and custom homebuilders. The master developer will sell lots to builders, who then complete the vertical phase of development. Depending on the size and complexity of the project, total build-out of new communities can range up to a decade or more.

The master developer will typically gain approvals; develop the master plan; and conduct the land development, including infrastructure, communal spaces and amenities. Through this process, the master developer creates value for the homes by providing future homeowners with the security of approved, complimentary and planned development and lifestyle amenities. The developer then sells lots to merchant and custom builders to complete the vertical construction. Although the developer has relinquished control of the home lots, a series of controls, conditions and requirements (CC&Rs) frequently accompany the sale and govern construction so the developer can maintain control of the design to ensure the original vision is achieved.

Master-planned communities can be fertile grounds for innovation when the infrastructure remains private. In the case of the Pinehills for example, developers have more flexibility to narrow roadways and change lot dimensions and building placement in private communities because they are exempt from municipal regulation. A study cited in Eran Ben Joseph's *The Code of the City* revealed that 61% of public officials surveyed stated their jurisdiction permitted narrower roads in private communities because the municipality incurred no "maintenance responsibility or liability."[8] The same independence is available for the stormwater management plans of private communities, allowing developers to adopt alternate neighborhood designs and IMPs to limit and control runoff. Despite the regulatory flexibility available through the private planned communities structure, all planned communities are not private and, thus, beholden to jurisdictional regulation. In the following chapters, the Pinehills and Haymount illustrate the flexibility allowed when infrastructure remains under private control while the Palisades showcases the difficulty of imposing innovation when municipalities will retain ultimate responsibility for parts of the road infrastructure.

Given the various stages and complexities of the development process, the following provides a brief overview of the major issues a master developer must address in order to successfully execute the horizontal development for which s/he is directly responsible.

7 Arendt, 11

8 Eran Ben Joseph, *The Code of the City: Standards and the Hidden Language of Place Making* (Cambridge: MIT Press, 2005), 140.

Acquisition A master developer will purchase a tract of land with the appropriate size and locational requirements, such as adequate access to employment centers, metropolitan areas, or recreational destinations. Given the size demands of such projects, site assembly may be necessary, which introduces additional consideration of time, cost and risk. In the cases discussed in the following chapters, the bulk of the land for the Pinehills and Haymount was acquired as a single parcel although additional parcels have been added since the initial acquisition. Conversely, the Palisades has taken a phased acquisition approach where they are able to purchase optioned land in a just-in-time fashion. This approach minimizes upfront capital costs and limits property tax payments on lots that haven't been sold for vertical development. In selecting a site, master developers also consider the parcel's access to utilities, major transportation linkages, topography, and jurisdiction.[9] The land ownership eventually moves from single ownership by the master developer to multiple ownership after its ultimate disposition from homebuilders to homeowners.

Financing Because of their size and the long time horizon required for completion, master-planned communities are capital intensive projects. Equity is necessary early for acquisition and to move the project through the approvals process. Heavy capital investment is required of the master developer for the land development and construction of amenities far before revenues can be realized through the sales of house lots. Large land holders, such as timber and energy companies, have the financial wherewithal for long-term, capital intensive development. Having ownership of large tracts of land and significant revenue from their primary business, such entities have the financial capacity to develop new communities. In fact, Crescent Resources, a subsidiary of Duke Energy in Charlotte, has pursued a number of development projects as one method to pull additional revenue from their land holdings.

Without the benefits of excess land and capital, often new community development requires multiple partners in order to shore up equity for land development and augment bank loans. Master developers have been able to ease some of their financial burden through early land disposition, such as selling portions of the parcel for golf course development- a technique the Pinehills used to bankroll the acquisition and predevelopment phase. Others may pre-sell house lots to merchant builders early in the land development phase to generate cash flow; however, this method of finding equity is often at the risk of selling lots below their full potential, before land development has had an opportunity to add value through infrastructure improvements.

Regulatory Approval After acquisition, the developer partakes in the permitting phase of the project, one of the most value-adding and important activities of the entire process. Gaining regulatory approval for large projects can be very complicated. For projects with long time horizons, approval must provide programming and phasing flexibility so that the developer can respond to market changes. Although flexible, regulatory approval must also allow the developer some level of assurance that the project- in its changed state- will be approved in later stages in order to justify the immense capital investment required to begin the project.[10] Developer's will provide a general master plan to gain approval, but this plan often lacks details of particular neighborhood development and is prone to adjust with the market. Furthermore, the status of the project as a public or private community greatly determines the scrutiny that

9 Ewing, 101
10 Ewing, 102

the planning and design receive from local planning boards.

Master Planning Throughout the regulatory process, the developer works with a design team to develop the master plan. Along with securing approval, the master planning process is among the most valuable activities of the master developer. Through an iterative design process, the master plan establishes a series of networks in the community, including, roads, sewer, water, open space, and other amenities. Concurrently, neighborhoods are placed in relation to this infrastructure. While this process fulfills the important task of placing all the elements of the project, it also establishes a vision and aesthetic for the community. Therefore, this phase poses an ideal opportunity for creativity as the process brings together a number of professionals and is positioned early enough in the process to explore novel ideas and alternative development forms.

Coordinating Vertical Construction In conjunction with completing the land development, the developer must also select homebuilders and sell lots. The developer typically does not construct a large portion of the vertical development but is intensely invested in the homebuilding. S/he establishes a set of rules to guide the construction process and the ultimate product in order to meet the vision of the community as a whole. Poor construction, inappropriately priced product, bad design, and intrusive construction activities can jeopardize the value of homes in the community and, ultimately, the value of the community as a whole. With future phases to sell, the master developer is always concerned about delivering a successful product even when s/he is not directly constructing it. Thus, a series of regulations controlling the homebuilders helps align the interests of the land developer and the vertical developer.

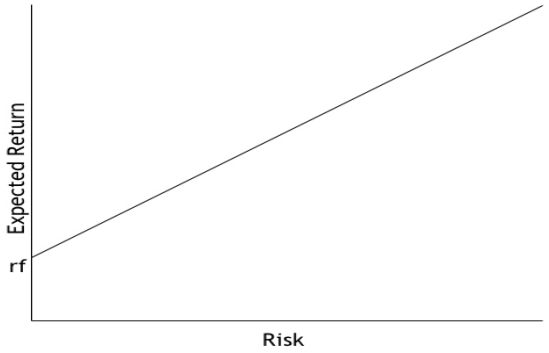
BIG IDEAS CREATE RISK AND REWARD

Risk is an integral part of any investment, a paramount consideration in real estate development, and the focus of this thesis. Every investment presents a certain amount of uncertainty because the investor is unsure whether the asset will lose some or all of his/her original investment. Risk attempts to quantify this uncertainty through applying a "combination of the probability of loss and the likely severity of loss if it occurs."[11] Depending on their volatility and track record, different investments have different levels of associated risk. For instance, a treasury note with a guaranteed rate of return is a fairly riskless asset while the stock of an upstart technology company may be highly risky. The financial economics literature defines risk strictly as a quantification of the uncertainty of a particular outcome. Because of the nature of this thesis and the difficulty in quantifying the true risks of LID, the colloquial usage of risk is evoked throughout the thesis with a meaning akin to uncertainty.

Although various investment vehicles carry different levels of risk, they also promise a range of expected returns commensurate with their risk. That is, investors are willing to tolerate the higher volatility and greater potential for the loss of their capital investment if the expected return is greater as well. Such opportunity for greater returns reflects the *risk premium* required to compensate for the risk of the investment. Therefore, the treasury note will have a much

11 David Geltner and Norman G. Miller, *Commercial Real Estate Analysis and Investments* (Saddle River, NJ: Prentice Hall, 2001), 191

Figure 3.1: This graph illustrates the risk/ reward relationship. Greater risk garners higher expected returns. (Source: Geltner and Miller, 196)



lower rate of return because it presents very little risk and the technology stock promises much greater returns on investment if the company is successful. Figure 3.1 illustrates this relationship between risk and return.

Like other assets, real estate provides a range of risk/reward opportunities. Historically, master-planned communities have been risky investments due to high equity demands, long time horizons, and uncertain long-term markets and consumer demand. However, success promises the master developer far above average returns on his/her investment. The following section describes a number of inherent sources of risks associated with the development of master-planned communities.

Regulatory Risk As discussed above, permitting land is one of the developer's single most important endeavors to increase the value of a piece of property. Given the tremendous value permitting approval can generate, it is appropriate that this process is among the most risky as well (referring back to the risk/reward paradigm described above). The approvals phase of the project is dominated by great uncertainty. Generally, the developer cannot predict how long approval will take and the changes and concessions the town will demand. The regulatory risk, therefore, is a direct translation of these unknowns as well as the cost and time associated with the process.

Master-planned communities often require rezoning so regulatory risk is typical when development new communities. Often the risk can be greater with the master-planned community product because of the scale of development and community concerns about its impacts. Such concerns can trigger several impact mitigation concessions from the developer, drastically change the proposed plan, or derail it completely. Innovation can often add another level of complication to the approvals process, increasing risk during pre-construction rather than introducing a new risk. In the case of the Pinehills, innovative stormwater management actually posed little additional risk because the community and infrastructure would be privately owned and maintained. Thus, they received little scrutiny from the city.

Timing Risk As with most real estate development projects, master-planned communities are developed during favorable periods in the market. If unforeseen schedule complications delay the project, the community could be much less successful than expected, resulting in slower

sales of homes or house lots. This can be a particularly damaging situation when the master developer has invested significant capital early in the project with the expectation of recouping those expenditures in early sales.

Design & Performance Risk Community-scale developments require significant land planning to accommodate the various neighborhoods and uses of the project. The developer assumes some risk of not getting the product s/he desired or the infrastructure not performing the way it was intended. Design and performance risk is usually fairly limited because often the infrastructure is relatively traditional and tested and avenues for recourse exist if the design or engineering is inadequate. Generally, developers and consultants interviewed during my research were not concerned about failure. This particular risk increases as innovations are introduced in the design and the infrastructure of neighborhoods, an issue that will receive further exploration in later chapters

Construction Risk Improper construction or construction delays are a concern for any development project. In the case of planned communities the risk is unique because the master developer has limited control over home construction. Merchant and custom builders must submit plans for design review by the master developer but there is no way for the developer to completely control the quality of the residential product. The developer is also exposed to price increases for materials and labor for the land development but somewhat insulated from the effect of rising house construction costs experienced by merchant builders. Despite the risks of the construction phase, this period of the project tends to present the least risk to the master developer.

Financing Risk With a long time horizon, financing is an important component for the success of the project. Lenders are aware of the risks listed above as well as the fact that this particular product requires substantial early investment to achieve uncertain returns in the future. The time horizon exposes the project to potentially significant market volatility, which could make it difficult for the master developer to meet loan payments. The many uncertainties of the project cam make financing through conventional sources difficult.

ASSIGNING RESPONSIBILITY, LIABILTY & RISK

The process of developing new communities and associated risks can be structured in a number of ways, depending on the *project delivery method* evoked. The project delivery method refers to the system the developer establishes to structure the financing, design, construction, and operation of a particular development project, which can involve one or more entities. The process is comprised of four components that shape the delivery method and assign responsibility and risk of each phase. The four factors to consider include:

the *scope of work*, which outlines the portion of the design and construction work assigned to any entity involved in the project. This includes the tasks of design, construction and finance.[12] For instance, a civil engineering company may be responsible for the design and planning of all roads on the site.

12 Christopher M. Gordon, "Constructability of Construction Contracting Methods with Projects and Owners" (M.S. thesis: Massachusetts Institute of Technology, 1991), 9.

the *selection method*, which describes the process by which consultants and contractors are selected. A competitive bidding process is often used to find the most competitive or market price for a scope of work.

the *organization*, which refers to one or more entities with whom the developer holds contracts to complete the design and construction of the project. This can be an architect, land planner, general contractor, a construction manager, a design-build team and any permutation of such entities. A further discussion of types of organization follows below.

the *contract type*, which controls how consultants and contractors are paid for their work. The contact type can range from a *lump sum* contract that pays a fixed price for a particular scope of work to a *unit price* contract which specifies a dollar amount for each component of the job to a *time and materials* contract where the owner must pay for all the materials involved in the work as well as an hourly wage.[13] The type of contract not only controls how a professional is paid but his/her assumption of risk. For instance, with a lump sum contract the contacted individual assumes all additional and unanticipated costs of the project because s/he has guaranteed a fixed price. Conversely, a time and materials contract places the risk squarely on the developer who must pay the consultant or contractor for every hour of work. Should the work take more time than anticipated or the cost of materials rise, the developer must pay for it, assuming all the risk in the contract. The guaranteed maximum price (GMP) contract has been touted as a method to create incentives for the consultant/contractor to minimize costs, and shift some risk away from the developer (unlike the time and materials contract). If the price exceeds the threshold of the GMP, the contractor has to assume that cost, providing the developer some price security and allocating some risk to the contractor.

The contract type not only reflects the allocation of risk between the contracted parties but also indicates a tradeoff between work as a commodity or specialized product. Generally, commodity-oriented jobs garner a lump sum contract because the product is predictable and poses few unexpected surprises. Specialized work tends to be less predictable at the onset or employs a unique process that may present unforeseen challenges. In these cases, consultants and contractors tend to negotiate contract types that shift risk away from them because they are unable to control their scope of work and the associated time or cost in the same way as if the work was a commodity.

In his MIT thesis *Constructability of Construction Contracting Methods with Projects and Owners*, Gordon describes 6 different *organization* methods with significantly different allocations of responsibilities and risk. The following is a simplification of a great deal of literature, thought and strategy prevalent in the construction field. The purpose is to provide a basic background of the various methods to control risk through delivery methods and contact types for application to the case studies rather than present a comprehensive survey of the literature and issues.

General Contractor The general contactor (GC) method is the traditional method of project delivery. This method bifurcates design and construction responsibilities. The developer is responsible for financing and usually leads the design process, which can be structured in various ways. The developer can assume full management responsibility of the design team or assign

13 Ibid., .9.

the coordination role to one of the design professionals who acts like a project manager. The construction phase is bid out to a general contractor after design is complete. The general contractor is responsible for delivery of the entire project and the contract is typically negotiated on a guaranteed maximum price or fixed price basis.

John Tishman finds two major disadvantages with the general contractor method. The developer lacks construction expertise during the design phase and "therefore no adequate means for evaluating the cost implication of the architect's designs."[14] During construction, the developer has little opportunity to control costs because s/he has limited control over the process. Furthermore, any changes during construction come at a great cost. Conversely, the developer has a great deal of control during the design process and can control cost, and subsequently risk, during this phase whereas the GC assumes the entire risk of the construction phase. With a lump sum contract, this is the least risky delivery method from the perspective of the developer although Tishman calls it the "most stilted and archaic form of project delivery" because the process is slow, proceeding linearly from design to construction.[15] However, the design and construction contracts can range from lump sum to time and materials to guaranteed maximum price. Therefore, apart from the organization, the contract type can significantly change the developer's exposure to risk.

Deviations from the traditional GC method can allow fast-tracking, institute construction expertise during the design phase, grant the developer more control during construction, or shift risk allocation. The following organizations of project delivery provide examples of these types of adjustments.

Construction Manager As a construction manager (CM), Tishman strongly supports the construction management form of delivery where the CM is involved during the design and construction phases, supplying the developer with construction expertise to evaluate design and then managing the construction phase. The CM's involvement during design is the greatest differentiation from the general contractor method. S/he is usually contracted on a fee or unit price basis as a consultant to the process; although this method can increase cost during the design period, its proponents believe it reduces cost during construction and realizes overall savings. During construction, the CM manages the subcontractors, the schedule and the budget. His/her contract can take any permutation of the contract types described above, although supporters and purists of this method recommend an agency approach were the CM is paid a fee. A fee or unit price contract has the benefit of aligning the interest of the construction manager with the developer but does not allocate any risk to the CM, who is responsible for delivery of the project. Therefore, many developers will choose other contract methods, such as the GMP, to allocate some to of the risk to the CM and encourage appropriate pricing, good quality and savings, if possible. As with the general contractor method, the developer finances the entire project.

Multiple Primes The multiple primes method allocates the most risk to the developer who contracts each consultant and contractor for the design and construction stages directly,

14 John L. Tishman, "Construction Management: A Professional Approach to Building" (The Robert B. Harris Inaugural Lecture, University of Michigan, April 13, 1988).
15 Ibid., 3.

manages the entire project, and secures financing. It is a time-intensive process that requires sophistication and experience with the development process. The multiple primes method gives the developer the greatest ability to influence design throughout the process and control time and cost. Thus, any cost savings will be directly realized by the developer. With such control, opportunity for savings, and, potential for greater financial reward comes increased risk. This method can be appropriate for a developer experienced in development and with the time and staff to manage the construction process.

Design-Build The design-build delivery method allocates all responsibilities for the design and construction to one entity, who also assumes much of the risk (save financing) of the project. Subsequently, the developer also relinquishes much control over the process with little opportunity to guide design and realize savings. Furthermore, because risk is shifted in large part to the design-build team, the cost for the services and delivery of the product are typically higher (due to a risk premium) than if the developer controlled it directly, as in the multiple primes method. Typically, the design-build method is well-suited for conventional products, such as a prototypical suburban office building, where the developer does not have special design needs, which allows the developer to relinquish control and the design-build team to fast-track the project.

Turnkey This method is similar to the design-build scenario with one major difference. The turnkey team is also responsible for financing the project. The developer pays for the product and delivery at completion when the key is turned over. The developer typically takes no risk in this kind of development and, abiding by the risk/reward regime, must pay more for the product (in the form of a risk premium to the turnkey team) and accept less reward for the actual development.

Design-Build-Operate (DBO) /Transfer (DOT) The DBO/DOT method is similar to the design-build and turkey methods in that one business entity performs all the design and construction of the project. Like the turnkey method, the team also provides financing for the project. The fundamental difference is that before turning the project over to the original developer or client, the team will also operate the structure for a period of time and collect the revenue. This method is often used in large infrastructure projects, such as highways. It allows the original developer to assume very little risk and potentially invest little capital in the project because the DBO/DOT team will rely on the operation phase for the bulk of their return.

TYPICAL PROJECT DELIVERY FOR MASTER-PLANNED COMMUNITIES

The preceding brief description of typical delivery methods is designed to illustrate some of the major considerations a developer encounters when crafting the project delivery method. Applied to land development, design and construction is most often conducted on a multiple primes basis where design consultants and construction contractors are directly contracted with and managed by the developer. They can be chosen by any selection methods and granted any of the contract types, depending on the preferences of the developer. This general organization method allows the developer the level of control necessary to realize his/her vision for the development and an opportunity to effectuate and realize savings. Furthermore, the added risk inherent in the multiple primes method provides an incentive for the developer to manage the development process well so as to generate higher returns. This typical methodology suggests

that master developers should have design and construction sophistication, access to financing, management capability, and risk tolerance.

Meanwhile, the vertical construction is closer to a turnkey method, where the homebuilder purchases the lots from the master developer and designs, constructs, and finances the home construction. At the end of construction, the builder sells the house or "turns the key over" to the end user, the homeowner. Through the sale of the lots, the developer seems to relinquish control of the vertical development. However, master developers often place a number of controls on the builder to ensure the design and intent of the community is realized. For this reason, the vertical development is not a pure turnkey delivery.

The division between land development and vertical construction and the different project delivery methods are apparent in each of the case studies. In many ways, the bifurcation is appropriate because it allows the developer to have the most control over the development and implementation of the vision without forcing him/her to do the development beyond his/her expertise or capacity. Furthermore, this allows the developer to add value through the design process and land development without having to take the additional risk or wherewithal to also perform the home construction. Thus, the project delivery organization allows the master developer's team to remain fairly lean throughout development relative to the scale of the project.

Chapter 4

Innovation: A Product & A Process

LOW IMPACT DEVELOPMENT AS INNOVATION

As a departure from traditional development prototypes and surface water management practices, low impact development certainly represents innovation in the real estate industry. Fagerberg, in his article "Introduction to Innovation", describes innovation as the first attempt to put an invention into practice, where an invention is "the first occurrence of an idea for a new product or process".[1] Application of new practices and design forms are particularly noteworthy in an industry renown for its conservatism and reluctance to innovate. At times the phases of invention and innovation are closely linked and seamless.[2] Other times a lag exists between invention and innovation. The emergence of LID practices in master-planned communities represents the latter phenomenon, where the emergence of new ideas (through the work of Arendt, McHarg and others) significantly predated their adoption into mainstream real estate development. On the whole the concepts of conservation design and low impact stormwater management have been applied to projects driven by principle and a dedication to environmentally-sensitive living, such as Prairie Crossing (Illinois) and Village Homes (California).

Low Impact Development's slow adoption in the mainstream real estate market suggests that "some or all of the conditions for commercialization are lacking" and demand complimentary innovations in order to succeed.[3] In addition, the real estate industry has been reluctant to adopt LID design forms and Integrated Management Practices not only because of the industry's tacit reluctance to accept innovation but also, perhaps, because this form of stormwater management fundamentally attempts to internalize what would otherwise be a free environmental impact imposed by the development. As discussed in Chapter 1, the private market is often reticent to accept these impacts of production because of the perception that companies will have to devote time and money to learning and implementing new methods that reduce environmental impact. An entity, such as a developer, primarily or exclusively driven by market forces is inherently unwilling to internalize such externalities unless it produces a net positive result for his/her bottom line. Therefore, not only are there the usual obstacles of adopting a new practice or implementing an innovation, such as acquiring expertise and market knowledge and creating certainty from a host of uncertainties, but a developer must also discover a strong market motivation if not motivated by regulation or commitment. The cases in coming chapters provide an example of each of these motivations. In the case of the Pinehills, the motivation was aesthetic. At the Palisades, county regulations dictated an alternative stormwater management plan. With Haymount, it is driven by principle. Despite the motivation, each developer has been able to spin these techniques into a marketing campaign to differentiate their product in the marketplace.

Strictly regulated by environmental controls, stormwater management has been viewed as a commodity in the development world. That is, it is considered a predictable and standard scope of work with few unexpected complications or novel processes required. Low Impact Development introduces an alternative management paradigm, which re-defines the technologies *and* process for creating a stormwater management plan. Perhaps adopting a new design paradigm will not be the biggest challenge for LID adoption however. Instead,

1 Jan Fagerberg, "Innovation: A Guide to the Literature" in *The Oxford Handbook of Innovation* eds. Jan Fagerberg, David C. Mowery, and Richard R. Nelson (Oxford: Oxford University Press. 2005), 4.
2 Ibid., 4
3 Ibid., 4

accepting surface water management as a service or specialized product rather than a commodity may pose a greater challenge to widespread adoption of LID techniques. Doug Beisch of Williamsburg Environmental Group (WEG) in Virginia has encountered this attitude among developers. WEG specializes in Low Impact Development, tailoring their stormwater engineering to the particular natural resources surrounding a project. However, they find that developers are not willing to pay a premium for alternative stormwater management even when informed that savings can be realized in infrastructure and maintenance.[4] Instead, developers prefer the known and predictable conventional surface water management plans and are only willing to pay a certain percentage of their soft costs for that plan. In their minds, the project will not derive additional value from a specialized stormwater management plan.

INNOVATION TYPES

Joseph Schumpeter, in his extensive work on innovation, describes a number of innovation types that include "new products, new methods of production, new sources of supply, the exploitation of new markets, and new ways to organize business" and are now entrenched in the literature, serving as the basis for almost all further inquiry on the topic. Essentially, his research outlined two fundamental types of innovation- *product* and *process*. Product innovation refers to "new and improved goods and services" while process innovation results in "new ways to organize work".[5] Utterback adds to this differentiation by describing the role of each innovation type during each phase of product development. His graph (Figure 4.1) suggests that product innovation is most prevalent in the early stages of a product's conception but then falls off and process innovation increases in the later phases when the product must be manufactured.[6]

Schumpeter's work also spurred another categorization distinguishing *radical* innovation from *incremental* innovation where radical innovation introduces completely new types of machinery or other technological revolutions while incremental innovations make small changes to existing products and processes.[7] In the realm of product manufacturing- the basis of much of the innovation literature- radical innovation departs completely from existing technologies, products, and modes of production, making the existing production paradigm obsolete and demanding that competitors or adopters assume a new set of skills. Meanwhile, incremental innovation is comprised of a series of minor improvements to an existing product or process. Schumpeter focused much of his research on the latter of the two, believing that incremental improvements had a greater cumulative impact on the economy.[8]

The four innovation typologies play an important and interrelated role in understanding Low Impact Development in the context of master-planned communities. Product innovation provides the point of departure for this investigation. The case studies deviate from the traditional planned community form by clustering development, introducing a mix of uses, and paying close attention to housing layout and positioning. In addition to differentiating

4 W. Douglas Beisch, Jr., Senior Water Resource Engineer, Williamsburg Environmental Group (Engineering consultant to Haymount), interview by author, 27 March 2006.
5 Fagerberg, 4.
6 James M. Utterback, *Mastering the Dynamics of Innovation* (Boston: Harvard Business School Press, 1994), xvii-xix.
7 Ibid., 7.
8 Ibid., 8.

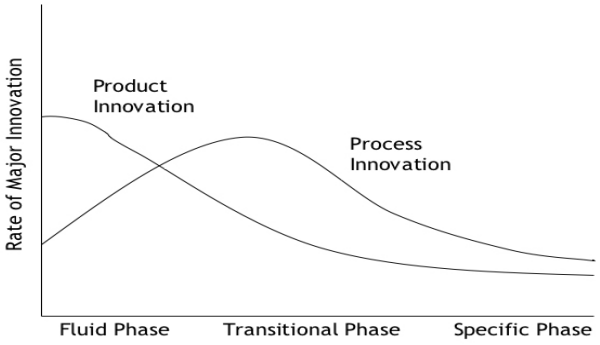


Figure 4.1: Utterback describes the relationship between product and process innovation as linear. (Source: Utterback, xvii)

their communities through design, each developer also implemented Integrated Management Practices instead of a traditional stormwater management plan. Although IMPs mimic many timeless natural processes, preserving and replicating these processes through LID is a relatively new practice in large-scale real estate development. Not only is LID a product innovation but also a radical innovation although perhaps not in the classic sense described above. Conventionally trained engineers and land planners are still able to design LID communities and contractors are still able to construct the design but design and construction professionals must approach their work from a very different perspective. In many ways, this product innovation demands a paradigm shift in the way teams approach land development.

Innovation and organizational architecture literature posit that product innovation often influences, even mandates, process innovation. Organizational architecture theory in the business management literature claims that "if an important aspect of the industry's environment changes, most companies in that industry will react by readjusting … decision-making authority, performance measures for evaluating employees, and incentive-compensation systems."[9] These mechanisms broadly define the organizational structure of a firm and a production process, governed by formal and informal contracts that align interests within the company. Applied to the development teams of master-planned communities, this description of organizational structure refers to the project delivery method which governs the overall structure of the team and to the contracts that manage an individual's relationship to the developer. An examination of the organizational architecture in each of the case studies will reveal whether such process changes have already begun in response to a new development form and stormwater management technology, and whether process changes are appropriate given the type or scale of the product innovation.

QUALITIES & ORGANIZATIONS TO FACILITATE INNOVATION

Product innovations may influence changes in the organization of teams and companies but firms themselves may be organized in such a way as to encourage innovation. Clark and Wheelwright find that a number of critical qualities create an environment that encourages innovation.

9 James A. Brickley, Clifford W. Smith, Jr., and Jerold L. Zimmerman, *Managerial Economics and Organizational Architecture* (Chicago: Irwin, 1997), 178.

Inspiration Imbibing a project with inspiration is the most fundamental component of facilitating innovation. Structurally, inspiration may come from leadership or from the team's interaction with others in their field and beyond for, as Brickely, Smith and Zimmerman observe, "a firm does not innovate in isolation".[10] This observation is confirmed by many in the development industry. Willa Kuh of Sasaki Associates and formerly of the Pinehills notes the importance of consultants in triggering real estate innovations. As a permitting consultant in a renowned national design firm, Kuh is able to learn from the work of her colleagues working on other projects across the country and incorporate their experiments and lessons into her work.[11] John Clark, the visionary of Haymount, notes that he is careful to be on the "cutting edge" not the "bleeding edge" by following emerging ideas in development.[12] He calls himself the *Faith Popcorn* of the real estate world. He receives 50 magazines a month, ranging from the Wall Street Journal to Urban Land to Esquire. He regularly scans them, looking for interesting concepts that may guide forward-looking real estate development. Lastly, regulators also provide a source of new ideas.[13] Through regulations municipalities, states, and the nation have forced many innovations in development and beyond.

Interpretation & Integration While inspiration and initial demonstrations of a new concept may trigger large-scale innovation, it cannot be realized without openness to new ideas, particularly early in the development process, and teamwork throughout.[14] Early in the process, teams must have "sufficient freedom to experiment with new solutions."[15] Lester and Piore advocate for *interpretative* management where the project manager facilitates and mediates a phase of open exploration within the team. This phase broadly explores options and "determines the range of alternatives from which business decisions are actually made."[16] However, a more analytic approach is typical of most businesses, including real estate companies. The analytic management process takes a rational decision-making approach by first identifying a problem or goal and then developing discrete tasks to meet that objective. By its systematic and prescribed approach to decision-making and production, analytic management can easily preclude exploration of new ideas.

In addition to an initial period of exploration, team integration across functions or specializations is also important in fostering innovative ideas. "Effective product and process development requires the integration of specialized capabilities. Integration is difficult in most circumstances, but is particularly challenging in large, mature firms with strong functional groups, extensive specialization, large numbers of people, and multiple, ongoing operating pressures."[17] A period of interpretation may not be typical in real estate projects but development projects inherently demand teamwork as many different skills are necessary to move a project from conception to

10 Ibid., 20.
11 Willa Kuh, Sasaki Associates (former Pinehills Director of Land Planning), interview by author, Watertown, MA, 29 June 2006.
12 John A. Clark. Developer, Haymount, Interview by author, Caroline County, VA, 27 March 2006.
13 Clark, 27 March 2006.
14 Fagerberg, 10
15 Ibid., 11.
16 Richard Lester and Michael J. Piore, *Innovation: The Missing Dimension* (Cambridge, MA: Harvard University Press, 2004), 9.
17 Kim B. Clark and Steven C. Wheelwright. "Organizing and Leading 'Heavyweight' Development Teams" *California Management Review.* 34, no.3 (1992): 9.

completion. Therefore, one of the foundational structural elements necessary for innovation is a typical part of real estate development team.

Small Organizations Clark and Wheelwright observe that innovation occurs more readily in small organizations. Large organizations make it challenging for people involved in day-to-day work to bring creative ideas to the leaders who implement change. Job definitions "create both physical and organizational distance" from other people in the firm.[18] In the cases discussed in this thesis, the project teams tend to be small at the onset and remain small throughout the development process. Clark and Wheelwright's theory suggest this is an ideal condition for sharing ideas as well as fostering interpretation and collaboration. It is important to note that their theory relates broadly to entire companies rather than project teams, a useful distinction to make in the real estate industry where the project team can be the entire firm as well. The Pinehills and Haymount both illustrate such overlap. Meanwhile, the Palisades project is managed by a project team in the context of a larger company, demanding more analysis to understand the pathways of authority and innovation.

Leadership Lastly, Schumpeter recognizes the importance of leadership in guiding innovation. Leadership is a catalyst for change and establishes the culture of a team or firm. Independent of organizational structure, leadership and advocacy for innovation may be the paramount quality necessary to facilitate innovation. These characteristics play an integral role in each of the cases.

In addition to fundamental characteristics of successful innovative teams, Clark and Wheelwright describe 4 basic organizational structures and their ability to innovate. Each structure establishes a distinctive system of authority, incentives and interactions among team and firm members. To the extent that each structure is able to embrace and replicate the qualities discussed above, it is able to foster innovation.

The *functional* team structure is most prevalent in large, mature firms and describes the traditional approach firms take to novel product development. Individuals are not dedicated to a particular project. Instead, they are attached to their functional department and specialize in one aspect of a new product's development. When an individual's task is complete they simply "throw it over the wall" to the next discipline, never interacting with the product before or after their particular function.[19] This structure creates a clear, sequential process and allows individuals to apply their expertise to any given product and be evaluated on that component of their work. Despite its orderliness, the functional team may stifle the creative or interpretative process by dividing tasks at "the project's outset, i.e. the entire development process is decomposed into separable, somewhat independent activities" and limiting the interaction among different discipline involved in the creation of a new product.[20]

The *lightweight* team structure retains the fundamental structure of the functional team with the addition of a lightweight project manager. The project manager plays a coordinating role, looking across the various functions and keeping the team apprised of cross-cutting issues.[21] Although this position is intended to improve the team's efficiency and the resulting quality of the product

18 Ibid., 9.
19 Ibid., 10.
20 Ibid., 10.
21 Ibid., 13.

, this rarely happens because the manager has no authority to guide the work of the team.

A *tiger (or autonomous)* team differs significantly from the functional team model. Individuals from different specialization areas are formally assigned and dedicated to a *single* project team. The team as a whole is dedicated to one task and is free to establish their own organizational structure and procedural norms, independent from the rest of the firm.[22] Furthermore, the project manager has real power to coordinate the work of individuals and is the sole evaluator of each team member. This focus and independence instills the team with an entrepreneurial culture and allows the team to explore a wide swath of possibilities and combine their expertise in novel ways. Oversight by a dedicated project manager encourages integration and aligns efforts to discover the best solution.

Despite the virtues of each of the teams above, Clark and Wheelwright support the *heavyweight* team structure as the most appropriate for realizing innovation. The heavyweight structure mimics that of the lightweight team with one important distinction- the heavyweight manager has primary control over the project and team members. Similar to functional teams, individuals remain in their respective functional departments (unlike tiger teams where individuals are reassigned to a project team). Therefore, the heavyweight manager works to align interests and coordinate responsibilities across disciplines. Clark and Wheelwright find that this structure benefits from "improved communication, stronger identification with and commitment to a project and a focus on cross-functional problem solving" which establishes an environment of ownership of and commitment to the project. [23] Often the heavyweight teams create an efficient system for innovation by using broadly trained generalist for a majority of the work and specialists to target particular aspects of the project.[24] Lastly, the heavyweight team structure naturally creates a champion for the project through the heavyweight leader who cultivates ideas and ensures that "the choices made are consistent and in harmony with the basic concept. This requires a careful blend of communication and teaching skills so that individual contributors and their groups understand the core concept, and sufficient conflict resolution skills to ensure that any tough issues are addressed in a timely manner."[25]

All four team structures appear throughout the real estate industry. In the projects discussed in the following chapters, the development teams adopt tiger and heavyweight structures, depending on the size of the development company. For instance, in the cases of the Pinehills and Haymount, the development companies are small, created only to realize one project. Conversely, the Palisades is only one project pursued by the developer, Rhein/Medall Communities. These different motivations necessarily effect each development company's internal structure. With one project and a unitary goal, Pinehills' and Haymount's development companies are assembled like tiger teams while Rhein/Medall Communities is closer to a functional team structure. Despite these differences at the company-level, the development team at the project-level in each case is very similar to the heavyweight team. Each team member has a specialized role on the team, such as land planning, engineering, and project management. Individuals are still responsible to their functional departments although they are

22 Ibid., 14.
23 Ibid., 16.
24 Ibid., 17.
25 Clark and Wheelwright, 23.

assigned to a particular project. (The last point is particularly true in the case of consultants who work for the developer but are still responsible to their consulting firm or their "functional department".) The work of the heavyweight leader- the developer- is to facilitate a collaborative environment, disseminate vision and inspiration to foster ownership and commitment, and establish the mandate for creativity among the team members. Because real estate development teams inherently have a number of heavyweight traits, they are naturally well-organized to conceive and implement novel ideas, which hedges the inherent risks associated with employing innovation.

Such commitment can solve a number of agency issues of which any structure must be cognizant, particularly when a number of team members are not part of the development company and have allegiance and responsibility to another company (as is the case with consultants). An agency relationship exists when one party, the principal (the developer), hires another party, the agent (in this case, a consultant or contractor), to perform a service.[26] Whether the agent is employed by a consulting firm or within the development company, agency issues exist where the agent is incentivized to shirk responsibilities, reduce product or service quality or other actions that benefit the agent at the principal's expense.[27] The problem of agency is particularly salient in the case of real estate development where consultants play integral roles in the design, construction and financing of the project. Typically, issues of agency are solved through contracts and the organizational structure to build incentives that align interests within the team. However, informal contracts, reputations, and relationships also play an important role in addressing agency issues and may be paramount in the real estate industry.

Brickley, Smith and Zimmerman assert that "*reputational* concerns can act as a powerful force to motivate contract compliance."[28] In an environment where information is quickly and widely distributed and the costs of cheating are high, reputational concerns can motivate behavior as effectively as a formal contract. The real estate industry provides a good illustration because projects are locally based and often dependant on local labor. Although design phase consultants may hail from all over the globe, permitting, construction and even materials expertise is often tied to the locality. Subterfuge and dishonesty from these entities can easily be communicated throughout the industry, injuring the ability of consultants, contractors and venders to be trusted by other developers. Likewise, a good reputation is also quickly communicated throughout the industry. Many of the people interviewed expressed the importance of their reputation in the industry as bringing them more business. The combination of the power of reputation and a tight, knit locally based industry "are most likely to be effective in promoting contract compliance when (1) the gains from cheating are small, (2) the likelihood of detecting cheating is high, and (3) the relationship is long run and repeated (where the returns from maintaining a good reputation are large)."[29] Brickley, Smith and Zimmerman's conclusions are strongly supported by the case research presented in the second part of this thesis.

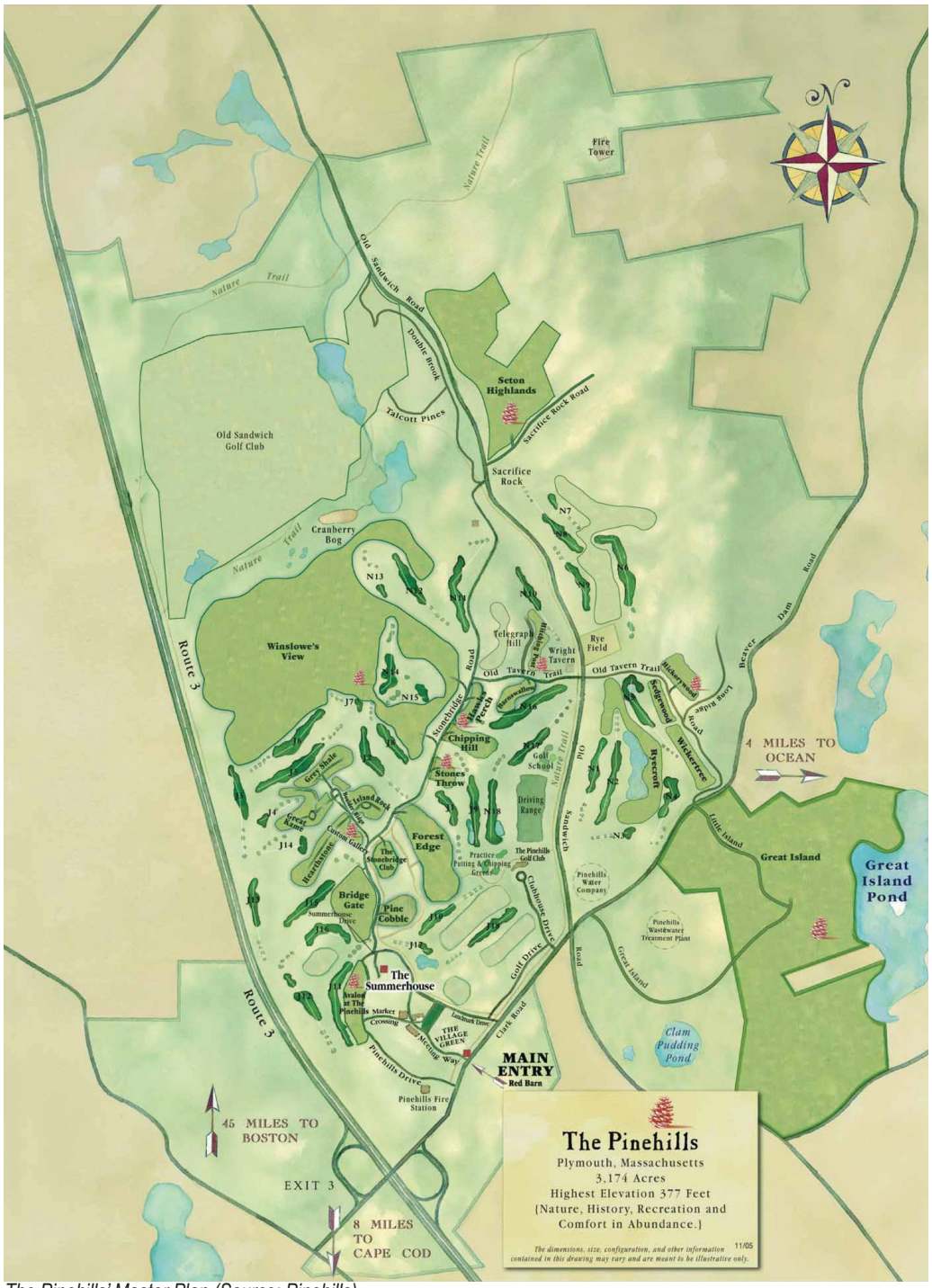
26 Brickley, Smith, and Zimmerman, 154.
27 Ibid., 154.
28 Ibid., 161.
29 Ibid., 162.

A FRAMEWORK FOR ANALYSIS

The first part of this thesis has developed a general understanding of (1) the principles of Low Impact Development, which serves as the product innovation in each of the cases; (2) the land development process of master-planned communities and the project delivery methods and contract types that assign responsibilities, risk and incentives to individuals on the development team; and (3) the array of innovation types and organizational mechanisms that facilitate innovation. Having established these conceptual foundations, this thesis will now turn to three case studies to understand where the innovation of Low Impact Development comes from and how the risk of such innovation is distributed among the development team members through project delivery methods and contracts.

Chapter 5

The Pinehills



The Pinehills' Master Plan (Source: Pinehills)

The Pinehills sits at the outskirts of the historic town of Plymouth, MA. Despite its central location in American history as the landing place of the Pilgrims and proximity to the Boston metropolitan area (40 miles north of Plymouth), Plymouth has remained a modest-sized coastal town with a population hovering near 60,000 people[1] The presence of a Massachusetts Bay Transit Authority (MBTA) commuter station however positions the town for greater growth in the coming years. A study by Reconnecting America in 2004 found that "400,000 people in Greater Boston live within one-half mile of the MBTA's 280 commuter rail and rapid transit stations" (including the Plymouth station) and projects that housing demand near transit nodes will grow to almost 840,000 households by 2025, particularly among "both aging empty nesters and families with children".[2]

The Pinehills may be at the forefront of anticipated growth around Plymouth's commuter rail station. With 3,000 acres, the Pinehills is the town's first master-planned community and represents the town's single largest residential project. Since 2001, the Pinehills has represented 17%-64% of total annual building permits issued by the town with an average of 45% (1,037 houses) over five and half years.[3] At completion, the Pinehills will preserve approximately 70% of the parcel as open space, develop 2,983 homes and provide 1.3 million square feet of mixed-use commercial space. Four golf courses, natural areas, and walking trails wind through the community's neighborhoods, completing the developers' (Tony Green, Steve Carp, and the Wallace brothers) vision of an open space-focused community targeted at the *empty-nester* and *dual-income/no children* demographic.

HISTORY OF THE PINEHILLS

The Pinehills parcel has always been an important piece of property to the town of Plymouth. Its large size and proximity to the town center positioned it well for future development with the capability to strongly influence the rustic quality of Plymouth. The parcel was first identified for development in the 1970s by Digital Equipment Corporation for construction of their corporate headquarters. The project required rezoning from 1 house/acre to a "Hi-Tech and Knowledge" Planned Unit Development", which was approved in 1978.[4] It was with the consideration and eventual approval of this project that the town recognized the unique opportunities presented by the land and understood the potential to develop it apart from its underlying zoning.

For better or worse, the Digital Corporation dissolved and the corporate headquarters never came to fruition. Subsequently, Tom and Walter Wallace (as the Walter Associates) optioned the property and went on to eventually form a partnership with The Green Company (Alan, Tony, and Dan Green) and New England Development (Stephen Karp and Steven Fischman) in 1996 that created the Pinehills. The partners viewed the property in November 1996, seeing potential they extended the option for the purchase and signed the Purchase and Sale agreement on September 1, 1997, beginning their endeavor as the Pinehills LLC.[5]

1 US Census Bureau, Census 2000, "Fact Sheet: Plymouth town, Plymouth County, Massachusetts," (27 July 2006).
2 "Housing", The Boston Indicators Project, http://www.tbf.org/indicators2004/housing/overview.asp, (07 August 2006).
3 Data provided by Lee Hartman, Director of Planning (Town of Plymouth), 21 June 2006.
4 Lee Hartman, Director of Planning (Town of Plymouth), interview by author, 21 June 2006.
5 Tony Green, Managing Partner (Pinehills), interview by author, 09 May 2006.

(from left) Rain garden positioned to capture runoff from driveway; Homes placed along ridge of hill to take advantages of golf course and forest views and aid with drainage.

DISTINCTIVE FEATURES OF THE PINEHILLS

The Pinehills LLC envisioned a traditional New England-style Village complimented by a number of distinct residential neighborhoods organized around open space and golf courses. Tony Green as the managing partner took a unique approach to the land development, creating intimate neighborhoods though clustering houses, non-standardized lot shapes, and preserving the landscape to add value to homes.

Design-by-Views While open space, whether as exclusive golf courses or natural areas, is a desirable amenity in old and new communities that can command a premium in the market, perhaps it is too simplistic to assume that consumers are merely seeking the inclusion of these amenities somewhere in the community. Developer Tony Green has applied marketing and lifestyle realities to the theory of conservation design through designing homes to capture beautiful *views* of the open space. A large portion of the homes at the Pinehills are oriented to provide views to forest, golf course greens, and water. By perching houses on hillsides below the treeline, homes are well-situated to take advantage of views and preserve the viewshed for others to enjoy (as houses are hidden by the treeline).

Although the golf course and 600 acres of natural landscaping and conservation forest are indeed an appreciated community amenity, Green creates additional value by providing views of these amenities from residents' homes. Sales at Pinehills have demonstrated the validity of this approach; homes with views have sold at higher margins than homes without views. Furthermore, consumers have also demonstrated a hierarchy of desirable views through their purchasing behavior. Water views garner the highest prices followed by golf course views that frame forest views. Meanwhile, forest views are priced lower because they often do not allow the same depth of a view. Consumer response to the design-by-view concept advances the concept of conservation design to more explicitly address consumer preferences and market realities.

Clustering Homes The Pinehills adopts the practice of clustering homes on the parcel. The community confines development to 30% of the parcel with golf courses and walking trails weaving between the neighborhoods. Clustering homes increases density within the


(from left) Homes at Stone's Throw are placed closely with living spaces and views strategically located to create a feeling of privacy; Three homes share one driveway, reducing impermeable surface. (See Appendix for lot plan of Stone's Throw neighborhood)

neighborhoods and creates a sense of place. However, the feeling of density is mitigated by Green's placement of homes, which creates a feeling of privacy.[6]

Flexible Lot Lines One of the truly unique and innovative features of the Pinehills is its refusal to establish standard lot dimensions, frontage and setbacks. Where lot lines are typically established before development, at the Pinehills, homes were placed first in relation to the topography and views. Lot lines were drawn in afterwards. The flexibility afforded was one of the principle mechanisms that allowed Green to meet his design-by-view vision. Without the constraint of established lot lines, Green was able to closely place and orient homes toward views.

Localized Stormwater Plan Instead of adhering to conventional engineering practices, the VHB engineering team recognized and took advantage of the parcel's greatest attribute for the purposes of stormwater management- its soil. Soil and percolation rates are fundamental to surface water management; however, very rarely do they justify little to no structural treatments as they did at the Pinehills. Overcoming internal concerns about performance and liability, VHB designed a Low Impact Development-inspired surface water ma2.2nagement plan that addressed runoff and water quality at its source, requiring a distributed approach to management in place of a centralized detention basin.

REGULATING THE PINEHILLS

The Pinehills LLC began the approvals process on June 17, 1997. Tony Green made a presentation to the town of Plymouth, describing the projects and philosophy of The Green Company as well as laying out a vision for the 3,000 acres outside of Plymouth. Much of The Green Company's work had targeted the "empty nester population" and focused on clustering housing and preserving significant environmental and cultural landscapes.[7] Nick Filla, then Chairman of the town's Planning Board, was thrilled by the concept, having studied under McHarg as a planning student at the University of Pennsylvania, and became an enthusiastic

6 Ibid.

7 Dave Caligaris, President (The Green Company), telephone interview by author, Newton, MA, 16 June 2006.

supporter of the project.[8] Despite his support, the Pinehills would require another year to gain approval.

Numerous complications delayed permitting. Green's proposal would require a new zoning ordinance. The town of Plymouth's planning board drafted the Open Space Mixed Use Development (OSMUD) ordinance, completed in October 1997, to serve as the legal framework that would guide the project.[9] Meanwhile, Green as the managing partner of the Pinehills LLC, was working with the design team to conduct environmental, habitat, and traffic studies to identify areas appropriate for development. Before assembling a town hall to gain approval for the project, Tony conducted countless workshops for the town staff and residents, bringing in consultants for a variety of topics to discuss the Pinehills' impact.[10] Despite Green's efforts to demonstrate the limited negative impacts that would result from his proposal, a group of town's people rigorously opposed the development, galvanized by environmental concerns. Among the many issues, opponents cited increased traffic, habitat and viewshed destruction, and hydrological contamination and depletion as reasons to deny rezoning.[11] Their stolid opposition forced the developer to undergo five public hearings until the Pinehills gained approval in April 1998 by earning the necessary supermajority vote (4-1) from the planning board.

The approved plan allowed 2,000 homes, four golf courses and 2.3 million square feet of commercial space. The OSMUD ordinance provided numerous controls to guarantee the developer's compliance with their proposal. For example, to assure that the project would not attract families and further burden Plymouth's school system, 1,000 units would be age restricted for the *55 and over* population. A very few number of houses could exceed two bedrooms and all houses would have the master bedroom on the ground floor.[12] These design elements were established to appeal to the needs of older populations while being unattractive to families with children.

Soon after the master plan's approval however, a group of Plymouth residents filed a lawsuit against the Pinehills LLC to stall the project. The developers ultimately settled with the plaintiffs, reducing the commercial program by 1 million square feet and increasing the residential program by 900 homes to appease opponents' traffic concerns.[13] Triggered by this roadblock, Green returned to the town and requested complete approval of the plan without the contingency of phase approval. Without such unilateral approval the project would be delayed or completely derailed at any phase by its opponents. Recognizing the immense risk posed by the phase-level approvals, the town planning board agreed to relinquish the most significant control they had over the project, thus, shifting some of the regulatory risk from the developer to the town. The project was granted the flexibility necessary to complete the project successfully at the cost of the town's ability to impose any checks on the project. Site Plan Review is the remaining formal check the town of Plymouth maintains over the Pinehills, requiring the developer to bring any changes to the plan to the board for approval. Gaining

8 Nick Filla, former chairman (Plymouth Planning Board), interview by author, Plymouth, MA, 21 June 2006.
9 Hartman (Director of Planning, Town of Plymouth), 21 June 2006.
10 Ibid.
11 Ibid.
12 Hartman, 21 June 2006.
13 Filla (former chairman, Plymouth Planning Board).

Plymouth fire station and naturally vegetated depression, which took the place of a conventional detention basin.

unilateral permitting approval has been identified by Green and others on the design team as the most significant victory for the project and a major contributor to the success of the project.[14] The project was no longer beholden to the town of Plymouth aside from having to follow the master plan that was already approved.

The stormwater management plan did not play a central role during the approval process largely because the community and its infrastructure would be privately owned and operated. The Pinehills' Homeowners' Association is responsible for the maintenance of the community's infrastructure in perpetuity. Furthermore, the master plan was very much in a conceptual stage during the approvals process. Details such as the stormwater management plan were largely schematic and undeveloped. If the town had retained the power to grant approval for each phase the scrutiny to the stormwater management plan may have been more rigorous.

Only on one occasion did the Pinehills stormwater management plan undergo the scrutiny of the town. As part of a land swap, the Pinehills contributed land for a fire station that would be owned by Plymouth. Serving as the land developer, the Pinehills furnished the town with a land plan of the site, employing low impact development principles. The engineers designed the system so the runoff would channel into an existing vegetated depression, which would retain the water and allow it to infiltrate back into the water table. Having little or no exposure to this type of design, the town engineers were unwilling to accept the proposed plan. They preferred a traditional detention basin lined with cement and surrounded by a guard rail. Their concerns included fear of creating a mosquito haven, the possibility of children falling into the depression, and the IMPs inability to adequately handle runoff. They were concerned about their liability should any of these things happen. It was only after a series of conversations between the project and town engineers and much convincing that the town accepted the land plan.

14 Green (Managing Partner, the Pinehills), 16 June 2006.

DESIGNING THE PINEHILLS

Much of the master planning paradigm that governs the Pinehills is influenced by the work of the Green Company. Since the 1970s Alan Green, Tony Green's father, experimented with developing dense residential developments through clustering development on the parcel. Through three decades of development, the Green Company has cultivated a unique residential product that focuses on preserving open space and orienting living space toward views to increase the feeling of privacy in dense communities. Roads are designed to evoke an old New England ambiance, winding and narrow. Such projects were never permitted by-right or special permit. Therefore, the Green Company developed an expertise in "difficult-to-permit" projects.[15] Tony Green exported this basic design model and permitting expertise to the Pinehills project.

The partnership saw the potential for a unique golf course community that adopted several land planning and marketing practices from the Green Company's experience. Once the partnership gained control of the land they began a visioning process with the objective to protect and enhance the site's most valuable natural features.[16] Through a series of land planning exercises, Sasaki (master planner) and VHB (site & civil engineering) forged a close working relationship where Sasaki would develop a conceptual design that VHB would then inform through engineering studies. These iterations helped create a plan that was at once reflective of the character and land planning practices envisioned and feasible from an engineering standpoint. Green adopted an uncommon method of evaluating the design by staking the centerline of roads and walking along them. The process allowed him to consider the views from the road as well as adjust the road to preserve natural features of the landscape, such as old trees and knolls.

During the visioning process VHB participated in the land planning exercises with particular emphasis on where the stormwater facilities would be in the landscape. Stormwater planning was complicated by the need to accommodate 3 different uses- residential areas, a commercial area, and golf courses integrated throughout the development. Through analysis of the geology of the site VHB engineers discovered that a traditional stormwater management system was not necessary. With a low water table and completely sandy soil, runoff was quickly absorbed. Thus, the VHB team began designing a low impact stormwater management system that took a localized approach.[17] Instead of designing a system to channel runoff quickly to a central detention basin, the civil engineers proposed a system that treated surface water at the source not the "end of the pipe". VHB identified depressions and directed runoff to them. Because these holes were vegetated and sandy, water would quickly be absorbed by the soil and plants. Therefore, the plan was designed to be non-invasive, small and integrated throughout the project. In addition to saving in infrastructure costs, the approach perfectly complimented the Pinehills aesthetic of maintaining a charming and natural New England landscape.

It is important to note that although the surface water management was unprecedented at that scale of development in Massachusetts, it was not the impetus of the project or the primary driver of the master plan. Instead, stormwater planning was applied to neighborhood designs.

15 Caligaris (President, The Green Company)
16 Ibid.
17 Curtis Quitzau, Project Manager (VHB), interview by author, Watertown, MA, 07 June 2006.

Often, however, the plans and lots would change to preserve landscape features that served as part of the runoff management. Economics were another important driver of the stormwater management plan. The proposed plan required minimal infrastructure and, thus, greatly reduced maintenance costs.[18] With reduced pipe sizes and short networks of piping, the developers were able to realize significant savings in the installation of the surface water management system.

Although the stormwater plan took advantage of the property's unique characteristics and provided significant economic benefits, it "raised a lot of eyebrows" internally at VHB.[19] Similar to Plymouth's town engineers, VHB's chief engineers were skeptical of the plan. Curt Quitzau, VHB's project manager on the Pinehills project, had to convince the chief engineers that the plan was sound. They did countless studies which revealed that there was almost no runoff of vegetated hills with a 25% slope from a 100-year storm event. The landscape itself was the most ideal management system on the site and they eventually decided to stop "wasting their client's money" testing that fact. [20] After extensive tests and examination of all the "what if" doomsday scenarios (Would homes flood?) Quitzau was able to get approval of the plan. This would be VHB's first project that extensively employed low impact design principles.

CONSTRUCTING THE PINEHILLS

While the design process was overseen by Pinehills' Director of Land Planning, Green hired a Director of Construction to manage the horizontal construction work. A strong aesthetic and lifestyle vision led the design process and required skilled execution in order for Green to realize his vision. No similar project had been developed locally, meaning local labor was uninitiated to the design form and its demands on construction. Conveying the distinct vision and aesthetic of the project and teaching subcontractors the skills necessary to execute it are among the most critical of Moore's responsibilities.

The roads in the Pinehills community range from 18'-22' wide with no conventional drainage system compared to the 60' wide curb and gutter roads typical of the rest of Plymouth. To create the illusion that the roads were old and established, Green required that mature trees be preserved.[21] Thus, the limits of clearing were very narrow and graders had to work in constrained spaces in order to protect existing vegetation. The roads had to have an intangible charming quality, as though "God had put them there".[22] These conditions demanded special attention from the subcontractor. On the job, Mr. Moore worked with subcontractors to explain the quality of work demanded. He describes the effect as "naturalized instead of industrialized."[23] Innovative road design is a tangential element of Low Impact Development. Reduced pavement and conservation of the ecological landscape certainly preserves natural stormwater management.

18 Ibid.
19 Ibid.
20 Ibid.
21 Tony Green, Managing Partner (Pinehills), interview by author, Plymouth, MA, 1 December 2005.
22 Ibid.
23 Ken Moore, Director of Construction (Pinehills), telephone interview by author, 28 June 2006.

(clockwise from top left) Moore marks narrow limits of clearing, creating a rustic and established feeling to new roads; silt runoff from construction sites can threaten the LID stoemwater management system; hay bales block silt from drainiage system.

After training, Moore would also provide extensive supervision and management during the site work. For instance, before grading Moore would walk the land and carefully mark the limits of clearing, just enough to accommodate the road or homes planned for the area and painstakingly preserving notable natural features and tree specimens.[24] Later in the construction process, often Moore and Green worked from design plans rather than construction documents or simply designed infrastructure "on the ground", at times without surveys or designs.[25] The freestyle approach to land development is unorthodox but allows the developer great aesthetic liberty to intimately tailor roads and homes to the landscape and strategically preserve important stormwater drainage areas.

In addition to teaching site contractors a new aesthetic and construction techniques, Moore also had to ensure protection of the drainage areas. Construction practices can result in soil compaction, which severely harms the land's ability to absorb runoff and undermines the LID plan. The Pinehills established construction standards to prevent excessive erosion from construction, and subsequent silting and blockage of depressions preserved to accommodate stormwater runoff. Despite established construction guidelines, compaction and silting occurred during construction, in part, due to lack of enforcement.

24 Ibid.

25 Ibid.

DELIVERING THE PINEHILLS

Design and construction of the Pinehills was performed through a multiple primes delivery method. Design phase contracts were on a time and materials basis and construction contracts were typically lump sum. The combination of these mechanisms placed much of the risk of the project on the developer.

Project Delivery & Team Structure The Pinehills employed a multiple primes project delivery method where all members of the design and construction team were contracted directly with the developer. Ultimately, the Pinehills LLC manages and directs the work of all consultants and subcontractors involved in the project. The Director of Land Planning functions as a project manager, coordinating the design consultants and directing their work toward establish goals. Likewise, the site work required for land development was also conducted through a series of contracts with subcontractors, whose work is directed and managed by the Pinehills' Director of Construction.

Green's internal staff has grown to strategically guide phases of the project as well as ensure quality and adherence to the vision. For such a large project, Green has kept his internal development team rather lean. The success of this method has been to strategically hire individuals in-house in order to have the most important expertise in each phase readily accessible in large supply and to align interests between the developer and employees (a consultant is foremost responsible to their firm and may have other projects that divide his/her attention), and save on costs. For instance, Willa Kuh came to the Pinehills from the enforcement side of the Department of Environmental Protection to manage the permitting/ MEPA phase as the Director of Land Planning. Her experience and relationships in the regulatory world were integral in to the success of the Pinehills' permitting strategy.

Green's corporate structure and project team structure are well-organized for innovation. At the corporate level, the company is organized like a tiger team- small, focused on a single endeavor, and led by a strong vision and manager (Green). At the project-level, the team is organized like a heavyweight team with the involvement and integration of several functional silos who work together to meet Green's development objective. Both these structures create ease of communication and sharing of ideas. Green's leadership helps establish a culture of openness to new ideas and commitment to the process of interpretation (Lester and Piore).

The multiple primes delivery method requires the developer assume the most risk in comparison to other delivery methods. The management of various consultants and subcontractors demands enormous time, skill and expertise. Furthermore, the developer assumes more risk as s/he is responsible for meeting deadlines and controlling costs. In the case of the Pinehills, the multiple primes arrangement was well-suited to Green's capabilities. His construction sophistication and risk tolerance coupled with strategically created internal positions to aid with management allowed successful project delivery. Furthermore, this method allowed Green to exert the level of control necessary to achieve his vision and allocate costs where he felt they were most important. A high level of control over quality and costs was particularly important given the strong vision, various innovations of the project, and importance of preserving the natural landscape as part of the stormwater management system.

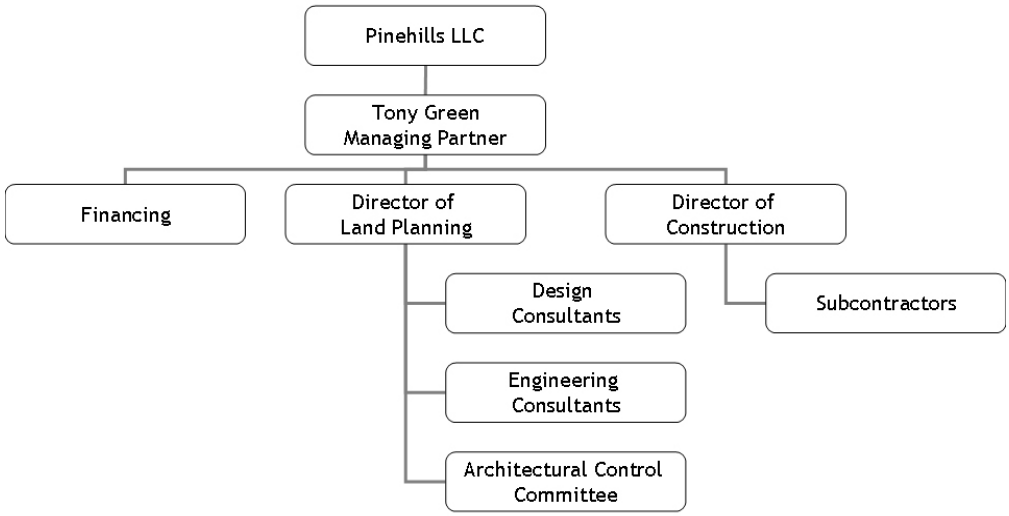


Figure 5.1: Pinehills corporate and team structure. Source:Charu Singh

Selection & Scope Green has based his selection of the design and construction team primarily based on the relationships he has established through previous projects. The design and construction has been almost entirely headed by companies or individuals that Green knew from previous projects. Having worked with Sasaki and VHB before, Green knew the caliber of their work and trusted them to deliver the product he wanted, demonstrating the importance of long-term relationships as suggested by Brickley, Smith and Zimmerman. Existing relationships often guide developer's decisions to hire firms; approximately 80% of VHB's work is repeat business.[26] At the inception of the project Green invited a number of companies to participate in the project but did not determine any scope of work. Instead each firm's role, particularly those of the engineering firms, was determined during the visioning process based on their strongest areas of service. Therefore, the Pinehills did not use a competitive or multi-parameter bidding process to assess skills and cost of a variety of firms.

The selection process for construction professionals differed from that for the design professionals. Initially, the first subcontractor was selected through a multi-parameter competitive bidding process where qualifications and price were important but secondary to whether the subcontractor had worked with Moore on previous projects.[27] Market drivers played an important role during subcontractor selection. Because the site work at Pinehills required an understanding of the project vision and the ability to bring that vision to fruition, no subcontractors in the area had the necessary experience for the project. The multiple primes construction method was well-suited to this issue because Moore, as the Director of Construction, was able to select and train firms to provide the quality demanded.

In a situation where the developer requires a specialized service, it can be difficult to control costs, especially if the subcontractor believes no one else can deliver the product. Thus, over time Moore trained 3-4 road graders.[28] He selected these firms based on his relationship with

26 Quitzau (Project Manager, VHB).
27 Moore (Director of Construction, The Pinehills)
28 Green (Managing Partner, The Pinehills), 09 May 2006

them from previous work in conjunction with a multi-parameter competitive process where he considered experience, price and delivery date.[29] As road construction projects became available, the work would be bid out to these pre-trained and, thus, pre-qualified companies. Once a cohort of qualified subcontractors had been established the developer was able to competitively bid out work to pre-qualified firms. This method allowed the developer to get the specialized skill and quality he sought as well as a competitive, commodity-driven price.

Contracts The contracts for the design phase were fairly informal. They were negotiated on a time and materials basis where the consultant assumes no risk in the pricing and delivery of their services. In the case of the Pinehills, the scope of work was largely undefined. For example, the contract VHB initially had with the Pinehills was not a "soup to nuts" contract.[30] Originally, they were contracted to do the master planning and MEPA permitting. However, over time the scope of work grew but the contract was never updated.[31] This suggests that actual contracts have not been important to the Pinehills in defining consultants' scope of work, shifting risk, or establishing incentive and penalties for the quality, time or cost of their work. Rather, the Pinehills has relied on the basic time and materials payment structure and an informal relationship and trust to guide their relationships with consultants. From a contractual perspective this approach does not seem sophisticated but it grants Green the flexibility of changing the scope of work easily, which is facilitated by the time and materials arrangement that provides a fixed price for every unit of work.

In Green's experience, time and material contracts are typical of consultants involved in design during pre-development.[32] Consultants are not willing to take any of the cost risk during permitting as this is a time of great uncertainty. Consultants are unable to accurately gauge the amount of work or time that design and engineering may take during permitting and, furthermore, are unable to control it. Quitzau estimates approximately 25% of a project's work is certain throughout its life. The remaining 75% represents the permitting risk, which can require the developer to submit multiple changes to the proposal. Such iterations create more work for consultants and increase the unpredictability of costs. This permitting risk is multiplied when a project is innovative and new to a municipality. That Green did not negotiate a different contract type or limit some of his risk exposure through mitigation clauses reflects his high risk tolerance as well as his confidence in his ability to manage the regulatory risk. Furthermore, Green recognizes the importance of spending time and money early in a project in order to achieve the quality desired at the end of a project. Design and engineering represent a small portion of total development costs and are not the best place to realize savings. This approach obeys Lester and Piore's call for interpretative management, allowing more time and exploration (and money) early in the production process to foster innovation.

Construction costs however are a significant portion of total development costs and provide greater opportunity to realize savings. At the Pinehills, contacts with construction professionals are typically lump sum contracts negotiated for a particular scope of work. For instance, graders are paid a lump sum per 1000' of road. The grader is responsible for building the roads to

29 Moore (Director of Construction, The Pinehills)
30 Quitzau (Project Manager, VHB).
31 Ibid.
32 Green (Managing Partner, The Pinehills), 09 May 2006.

specification and delivering them on the negotiated date. In contrast to the design phase of the land development, the construction phase was treated like a commodity through the selection method and contract type.

Interestingly, although Green desired a specialized product which implied that he would require specialized work, he paid commodity prices because Moore cultivated a cohort of trained subcontractors who would bid against each other, bringing down the cost of the work. Through a unique combination of selection, training and contracting, the developer reduced his exposure to cost and schedule risk during the construction period without compromising the quality of work. Developer oversight of the site work allowed quality control. However, the Pinehills' unique methodology of adapting design plans to the landscape and designing "on the ground" during construction could have the potential of ballooning costs through change orders. Moore was able to control change order costs in large part because of the relationships he established with subcontractors and a "horse trading" or barter system he forged on trust.[33] Often changes were minor with no costs implications. Many times changes actually reduced cost and eased work by moving roads around obtrusive landscape features, such a large trees and boulders. These types of changes would accrue as a *credit* in the barter system and would be traded for changes that incurred costs. This informal system allowed simple contracts and reduced the paperwork involved with change orders. The system of incentives and penalties were equally informal. The sheer size of the project and promise for future work acted as sufficient incentive for subcontractors to present fair prices and quality work.[34] Losing future projects functions effectively as a penalty for poor work as well.

THE ALLOCATION OF RISK

There are a number of risks associated with any development project. An analysis of the design phase of the Pinehills reveals a number of risks that are general to development, particular to the master-planned community product, and special to innovation at the site planning level. These risks are experienced to some extent by almost every member of the design team. The extent to which each consultant and the developer assume risk is, in part, dictated by the project delivery method and contracts.

Regulatory Risk Broader site planning practice posed greater risk to the project. Clustering homes, increasing density, irregular lots, set back guidelines and a mix of uses deviated from the traditional residential development in Plymouth. Educating the town and residents of the benefits of this type of development greatly increased the time and cost to achieve approval. Furthermore, in order to secure approval, the project had to garner supermajority support from the planning board with a 4-1 vote.

From the perspective of project delivery structure and contracts, the developer absorbs almost all the regulatory risk. Multiple primes delivery requires that the developer assume the entire responsibility of coordinating consultants, establishing benchmarks, and securing deliverables. Management risk is coupled with the cost risk related to the contracts negotiated with the design consultants. The contracts with Sasaki, VHB and other consultants were on a time and

33 Ibid.
34 Ibid.

materials basis. Thus, as the regulatory process drags out and changes are required of the plan, the cost of design and approval increases direct costs in the form of fees paid to the consultants and carrying costs of the project. Time cost is also associated with the longer approval process. However, the Pinehills LLC chose to create the risk by pursuing an alternative development form in a town unfamiliar with such development. The allocation of additional cost and associated regulatory risk to the developer is justified by the risk/reward paradigm discussed in Chapter 3. Because the developer creates value and can collect returns from an approved project, the paradigm suggests it is appropriate for the developer to assume the additional regulatory risk and associated costs to permit an innovative project.

The Pinehills was not the only entity assuming risk during the regulatory phase. The town of Plymouth ultimately assumed significant risk as well. Residents and town staff were particularly concerned about the infrastructural demands of a large, mixed-use project. Although several specialists analyzed these impacts, there is always a level of uncertainty of what will actually happen. The town was able to eliminate some of this risk during permitting by mandating that the Pinehills was responsible for mitigating any negative traffic impacts created by the project over time. Deed and design restriction prevented the development from introducing many new families to the town. However, they assumed significant risk after giving unilateral approval to the project, not requiring approval for each phase of development. While this protected the developer from further delays and lawsuits at each phase, the town relinquished almost all their control over the project.[35] "I recognize that's what they [the Pinehills] needed to be successful," admits Hartman, "but you never become comfortable" relinquishing that much control over a project.[36] Such flexibility was unprecedented in Plymouth and Hartman believes is an integral component of the success of the project. While the town of Plymouth assumed a general risk by relinquishing control of phase-level permitting, they assumed no risk from the stormwater management plan because the Pinehills is a private community.

Design Risk The amount of risk assumed by the design consultants is of lesser magnitude than the developer. In this case, the consultants assume a risk that is typical in the development industry- getting paid for their services. Because consultants usually bill clients after they have begun work, a firm has little ability to force or assure payment for services rendered. Therefore, design consultants, to some extent, "assume risk every single hour [they] work."[37] Companies, such as Sasaki and VHB, extend their lines of credit and hope to get paid in a timely manner. To the extent that developers are delinquent on payments, design consultants have some exposure to general regulatory and construction risk in that their fee may be tied to the success of the project. Firms are willing to accept the inherent risk because of an "inherent trust" they have with their client, as pointed out by Curt Quitzau of VHB. Firms are able to minimize this risk by putting clients on retainer; however this practice seems to be limited to new or untrustworthy clients rather than becoming a regular method of controlling risk exposure.[38] Design firms' tolerance of delinquent payments and reluctance to use retainers suggests that consultants are willing to extend some leniency to developers, who must bankroll extensive predevelopment costs without any revenue. While this is a general risk that consultants assume,

35 Quitzau (Project Manager, VHB).
36 Hartman (Director of Planning, Town of Plymouth).
37 Quitzau (Project Manager, VHB).
38 Ibid.

Examples of drainage failure due to silt runoff during construction.

it may be exaggerated during innovative projects that can require more approval time, more upfront capital on the part of the developer and could make it difficult for the developer to pay consulting fees.

In addition to general risks, consultants, particularly the site and civil engineers in the case of the Pinehills, had to assume innovation-specific risk related to the performance and liability from employing a new approach to surface water management. VHB was particularly concerned about liability associated with the Low Impact Development approach of the Pinehills project. If the system failed and homes flooded from insufficient drainage or cars crashed because roads were too narrow, VHB would be exposed to litigation. Given VHB's concern about this risk, they conducted numerous studies to test their assumptions and protect the company from litigation. The risk and subsequent liabilities created by the site engineering innovations in the project are assumed by the firm but at some cost to the developer through the time and materials contract. The Pinehills paid for the additional testing and the time Quitzau spent convincing chief engineers at VHB to approve the plan. Therefore, although the engineering firm exposes itself to some risk through the innovation, the developer pays a risk premium.

Construction Risk The Pinehills LLC assumed significant risk during preconstruction and design but they were able to limit their risk exposure during construction through the project delivery method and contracts. Pinehills limited this risk by hiring a trusted and experienced Director of Construction to manage the land development, thus ensuring the work was completed according to the unique vision of the developer and aligning interests between construction management and the developer. Moore further mitigated construction risk by hiring subcontractors he was familiar with, conducting detailed training, and providing extensive management during site preparation.

Although risk exposure during construction was limited by contracts, Green created additional risk through his approach to construction. Because much of the land development was dictated by a vision of a quaint New England setting, many land plans were reworked during construction to adjust to the natural surrounds. Often they would work with planning documents instead of construction documents and improvise for the sake of aesthetics. The result is a beautiful,

idyllic landscape but at the developer's liability. If stormwater mechanisms fail due to inadequate grading, for instance, the developer could be held liable because he didn't follow the engineering plan. Recognizing the liability created, VHB has developed a paper trail of these deviations to protect themselves in the case of litigation.

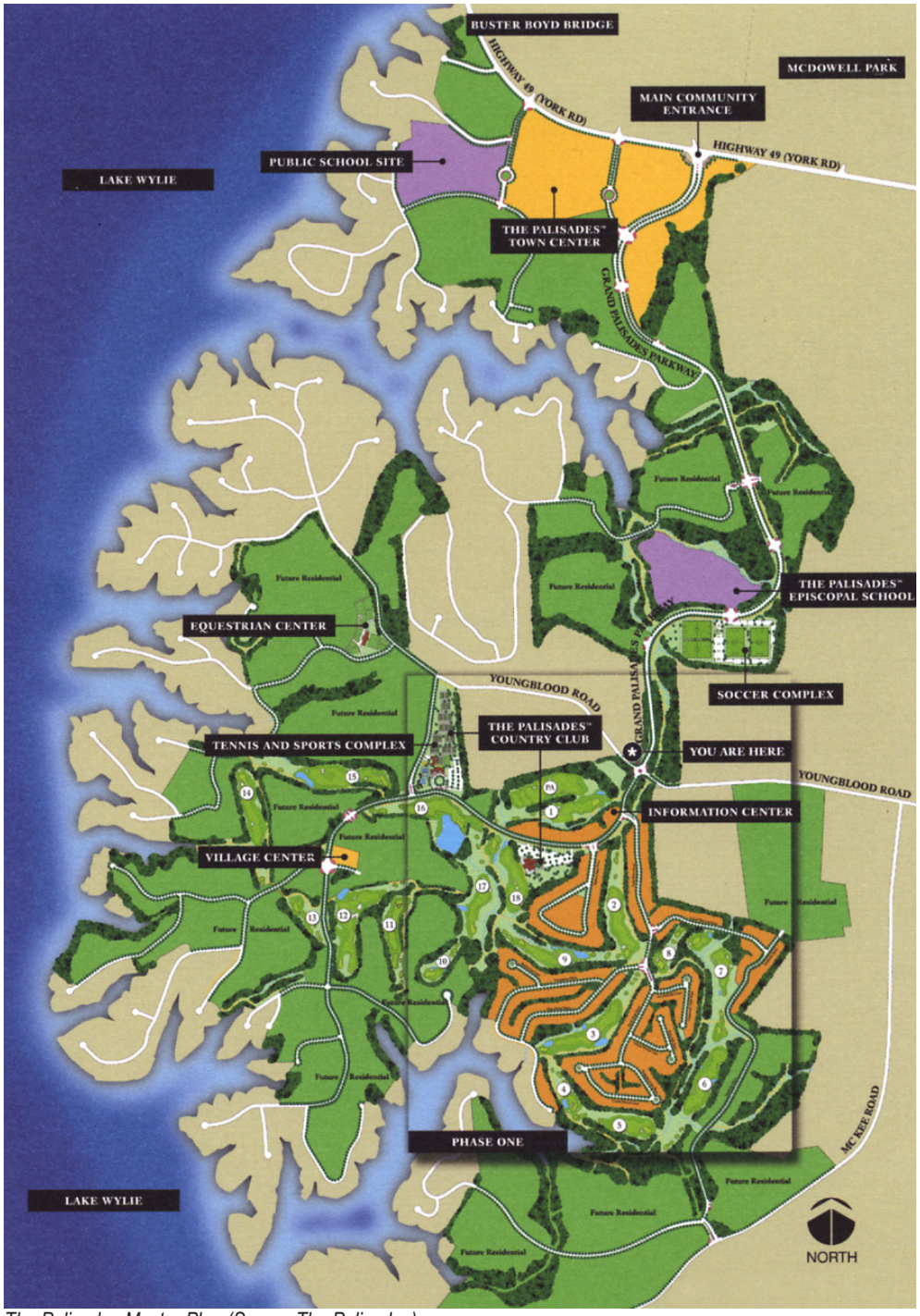
DEFINING A NEW PROCESS FOR INNOVATION

The Pinehills case highlights the importance of process innovation. From the onset, the team structure was well-structured to conceive innovation with strong leadership, a small but diverse team, and an environment encouraging of creativity. This heavyweight team structure helped encourage the product innovation of Low Impact Development at the Pinehills. Admittedly, the implementation of Low Impact Development practices was fairly limited in this project as the plan largely relied on the landscape for stormwater management and was not forced to incorporate structural IMPs as the other cases in the following chapters. However, the process innovation observed in this project was extensive. At every phase, Green found new ways to envision and execute his vision, through "on the ground" design and extensive subcontractor training and oversight.

In part, the multiple primes delivery method and time and materials contracts may have encouraged such process innovation. These mechanisms did not require strictly defined scopes of work for the consultants and bestowed the flexibility necessary for Green to invent design and construction processes tailored to his vision. For instance, time and materials contracts were well-suited to the project because the Green was able to easily change the scope of work and closely direct the work of consultants at each phase. This flexibility allowed Green to pursue process innovation unfettered by restrictive delivery methods or contracts. While these mechanisms placed significant risk on the developer, they also created incentives (through the potential for greater returns) for him to discover new methods to successfully realize his vision. As the primary coordinator of the project, Green was able to add the most value through discovering new processes of design and construction to more completely explore and realize his vision. The result is a uniquely constructed environment that significantly increases home values and provides greater returns to the developer.

Chapter 6

The Palisades



The Palisades Master Plan (Source:The Palisades)

A string of lakes grace the western edge of Charlotte and its suburbs. The land surrounding the series of lakes in the Charlotte region was originally acquired and owned by Duke Energy in the early 1900s. From 1910-1963, Duke Energy developed a series of dams and reservoirs along the river to generate power and supply as drinking water.[1] Today more than 11 lakes and reservoirs built by Duke Energy lie along the Catawba River, including Lake Norman, Mountain Island Lake, and Lake Wylie.[2] The land surrounding the lakes was controlled and harvested for timber for several decades by Crescent Resources, a subsidiary of Duke Energy. 20 years ago Crescent Resources began aggressively selling its land and pursuing development on its own. The parcel which became the Palisades was part of this disposition.[3]

Historically, the Lake Wylie area where the Palisades is located has had the least valuable property values at all of Charlotte's lakeside communities. Kristin Perez, the Community Association Manager of the Palisades and long-time resident of Charlotte's suburbs, speculates that growth in the Lake Wylie region has trailed behind other Charlotte suburbs because off its geographic positioning. Sitting at the bottom of a chain of lakes, Lake Wylie receives runoff and pollution from the rest of the lakes upstream and their surrounding activities. Thus, Lake Wylie has been the dirtiest and least attractive of the lakes surrounding Charlotte. Subsequently, the area has developed more slowly and home prices and land values have appreciated more slowly. However, with exceptional growth since 2000 and declining available land in other suburbs Lake Wylie has become a hotbed for residential subdivisions, master-planned communities, strip malls, and retail power centers.

HISTORY OF THE PALISADES

The Palisades is a 1,500 acre master-planned community located on the southern skirt of Charlotte, NC along Lake Wylie. It is comprised of five separate neighborhoods, each targeting differentiated markets through distinct style and price points. The community will feature 2,000 homes on 70% of the parcel, leaving the remaining 500 acres as open space in the form of a Nicholaus Design golf course and parks and trails. Additional amenities at the Palisades include a private country club, gym, tennis courts, equestrian center, town retail center and a network of trails and paths.

As the president of Rhein/Medall Communities and developer of the Palisades, Jim Medall envisioned a premier master-planned community differentiated by detailed attention to architectural styles, world-class events, and comprehensive amenities. He has achieved these goals through strict architectural controls to ensure true replication of era architecture.[4] He has aggressively pursued the golf and tennis industries to establish championships at the Palisades with the community's first golf tournament, the Champions Cup Charlotte, beginning in late September 2006.[5] Medall's goals for the built environment and amenities are interwoven with innovative and conventional stormwater management structures. He has incorporated Low Impact Development practices throughout the site to facilitate ground water recharge and

1 Rusty Rozzel, Water Quality Officer (Mecklenburg County Water Quality Program), telephone interview by author, 03 July 2006.
2 Ibid.
3 Ibid.
4 Kristin Perez, Community Association Manager (Palisades), interview by author, Charlotte, NC, 29 March 2006.
5 Mike Mastin, Vice President/General Manager (Palisades), interview by author, Charlotte, NC, 29 March 2006.

stormwater treatment to protect the water quality of Lake Wylie. In doing so, Medall has also pursued a personal mission to prove that low density development is not the only way to protect water resources.[6] To the extent that he has succeeded in his agenda, Medall has begun to develop a noteworthy master-planned community in the rampant sea of development surrounding Charlotte while setting a precedent for low impact stormwater management in large-scale development.

To ease demanding equity requirements at the onset of the project, Medall optioned the land that would eventually become the Palisades rather than purchase the entire site in a single acquisition.[7] Optioning the land with purchase contingent upon rezoning allowed Medall the security of controlling the land without the commitment to buy until he had obtained rezoning. This method of acquisition can be costly but less capital intensive and less risky than purchasing the entire site before rezoning. Furthermore, Medall controls costs by purchasing the land as the phases reach construction. This way the developer avoids paying for carrying costs and property tax for long periods of time before selling the lots to homebuilders.

DISTINCTIVE FEATURES OF THE PALISADES

Compared to the Pinehills and Haymount, the Palisades is a fairly conventional-looking master-planned community. When compared to the plethora of new communities sprouting up at the edges of Charlotte however, this community presents some unique characteristics that may influence the Lake Wylie real estate market and local construction practices. Although much of the master planning is similar to other golf course communities, a number of controls during the construction phase distinguish this project from others along NC Highway 49.

Architectural Controls As with most planned communities, a Master Declaration of Covenants, Conditions, and Restrictions (CCRs) controls the design of all the homes and neighborhoods at the Palisades. In the Charlotte context, the Palisades' CCRs are uncommon. They stress historical accuracy and integrity in the new construction. The CCRs ensure that historically significant architectural styles rather than an amalgamation of disparate architectural elements are constructed in the neighborhoods.[8] Upon becoming a builder at the Palisades, each homebuilder receives a copy of *A Field Guide to American Homes*, which describes the characteristics of each American style in detail. Homebuilders are able to mimic any of these styles but must include five pre-determined identifying features of the style in order to establish a feeling of architectural authenticity.[9] As the Community Association Manager, Perez must oversee the approval of all custom homes. She notes that homebuilders have had a more difficult time getting approval for their designs at the Palisades compared to other communities because the architectural standards are higher and the community's Architectural Controls Commission (ACC) examines plans with more scrutiny. Greater fluency in traditional architectural styles is demanded of both the architect and the builder in order to execute the vision of the Palisades. The CCRs along with design review by the ACC allow Medall to ensure his vision of architectural integrity will be achieved and differentiate the Palisades community

6 Jim Medall, President (Rhein Medall Communities), interview by author, Charlotte, NC, 29 Mach 2006. 13 July 2006.

7 Mastin, Vice President/General Manager (Palisades), telephone interview by author, 13 July 2006.

8 Perez (Community Association Manager, Palisades).

9 Ibid.

(clockwise from top left) Typical architectural features and placement of homes at Palisades; Grass swale along Parkway; Sediment forebay and retention basin to treat runoff; Silt fence to prevent silt runoff during construction; Inlet filter to protect drainage system from silting.

from others in the area.

Water Quality Construction Controls Over the past several decades Mecklenburg County's Water Quality Program has sought to protect its extensive network of water resources through construction controls. Environmental controls on construction focus on controlling silt and pollution runoff from construction sites by establishing silt fences around the construction site, street sweeping, and inlet protection around gutters. These controls are designed to protect the water quality of nearby lakes, rivers, and streams from the negative environmental impacts of development, such as erosion, silt build-up, and pollution. A rapidly growing economy and related residential and commercial development make these water quality protection measures particularly important in Charlotte and Mecklenburg County.

While these controls have been in place for a number of years, little enforcement from developers, builders and the county has resulted in low compliance.[10] The Palisades is among the first communities to enforce these measures. All contractors and builders involved with the project are required to pass a county training of best practices during construction to protect the water quality of nearby resources. Pre-construction meetings with the Palisades' General Manager, Mike Mastin, stress the importance of water quality measures and outline the developer's expectations for builders and contractors. Lastly, Palisades' staff often patrol the construction site to ensure proper construction protocol is being implemented and issue fines where builders fail to limit sediment runoff, maintain buffers to the lake, or erect silt fences to protect vegetation surrounding the construction site. With increasing enforcement, Builder Shannon Shea has invested in materials and labor to address water quality on his construction sites, estimating additional costs of $700-$1000 per home.

10 Shannon Shea, Shea Homes, interview by author, Charlotte, NC, 30 March 2006.

Stormwater Management Plan The project's surface water management plan is among the first in the Charlotte area to adopt Integrated Management Practices to control stormwater. The plan adopts a treatment train approach where runoff must travel through a series of treatments before release into Lake Wylie.[11] These measures include vegetated buffers and other energy dissipaters to increase infiltration and sediment removal as well as ponds and swales. The Low Impact Development approach assures that total suspended solids (TSS) are reduced to acceptable levels to protect Lake Wylie and its tributaries from silt accumulation and pollution runoff. Furthermore, the plan returns more water to the local water table, helping to maintain local water recharge rates integral for the survival of Lake Wylie and surrounding water resources. In addition to incorporating LID practices, the Palisades is also required to monitor the seven coves it impacts before and after construction to ensure the success of the management plan.

The plan was devised through a rigorous water model to predict runoff based on the level of development and mix of land uses of the project. This model, developed over the course of one year, involved the collaboration of a team of consultants, the developer, and Rusty Rozzel from the Mecklenburg County Water Quality Program.

Although the Palisades has pioneered large-scale adoption of LID practices in Mecklenburg County it has stopped short of fully embracing the philosophy entirely and implementing all the techniques.[12] Other examples in the area demonstrate the management and design potential of LID. The Sanctuary, developed by Crescent Resources, shares the Lake Wylie shoreline with the Palisades. The development model the Sanctuary adopts varies greatly from the Palisades.[13] The project pursues large lot development; voluntarily incorporates a larger array of IMPs; adopts a more localized approach to surface water management afforded by low density; and takes advantage of the aesthetic benefits of Low Impact Development. Despite these differences, it is important to note that the Palisades pre-dated any other LID project in the area and, thus, approached the development model with caution, limiting their adoption of IMPs.[14] Because of the public nature of some of the Palisades' roads, incorporating more LID features may have lengthened an already extended approvals process. Lastly, Medall limited the incorporation of additional features because he perceived the cost would be too great.[15] With a focus on a broad swath of the market, Medall may not have been able to adopt the more costly, specialized LID features of the Sanctuary, which is exclusively targeting higher income groups.

Audubon Community Accreditation In early July 2006, the Palisades became one of a handful of communities to receive Gold certification from Audubon International's Signature Program.[16] The certification validates that the community upheld environmental conservation throughout the design and construction of the project. In a market inundated with green development, the Audubon accreditation gives weight to the Palisades' claims of environmental-consciousness. In fact, the project's environmental principles dominate the community's marketing campaign as evident by the interpretive material in the Welcome Center.

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11 Medall (President, Rhein Medall Communities)
12 Rozzel (Mecklenburg County, NC Water Quality Program).
13 Ibid.
14 Ibid.
15 Ibid.
16 Mastin, Vice President/General Manager (Palisades), 13 July 2006.

The Welcome Center highlights the Palisades' environmental commitment.

REGULATING THE PALISADES

In 2000, when Rhein/Medall Communities optioned the Palisades, the parcel was zoned to allow 7,500 units as-of-right/ five single family homes per acre. However, the zoning was fairly restrictive, prohibiting all multifamily, condominium, commercial and non-residential development.[17] In order to achieve the mix of uses and amenities critical for the success of a master-planned community Medall needed flexible zoning. The rezoning downzoned the property to 2,000 units, reducing the total number of permissible units but allowing a greater mix of residential products and multiple uses. Without such flexibility and mix of uses permitted with the rezoning, the project would not have been feasible.[18] Originally, the community was planned to open in 2004. However, the permitting process was long and onerous, beyond the developer's expectations.

After a year of zoning hearings and meetings, the Palisades received conditional rezoning from the county in 2001.[19] At the time of rezoning, the land was located in an extra-jurisdictional area outside of Charlotte, slated for future incorporation into the City of Charlotte. Until incorporation the land was under the jurisdiction of the county. Shortly after rezoning the land was incorporated into the City of Charlotte and accountable to the city's development and planning regulations. (The property's transitional jurisdictional status would serve as a point of complication for the stormwater management plan.)

With conditional rezoning, the Palisades plan could proceed as-of-right but only after Medall met a number of environmental stipulations attached to the rezoning by the Mecklenburg County's Water Quality Program. The parcel lay in the *Lower Lake Wylie Watershed Overlay District*, one of most restrictive watershed districts in the county and the Water Quality Program was concerned about the project's environmental impact. Primarily, Water Quality officials were disturbed by the dramatic increase of impermeable surface, potential for nutrient runoff from the golf course, and increased sedimentation runoff during and after construction degrading the coves affected by the Palisades. Therefore, they imposed strenuous conditions on the developer, including extensive water quality monitoring; modeling water runoff and quality resulting from the project; and developing a watershed management plan, which outlined the project's

17 Ibid.
18 Ibid.
19 Don Cecceralli, Mecklenburg County, NC Water Quality Program, telephone interview by author, 30 June 2006.

The Parkway lacks consistent runoff maangement paradigm with grass swales and curb and gutter together.



stormwater management plan. The cost of the monitoring and modeling would be significant but the officials felt it was justified because the size and location of the parcel included the entire watershed that drained to seven coves in Lake Wylie. Historically, the county required developers to monitor key areas to protect the water resources adjacent to development. This was the first time a developer was required to conduct water modeling for the project, develop a comprehensive watershed management plan, and conduct regular monitoring of coves. Typically, Water Quality officials would develop the watershed plan because many landholders affect the drainage and runoff. However, in the case of the Palisades, one developer had "complete control of the destiny of those coves." [20] The process of developing the watershed plan took another year after zoning, at which point the project was ready to move forward.

The Palisades inter-jurisdictional status further complicated the stormwater management plan. Shortly after rezoning approval in 2001, the City of Charlotte incorporated this inter-jurisdictional area, placing the Palisades under jurisdiction of the city and beholden to the city's development agenda and regulations. Because some of the Palisades' roads would be publicly owned and maintained, the city was concerned about accepting alternative road design and related runoff mitigation. Medall quickly found himself answering to two different agencies with divergent agendas for stormwater management and development forms.

Medall's plan called for narrower roads, less impermeable surface, and IMPs alongside the roads. The city was reluctant to accept such a plan. The *Parkway* leading from the entry of the Palisades into the project demonstrates the difficulty Medall encountered gaining approval and proposing innovation. With direction and support from the county the Palisades adopted an LID approach to the land development. Meanwhile, Charlotte promoted an urban form of development and, subsequently, traditional stormwater management. The urban-oriented design paradigm tends to introduce more impervious surface through wide roads and sidewalks on both sides, not an entirely appropriate design form for the Palisades.[21] In order to appease the conflicting agencies and discover a compromise, Medall was interested in mixing the two paradigms together. The city was not supportive of the plan, but eventually through working with the county's Water Quality Program, the Charlotte planning board accepted the plan. Rozzel acknowledges "it is not a pleasant experience [for a developer] when different agencies

20 Rozzel (Mecklenburg County. NC Water Quality Program).
21 Ibid.

are telling [him/her] different things."[22] Such regulatory conflict results from having to work with different agencies that have different priorities.

In addition to conflicting objectives, city and county agencies were unable to agree on standards for many of the Integrated Management Practices. They could agree to allow certain stormwater control measures but were unable to agree on standards by which to measure the effectiveness of the proposed IMPs.[23] These conflicts eroded the innovative nature of the LID plan as elements of the plan would disappear to appease one agency's agenda or because authorities could not establish a common standard to apply to new practices. The demands of the rezoning process and inter-agency conflict protracted the regulatory process to two years opposed to the six months typical for ordinary projects and cost the developer $400,000 to develop the plan.

DESIGNING THE PALISADES

The Water Quality Management Plan played an integral role in driving the design process. Researching the water quality impacts of the proposed development required an environmental assessment of the site with analysis of habitat, vegetation, soils and geology.[24] The resulting watershed plan determined areas demanding protection and vegetated buffers and areas suitable for development. Furthermore, it creates a plan of Integrated Management Practices to control runoff. The engineering firm Yarbourgh-Williams and Houle (YWH) worked extensively on the plan with scientists hired by Medall. Of the process, Jay Nivens of YWH remembers that "it took a whole new train of thought because the plan was not typical."[25] Their work not only required learning a new stormwater management form but also had to fit these structures around a variety of uses and piece together a number of different techniques into a treatment train that would meet county treatment standards.

The work of the engineers during the design phase also included educating city regulatory staff about the Palisades' Water Quality Management Plan and the design of the project. As described above, the rezoning period was contentious because city engineers did not support the new stormwater management paradigm. YWH engineers invested significant time and effort educating the city about the research and advocating for their watershed management plan.

CONSTRUCTING THE PALISADES

The Water Quality Management Plan also provides guidelines for the construction phase by limiting the area of denuded property to 50 acres at any given time in the project.[26] This measure intends to manage the potentially massive erosion that can result from large-scale deforestation but also controls the pace of development; in order to prepare land for future phases, the Palisades has to quickly develop existing disturbed land. The control may limit

22 Ibid.
23 Mark Houle, Partner (YWH), telephone interview by author, 27 July 2006.
24 Ibid.
25 J. Jay Nivens, Manger, Engineering Services (YWH), interview with author, Charlotte, N.C., 30 March 2006.
26 James Medall and Richard A. Reichel. The Palisades Water Quality Management Plan Volume One (Charlotte, NC: Rhein Palisades LLC, 2003), 4-9.

the pace and scale of development at any given time but also prevents the developer from wholesale clearing and grading far ahead of construction.

All builders and construction workers, as described above, were required to attend and pass a Water Quality Training class. Classes were designed to teach construction professionals better environmental protection practices. The practices themselves are designed to prevent silt and sedimentation runoff. The Palisades strictly enforces these regulations through Mastin, the Vice President/General Manger of the project, and Reichle, the Water Quality Enforcement Officer. Because the Palisades and the DEP both monitor affected coves of Lake Wylie throughout the development process and negative impacts can result in large fines, the Palisades is incentivized to follow and enforce responsible construction practices.

DELIVERING THE PALISADES

Rhein/Medall Communities adopted a multiple primes delivery method for both the design and construction phases of the land development. The Palisades case differs from the Pinehills in a number of important ways. Most significant is the size of the development company. Rhein/Medall Communities is larger and pursues numerous projects simultaneously, of which the Palisades is one whereas the Pinehills is a small company created only to realize the Pinehills. Although the corporate structures of the firms vary the general structures of the project teams are similar as were their selection methods for consultants and subcontractors.

Project Delivery Method & Team Structure Through a multiple primes approach all design and construction professionals are directly contracted with Rhein/Medall Communities and control the entire development process, similar to the Pinehills. The project-level team structure is also similar to the Pinehills in some ways; the Palisades' design team is comprised of design, engineering and construction consultants directed by a Project Manager from Rhein/Medall Communities. Medall as the developer and visionary is involved in the design phase as well. The Palisades team differs from the Pinehills in that they also incorporate trusted construction expertise during design (described in Chapter 3). The firm's Vice President of Construction provides construction, pricing and value engineering expertise for all of the company's development projects.[27] Therefore, he remains within his functional silo and provides input in his area of expertise for every project. The Palisades team organization also differs in that the Project Manger is responsible for 2-3 projects at a time rather than dedicated to one project.[28]

This team structure deviates from the Pinehills' team organization, which was assembled like a tiger team at the firm-level but as a heavyweight team at the project-level (with the inclusion of consultants). By contrast, Rhein/Medall Communities adopts a functional corporate structure where individuals remain within their functional groups and perform their specialized function for every project. At the project-level, they operate as a heavyweight team. Each individual remains within their functional group but is dedicated to a number of projects. In this case, the project manager acts as the heavyweight manager. The functional team corporate structure allows Rhein/Medall Communities to pursue many different projects in varying stages of completion with a minimal number of staff but can significantly undermine the ability of team

27 Gary Parker, Vice President of Construction (Rhein Medall Communities), telephone interview by author, 21 July 2006.

28 Mike Mastin, Vice President/General Manager (Palisades), telephone interview by author, 13 July 2006.

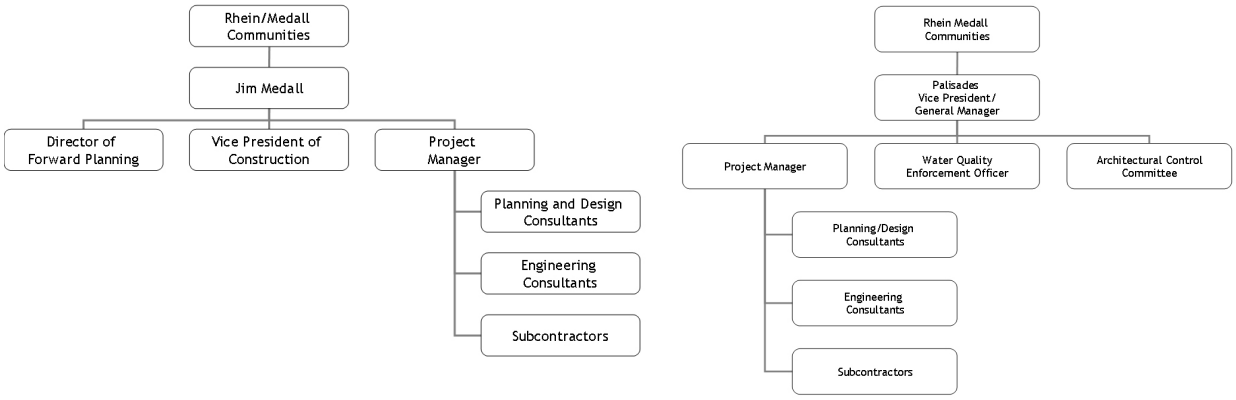

Figure 7.1: (from left) Rhein/Medall Communities' corporate structure; Palisades' project team structure. Source: Charu Singh

members to think innovatively about the project. Currently, the developer has almost 12 projects underway with the Palisades being the biggest project. This structure permits the developer to do more projects simultaneously but it divides the attention of staff. Clark and Wheelwright's theory would argue that diluted attention and the separation between functional silos can pose a significant barrier to conceiving novel ideas.

This heavyweight team structure continues during construction for typical Rhein/Medall Communities' projects but is amended in the case of the Palisades with added layers of management and authority. Medall has developed several master-planned communities but the Palisades project is unique because of the size, architectural demands and environmental controls during the construction phase. Traditionally, Rhein/Medall Communities has focused primarily on the land development, delivering the roads and community entry. All the vertical construction was relinquished to homebuilders through selling the lots and minimal controls were imposed. The construction phase is typically managed by the Project Manager with supervision by Parker, the Vice President of Construction, during construction.

The Palisades is a departure from this practice as the developer has hired several staff to form the project's Architectural Control Commission (ACC), whose role it is to approve the design and architecture proposed by each home builder and staff to monitor environmental compliance during construction to ensure compliance with the water quality runoff regulations. This additional layer of management is overseen by Mastin as the General Manger of the Palisades, a position unique to this project in the Rhein/Medall Communities portfolio. The Project Manager of the Palisades must answer to both Mastin and Parker. Additional staff has been necessary for a number of reasons. Mastin explained that the Palisades was the first project that sold lots to custom builders (in addition to merchant builders) whose designs are not predetermined at the time of lot sale.[29] In order to maintain the design integrity and style of the Palisades more rigorous architectural controls were necessary compared to previous projects. Such in-house staffing has allowed Medall to exert the design control he seeks in the project. Furthermore, with a commitment to complying with area regulations and standards,

29 Ibid.

Medall has been particularly attentive in ensuring homebuilders are utilizing all environmental protection practices during construction.

Selection & Scope Medall selected Yarbourgh-Williams & Houle to develop the master plan, the water quality management plan, and perform the site and civil engineering. Similar to every other consultant involved in the project, the firm was selected based on their existing relationship with Medall and their previous work with him. Although this project differed significantly from his previous projects in scale and environmental objective, the same design and engineering firms were hired. Parallel to the other cases included in this study, Medall did not adopt a competitive bidding process to assess the variety of design experience and cost available in the market. Instead, he approached the companies he knew and trusted and negotiated the contract with them directly instead of through a bid process. That Medall did not look for consultants experienced in Low Impact Development is due to the fact that the project- locally- was at the cutting edge and no local firms had experience with that sort of stormwater management. The developer could have selected a more experienced national firm but without established relationships in Charlotte, which could be a liability during permitting. The trust YWH has established with Charlotte's regulatory officials over the years was particularly valuable when negotiating the Palisades' rezoning. The selection of YWH indicated that local expertise and relationships prevailed over specialized expertise when selecting the engineering firm.

Contracts The Palisades' contracts for design were negotiated on a time and materials basis, similar to the Pinehills. Because YWH was involved early in the project they were able to see that the work demanded by the project would be unpredictable given the unprecedented environmental responsibility bestowed on the developer by the county. For this reason, YWH negotiated a contract where they did not assume any time or cost risk.

Once again paralleling the Pinehills, the Palisades' construction phase negotiated contracts on a lump sum/ unit price basis. The contracts were very simple. An examination of a road contract with CMI Contracting, Inc. reveals several pages of unit prices for every element of work but no clauses outlining schedule, insurance, indemnification, inspections, change orders, guarantees, incentives and penalties, or any other parameters to regulate the relationship between the developer and the contractor.[30] The unit price contract, although it provides a total lump sum for the work, provides some pricing predictability to the developer who knows the cost of changes to the scope of work.[31]

In an industry concerned with liability, such bare contracts are surprising and highlight the paramount role of informal negotiation and trust to regulate construction relationships. For instance, the CMI contract does not address situations where construction costs rise dramatically during construction. At a time when construction costs are increasingly dramatically, Warr (owner of CMI Contracting) has great difficulty providing clients with a stable price. He has given the Palisades a favorable cost-sharing arrangement where the developer pays for the increase in raw materials without an increase in Warr's fee.[32] Effectively, when construction prices increase Warr's fee for service becomes a smaller percentage of the total cost of the

30 CMI Contracting, Inc Road Contract, 19 July 2006.
31 Parker (Vice President of Construction, Rhein Medall Communities).
32 W.M. Warr, Sr., CEO (CMI Contracting, Inc), interview by author, Charlotte, N.C. 30 March 2006.

work. Warr has offered several favorable conditions to the Palisades, such as guaranteeing lump sum prices for longer periods of time, because of their long relationship working together and Warr's fierce loyalty to the developer.[33] Such informal conditions are a benefit of their relationship and hope to secure CMI Contracting's participation in future phases of the project.

THE ALLOCATION OF RISK

Regulatory Risk Tony Green from the Pinehills attributed much of the regulatory success of his project to strong relationships with supportive members of the planning board. The role of advocates within the municipality and maintaining positive relationships in easing the regulatory process is unquantifiable but clearly very valuable. Likewise, collegial relationships geared toward partnership and compromise have aided the successful approval of the Palisades.[34] Although engineers on the regulatory and project sides had different levels of understanding of LID, they worked together to understand each other's goals and establish fair standards for approving the project. This accommodating approach to the approval process helped ease the jurisdictional tensions that resulted from various and conflicting agendas of the city and county.[35]

Being located in the Lower Lake Wylie Overlay district added significant time and cost to the regulatory process in order to accommodate the level of development Medall desired and provide the level of environmental protection required by Mecklenburg County. This portion of the permitting process added another year to the approval process and $400,000 to create the Water Quality Management Plan. Despite the high risk of the regulatory period, the developer was able to take advantage of the tremendous value of a large parcel of land located on a lake, resulting in (potentially) commensurate returns.

Design Risk Perhaps the employment of engineering consultants with no previous exposure to low impact development presents one of the greatest design risk to the project. Consultants are hired for the expertise they bring to a project. With no prior experience with Low Impact Development, YWH could potentially introduce greater design and performance risk to the project. The extensive research and resulting Water Quality Management Plan, however, greatly amended YWH knowledge and hedged design risk. In fact, Jay Nivens from YWH was not concerned about performance risk and related liability from the plan despite his and his colleagues lack of experience.[36]

Construction Risk The Palisades' construction phase is among the most instructive and educational of the project, displaying incidence of risk shifting caused by the innovative stormwater management plan. In many ways, some of the additional regulatory risk experienced by the developer has been passed on to subcontractors and builders. Warr from CMI Contracting relays a number of construction problems caused by the permitting process, saying "this project has been a real, real trying process."[37] For example, although Warr had a contract to complete seven miles of the Parkway in 18 months, he ultimately was only granted seven months when permitting took nine months longer than expected and the delivery date was not

33 Ibid.
34 Ibid.
35 Ibid.
36 Nivens (Manager, Engineering Services, YWH).
37 Warr (CEO, CMI Contracting, Inc.).

extended by the developer.[38] Warr has accepted such changes and constraints because of the importance of his relationship with Medall and the hope of securing future work on the project.

Regulatory uncertainty not only creates delays for the developer but poses schedule uncertainty for subcontractors and builders. Builder Shannon Shea has foregone other projects in the Charlotte area to make sure his company has the time and labor available to begin building at the Palisades once permitting is granted. Shea's strategy can result in losses as he completes fewer projects waiting for the Palisades. In the meantime, he is building fewer homes when the market is peaking and home prices are at their highest.[39] Warr has taken a different approach from Shea, renting and holding grading equipment so he can continue to work at full capacity during Palisades' regulatory delays but still have equipment available to work as soon as the project phases are approved.[40] Both these methods can be costly to construction professionals. However, the size of the project and it marketing power is great enough to compel builders and contractors to refuse other work to ensure a place in the project. Therefore, the developer is able to shift some of the risk and cost encountered during the rezoning process to construction professionals.

The Water Quality Management Plan itself (at 300 pages) has increased risk during construction simply because it is so complicated. Subcontractors and builders receive the manual and are expected to read, understand and abide by the plan. But many can't understand the manual; even some of the engineers had difficulty understanding the plan because of its complexity.[41] Although Medall has asked the land and vertical construction team to learn the manual, the Water Quality Training class taught by the county and required for all Palisades' construction labor provides a sufficient background to learn the principles and techniques to manage their construction site. Furthermore, enforcement mechanisms, such as fines, for improper construction maintenance help ensure compliance.

THE IMPORTANCE OF ORGANIZATIONAL STRUCTURE

The Palisades is unique among the cases because innovation was required by the government. The county's demands necessitated that Rhein/Medall Communities adopt a new design process that focused on environmental analysis. Therefore, both product and process innovations were encouraged by the county. This source of innovation, however, can act to stifle further innovation. When compared to other projects where LID principles were adopted voluntarily (such as the Pinehills or the Sanctuary), the Palisades' LID approach appears utilitarian and unfocused.

Although the government certainly plays a role in the schizophrenic nature of the stormwater management system, leadership and organizational structure may partially explain the lack of further product or process innovation. A functional corporate structure and larger firm (compared to the Pinehills) can act to reduce opportunities for collaboration and integration within the company. Managing multiple projects simultaneously can severely limit individuals' ability to think creatively about a project. In addition, the process of developing the Water

38 Ibid.
39 Shea (Shea Homes).
40 Warr (CEO, CMI Contracting, Inc.).
41 Nivens (Manager, Engineering Services, YWH).

Quality Watershed Plan involved fewer disciplines, led by the engineering team in collaboration with a few scientists. Compared to the Pinehills, where a variety of disciplines and backgrounds were involved in the master-planning and stormwater engineering process, the Palisades suffered from less interdisciplinary input, which could also thwart innovation. These organizational characteristics could have been a significant factor of limiting innovation at the Palisades.

Chapter 7
Haymount

Haymount Master Plan by phase (Source: Haymount)

Lying one hour to the south of Washington D.C., Caroline County, VA has managed to sidestep the growth of the region over the past decade. While Washington and its surrounding suburbs have experienced great growth in the part five years, Caroline County has ambled along at a 1-1.5% growth rate from 1990-2000, totaling a growth of approximately 3000 residents over 10 years for a total population of 18,000.[1] Although the county lies at the edge of Fredericksburg, VA, it has been outside of traditional commute patterns to Washington D.C. and Richmond, VA. Since 2000, however, the county has experienced increasing interest from the residential development industry.[2] John A. Clark, developer of Haymount, recognized the county's potential for growth in the late 1980s when he purchased 1,808 acres of undeveloped land along the Rappahannock River.

HISTORY OF HAYMOUNT

At the time of purchase, the parcel that would become Haymount was zoned as rural conservation land. After an arduous rezoning process, Haymount has been approved to provide 4,000 homes, 250,000 square feet of retail and 500,000 square feet of commercial/ office space; projected to introduce 10,000 new residents to the area, Haymount will be a new town in bucolic Caroline County.[3] In order to foster strong civic participation and healthy communities, public and civic infrastructure will play a central role at Haymount with 8 churches, 3 schools, a public park, and other recreational amenities.[4] In addition to a number of public facilities, the town will also provide diverse housing typologies at a variety of price points, ranging from $139,000 to $575,000, to encourage socio-economic diversity. The development will be delivered over the course of 8 years in 3 phases with Phase 1A slated to begin at the end of July 2006. The aim is to establish a mixed-use, New Urbanist community, utilizing progressive design and planning practices in order to create an engaging, pedestrian-oriented, socially-diverse and environmentally-sensitive community.

Andres Duany and Elizabeth Plater-Zyberk's (DPZ) project Seaside served as the original inspiration for Haymount.[5] After his visit to Seaside, Clark vowed to develop a New Urbanist town where he would integrate the design form and vernacular of traditional towns with his commitment to social and environmental sustainability. Over the course of 15 years, Clark has worked to realize his vision. As a result of extensive planning during the predevelopment and design phases, Haymount promises a number of unique characteristics that distinguish it from conventional planned communities. Much of the innovation of the project is grounded in the objective of creating an "environmentally sound place for families to live and work." [6] This objective is met through building and landscape-level initiatives, such as establishing an environmental code, advancing an alternative design paradigm, preserving extensive open space, evoking innovative wastewater treatment technology, and implementing a low impact stormwater management system.

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1 Mark Finchum, Director (Caroline County Department of Planning and Community Development), telephone interview by author, 26 July 2006

2 Ibid.

3 Haymount, "Haymount: Home,"<http://www.jaclarkco.com/overview.htm> (24 May 2006)

4 John A. Clark, General Partner (Haymount), interview by author, Caroline County, VA, 27 March 2006.

5 Ibid.

6 Haymount, "Haymount-at-a-Glance," <http://www.jaclarkco.com/at-a-glance.htm> (24 May 2006)

A rendering of the New Urbanist concept of the town.

The Haymount partnership is comprised of John Clark and Bill Miller (a local homebuilder) as general partners. The original owners of the land and Clark's original partner are limited partners in the project. Clark also acts as a fee developer in this arrangement. Running a lean operation during predevelopment, the partnership required little financing. Miller was able to fund predevelopment costs, including environmental studies, consultants fees, and Clark's salary. Financing was secured in July 2004 in the form of a revolving loan from GMAC and the project began drawing on it in 2005.[7] Originally, in 2001, Clark attempted to secure bond-like financing to provide a source of low cost patient capital over the course of 18 years. However, the deal fell through after the events of September 11, 2001.[8]

DISTINCTIVE FEATURES OF HAYMOUNT

Haymount has a number of notable features, demonstrating its commitment to architectural quality, alternative development form, and environmental innovation.

New Urbanism Traditional Neighborhood Design (TND) design has gained prominence over the past decade as an alternative to conventional community development. With an emphasis on architectural detail, pedestrian-oriented design, and a mix of uses, new urbanism has been greeted by developers and homebuyers with ambivalence. The number of these types of communities grows every year as does market acceptance. At completion, Haymount promises to be a vibrant and comprehensive community complete with a diversity of housing and income groups, a commercial center, numerous pocket parks, community amenities and an urban farm. To the extent that Clark has embraced TND principles and seeks to implement them on a grand scale to create a paradigm shift in the way people live, the development form and design of Haymount is an advancement in how developer's can think about the design of new communities.

Environmental Codes Vertical construction at Haymount is governed by the Haymount Code. Similar to architectural controls imposed in conventional master-planned communities to guide home designs proposed by homebuilders, the Haymount Code sets design standards as well as

7 Clark (General Partner, Haymount), 27 March 2006.

8 The importance of and mechanisms for long-term, low cost financing for the sake of environmentally-conscious, large-scale projects would be an interesting topic for further study.

environmental regulations through the Energy Code and Healthy Building Materials Code. These regulations assure that every building developed in Haymount will maximize energy efficiency and utilize materials listed on the Healthy Building Materials national database, guaranteeing that all development will reflect the environmental integrity upon which the town was founded.[9] Landscape-wide environmental sensitivity is demonstrated by native planting regulations and a low impact stormwater management plan. Such community-wide standards are uncommon in mainstream development. Haymount is part of a small cohort of large development projects, such as Stapleton in Denver, CO and Noisette in North Charleston, SC, that are placing extensive environmental guidelines for land development and vertical construction.

Open Space Conservation Arendt's principles are expertly executed in the master planning of Haymount. Many master-planned communities only adopt a fraction of these principles to claim their allegiance to environmental preservation. Often projects fail to adopt the more difficult and restrictive recommendations, such as clustering homes along existing roads or the edges of conservation areas, and preserving large tracts of land instead of segmenting the conservation area with clusters or development. Haymount engages the full spectrum of practices associated with conservation design. The development is clustered in the northern portion of the parcel. Natural open space is contiguous and undisturbed by intermittent clusters of housing or golf courses. Furthermore, the conservation land is envisioned as a true amenity to future residents. Planning is underway for educational and recreational programming.

Wastewater Treatment Plan Haymount's wastewater treatment plant illustrates Clark's commitment to innovation and environmentally-conscious development. From the inception of the project, Clark was interested in using alternative water treatment technology used by John Todd's Living Machine to serve as the town's primary wastewater treatment.[10] The Living Machine is an alternative treatment system that harnesses the biological treatment power of aquatic animals, organisms, and vegetation to treat wastewater through a tiered system that produces re-use quality water.[11] Upon purchase of the land in 1989, Clark began to aggressively work with Todd to implement the Living Machine at Haymount. In June 2004, after years of addressing patent and design issues, Todd's company, Solar Aquatics, was unable to provide a performance bond for the system, forcing Clark abandon the municipal approval process and his investment of $500,000. Subsequently, Clark hired engineering company Earthtech to develop an alternative using Sequence Batch Reactors (SBR) where influent is treated in batches with organisms that perform the same function as the aquatic vegetation and marine life utilized in The Living Machine.

The process as well as the infrastructure of the treatment plant itself aim to be environmentally-sensitive. The plant is designed to take advantage of gravity to limit the energy required for treatment. Meanwhile the plant will house a rooftop garden and the methane created by the treatment process provides a potential source of alternative energy. Upon completion, the wastewater treatment plant will have the capacity to treat 1 million gallons of influent daily. In developing the wastewater treatment plant for Haymount, Clark approached the US Green Building Council (USGBC) to establish the first Leadership in Energy and Environmental Design

9 Haymount, "Haymount: The Code,"< http://www.jaclarkco.com/code.htm> (24 May 2006)
10 Clark (General Partner, Haymount), 27 March 2006.
11 Ibid.

(LEED) certification for industrial processes. He hopes the plant will be able to earn a platinum industrial building rating once the accreditation standards and processes are developed.

Stormwater Management Plan Reflecting the driving principles of the project, the stormwater management plan adopts Low Impact Development principles. The town will be developed with several dense neighborhoods. Stormwater and runoff will flow into a curb and gutter system which leads to a series of Integrated Management Practices in the form of bio-retention ponds and constructed wetlands on the outskirts of the community. After absorption and treatment, the remaining water flows into nearby streams leading to the Rappahannock River.[12] Because the Haymount's neighborhoods will be denser and more urban (due to the mix of uses) than the communities created at the Pinehills or the Palisades, the project employs more conventional stormwater management practices than the other 2 cases. Curb and gutter is utilized throughout the project. This system empties into the Integrated Management Practices located at the edges of development.

REGULATING HAYMOUNT

The project underwent a rigorous and lengthy rezoning process due to strong opposition from county residents. The comprehensive plan designates the Haymount parcel as a rural preservation area because of its location along the Rappahannock River and the presence of sensitive eagle habitat.[13] Therefore, Clark had to file for a comprehensive plan amendment as well as rezoning. Without rezoning Clark would only have been able to develop 200 homes on large lots, falling quite short of his dream to create a New Urbanist town. Instead of being impressed by Clark's lofty social, civic and environmental goals, residents were concerned about the tremendous growth Haymount represented to their community of 18,000 residents and the threat to conservation and farmland. The issue of location was paramount in the rezoning discussion and superseded any discussion of the innovative elements of the project. One resident noted that it was the right project in the wrong place.[14]

After 3 years of extensive workshops, expert analysis of the project, and 2 lawsuits, Haymount received approval in 1992. Like Tony Green with the Pinehills project, Clark conducted numerous workshops educating the public about the project and its impacts. He also provided the county with specialists who had the capacity to evaluate the plan. At that time- late 80s/ early 90s- there was little mainstream awareness about New Urbanism and sustainability issues.[15] Clark was leading the charge of progressive real estate development and had to do extensive work to bring the county and public along with him.

Subsequently, Caroline County has approved several planned communities in recent years, mandating TND design. Furthermore, the county engaged Clark and his team in devising a Rappahannock River Corridor Ordinance to ensure that any further development along the river will abide by the same standards that Clark has applied to Haymount.[16]

12 Shelly F. May, Environmental Manager (Haymount), interview by author, Caroline County, VA, 27 March 2006.
13 Michael Finchum (Director, Mecklenburg County Department of Planning and Community Development).
14 Ibid.
15 Dan Slone, Legal Counsel to Haymount (McGuire Woods, LLP), telephone interview by author, 28 July 2006.
16 Ibid.

DESIGINING HAYMOUNT

While waiting for the Fredericksburg market to strengthen, Clark began the process of understanding the existing land and resources before entering the design process. Using GIS, Clark hired consultants to create layers of the natural characteristics of his property, including boundaries, topography, wetlands, forests, and other resources on the site. In addition, he hired David Tise, a forestry and wildlife biologist, to evaluate the forest canopy and provide habitat analysis. Tise documented 302 species on the property, including an eagle habitat.[17] Together, these analyses indicated environmentally-sensitive areas that would suffer from development as well as areas well-suited for development. This methodology embraces Arendt's recommended development process and demonstrates Clark's sincere dedication to developing the built environment in harmony with the natural environment.

Based on this site analysis, Clark began to identify potential areas for development. Originally, development was planned along the northern part of the river, the northeastern portion of the parcel and portions in the southern part of the parcel. The southern portion of the parcel is home to a stand of old growth forest and is divided from the northern part of the parcel by wetlands and jurisdictional streams. Because of its location and sensitive natural areas, development on the southern portion was not ideal. Eventually, the master plan changed to leave the southern portion undeveloped and move the commercial uses to a more suitable parcel Clark acquired at the entrance of the road leading to Haymount.

Because of their impressive work on Seaside, Clark hired DPZ to develop the conceptual plan for the project. In the fall of 1989, DPZ led a week long pre-design charrette to identify a common vision for the project.[18] DPZ brought a team of 20 staff to participate. They were joined by Clark and the consultants who had conducted site analysis and feasibility studies. During that week, this group of people conceived the plan that still exists today for Haymount. A low impact stormwater management plan was part of this original vision. The density and urban nature of the town demanded a more conventional system, using pipes to move runoff away from development. This system however is designed to empty into a series of IMPs for treatment and infiltration. That a plan created in the late 80s remains relevant today speaks to the innovative nature of it and the ability of early comprehensive planning to ease design and engineering in later stages.[19]

CONSTRUCTING HAYMOUNT

Haymount is poised to begin land development at the end of July 2006. With no construction completed, the description of this process is limited. As with the other cases, the developer will conduct the land development and sell lots to homebuilders for the vertical construction. The stormwater management system, in particular, will be built by a number of professionals. Therefore, the Integrated Management Practices will be installed in phases by different subcontractors rather than by one company. Graders will shape the structures and different contractors will provide the substrates and native vegetation essential for the absorption and treatment of runoff from the town's curb and gutter system.[20]

17 John A. Clark, General Partner (Haymount), interview by author, Caroline County, VA, 28 March 2006.
18 Clark (General Partner, Haymount), 28 March 2006.
19 W. Doug Beisch, Jr., Senior Water Resource Engineer (WEG), telephone interview by author, 27 July 2006.
20 John A. Clark, General Partner (Haymount), interview by author, Caroline County, VA, 21 July 2006.

DELIVERING HAYMOUNT

Haymount's delivery most closely resembles that of the Pinehills in its organization, employing a multiple primes delivery method and tiger/heavyweight structure within the project team. However, Haymount's approach to the design and construction of the stormwater management system and contracts departs from both the Pinehills and the Palisades with repercussions to the allocation of risk.

Team Structure Clark's approach to assembling his development team over the years of predevelopment is an interesting study in how to efficiently and cost-effectively assemble groups for the purpose of innovation and environmentally-oriented development. Because Haymount was still in the preconstruction phase during my research, I will only describe the delivery of the design and permitting phase in detail. Figure 7.1 illustrates that the master planners, DPZ, as well as all the engineering firms for the land development of the project are directly contracted with the developer in a multiple prime structure, similar to the other cases discussed in this thesis. Clark has supplemented these consultants with an in-house staff, who help manage and augment the work of consultants. Despite Haymount's organizational similarities with the Pinehills and the Palisades, a few significant difference exist with the construction of the IMPs.

The multiple primes method is particularly appropriate for Haymount because of the engineering innovation demanded by the project. Two different engineering firms were employed for Haymount: one for the conventional road engineering and grading work required "off site" and a separate firm (Williamsburg Engineering Group (WEG)) to perform the engineering on-site, including the Integrated Management Practices designed to handle runoff, treatment and disposal of surface water. This bifurcated approach to engineering has allowed Clark to realize savings by paying a commodity price for conventional civil engineering and a higher price for the specialized engineering expertise required for the stormwater management system.

The design and construction of the stormwater management system is entirely the responsibility of WEG through a design-build delivery method.[21] This method allocates much of the time, cost, and management risk to WEG. However, as specialists in Low Impact Development they are best able to control these risks, manage the process, and ensure the proper functioning of the IMPs. Instead of simply fitting a conventional system to a developer's design, WEG strives to "develop a plan that is resource-specific," which often results in a more successful permitting process.[22] This approach defies a developer's traditional treatment of a project's stormwater management system as a commodity. Because the system is tailored to simultaneously take advantage of and protect the area's natural resources, the resulting management system is more of a specialized product rather than a commodity. Through this strategy WEG has developed an expertise in the technical as well as permitting aspects of such surface water management systems. Of the three cases, Haymount is unique for hiring an experienced specialist for the design and construction of the innovative stormwater management system and using a design-build delivery method for the IMPs.

21 Clark (General Partner, Haymount), 21July 2006

22 W. Doug Beisch, Jr., Senior Water Resource Engineer (WEG), telephone interview by author, 27 March 2006.

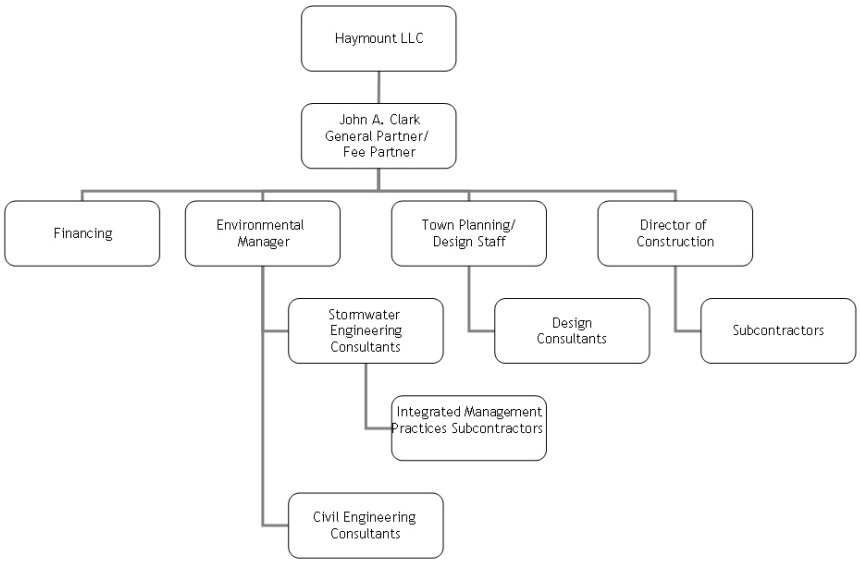

Figure 7.1: Haymount's corporate and team structures.

In addition to hiring specialists and leaders in the consultant field to provide specific design work for the project, Clark assembled a combination of specialists *and* generalists on his in-house team to augment and guide the work of consultants. This approach shares many similarities with the Pinehills. Very early in the project Clark worked alone, conducting all due diligence and working with consultants to inventory natural resources and design the new town. This approach to in-house staffing has been appropriate for the project for a number of reasons. First, it allows the partnership to maintain a lean operation. Given the time and risk involved in predevelopment, particularly during the permitting process, limiting staffing keeps costs low. Second, predevelopment requires a wide variety of expertise ranging from regulatory knowledge and financial analysis to design skills, and political savvy. A strategy that hires consultants for discrete needs can be much more efficient and cost conscious than one that hires that expertise in-house. Lastly, strictly limiting staffing until closer to construction has allowed Clark to control the process, design and approval of the project and shape his vision of Haymount.

As the approvals process became more involved and the construction phase approached, Haymount began to staff up. In October 2004, Clark hired Haymount's first staff person. Since then Haymount's staff has grown to include an open space planner, a town planner, and a project manager. Although the roles are neatly defined by their titles, each person's responsibilities are broad and diverse. Each has added a particular skill to the team; however, each also possesses a broad range of skills, especially in regards to the environment that can be applied to a variety of work required to prepare Haymount for development. Because large development projects require a variety of work and circumstances can change quickly (often due to regulatory or financial constraints), it has been important for Haymount's staff to posses specialized skills as well as professional flexibility so that the team can fulfill the many and varied tasks required to reach the construction phase. For instance, Bill Brozny is a landscape architect who was initially hired to design the open space plan and program the parks and civic space at Haymount. However, his work has included very little of his original job description. Circumstances have dictated that he lead the town planning of Haymount instead, focusing on

the built rather than landscaped and natural worlds. The role of generalist has augmented the work of consultants. Brozny's work as town planner allows Haymount to control costs because the many design iterations and process of interpretation described by Piore and Lester can be done in-house with only occasional expert feedback from DPZ. Furthermore, this process gives Clark much more control over the final design, allowing him to more completely fulfill his vision.

Although generalists and flexibility have been important in the early staffing of the project, Clark has simultaneously pursued a strategy to hire critical in-house expertise. With the primary objective of developing an environmentally-sensitive new town, environmental expertise has been a paramount requirement of the Haymount staff. In fact, many of the roles have been filled by landscape architects although much of the current work has focused on urban planning. Even though town planning is integral to Haymount, the importance of the natural world is a guiding principle. Clark has sought to maintain this priority by infusing the urban planning role with a landscape perspective.

Environmental regulation is another pervasive and extensive control on development imposed by the state and the county. Clark ensured expertise in this field when he hired the project manager, Shelly May, who has a Master of Science in Biology and a former life in the Virginia Department of Environmental Quality, Shelly knows the regulatory environment very well and is able to provide insight into not only the process of environmental control but also the intent of the regulations and the scientific reasoning and objectives that drive them. With this background and a genuine commitment to the environment, Shelly is able to offer valuable advice throughout the development process, saving the project considerable expense in consultant fees and time during the approval process.[23] Also she is able to truly monitor and judge the environmental impact for herself instead of being completely guided by the regulations; this is especially important as the project attempts to circumvent regulatory controls which could cause significantly delays and threaten the project's feasibility. The inclusion of Shelly's expertise is integral to meeting the developer's goal to advance innovative environmentally-sensitive development that goes beyond regulations and still achieve financial success. Her presence, input and evaluation help ensure that Haymount is truly meeting its goal of limiting the environmental impact of the project, especially when the project goes beyond the expertise of local regulatory officials. Like the Pinehills, Haymount has tailored in-house expertise to the needs of the particular phase of development. At this point, it is difficult to determine if this strategy will continue through future stages as the project is in its infancy.

The team structure of the Haymount project team parallels the Pinehills team structure. Internally, at the company level, Haymount pursues a tiger team structure. More than the Pinehills, Haymount embraces the tiger team culture of discarding the standard organizational rules. In part, the Haymount team conveys a greater sense of independence from conventional teams and greater organizational flexibility because of the project's high environmental, social, and civic standards and the entrepreneurial spirit with which it pursues that vision. In addition, Haymount employs more design, regulatory, and environmental staff within the company. Their roles are at once defined and fluid, providing opportunities for interaction, integration, and interpretation. At the project level, the team assumes a heavyweight structure, particularly, because the design and engineering consultants remain in their functional silos with project

23 May (Environmental Manager, Haymount).

leadership from the developer. This combination of corporate and team structure; the complimentary and synergistic relationship between generalists and specialists; a culture of open exploration and interpretation; and strong leadership creates an ideal environment for innovation.

Selection & Scope Each consulting company selection for Haymount's design team was based on a combination of the company's reputation, the developer's previous experience with the firm, and his relationship with the principal of the company.[24] There was no competitive bid process to determine the most appropriate, skilled, or low cost firm for the project. Instead, in each case, the developer approached a particular company for a discrete scope of work and negotiated a contract. In this group of cases, Haymount is unique because Clark selected DPZ based purely on their reputation, their specialization in New Urbanism, and his respect and appreciation for their past projects. Because the project's land development is innovative and an integral component of the master plan, the engineering firms would play an instrumental role helping Clark realize his goals. Clark hired WEG because of their work on several Low Impact Development projects, pioneering this stormwater management practice in the Fredericksburg area.

Contracts Haymount also differs from the other cases in the contract types used for consultants during the design phase. DPZ, site and civil engineers, and water management engineer were all contracted on a lump sum basis. Only Earthtech, the wastewater treatment engineers, were paid on a time and materials basis for designing the plant, which was 40% of the contract. The remaining 60% comprised of construction management and operation was a fixed price contract. The only reason Clark agreed to the TM contract was because he wanted to fast track the project. He admits that the "fast track is also the loose track" money-wise, making it difficult to control costs.[25] The dominance of lump sum contracts seems like a significant difference from the other cases, suggesting Clark's ability to shift some of the design and innovation risk on to consultants. However, Clark explains that such contracts are typical of the local development industry.[26]

DPZ also agreed to a lump sum contract the bulk of which covered the design charrette and creation of the original plan. Since then DPZ has an annual fixed contract based on an hourly rate for three days a month.[27] A clearly defined, lump sum contract allows Clark to manage costs. By hiring design staff in-house, Clark is able to further control costs. His design staff performs the bulk of the design work for a fixed salary and DPZ provides their expert critique of this work through their limited contract. This arrangement allows Clark significant involvement in the design of the community and the ability to control costs without sacrificing expert design consultation by splitting design responsibilities between in-house staff and consultants.

Clearly, the lump sum contract shifts most of the cost risk to the consultant but the cost of the project can be more predictably accounted because the consultant's past experience on similar projects allows them to price the project more accurately. The design risk is born by both the developer and the consultant but is significantly diminished with the selection of consultants

24 Ibid.
25 Clark (General Partner, Haymount), 27 March 2006.
26 Clark (General Partner, Haymount). 21 July 2006.
27 Ibid.

experienced in the particular innovations employed at Haymount. It is difficult to assess whether and, if so, to what extent consultants add a risk premium to their lump sum price. The theories of project delivery and risk/reward suggest the firm will add a risk premium to lump sum fees. But it is unclear what each consultant perceives to be the risk and how much risk they perceive. For example, the firm may apply a risk premium for the general cost risk associated with a lump sum contact or a premium for an unconventional product as well.

THE ALLOCATION OF RISK

Regulatory Risk Haymount's regulatory experience parallels that of the Pinehills. The project faced significant opposition from local residents. While the regulatory phase certainly presents significant risk to the feasibility of a project, Clark created additional risk by purchasing land that was zoned for large lot rural development and designated as a rural preservation area. The county had targeted areas for growth and the Haymount parcel was not one of them. As with both the Pinehills and Palisades, the vital role of advocates on the planning board is apparent from Haymount's experience.[28] Upon their approval with a 3-2 vote, members of the planning board stated the importance of the environmental-sensitivity of the proposal.[29] Without such care given to the environmental impact of the development, the project would never have appeased its detractors. It is noteworthy that Caroline County only requires a project achieve a majority vote for rezoning while the town of Plymouth (Pinehills) requires a super-majority, increasing the risk of the approval process.

Similar to the other cases, the Haymount project, despite the controversy it provoked, has served as a template for future development in Caroline County. All new projects have had to incorporate Traditional Neighborhood Design principle. In addition, after rezoning Clark worked with the county to establish a Rappahannock River Corridor Ordinance to control any secondary growth that Haymount might trigger.[30] In response to environmentalists' concerns, the ordinance requires any development within the corridor to abide by the standards Haymount instituted for its own development. The ordinance secures the future of the Rappahannock River, its watershed, and surrounding flora and fauna.

Design Risk Probably more than any of the other developers, Clark was able to mitigate the design risk of implementing an innovative stormwater management system. His employment of consultants with previous experience in the precise technologies and design forms instituted at Haymount greatly lowers the risks of the design not meeting the vision and performance failure of new products. Clark further controlled this risk by assembling an in-house staff that had broad experience with the environment but specific skills relevant to the predevelopment phase. His staff coupled with his vision guided the work of consultants to ensure the quality desired.

Construction Risk Because the project is only entering the construction phase, it is difficult to comment on general construction risks. The use of a design-build delivery method allow some speculation of the risk associated with the construction of the IMPs. The construction will require significant construction management as the work of several subcontractors must be coordinated to complete the construction of the stormwater management system. The design-

28 Clark (General Partner, Haymount), 28 March 2006.
29 Finchum (Director, Caroline County Depart of Planning and Community Development).
30 Slone (Legal Counsel to Haymount, McGuire Woods LLP).

build method allocates almost no risk to Clark. Although WEG assumes much of the design and construction risk, their extensive experience in this type of engineering and construction management makes them well-suited for the work. In order to shift this risk from himself, Clark must pay a risk premium. Assumedly, Clark could lower costs by managing the construction process himself through a multiple primes method but would have less quality assurance and more liability.

A STRUCTURE SUITED TO PRODUCT INNOVATION

Haymount presents an example of innovation coming directly from the developer. Although his project, including the stormwater management system, is ambitious, the developer assumes little risk for the innovation. Through a design-build delivery method and lump sum contracts Clark is able to shift some of the risk of design and construction to the engineering company. Although much responsibility is allocated to the consultant, the developer still bears the risk that the final product will not garner expected returns. Therefore, the cost of the stormwater management system is fixed through contracts but benefits to the developer are uncertain. This allocation of risk is appropriate because Haymount focuses on product innovations more than process innovations. A specialized engineering company is better able to lead the development of the stormwater management system. The design-build delivery method and lump sum contract not only allocates the risk to the engineering company but also gives them the incentives to execute the project by assigning them complete control, an opportunity to realize savings, and a risk premium through the lump sum contract. Meanwhile, it is appropriate the developer retain the risk associated with the market success of the innovation.

Chapter 8
Synthesis

Each of the preceding projects was chosen based on their adoption of an innovation. Their adherence to broad Low Impact Development principles and incorporation of Integrated Management Practices have put them among the few market-driven, environmentally-minded master-planned communities in the country. Given the number of barriers to innovation in the real estate development industry, it is interesting to examine *who* motivated the adoption of LID practices in each of the projects and *how* LID innovation was facilitated through organizational structure and the design and construction processes.

With any innovation comes risk, and the experience of each of these projects certainly illustrates increased risk due to their adoption of LID. Typically, financial economics defines risk as the quantification of the uncertainty of a particular outcome or the variation in the expected returns or timeline. This thesis has adopted a more colloquial, less quantitative definition of risk interchangeable with uncertainty. An evaluation of risk shows that the process of implementing LID practices in master-planned communities increases risk but does not necessarily add new risk. Rather LID implementation tends to exacerbate existing sources of risk for development. Project delivery methods, contracts, and industry relationships help control and shift the risk associated with real estate development in general and adopting new practices, such as LID, in particular. This chapter seeks to synthesize the lessons taken from the case studies to arrive at conclusions about the optimal sources and processes of innovation as well as an appropriate allocation of risk through project delivery methods and contracts.

THE NATURE OF LOW IMPACT DEVELOPMENT

Low Impact Development has assumed different levels of importance in each project. When evaluating the nature of LID in each case, it is important to recognize that none of the projects has reached completion; thus, any evaluation must rely on plans for the system rather than observation of their performance.

At the Pinehills, the stormwater management plan is secondary to the driving philosophy of design-by-view, which preserves the natural landscape to add value to homes. Stormwater management relies more on site planning and grading to direct water to naturally occurring vegetated depressions rather than on structural Integrated Management Practices. Because the soil is sandy and naturally capable of accommodating the drainage needs of the development, Low Impact Development was only partially employed at the Pinehills, implementing many of the design and planning processes associated with LID but few of the treatment structures. For these reasons, Table 8.1 categorizes the Pinehills' LID plan as a moderate product innovation.

Design and development at the Palisades, because of the extent of water quality regulation (and less accommodating soils than the Pinehills), has been more strongly guided by their low impact stormwater management plan and employed more structural Integrated Management Practices to mimic the natural hydrological processes of the land. The project implemented a disjointed approach to stormwater management by adopting both Integrated Management Practices and conventional stormwater measures throughout the site. In part, this was a result of the conflicts between city and county agencies, each with their own design and environmental agendas. Inability to develop common standards to measure IMPs further diminished the innovative nature of the plan by significantly reduced the number and type of IMPs employed at the site. Finally, the Palisades has relied on Integrated Management Practices largely for

	Instigator	Motivation	Types of Treatment	Level of Product Innovation
Pinehills	Engineer	Geology/ Cost-savings	Mostly Non-structural	Moderate
Palisades	County	Regulation	Structural and Non-srtructural	Moderate
Haymount	Developer	Environmental Commiment	Structural and Non-srtructural	High

Table 8.1: Summary or LID origins and practices.

utilitarian purposes, failing to take advantage of the aesthetic advantages of this type of runoff management. When evaluated solely on its stormwater management system, the Palisades also shows moderate product innovation. However, the community is not completed and may present a more integrated, less utilitarian approach upon completion.

With Haymount, the Low Impact Development approach is an important component of the project but is just one environmentally-conscious technique in a host of green technologies and planning practices employed in the project. Unlike the other cases, LID was incorporated into the project from the onset in a purposeful manner due to commitment and direction from the developer. Although Haymount, like the Palisades, takes a hybrid stormwater management approach by using both conventional and progressive stormwater management measures, the system functions in a more holistic and comprehensive manner, utilizing each treatment paradigm in the most appropriate areas. A conventional system is within the development itself, which has dense, urban environments, and connects with Integrated Management Practices along the edge of the town to treat runoff and return it to the hydrological cycle. The application of the breath of both the site planning practices and structural treatments of Low Impact Development in a focused and consistent manner ranks the innovation as high in Table 8.1.

The quality and novelty of each project's stormwater management plan seems to depend on (1) how well the developer articulates the environment's role in the project and (2) how well LID principles fit in with that environmental objective. In the case of the Pinehills, the environment played a central and well-defined role from inception. Environmental preservation was essential to establish a natural, rustic character and provide beautiful views for residents. Within this framework, designers and engineers were able to incorporate LID features in a seamless manner to fit with the overall theme of the community. Likewise, at Haymount the developer articulated a focus on environmental conservation at the onset. In this context, Low Impact Development planning practice and structural treatment techniques are able to meet the functional imperative of hydrological protection.

The Palisades differs from the other two projects because it does not seem to have a framework defining the role of the environment in the project. The focus has been on recreational amenities and the built environment more than the interface between the built and natural environments. Therefore, LID practices are not guided by a strong vision of the environment's unique role in the project. This is evident from the interviews I conducted where no one articulated a mission or vision for the Palisades from an environmental perspective

(unlike interviewees from the other case studies).

These differences can have a profound effect on the level of environmentally-oriented innovation encouraged in development. Without an understanding of the purpose of the environment in a project, it is difficult provide a framework for the incorporation of new products so that they compliment the overall vision. Furthermore, such a framework provides direction for further product and process innovation. The case studies illustrate how an articulated and clear purpose for the environment in a project can result in novel applications of innovative principles and create unique and appealing communities for future residents.

THE PEOPLE AND ORGANIZATIONS OF INNOVATION

The cases reveal that Low Impact Development techniques were motivated in each case by different individuals. In the case of the Pinehills, the managing partner, Tony Green, established the open space-oriented master plan but the engineering consultants noticed the opportunity for alternative stormwater management. The Palisades was obligated to include LID practices by regulation. And John Clark, the general partner at Haymount, led the charge to adopt Low Impact Design principles to compliment the litany of other environmentally and socially-responsible elements planned for the project.

Those who motivates innovation can greatly alter the nature of that innovation. Pauly found that environmentally-oriented innovation in the real estate industry- when voluntarily and independently pursued by the private sector- resulted in "more radical and systematic innovations" than if environmental innovation was mandated by the government.[1] The case studies in this thesis support Pauly's findings. Compared to the other cases, the Palisades (mandated by the county to adopt LID practices) implemented a sub-optimal, piecemeal stormwater management system due to governmental agency disputes about performance measures. The Pinehills and Haymount present more comprehensive models of LID systems. These case studies also suggest that the private sector plays a critical role in advancing innovation. In each case, even that of the Palisades where regulation mandated LID practices, public entities have been reluctant to accept stormwater innovation, appreciating their environmental benefits but harboring concerns about liability and performance. However, after approving each project the respective municipalities has adopted innovative aspects of the projects for application in future development. These examples illustrate that private development plays a critical role in educating the public about the challenges and benefits of innovation and the optimal methods of application.

In addition to understanding who is motivating the adoption of LID in master-planned communities, the process by which new products and processes are incorporated is critical to understanding the facilitating factors of innovation. Corporate and project team organization can play an integral role in conceiving, communicating and implementing novelty. An examination of the cases reveals some fundamental similarities that might have played a critical role in facilitating innovation as well as some differences that could affect a team's ability to conceive and disseminate LID innovation.

1 Pauly, 3.

	Corporate Structure	Project Team Structure	Ability to Innovate
Pinehills	Tiger	Heavyweight	High
Palisades	Functional	Heavyweight	Moderate
Haymount	Tiger	Heavyweight	High

Table 8.2: Summary of Organizational Structure

Organizational Architecture In each case, the project's team were relatively small and interdisciplinary, ranging from 6 to 10 staff and consultants with backgrounds in design, engineering, policy, landscape architecture, and construction. Clark and Wheelwright contend that smaller teams provide greater ease of communication. Meanwhile, the interdisciplinary nature of real estate teams meets Lester and Piore's criteria of creating *organizational integration,* where different types of specialists have opportunities to work together to share and cultivate ideas. The effectiveness of this team structure is evident in the case of the Pinehills where engineers at VHB introduced a creative idea that was accepted by the developer. The engineers worked with land planners to incorporate alternative stormwater management design into the neighborhood planning. Clark and Wheelwright believe this arrangement, a heavyweight team structure, is ideal for facilitating and realizing innovation.

In fact, each case presented a heavyweight team structure at the project-level (as indicated in Table 8.2). However, the cases differed in their corporate structure. Rhein/Medall Communities, as a larger company of almost 30 employees, has a functional structure, which can divide individuals and prevent integration. Furthermore, staff members work on multiple projects, dividing their attention and undermining feelings of ownership. By contrast, the Pinehills and Haymount have a tiger team corporate structure, which is small, integrated and imbued with entrepreneurialism. The companies are dedicated to one project, which fosters ownership among staff and, ultimately, innovation (earning them a ranking of high ability to innovate in Table 8.2). Based on Clark and Wheelwright's criteria, the Pinehills and Haymount are better organized to conceive and implement innovation at the corporate level. These corporate and team structures may have played a critical role in facilitating the process and product innovations in each project.

While organizational architecture can facilitate innovation, the cases reveal that culture and leadership are also integral facilitators. Clark and Wheelwright mention the importance of an entrepreneurial spirit (in tiger teams) and feelings of ownership and *corps de esprit* (in heavyweight teams) in facilitating innovation.[2] Lester and Piore in their book *Innovation: The Missing Dimension* advocate for an *interpretive* management style that encourages team members to creatively explore a broad range of ideas before entering the *analytic* process of narrowing down choices, problem-solving, and systematically delegating tasks. Both Haymount

2 Clark and Wheelwright, 16.

and the Pinehills demonstrate a commitment to exploring the possibilities. Working on the Haymount project, Doug Beisch of Williamsburg Environmental Group recalls meeting with Clark, who- upon learning they would not have to do much stormwater intervention to meet county regulations- stated that he didn't want to just meet the regulations, he wanted to exceed them and challenged his engineers to come up with more ecologically-oriented stormwater management interventions. The Pinehills also demonstrates a unique method of establishing an interpretive process. During design, Green would lead field walks with the engineers along proposed roads to understand how they interact with the landscape. This same iterative process continues during construction where Moore and Green adjust the design to accommodate landscape features. At the Pinehills, the interpretive process is a continual part of the project.

The culture of a team depends significantly on its leadership. Without the strong leadership and vision of the developer in each of the cases, a Low Impact Development plan may never have been adopted. The level of leadership and involvement by the heavyweight manager or the developer can overcome some organizational challenges to innovation, such as the functional corporate structure. Leadership is also essential for developing an environmental framework for the project and encouraging a culture of interpretation and integration.

THE PROCESS OF INNOVATION

Organizational structure is only one aspect of the process of innovation. In the context of land development, the broader design and construction processes also play an important role in discovering novel ideas. When implementing a product innovation the process may need to change in order to fully realize the new product.

The cases reveal incremental process innovations that accompany Low Impact Development. Each project introduced significant environmental analysis during the design process. To some extent, each case utilized elements of Arendt's recommended process for determining the scale and location of development on a parcel. Inventory and evaluation of habitat, vegetation, soil conditions, and drainage areas informed each of the master plans discussed. For instance, after extensive environmental investigation, Haymount placed all development on deforested, former farmland rather than conducting more clearing for the community.[3] This design approach greatly differs from conventional practices and represents a novel alteration to the typical design process.

The construction process also indicated some changes necessary to fully realize the Low Impact Development plan. The cases demonstrate a number of modifications, including greater subcontractor education, more construction oversight, and greater regulation for construction practices. The Palisades implemented the greatest change to the construction process as the developer required all builders and subcontractors to attend the county's Water Quality Training class. The developer enforces environmental construction practices through issuing fines for violations. Furthermore, the Rhein/Medall Communities added a new layer of management (Mastin as the Vice President/ General Manager and Reichel as the Water Quality Officer) for the Palisades project to monitor the site work and vertical construction. The Pinehills has also instituted subcontractor education but in a more informal setting. Moore, the Director of

3 Beisch, (Senior Water Resource Engineer, WEG), 27 July 2006.

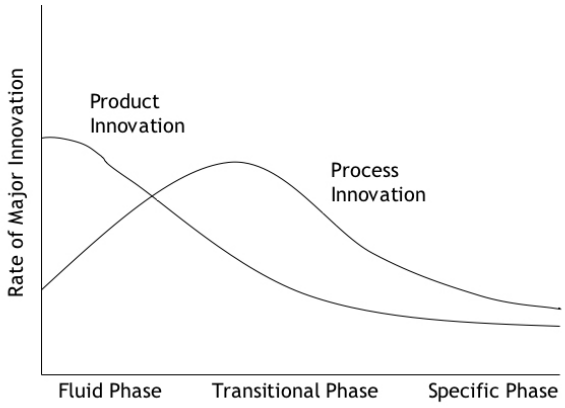

Figure 8.1: Utterback's illustration of the relationship between product and process innovation (Source: Utterback, xvii)

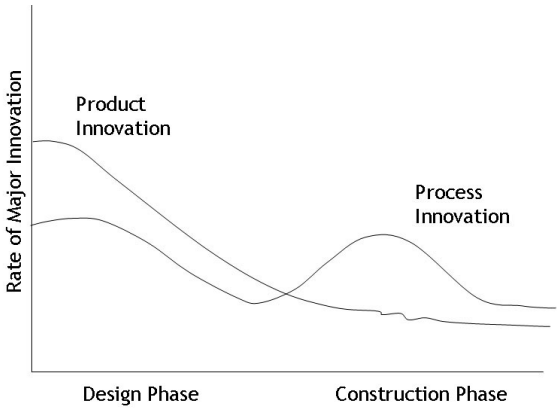

Figure 8.2: The relationship between product and process innovation suggested by the case studies. (Source: Charu Singh)

Construction, has taught a cohort of subcontractors new grading and clearing techniques that met the aesthetic vision of the project. Although the primary objective is aesthetic the result provides environmental benefits espoused by LID- preservation of the natural landscape and less impermeable surface. The Pinehills did not enforce strict controls on the construction practice of homebuilders, resulting in the compaction and silting of some the naturally-occurring depressions designated for handling runoff. Haymount has taken a different approach by completely handing over the design and construction of the Integrated Management Practices to WEG in a design-build arrangement.

Whether these process changes have been motivated by regulation or by the volition of the developer, they define a series of incremental changes in the process of realizing product innovation. Utterback proposed that product innovation and process innovation followed fairly linear patterns where product innovation dominated the early planning phase of product development and process innovation became more important during execution as illustrated in Figure 8.1. The experiences conveyed in the case studies suggest that the relationship between product and process innovation may be different in the realm of environmentally-sensitive real estate development. Rather than largely occurring during implementation (construction phase), process innovation seems to peak during the planning and conception (design phase) as well. Figure 8.2 suggests a new model for understanding the relationship between product and process innovation. Radical product innovation and incremental process innovation occur during the design phase. In the construction phase, product innovation becomes less significant but incremental changes continue. During this time, incremental process innovation also occurs in the form of increased training and construction oversight.

INCREASING RISK THROUGH INNOVATION

This thesis also hypothesized that increased risk accompanies innovation. The cases reveal that, indeed, implementing an LID approach to stormwater management created additional risk in each phase of the project. More specifically, Low Impact Development tends to increase uncertainty typical of the phases of development rather than introduce new risks. Much of the greater risk is due to lack of education of industry professionals, municipalities, and citizens.

	DESIGN & ENGINEERING				CONSTRUCTION			RISK TO DEVELOPER FROM LID FEATURES		
	Firm Selection/ Award Method	Project Delivery Method	Contract Type	In-house Staff	Firm Selection	Contract Type	In-house Staff	Regulatory	Design	Construction
Pinehills	Relationship	Multiple Primes	Time & Materials	Director of Land Planning	Relationship	Lump Sum	Director of Construction	Low	High	High
Palisades	Relationship	Multiple Primes	Time & Materials	Project Manager	Relationship	Unit Price	General Manger, Water Quality Officer, VP of Construction	High	High	High
Haymount	Relationship/ Expertise	Multiple Primes & Design-Build (stormwater management system)	Lump Sum	Environmental Manager, Landscape Architect, Town Planner	Bid	Unit Price	Construction Manager	Low	Low	Low

Table 8.3: Project delivery methods and contracts help determine risk to the developer in each phase of development.

Regulatory Phase The regulatory phase presents the riskiest period for each project. Because of their size and location in rural and environmentally-sensitive locations, each of the projects discussed in previous chapters underwent a contentious, time-consuming approvals process, which posed significant risk to the feasibility of the project. Interestingly, the risk posed by some of the cases in this study was not due to Low Impact Development. In the cases of the Pinehills and Haymount, opposition stemmed from concerns about density, traffic and environmental degradation. The projects' stormwater management systems were a non-issue posing little regulatory risk (as indicated in Table 8.3), largely because the infrastructure would be privately owned and maintained by the Homeowners' Association. The Palisades differs from the other two cases because its stormwater management system was *the* point of contention. In order to protect the watershed and water quality of Lake Wylie, the developer was required to develop a watershed management plan that incorporated LID principles in order to gain rezoning. Although each project sparked controversy in their respective communities, the planning boards have subsequently adopted the controversial stormwater management practices and site planning techniques for future development. For instance, since the Palisades project was approved, the Charlotte and Mecklenburg County have been working with YWH to develop LID ordinances to control development. Likewise, Caroline County has included traditional neighborhood development (TND) principles from Haymount in their design guidelines for new construction.

Design Phase Adopting LID principles during the design phase introduced some risk to the project. In two cases (Pinehills and Palisades), the stormwater management plan was developed by engineering firms with no experience in this type of system, resulting in increased design risk (Table 8.3). In particular, the engineering firms were concerned about incurring liability if IMPs did not meet performance expectations. The example of VHB working on the Pinehills project demonstrates they were able to address liability and performance concerns. The firm performed extensive testing to guarantee the model would function as expected. With the Palisades similar testing was already built into the design process because the conditional rezoning demanded they perform extensive research. Participating in the creation of the Water Quality Management Plan played a critical role in educating the engineers from YWH and helping them become comfortable with the performance abilities of IMPs.

Construction Phase The construction phase is typically the least risky phase to the developer. These projects experiences an increase in the typical construction risk because subcontractors were not accustomed to the new construction practices required in each case. Each project met this information gap through both education (formal and informal) and experimenting with

project delivery methods. The need to adopt and teach new construction practices increased the construction risk the Pinehills and the Palisades experienced (resulting in moderate risk as indicated in Table 8.3). Meanwhile, Haymount experiences low construction risk because the developer passed on construction responsibility to the engineering firm.

ASSIGNING AND MITIGATING RISK

At each stage of development, the case studies illustrate additional risk created by pursuing innovation in real estate development in general, and in Low Impact Development in particular. Based on the project delivery methods and contract types negotiated in each project, the developers of the Pinehills and the Palisades incurred greater risk than the developer of Haymount. In response, developers have devised several mechanisms to shift and mitigate these risks.

Jurisdiction The ownership structure of the community's infrastructure plays an integral role in controlling regulatory risk. As private communities, each project would maintain its own stormwater infrastructure. This ownership greatly reduced the city and county's scrutiny of the system. Instances where the city or county would take ownership of some portion of the project revealed their concerns about liability and performance. At the Pinehills, VHB provided the site engineering plan for the fire station that the city would eventually own. The city was concerned about the LID approach to runoff and demanded a conventional detention basin. Only after much debate were city engineers willing to accept the LID plan. This situation illustrates the difficulty a developer would encounter if the project's Integrated Management Practices would be publicly maintained.

Project Delivery Methods The cases present different approaches to designing and constructing an innovative stormwater management system. The Pinehills and Palisades took a multiple primes approach where the developer coordinated all the design and construction. Subsequently, the developers were able to better control the process and potentially realize savings. However, it also requires they assume more risk, which acts as an incentive for them to manage the projects well and deliver a successful product. Haymount also took a multiple primes approach for most of the design and construction but used a design-build approach for the stormwater management system. The design-build method shifts risk from the developer to the engineering company. It is particularly appropriate for Haymount because the project incorporates several structural IMPs, such as bio-retention areas and constructed wetlands, requiring significant design and construction. This delivery contract arrangement not only transfers risks to the engineering company but also incentives in the form of greater control to realize success and savings (and the premium typically attached to lump sum contracts). A design-build approach would not have been ideal for the Pinehills which relied largely on preserving natural drainage areas and directing runoff to existing vegetated depressions. Their stormwater management system did not require specialized construction and management. Instead, coordination of the design and construction process controlled the success of the project. Therefore, multiple primes delivery and time and materials contracts were more appropriate because they allocate the incentives (increased control and returns) to the developer to manage the process successfully.

Contracts Contracts certainly played an important part in determining the allocation of risk in the project. Time and materials (TM) contracts were negotiated with all the design consultants involved with the Pinehills and Palisades. This exacerbates the risk the developer assumes during the approval process. With an innovative project that might experience more regulatory difficulty, TM contracts add to the cost risk associate with a long approval period as more work and time may be necessary from consultants. However, this contracting method is appropriate given that the scope of the work during the design phase is often undefined and difficult to control. In addition to risk, the TM contract places all the educational cost on the developer, who pays consultants to learn a new model for stormwater management. Neither of the engineering firms discounted their fee to account for the significant training they earned from the project and inefficient work production that results from inexperience. Furthermore, the TM contract forces the developer to pay a premium for firms to protect themselves against liability as illustrated by the example of VHB conducting extensive testing to prove the effectiveness of their plan. Both projects also negotiated lump sum and unit price construction contracts, which shift the cost risk to the subcontractors. Because the scope of work can be more easily defined during construction, lump sum contracts are more appropriate.

Haymount differed from the other cases because it negotiated lump sum contracts with all the design and construction professionals. In order to relinquish the risk, the developer typically has to pay a premium to the consultant; resulting in a higher cost. The developer also surrenders considerable control to the consultant. In the case of Haymount, Clark had already developed a clear conceptual plan to guide the work of consultants, which allowed him to provide significant direction to the consultants and define a clear scope of work.

Relationships vs. Expertise The cases also reveal two distinct approaches to hiring consultants. Existing relationships with consulting companies drove much of the selection by developers. Both Green and Medall selected design, engineering, and environmental consulting companies based on the relationships they had already established with them through previous projects rather than the consultant's experience with LID or any of the other site planning innovations of each project. Although Clark selected some consulting companies based on his relationships, he also hired a number of consultants based on their experience with the particular innovations Clark was pursuing at Haymount. Not having worked with either before, Clark hired DPZ for the master-planning because New Urbanism was one of the most important driving forces of the project. He also hired WEG because of their experience and sophistication with LID projects.

Both selection methods act as a hedge against risk. Strong professional relationships help address agency issues that may arise. Established relationships, mutual trust and the promise of future work create incentive mechanisms to ensure that the consultant will strive to provide good quality work and fair billing. However, the shortcoming of this risk mitigation technique is that it may solve agency problems but at the cost of specialized expertise an innovative project may demand. This can result in poor quality work and higher fees due to learning on the job. Likewise, selecting consultants purely based on their expertise presents benefits and challenges. It ensures that the consultant will supply the specialized skills necessary to realize the innovation. However, agency issues may emerge if the contract does not provide controls.

Shifting Risk from the Regulatory to Construction Phase The Palisades successfully used this tactic to shift the time cost they incurred during rezoning. The approval process took over a year longer than anticipated, delaying the project significantly. The developer was able to recover some of this cost by reducing the time available for land development and vertical construction. Contractors and homebuilders were willing to tolerate shortened schedules and delays in work as well as forego other jobs in order to work at the Palisades when it was ready for construction.

Bifurcating responsibilities between in-house staff and consultants Both the Pinehills and Haymount demonstrated a strategy of employing generalists in-house that were able to perform a variety of functions necessary to move a project through predevelopment while also supplying necessary expertise in a particular area. For instance, Shelly May's position as an Environmental Manager at Haymount requires that she perform broad project management tasks. However, her environmental and regulatory backgrounds allow her to supply the project with this expertise which is essential to meeting Haymount's vision. Such generalists are augmented by consultants who have more specific skills and are hired to perform discrete tasks, which are easily contractible because of the defined scope of work. This staffing strategy is cost effective because consultants are used on a limited basis, and strategically effective because the developer through in-house staffing is able to secure unlimited expertise on a particular topic, which would be costly and most likely more limited if contracted to a consulting firm.

Awards and Certification Certification and awards have been significant in demonstrating the innovative nature of each of these projects and granting legitimacy to their environmental marketing claims. Pinehills has received numerous awards for its innovative design-by-view methodology, earning the 2003 Prism award for "Best in Innovative Land Planning" and National Association of Home Builders' 2003 gold and silver awards for "Best Master-Planned Community" and "Best Landscape Design".[4] Meanwhile, the Palisades recently received gold certification from Audubon International's Signature Program, confirming the developer's commitment to preserving the environment during the development of the community. The certification ensures that Medall went through a process that considered the environment and created a land plan that is environmentally-sensitive. To demonstrate the innovative nature of aspects of his project, Clark has approached the US Green Building Council to develop a new LEED standard for industrial processes through the development of Haymount's innovative wastewater treatment plant. If all goes according to plan, he will help develop and receive the first LEED industrial certification. Awards and certifications help distinguish each project and mitigate the risks and costs incurred during development by bestowing legitimacy to each project's environmental claims, differentiating their product in the marketplace, and drawing attention from the media and consumers.

WHO ASSUMES RISK?

The project delivery methods and contracts discussed in each of the cases present two distinct and opposing stories of risk. The Pinehills and the Palisades demonstrate that developers are assuming the bulk of the risk associated with their projects and with the training of regulatory, design and construction professionals. Haymount provides a very different example, delivering

4 The Pinehills, "Behind the Pinehills: Awards", <http://www.pinehills.com/behind/awards.php> (29 July 2006).

low impact stormwater management systems through design-build delivery and lump sum contracts. This delivery system shifts a majority of the risk from the developer to the consultant.

In the context of development, determining the appropriate delivery method for a given project is dependent on the particulars of the project. For instance, a multiple primes delivery method seems particularly appropriate for the Pinehills because the project does not require much dedicated construction for the low impact stormwater management system. Instead, it requires that all contractors and homebuilders involved in the project protect designated drainage areas and complete grading to specification so that runoff will flow toward natural drainage areas. Furthermore, both the Pinehills and the Palisades employed known consultants and contractors, which hedged some of the overall risk of the project.

That Haymount assumed less risk with respect to the delivery of the stormwater management system than the other two cases is particularly interesting because in many ways Haymount's approach to stormwater management is more innovative and complex than either the Pinehills or the Palisades. Haymount incorporates more structured IMPs, which requires more engineering of retention and treatment areas as well as more dedicated construction of the system. Considering the technical nature of Haymount's stormwater management system, however, the delivery and contract arrangements are sensible because they encourage the engineering firm to deliver an innovative product (by clearly defining their task), but allows them to use their expertise to determine the most effective process to realize that innovation. This method also protects the developer from the risk related to hiring a new engineering firm for the LID system because he assumes no cost or timing risk directly; rather the consultant must guarantee cost and delivery and is incentivized to meet that obligation because they bear the repercussions if their design and construction management results in cost overruns. Therefore, the design-build mechanism gives the consultant the incentives to create an innovative product but also control costs. As long as the developer can assure the quality of the product, this delivery method is ideal for complex product innovations.

The two approaches also differed in contract types negotiated during the design phase with implications for risk allocation. The Pinehills and Palisades relied on industry relationships and informal contracts, incentives and penalties to establish and regulate the relationships between the developer and design and construction professionals. While informal selection processes and contracts can help mitigate risk (such as agency problems), they may also allocate more risk to the developer. By choosing consultants with no prior experience in LID, the developers introduced design risk to the project. Furthermore, such consultants are most likely less willing to accept anything other than time and material contracts because their inexperience makes them less able to control costs and time. Conversely, Haymount selected WEG based on their specialization in the permitting, engineering and construction management of low impact stormwater management plans. That WEG was experienced with such projects allowed Clark to negotiate a lump sum contract.

Time and material and lump sum contracts both have challenges and benefits. While time and material contracts allow the developer infinite control, lump sum contracts establish price security but potentially creates agency problems where the consultants feels compelled to cut corners to preserve his/her fee. In the case of LID, developers may not be able to negotiate lump sum contracts given the reluctance demonstrated by design consultants working on the

Pinehills and Palisades projects. Instead, a more appropriate contracting method might combine the benefits of both contract types. A New York City developer, The Hudson Companies, recommends establishing a guaranteed maximum price for the contract. All work would be billed on a time and materials basis up to the pre-determined threshold after which point any further costs are either entirely or partly absorbed by the consultant.[5] The contract should also include incentives that encourage the consultant to create savings, such as a savings-sharing provision where consultants receive a percentage of any savings they realized. This type of contract provides the developer with some control over the work of the consultant as well as a secure price for service. Furthermore, it requires inexperienced consultants to absorb some of the educational cost of learning a new design form or stormwater management system. While such a contract would limit the cost risk to the developer, it might not be appropriate for all LID projects or all developers because it necessarily limits the interpretation and exploration process and reduces opportunities for innovation and creativity. However, when employed for discrete tasks such a contract might significantly reduce the developer's risk without jeopardizing innovation and quality of the project overall. Alternatively, such contracts may be appropriate when a developer is replicating an LID project. For instance, as Green pursues new projects based on the same design model as the Pinehills, he may be able to streamline the process and more clearly define the work with his established and experienced cohort of consultants so as to avoid time and material contracts without sacrificing quality or the interpretation process.

SHOULD OTHERS ASSUME RISK?

That developers assume a majority of the development risk is appropriate because they will also receive a majority of the returns from the endeavor. However, because Low Impact Development provides an environmental benefit enjoyed by society, it might be argued that the public should also assume some risk in the development. Such participation can serve to encourage environmentally-responsible development by diminishing some of the added associated risks. The cases provide examples of municipalities absorbing some regulatory risk in recognition of the flexibility required for the development of master-planned projects. In the case of the Pinehills, the town of Plymouth relinquished substantial approval control to grant the project the flexibility necessary for successful realization of the vision. The Mecklenburg County Water Quality Program provided training classes to teach construction professionals techniques to reduce the water quality impacts of construction. This class was a valuable support and important component of the education and enforcement of environmentally-sensitive construction practices at the Palisades. These examples provide illustration of some of the numerous ways local and regional government entities can ease the risk of environmentally-oriented development. As with many of the process changes described above in this chapter, some government-level participation and risk mitigation revolves around providing training, education and research to increase awareness of environmentally-sensitive site planning and development practices and demonstrate the effectiveness of such techniques. Ignorance and inexperience at every level of the real estate industry about the product innovation itself and the process for implementation may pose significant barriers to the adoption of Low Impact Development in the real estate industry.

5 Alan Bell, The Hudson Companies, interview by author, Brooklyn, NY, 01August 06.

Galvanized by the example of the Pinehills, the Massachusetts' Executive Office of Environmental Affairs (EOEA) and the Boston Metropolitan Area Planning Council (MAPC) have begun a rigorous campaign to educate municipalities and developers about the benefits and practices associated with Low Impact Development.[6] These agencies have worked together with the aid of private industry consultants to lead numerous workshops and develop a toolkit aimed at educating municipalities, developers, land owners, and design and construction professionals.[7] Although LID has not been included in local zoning throughout most of Massachusetts, these agencies endeavor to educate towns to update their by-laws and motivate developers by highlighting the savings available through LID. This type of advocacy and education is a necessary and appropriate supplement to the education of design and construction professionals that developers facilitate through the creation of environmentally-oriented communities. Such education coupled with regulatory flexibility and even subsidy help alleviate the additional risk a developer must assume when implementing an innovation and creating a public benefit. Without the encouragement and support of regulatory bodies such endeavors and adoption of environmentally-oriented innovation will lag behind the invention (the first inception of the idea) because of "the conditions for commercialization are lacking" due to lack of knowledge or market power.[8] Regulatory officials must identify these barriers to commercialization and erect programs, regulations and incentives to encourage progressive development that reduces the impact of human activity on the environment.

AREAS FOR FURTHER STUDY

This investigation of Low Impact Development and the role innovation, organizational structure, project delivery methods and contracts has been simultaneously overly broad and narrow. It is broad in its treatment of understanding the origins of innovation and team organization. An immense body of literature exists treating both of these topics in relation to other industries, such as product development and manufacturing. There is great opportunity to relate these theories to other examples of real estate development to better understand how the industry conceives and executes innovation.

This thesis provided a limited view into understanding the roles of project delivery methods and contract types in controlling the quality and risk of innovative environmentally-oriented development practices because of its focus on private, market-driven projects. The examples did not provide an opportunity to evaluate how competitive bidding and firm selection could affect risk and cost allocation because none of the developers utilized a competitive selection process and negotiated fairly simple contracts. Examples of LID projects undertaken by the public sector might provide an interesting counterpoint to the findings of this thesis. Public agencies are beholden to strict bidding and selection protocol, which would provide an opportunity to understand the trade-offs during selection better. The public sector is also often more concerned with cost, liability, and risk, which can further alter project delivery methods and contracts. Therefore, more explicit contracts, incentives, and penalties may be apparent in the design and construction contracts government agencies negotiate with consultants and contractors.

6 Kuh, Sasaki Associate (former Director of Land Planning, the Pinehills).

7 Low Impact Development, Executive Office of Environmental Affairs, <http://www.mass.gov/envir/lid/default.htm> (1 August 2006)

8 Fagerberg, 4.

In its narrow treatment of Low Impact Development, this thesis has failed to consider a myriad of issues related to the barriers to environmentally-responsive real estate development. Much fundamental research about LID is lacking, such as understanding the breath and depth of knowledge among developers, municipalities, and design and construction professionals. This thesis broadly cited studies and evidence of the marketability of open space and environmentalism among consumers but did not specifically investigate market advantage and consumer demand in relation to the low impact stormwater management practices. A focused cost/benefit analysis of Low Impact Development features would elucidate whether LID techniques in particular have marketing cache among mainstream and environmentally-conscious customers alike. Such a financial and market analysis would also be valuable in understanding whether LID practices truly reduce total development costs and whether additional spending during design and planning result in later savings during construction as the literature suggests. Given the fact that master-planned communities and other large-scale projects require a long time horizon and have the potential to drastically reduce their environmental impact long term, low cost financing can be a critical component to realizing such development. A study of financing vehicles tailored for the needs of such projects and other environmentally-oriented development would be an important contribution to the collection of research about such development.

Continuing research into both the product and process innovations of environmentally-oriented real estate development is an integral step in informing real estate professionals about this growing genre of development and encouraging progressive development. Without continued exploration, the real estate industry will continue to lag behind other industries in its adoption of environmental practices, missing opportunities to take advantage of trends and catalyze change among consumers, municipalities, and industry professionals.

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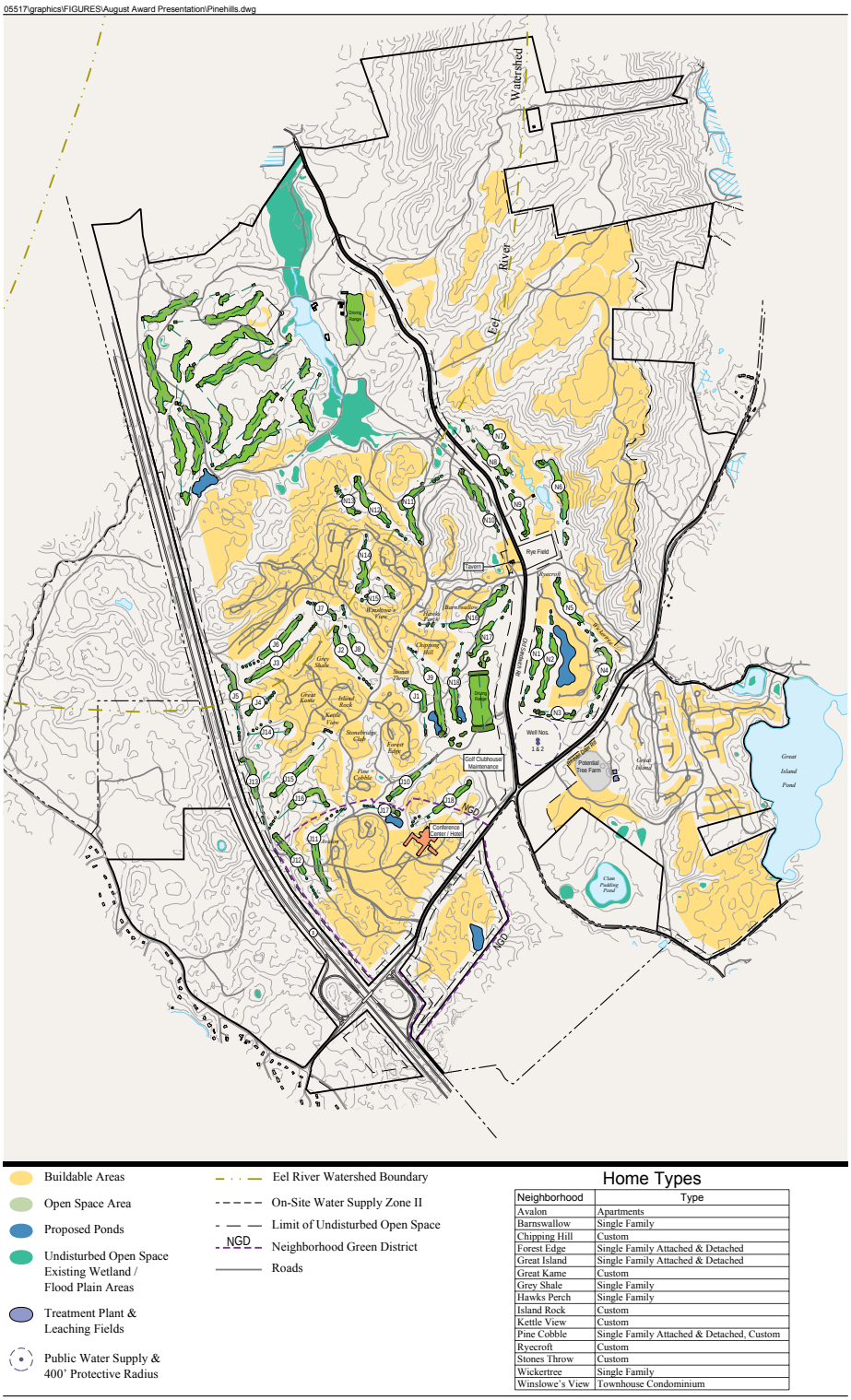
Appendix I
The Pinehills



Home Types

Neighborhood	Type
Avalon	Apartments
Barnswallow	Single Family
Chipping Hill	Custom
Forest Edge	Single Family Attached & Detached
Great Island	Single Family Attached & Detached
Great Kame	Custom
Grey Shale	Single Family
Hawks Perch	Single Family
Island Rock	Custom
Kettle View	Custom
Pine Cobble	Single Family Attached & Detached, Custom
Ryecroft	Custom
Stones Throw	Custom
Wickertree	Single Family
Winslowe's View	Townhouse Condominium

Figure 1: Pinehills Neighborhood Plan (Source: VHB)

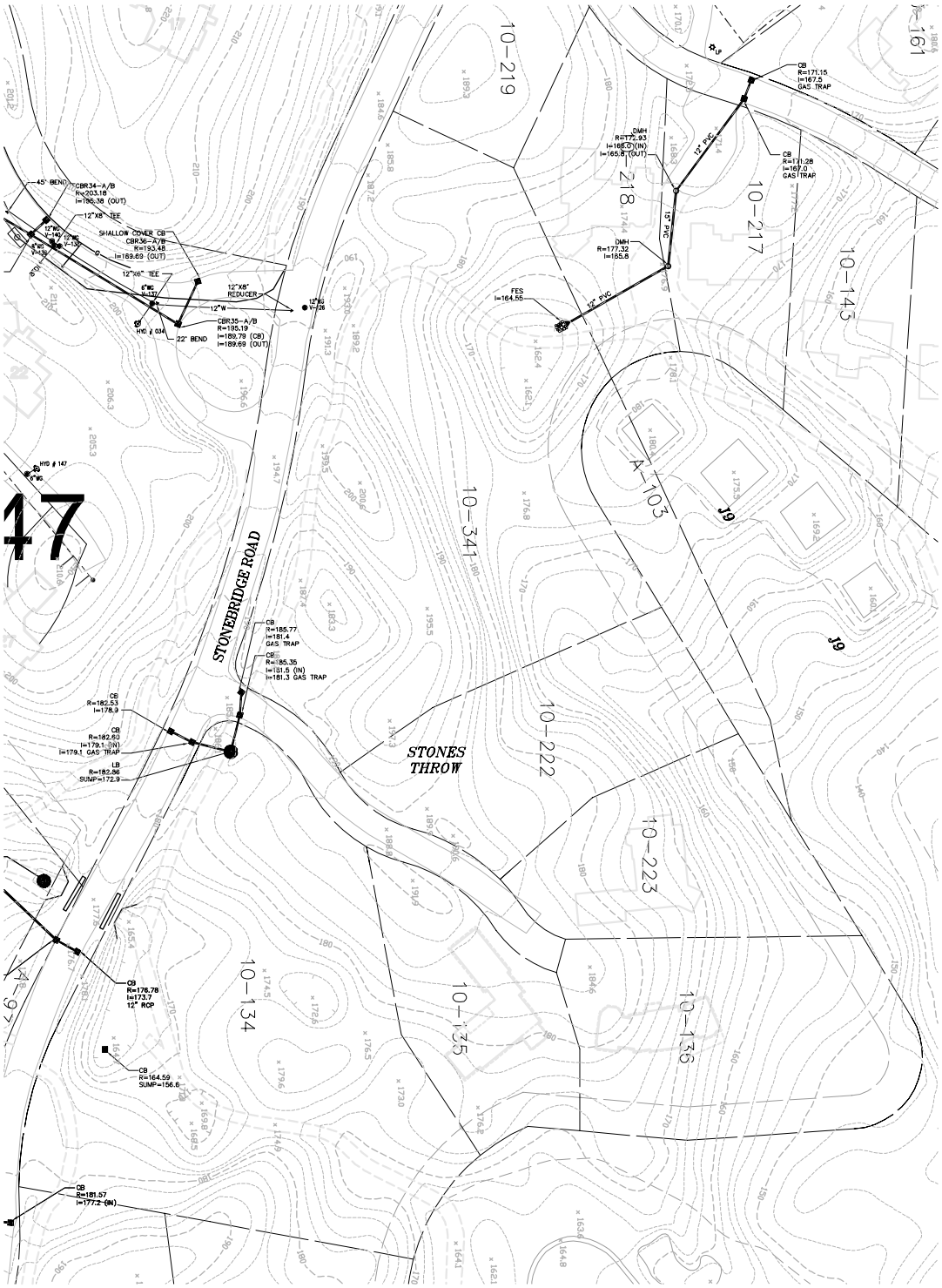


Figure 2: Stone's Throw Neighborhood Lot Plan (Source: VHB)

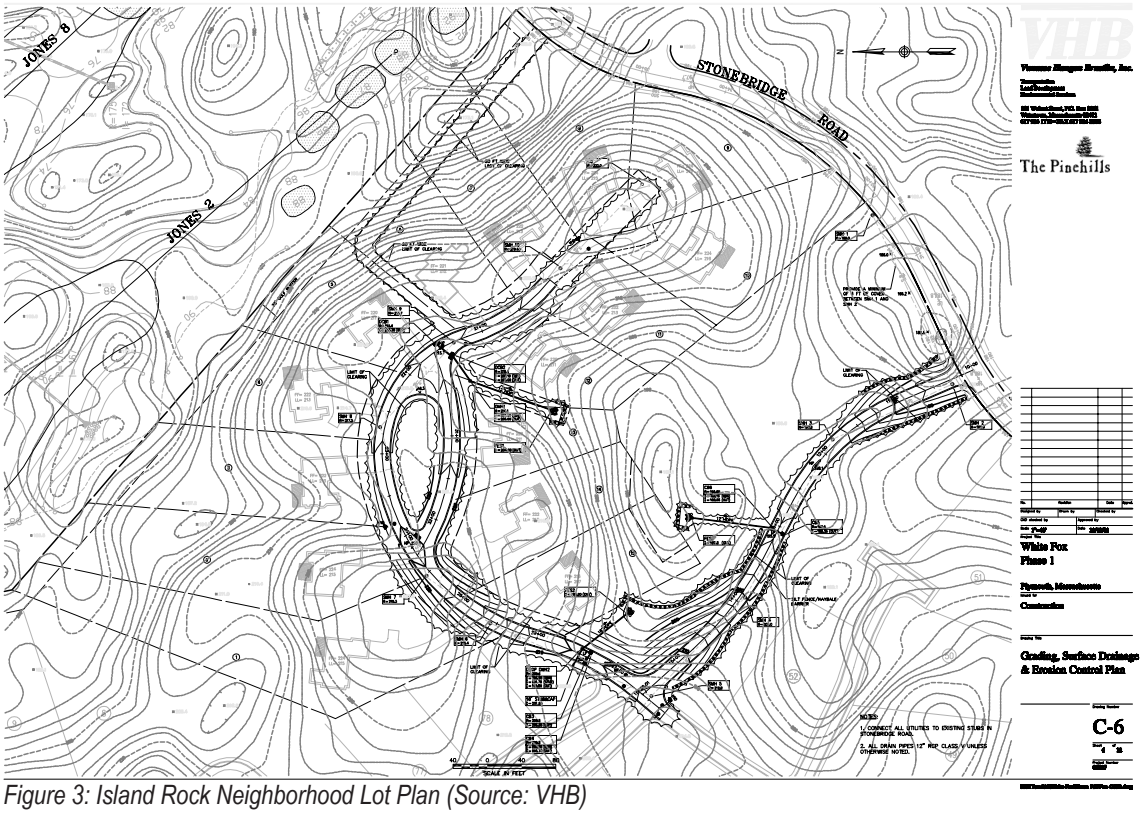


Figure 3: Island Rock Neighborhood Lot Plan (Source: VHB)