VANKE VISION:
SUSTAINABLE
RESIDENTIAL
DEVELOPMENT IN
SHANGHAI

vol. 2: design workshop | spring 2006

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INTRODUCTION
From September 2005 to June 2006, with the generous support of the Vanke Real Estate Group (Shanghai Office), three graduate courses were offered by the Department of Urban Studies and Planning at MIT: Research Seminar in Fall, 2005; Field Survey during Independent Activities Period (IAP) in January 2006; and Planning and Design Workshop in Spring 2006. Vanke’s goal is to continue to improve the design of their housing communities as issues of sustainability become national priorities. All three courses take as their organizing principle that sustainability is not just concerned with environmental issues but equally with economics and equity. Our purpose is to find solutions that are environmentally sound, economically viable and accessible to all residents.

This Urban Planning and Design Handbook is the work of the Planning and Design Workshop. Vanke provided two sites for the class to explore: Baima and Qibao. Baima is surrounded by farmland and low-density villas. Qibao is in a fully urbanized context. In the first stage, students revised the development principles developed during the Research Seminar. Based on their field observations, resident surveys and interviews, they reorganized the original four categories into three systems (community facilities, site systems, and building systems). In order to design for the long term, we identified several scenarios:

1. National regulations will prioritize energy conservation, resource conservation, environmental protection, economic growth, public transportation, social equity (urban/rural and intra-urban), and local control.

2. Energy (oil, coal, and electricity) prices will rise significantly.

3. There will be serious resource depletion including drinking water, building materials, cheap labor, land (farm land, building land, recreation land, and land for solid waste disposal).

4. Increase in air and water pollution.

5. Demographic changes including aging population, more in-migration, fewer children, later marriage and childbearing age, the diminishing centrality of the family.

6. Life style changes including increased consumerism/consumption, higher indoor comfort levels, more auto ownership, increased demand for recreation and entertainment, higher incomes, more services and fewer industrial jobs, more internet use.

Students were then divided into two teams working on both sites proposing both programs and design schemes. After mid-term, each team spent two weeks switching their sites and made quick proposals for the other sites in order to take advantage of students’ various background and interests. Then they worked on their original sites and developed comprehensive schemes for the rest of the semester.
AUGUST
SITE VISIT
PROFESSOR TUNNEY LEE AND LIANG ZHAO VISIT SHANGHAI VANKE.

SEPTEMBER
TRENDS AND PRECEDENTS
TWO TEAMS RESEARCH THE FOLLOWING TOPICS:
• SHANGHAI'S TRENDS IN THE NEXT DECADE
• PRECEDENTS OF RESIDENTIAL DEVELOPMENT IN OTHER COUNTRIES

OCTOBER
SUSTAINABILITY RESEARCH
FOUR TEAMS EXPLORE ISSUES REGARDING SUSTAINABLE RESIDENTIAL DEVELOPMENT:
• COMMUNITY FACILITIES
• SITE SYSTEMS
• OPEN SPACES
• BUILDING SYSTEMS

NOVEMBER
DECEMBER
THE STUDIO PROCESS
SURVEY
PREPARE QUESTIONNAIRE AND ON-SITE SURVEY
JANUARY
- Site Visit: Students in Research Seminar and Design Studio Visit Shanghai
- On-site surveys conducted at the Holiday Town Project
- One day design exercise for two new sites: BAI MA and QIBAO

FEBRUARY
- Site Analysis & Programming
  - Community
  - Site Systems
  - Building Systems
- Needs Defined

MARCH
- Lecture 1: Tunney Lee and Liang Zhao: Identifying Scenarios
- Lecture 2: Lifang Wang: Public Spaces in Chinese Traditional Courtyard Houses
- Lecture 3: Na Sun: Gated Community Study 1
- Lecture 4: Na Sun: Gated Community Study 2
- Lecture 5: Ed Rice: Daylighting Issues in Buildings
- Site Switch
  - The two teams trade projects to gain different perspectives
- Synthesize

APRIL
- Refine Schemes

MAY
- Final Review
- Exhibition: Students display final designs and documents
Sustainable communities have the following components:

**Flexible**
Having the ability to adjust over time.

**Equitably Sustainable**
Across age groups and in access to amenities.

**Economically Sustainable**
Non-isolated, maintaining economic value with sustained economic activity.

**Environmentally Sustainable**
Efficient resource use and connect residents to the environment to enhance sense of ownership.

This chapter establishes guidelines for how best to plan for sustainable communities in Shanghai. The contents are outlined below.

**connections**
Building connections is critical to creating sustainable developments in Shanghai. In this section, three types of connections are considered.

- **SECURITY**
Secure communities offer a sense of safety without separating residents from each other and amenities.

- **ACCESS**
Access is required to meet the requirement of flexibility and equitability.

- **INTERNAL CIRCULATION**
Circulation links residents to on and off-site amenities.

**amenities**
There are three types of amenities considered in this section in relation to sustainable development in Shanghai:

- **COMMERCIAL SERVICES**
- **RECREATIONAL SERVICES**
- **COMMUNITY**

People enjoy games during a day in the park in Beijing.
SECURITY

value
Effective use of systems that secure but do not isolate a development.

goal
Minimize the visual presence of security systems while maintaining residents’ sense of security.

user needs
children
For young children, security and safety are intertwined. They need to be protected from car traffic, and easily watched.

teenagers
Teens will desire semi-private spaces to congregate, which must be distinct spaces but not “blindspots.” The security systems that young people encounter will be formative in their ideas of security and public-private interaction.

parents and single/double income no kid households (SINK/DINKers)
Parents, SINK/DINKers have similar security needs, though parents will be more concerned about the needs of children. These adult groups are more likely to enter the site after daylight so lighting will be important, as well as security of material possessions.

seniors
Security should not create a barrier to access for seniors. Seniors can serve as “eyes on the street” during the day.

context
qibao, urban
An urban context, like Site 53, presents the challenges of creating a sense of security while integrating the site into existing pedestrian and car traffic. On a mixed use site there will be a large number of non-residents on-site. A dense urban site does, however, present opportunities to use private lobbies, and above ground floor resident spaces.

baima, suburban
Typical suburban developments are surrounded by other gated communities. The Baima site still has agricultural neighbors as well. Entry by car and garage security will be important. There will be fewer non-residents on-site so security systems must address “strangers.”

current practices/baseline standards

holiday town
Holiday Town employs a large number of uniformed security guards to monitor pedestrian and vehicular access to the site and to the villa area within the site. In addition, conspicuously placed security cameras feed back to the security office in the management office. Access points are limited; the site is otherwise walled off from surrounding communities. Pedestrian entrance gates and individual buildings use a keycard or code entry system.
case study

Address, Daikanyama, Tokyo is a multipurpose development adjacent to an elevated subway stop, first and second floor retail, and residences. The retail, office, and residential components of Address are all clearly visible and accessible from the street and from other uses. Separate entrances, differentiated paving, and changes in elevation (slope) are used to distinguish office, retail, and residential areas.

developer recommendations

Vanke can easily take the lead in redefining site security, and has already started at Holiday Town. New developments, and redesign at existing developments, should reduce the use of physical barriers such as fences and walls. Existing site features such as canals and slopes; building massing; landscaping features like paving, plantings, and decorative gates; pedestrian traffic, including security personnel; and technology such as card entry systems and closed circuit TV, should be used to create clear distinctions between public and private spaces.

municipal recommendations

Municipalities can utilize design regulations and review to reduce the use of fences and walls, particularly around areas designated for public use. In addition, they should facilitate meetings between the management firms of neighboring developments, as well as local police, to address safety and security issues on a district level.
ACCESS

value
Increasing access through increased on-site/off-site flows and exchanges enhances community quality and sustainability by enabling residents to utilize surrounding amenities.

goal
Create strategically porous boundaries that do not conflict with security interests to increase amenity use within and outside of the development.

user needs
Porous boundaries affect age groups similarly by increasing access to the amenities that each group seeks. Desire for porous boundaries probably varies more individually than between groups. All would likely benefit from the more diverse, active, and lively community that would be created by breaking down the insularity in a region.

case studies
the falls at arden mills, fitchburg, ma: (204 units along the Nashua River) This gated community has a private river walk on one side of the development and a public area for sports events and concerts at the civic center, a public library, and shops and other facilities not contained within the development.

suzhou, china: Attractive examples of public canal walls and linking bridges can be found in designs for restoration of canals in Suzhou. These designs create pleasant, public, partially commercial spaces facilitating formal and informal interaction.

context
qibao, urban
The value of more porous boundaries is more immediate in urban areas, where developments may be smaller with fewer on-site amenities. Residents of Site 53 would benefit from easy access to the large neighboring commercial areas. Creative strategies should allow for privacy in a busy environment while providing convenient links to transportation, commercial areas, and other amenities.

baima, suburban
Suburban developments are larger and more self contained in terms of community and amenities. If there are few nearby amenities, like at Baima, a porous boundary may not seem justified at first. However, the rapid development of Shanghai ensures that amenities will appear over time. Adopting strategies towards creating a porous boundary may encourage similar strategies at neighboring developments and lead to a more integrated area once the region is developed. Canals offer a great opportunity for flexible boundaries.

current practice/baseline standards
shanghai
Most Shanghai developments appear to be mostly private with few access points, generally large gates preventing outsider access.

holiday town
At Holiday Town, an attempt is made to open up the developments and provide some public access to amenities via a through street separating the northeast section of the development.
**developer recommendations**

**general**

» Design variety of subtle access points: These should improve flow while maintaining a sense of privacy and community inside the development.

**pedestrian**

» Provide pedestrian-specific access: Pedestrians access points should be distinct from vehicular access and provide direct, convenient access to homes and amenities via attractive walkways with view that encourage easy orientation and safety. Pedestrians should also have easy access to commercial services, reducing vehicular congestion and improving potential for informal interaction.

**vehicle**

» Baima: Access points should be multiple off of the north-south oriented roads and serve all areas of the development. Delivery access should be provided to the commercial area and a separate public entrance to parking lots near amenities intended to serve a regional market.

» Site 53: Access to vehicles should be limited to one parking entrance near Soho offices and other commercial developments off of the main road. If a public parking deck is built to serve a hotel or large-scale commercial area, a separate entrance should be built taking into account effects on traffic flow.

**boundaries**

» Create more intermediate, public-private spaces: Similar to our recommendations regarding security, a “grey area” of intermediate space between public and private space should provide a soft boundary.

» Create more public areas on development boundaries when appropriate, making use of available amenities: If the canals can be cleaned, they can be utilized to create a vibrant public or private space on the edge of developments, softening the boundaries and possibly linking developments. These areas should be designed for pedestrian use, with some bicycle paths.

Smaller, less formal commercial spaces can provide an alternative to large markets. To encourage use there should be subtle access points that lead residents out but do not draw outsiders in.

**phasing**

We use the example of creating a public walk along the canal to illustrate phasing issues with providing a wider variety of access:

1. Improve the quality of the river can be improved and build multiple access points and small-scale intermediate areas.

2. Create an attractive river path, a pleasant open space for joggers, walkers, and other people from the development wishing to enjoy a more natural outdoor path. Space should be retained for future commercial and community services.

3. Bring in a few anchor tenants and subsidize new commercial tenants.

**municipal government recommendations**

Require more regional consideration of coordination between developments and establishment of softer boundaries, multiple access points, and a certain number of diverse public spaces within a region of numerous developments.
INTERNAL CIRCULATION

value
Regular interaction between residents of all generations builds a sense of community.

goal
Facilitate regular resident interaction through site and building design as well as programming that encourages pedestrian and bicycle traffic along common pathways and create a vibrant, pedestrian-accessible commercial node.

user needs
The planning of internal circulation is of particular importance with respect to children and seniors. The circulation paths should be established and designed to ensure the safety and comfort of these age groups. In addition, needs will vary for different modes of transportation such as pedestrians, bicycles, and vehicles. Design choices made regarding internal circulation can influence the residents’ choice of transportation.

context
qibao, urban
A key consideration in an urban infill development is the level of public access allowed to internal circulation. There should be clearly defined public, semi-public, and private space. Another consideration is the matching up of internal roads and pathways with existing neighboring developments that have already established a street pattern. In addition, the developer must take into account amenities in the surrounding neighborhood so as to take advantage of opportunities to enhance the link between facilities, and become a vibrant piece of the urban fabric.

baima, suburban
The internal circulation within suburban developments should be designed to accommodate changing conditions as the development matures. For example, density will likely increase, and boundaries that may start out as closed may open up to public circulation. In addition, viable commercial development will increase as time progresses, and this should be taken into account. As in the case for access, pathways along the canal system offer a great opportunity for unique internal circulation patterns and designs.

current practice/baseline standards
shanghai
Internal circulation in Shanghai developments appears to be left to the purview of each individual developer. This often results in internal streets that do not line up or continue from development.
to development.

**Holiday Town**

At Holiday Town, there is a public street that cuts through the site, separating the northeast quadrant of the development from the rest of the site. Vanke has placed commercial and community uses along this road, ensuring high visibility and access for vehicular traffic. On a pedestrian level, however, the attention seems to be on security over access.

**Case Study**

**Downtown Mountain View, CA:** Castro Street was narrowed from a four lane street to a two lane street. This allowed for wide sidewalks lined with benches, sidewalk cafes, planter boxes, trees, and lampposts. The downtown’s sidewalk cafes, parks, and outdoor plazas make it a great public place for all ages to interact with one another while supporting the local businesses.

**Developer Recommendations**

- Ease physical conditions by providing adequate walkway, seating, and protection from the elements: Comfort is one of the decisive factors in determining walking distance, along with safety, security, convenience, continuity, system coherence, and aesthetic quality.
- Create “shortcut” pedestrian- and bicycle-only pathways: Landscaping such as the canal system can be used as a natural barrier to deter automobile use while pedestrian bridges can be utilized to provide a pedestrian benefit in addition to a pleasant aesthetic experience. This can also create a “safe zone” for children to commute without the threat of vehicular accidents.
- Control traffic speeds: Design internal streets so as to keep vehicular traffic speeds low by using narrow widths, on-street parking, street trees, and other traffic-calming methods.
- Develop a commercial hub that is pedestrian-accessible and encourages social gathering: Incorporating commercial nodes into the residents’ path of travel will both support the economic viability of local establishments and add elements of interest to encourage pedestrian activity throughout the development. This in turn will lead to increased exposure of residents to one another, especially if the commercial hub becomes a destination where one can go to convene and socialize.

**Municipal Government Recommendations**

- Design land use plans that create mixed-use pedestrian-friendly commercial hubs to encourage social gathering.
- Incorporate commercial nodes into the residents’ path of travel to both support the economic viability of local establishments and add elements of interest to encourage pedestrian activity throughout the development. This in turn will lead to increased exposure of residents to one another, especially if the commercial hub becomes a destination where one can go to convene and socialize.
COMMERCIAL

value

Commercial facilities that meet the needs of the internal and external community will improve their economic viability and enhance the fiscal sustainability of community amenities.

goal

Phase, locate and encourage a diverse mix of commercial amenities to create a sustainable economic core.

user needs

Commercial facilities should cater to residents of all ages such that the experience of frequenting commercial establishment becomes one where all members of the community can interact with one another.

context

qibao, urban

On urban sites, the amount of commercial space that can be supported will be far greater than the demand of just the residents. In particular, with a transit-oriented development, a developer has a responsibility to be more regional in their approach to the site program, given that the facilities will be accessible by many more than just the development’s residents.

baima, suburban

At a new greenfield development, the developer needs to realize that the initial demand for retail may be low as the development gets built out, but the lack of surrounding neighborhood amenities means that certain commercial services should be provided, and subsidized by the developer until the resident population grows to a level to be able to support the commercial facilities.

Ground-floor retail along major north-south artery in Qibao.

current practices/baseline standards

Shanghai Standard:

Retail: 120 m²/1k persons built, 228 m²/1k persons land

Holiday Town:

Commercial: 16,000 m² total built, 13,720 m² total land
This building type can accommodate shifts between residential and commercial demand, ensuring that market volatility is tempered (programmatic flexibility).

Design common spaces along the path of entry to encourage casual interaction: Common spaces with units’ entries opening onto them increase the chances of casual meeting.

Case study

telegraph gateway, oakland, ca: This 5-story, 45-unit live/work-over-retail project is located on a busy urban corner lot. The building contains three floors of flats above a parking podium wrapped by ground-floor commercial retail totaling 5,000 sf. Many of the units open out onto a central courtyard at the podium level. The nature of the common spaces along the entry path can make the difference between an alienating structure and a fully functioning community. In this project, residents cross paths as they come and go, and opportunities to socialize arise. The architect shaped common spaces along the entry path that encouraged casual interaction, designing the common spaces with the units’ entries opening onto them to further increase the chances of casual meeting.

Developer recommendations

» Locate retail and food service establishments along major arteries: Siting commercial amenities to take advantage of both pedestrian and vehicular through-traffic is vital for their economic health.

» Develop flexible, modular shells: Design retail bays that can accommodate establishments of different sizes and uses over time (physical flexibility).

» Develop flexible “SoHo” space

: This building type can accommodate shifts between residential and commercial demand, ensuring that market volatility is tempered (programmatic flexibility).

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Municipal government recommendations

» Increase levels of commercial development around transit nodes to create a critical mass of retail and to encourage transit-oriented development.

» Allow for flexible live/work zoning to allow for flexibility of use.

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value
Physical and social stimulation that contributes to community interaction.

goal
Promote a stable, attractive community by providing sufficient access, variety, and integration of recreational uses. Facilities and programming that provide opportunities for formal and informal resident-resident and resident-non-resident interaction.

users needs
Appropriate indoor and outdoor recreation amenities should be provided for all age groups.

children
Children will primarily need outdoor playgrounds and indoor space for socialization (ie child care) until they are school age. School age children will use amenities after school and on weekends; socialization with other on-site children will be important given school patterns and can also create connections between parents.

teenagers
Teens should be provided with space and programs that allow them to develop independence and site-based friendships.

parents, SINK/DINKers
Parents, SINK/DINKers have similar schedules, using recreational activities during evenings and weekends. These two groups are most likely to interact during virtual or real interest-based activities like flower-arranging classes or car clubs. Parents are more likely to participate in intergenerational activities.

seniors
Seniors are likely to be daytime users of recreational amenities and, like children, their physical safety should be considered in amenity design. Through regular use of amenities, seniors can provide an important degree of stability.

context
In both urban and suburban environments, Vanke favors a centralized clubhouse model for recreation.

qibao, urban
An urban context will likely have alternative facilities available to residents, like the sports facilities nearby Qibao. This opportunity to customize on-site facilities must be balanced with conventional use of the clubhouse as an identity creator. In the urban context, there is also an opportunity for multipurpose spaces that could be used for business or cultural events, and provide additional users and income for the facilities. Open space will be at a premium in urban areas and should be multifunctional for highest efficiency.

shanghai
Senior Center: 24 m²/1k persons indoor, 48 m²/1k persons land
Public Green Space: 2000 m²/1k persons

holiday town
Public Green Space: 12,113 m²/1k persons
Sports and Cultural: 4177 m² total indoor, 6655 m² total land

the jewish community center, san francisco, ca
maintains a sense of religious community identity while being an inclusive pay-for-use facility. Programming serves all generations at appropriate hours, including after-school tutoring, a teen “club,” sports classes, book clubs, singles activities, and senior wellness classes. Fitness hours are long to accommodate many schedules. Generally, sports facilities are available at a fee, social activities are available to members, and spe-
cial events/performances are by ticket for both public and members.

**developer recommendations**

- Flexible spaces
- Lobby-type spaces for everyday social uses and cultural events like performances and wedding parties
- Rooms that can be used for games and meetings
- Gyms for multiple sports (basketball, badminton, volleyball)
- Plazas that can accommodate tables and chairs, as well as performances
- Programming through out facility hours, and hours that accommodate all user types.
- Specialized staff to plan and lead programming
- Partner with firms specializing in facilities maintenance and programming, particularly in the urban context.
- Facilitate informal interactions through opportunities to exchange information and branch off of formal groups, and by providing physical and virtual space.

**municipal recommendations**

Operational support for sites that provide cultural recreation. Design review of planned facilities to minimize duplication of existing district facilities. Requirements for public access to facilities.
SERVICES

value

Diverse and interactive services, including those that satisfy recreational, health (mental and physical), transportation, informational, and educational needs, increase interactions between residents, engages residents in the community, and promotes healthy lifestyles.

goal

Provide a comprehensive package of age-appropriate services that are linked in such a way as to facilitate intergenerational interaction.

user needs

children

Education and play are key components of children's service needs. For example, educational opportunities, such as an afterschool tutoring program, could link children to other generations and engage them in their neighborhood.

parents

Parents may require support networks, including daycare and health services, for their children and elderly parents while they work. Family activities are relevant for this group, as well as more individual services such as family planning and mental health services. Parents may be sources of volunteer engagement, perhaps serving as a contact point for the whole family.

SINK/DINKERS

Needs will likely include more social and transportation related activities. SINK/DINKs and other groups may utilize various online communities offering peer consultation on home improvement, pet care, and other aspects of lifestyle choices.

seniors

Seniors benefit from the services of Community Councils including mental and physical health and social activities.

context

qibao, urban

Urban sites may be too small to efficiently provide all required services on-site. Instead, analysis of existing services should yield strategies for linking residents to regional services.

baima, suburban

Services will be more self-contained, but linkages between developments’ services should be facilitated so that residents are connected to a regional network of services.

current practices/baseline standards

See the tables below.
Case Studies

Boston Chinatown Neighborhood Center, Boston, MA: A multiservice non-profit agency provides an example of how one organization can provide a variety of services, including inter-generational programs, to improve community life. Boston Chinatown Neighborhood Center is funded by foundations and donations, which is of course a very different structure than what might provide such services in China. It provides adult education, child care (where seniors can volunteer), summer programs for children (including adult mentoring), family services (such as counseling and family activities), and recreational activities at low or no cost to residents of the area. Nonprofits like this organization view members of a community as resources and connect residents through appropriate services.

Churches in the U.S. are another example of community-focused organizations that provide support networks and other critical services through volunteer work. Secular volunteer groups such as the City Cares network in the U.S. offer a variety of volunteer activities for a range of individuals. Examples of projects include spending time with sick and elderly and reading programs for young children.

The Bike Station, Millennium Park, Chicago: The Bike Station provides extensive transport related services to meet the needs of various users. It offers bicycle parking, valet for special events in the park, lockers, showers, towel service, bicycle rental, bicycle repair, bicycle tours, a bicycle camp, car sharing, a coffee bar, and internet stations. Membership provides access to all of these services and costs $99 per year or $1 per day. Customers must pay to rent bicycles, including many styles and attachments for children.

Developer Recommendations

Education
» Interactive education: Design open spaces, and playgrounds in particular, to provide an interactive educational environment for children.

Transportation
» Provide convenient links to existing transportation: The Holiday Town shuttle was not a convenient mode of transportation for the residents we interviewed. Other strategies for linking to public transportation may include car sharing or bike rentals.

Health
» Structure comprehensive health services: Health clinics and services should be located within convenient access of homes and clusters of senior housing, but should provide health services for all age groups and strive to engage entire families in health care.

Information
» Provide online community and other forums for resident interaction: Internet and intranet infrastructure.

Service Provider
» Expand reach of Community Council: Vanke can provide infrastructure for a more dynamic Community Council or a new group that takes a more comprehensive approach to service provision.

Municipal Government Recommendations

The government could rethink the role of the Community Council in meeting the needs of all residents. It should also consider making requirements to ensure that all services are provided within certain areas and think about requirements for linkages between services.
the soils of shanghai

Shanghai rests on soils deposited from centuries of river flooding, creating an extremely unstable foundation for a major city to be built upon. These soils, classified as “entsols”, are excellent for agriculture and cultivation, as displayed by the fertile farmland around Shanghai. However, they are very difficult to manage when it comes to urban development.

Within the entsols soil classification, a more detailed naming system exists. Shanghai soils are considered Entisols – Aquents, and are composed of very fine sand to a sandy silt loam having a water table at or near the surface for much of the year. This clearly makes the creation of sub-surface structures and foundations a difficult and costly experience as the soils are prone to constant water saturation. The structure of these soils is a major contributing factor to sinking land all across the city. When combined with the extremely wet rainy season, coping with this geological and hydrological condition is a major issue.

Dealing with stormwater, or all surface runoff that occurs from a rainstorm, is a major component of sustainability. Impervious surfaces, contaminants, and the complex entisolic soils make this fairly difficult, especially in the wake of major urban development. Increased stormwater runoff puts major stresses on rivers and streams of all sizes and contributes to massive flooding and land erosion.

The following pages contain tools to deal with these problems. Images and descriptions of what are known as stormwater ‘Best Management Practices’ display various techniques to reduce the negative impacts of stormwater runoff, leading to more sustainable development. It must be noted that the climate of Shanghai and its wet/dry extremes does affect the compatibility of each of these tools, and further research and study of their applicability is strongly encouraged.

Different techniques for dealing with stormwater runoff should be applied to the suburban Baima and urban Qibao sites. Baima is a development on agricultural fields with areas of saturated soils visible on many parts of the site. Given that this development is lower density, most of the tools can be used around the site throughout its open space networks, next to its buildings, and in combination with its impervious surfaces and parking lots. All tools in the chart are considered effective for Baima, except for those colored with orange backgrounds which should NOT be used because of the extremely high water table described above.

The urban Qibao site is very different in that there will be very little room to incorporate such a variety of stormwater management tools. However, there are many opportunities to be innovative and effective in the treatment of runoff given the amount of impervious surfaces what will be on that site. Potentially, the most effective stormwater management tool for the Qibao site will be the incorporation of porous surfaces and extensive green roofs on structures. Green roofs have been studied extensively in the temperate climates of Europe and North America, but very little if any research exists on their effectiveness in China. The major issue is that they are supposed to deal with extremely dry and stressed environments, whereas China’s wet season could seriously alter their effectiveness and make them non-functional in the treatment of stormwater. If there is any-thing to take from this, it is that Vanke should invest in green roof research in China, much like that below. If so, they will be on the leading edge of a major growth industry that is excellent for treating stormwater.

Further detailed discussion and diagrams of surfaces for treating stormwater at Site 53 can be found within the Qibao chapter in diagrams of our proposed design.

Entisols (Aquents) Soil Classification
-very fine sand to a sandy silt loam
-Aquents - Entisols with a water table at or near the surface for much of the year

The principal criterion for placing a soil into the Entisol order is the absence of organization of soil materials. They show little or no structure or horizon development and resemble material in a pile of freshly screened sand or soil.

They support vegetation that tolerates permanent or periodic wetness. They are used mostly as pasture, cropland, forest, or wildlife habitat.

CITY: SHANGHAI  PROVINCE: SHANGHAI
LATITUDE: 31 DEG 10 MIN N  LONGITUDE: 121 DEG 26 MIN E  ELEVATION: 15 FT

<table>
<thead>
<tr>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
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<tr>
<td>TOT (F)</td>
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<td>48</td>
<td>55</td>
<td>65</td>
<td>74</td>
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<td>LOW (F)</td>
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<td>35</td>
<td>41</td>
<td>51</td>
<td>60</td>
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<td>77</td>
<td>76</td>
<td>69</td>
<td>58</td>
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<td>RAINFALL (IN)</td>
<td>1.6</td>
<td>2.3</td>
<td>3.3</td>
<td>4.1</td>
<td>4.7</td>
<td>6.2</td>
<td>5.5</td>
<td>5.1</td>
<td>6.0</td>
<td>2.3</td>
<td>2.0</td>
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<td>HUMIDITY (%)</td>
<td>74</td>
<td>76</td>
<td>78</td>
<td>79</td>
<td>80</td>
<td>83</td>
<td>83</td>
<td>82</td>
<td>81</td>
<td>77</td>
<td>76</td>
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<tr>
<td>DAYS OF SNOW COVER</td>
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<td>2</td>
<td>0</td>
<td>0</td>
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<td>0</td>
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sources: University of Idaho, The City of Shanghai
extensive green roofs

summary of a rainfall event

Green roofs retain and detain (slow down) stormwater runoff. The graphs below are a compilation of data from research buildings (3 green and 3 non-green) at the Center for Green Roof Research at Penn State located Rock Springs, PA. Spring, 2003 was very wet and cool.

Start: 5/31/03 4:33 am
End: 6/1/03 10:33 am
Duration: 30 hours
Total Time: 51.75 hours
Total Rain: 1.11 inches

Runoff non-green 0.984 +/- 0.075
Runoff green: 0.746 +/- 0.018

Peak runoff total: 0.05 inches/5 minutes
Peak non-green: 0.041/5 minutes (82%)
Peak green: 0.011/5 minutes (22%)

Percent runoff non-green: 88.6%
Percent runoff green: 67.21%

Cumulative total (5/23-6/1): 2.21 inches
Green roof retention: 1.045 inches (47.29%)

vegetated roof covers add financial value to a residential, commercial, governmental, or industrial building by:

» Extending the service life of the roof
» Reducing energy costs
» Conserving valuable commercial space that would otherwise be required to provide stormwater runoff controls
» Increasing property values
» the service life of the underlying waterproofing is doubled - or even tripled - because the vegetative cover
» Protects from mechanical damage (mostly from humans, but also from wind blown dust and debris, and animals)
» Shields from ultraviolet radiation
» Buffers temperature extremes, minimizing damage from the daily expansion & contraction of the roof materials

Extending the service life of the waterproofing not only returns the owner’s investment in the green roof over time, but reduces landfill waste.

This research has been done in the context of the Mid-Atlantic region of the United States. Similar research needs to be carried out for the Shanghai region. New research is necessary and could be broadly applied in Asia.

source: Center for Green Roof Research, The Pennsylvania State University
<table>
<thead>
<tr>
<th>STRUCTURAL BMP</th>
<th>PURPOSE</th>
<th>PHYSICAL LIMITATIONS</th>
<th>TARGETED POLLUTANTS</th>
<th>LOCATION/SCALE</th>
<th>COST</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DETECTION BASINS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>dry extended detention pond</td>
<td>dry between storm events - detain runoff to reduce peak flow - some quality treatment</td>
<td>10-50 acre drainage area max slope 10% min bedrock depth 6 min water table 4 soil types ABC</td>
<td>45% sediment 25% phosphorus, 50 trace metals, 50 hydrocarbons</td>
<td>development, precipit, regional</td>
<td>high; $15-30 per cubic meter of storage volume; annual maintenance @ 3-5% of construction cost</td>
</tr>
<tr>
<td>wet extended detention pond</td>
<td>combines pollutant removal of permanent pool of water with flow reduction capabilities of detention pond</td>
<td>10-50 acre, min bedrock 3', min watertable 2', soils CD, require sufficient land area, 20' min from structure, 100' from water supplies (unless contaminants are in check)</td>
<td>80% sediment, 65% phosphorus, excellent for trace metals, 50 bacteria/hydrocarbons**</td>
<td>development - precipit - regional</td>
<td>high</td>
</tr>
<tr>
<td>sedimentation basin</td>
<td>pretreatment of suspended solids before they enter other BMPs</td>
<td>10+ acre drainage area, min bedrock depth 3', min watertable depth 2', CD soils</td>
<td>60% sediment, 30% phosphorus, some trace metals</td>
<td>small, precipitates of other BMPs</td>
<td>incorporated into accompanying BMP</td>
</tr>
<tr>
<td><strong>VEGETATED FILTER STRIPS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>vegetated filter strip</td>
<td>vegetated strip but pollutant source and stream/pond/wetland - buffer</td>
<td>sheet flow only, grasses exceptional, 5 acre drainage area, min watertable 3', BCD soils, typically 25'-180' long in direction of flow</td>
<td>50% sediment, 59% phosphorus, some metals/hydrocarbon removal</td>
<td>small (p. std)</td>
<td>moderate/ natural vegetation</td>
</tr>
<tr>
<td><strong>INFILTRATION BASINS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>infiltration basin</td>
<td>temporary runoff storage, soluble, particulate pollutant removal.</td>
<td>5-10 acre drainage area, high failure rates, min bedrock/watertable 4' should not be used in sandy soils near water bodies, mosquitoes</td>
<td>soluble and fine particulates</td>
<td>development - regional</td>
<td>high</td>
</tr>
<tr>
<td><strong>MEDIA FILTERS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>compost stabilize filter</td>
<td>not stormwater related, pollution/particulate cleansing</td>
<td>n/a</td>
<td>95% sediment, 45% phosphorus, excellent for metals and oil removal</td>
<td>n/a</td>
<td>high; a new technology</td>
</tr>
<tr>
<td>geosynthetic filter</td>
<td>reinforcement/erosion control, filtration, rapid vegetative cover establishment</td>
<td>n/a</td>
<td>some sediment collection</td>
<td>embankments, swales</td>
<td>low-cost, low-maintenance</td>
</tr>
<tr>
<td>earth retention basin</td>
<td>provide some removal of settleable solids</td>
<td>5,000 s.f. drainage area, maintenance intensive</td>
<td>35% sediment, 5% phosphorus/concrete, filter</td>
<td>n/a</td>
<td>low; comparable to pre-cast inlets</td>
</tr>
<tr>
<td>level spreader</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POROUS PAVEMENT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>porous asphalt</td>
<td>runoff reduction, increased infiltration</td>
<td>min bedrock/watertable depth 1.2 meters</td>
<td>all types effectively reduce 63-95% of sediment, 65% phosphorus and 80-85% nitrogen</td>
<td>parking lots</td>
<td>~$6,000 per hectare (new construction)</td>
</tr>
<tr>
<td>porous concrete</td>
<td>runoff reduction, increased infiltration</td>
<td>min bedrock/watertable depth 1.2 meters</td>
<td>parking lots</td>
<td>parking lots</td>
<td></td>
</tr>
<tr>
<td>porous geosynthetic</td>
<td>runoff reduction, increased infiltration</td>
<td>min bedrock/watertable depth 1.2 meters</td>
<td>parking lots</td>
<td>parking lots</td>
<td></td>
</tr>
<tr>
<td><strong>RETENTION PONDS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bioretention basin</td>
<td>emulates hydrology of upland meadow/forest, most runoff is evaporated, or infiltrated; extremely low runoff, total treatment</td>
<td>1 acre drainage area, min bedrock depth 6', min watertable depth 1', AB soils - 10-25% clay content, 3-5% organic content, pH 7.5-8.5, should not be used in areas with shallow aquifers</td>
<td>90% sediment, 75% phosphorus, excellent removal of trace metals, bacteria, and hydrocarbons</td>
<td>small (phase scale) with multiple in development</td>
<td>low if incorporated into site characteristics and design</td>
</tr>
<tr>
<td><strong>PERCOLATION TRENCHES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>infiltration trench</td>
<td>reduce and filter surface runoff</td>
<td>5 acre drainage area, min bedrock depth 4', min watertable 10'; AB soils should not be used in sandy soils near water bodies</td>
<td>75% sediment, 55% phosphorus, excellent for trace metals, bacteria, and hydrocarbons</td>
<td>residential lot, parking lot</td>
<td>high</td>
</tr>
<tr>
<td><strong>WETLAND BASINS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wet pond (conventional)</td>
<td>maintain permanent water, temp, store storm runoff, slow runoff, good for conventional pollutant clean up</td>
<td>10-20 acre drainage, require sufficient land area, 20' min from structure, 100' from water supplies (unless contaminants are in check)</td>
<td>80% sediment, 45% phosphorus, excellent for trace metals, ox for bacteria/hydrocarbons**</td>
<td>development, mostly non-urban</td>
<td>high</td>
</tr>
<tr>
<td>wet pond (nutrients)</td>
<td>similar to conventional wet pond, but has a shallow marsh forebay for additional nutrient pollutant processing</td>
<td>5-20 acre drainage, min bedrock/watertable depth 2', CD soils, see above</td>
<td>80% sediment, 65% phosphorus, excellent for trace metals, ox for bacteria/hydrocarbons**</td>
<td>development</td>
<td>high</td>
</tr>
<tr>
<td>bioretention basin</td>
<td>constructed wetland on non-wetland site for controlling runoff, pollution, create aesthetic, recreational, wildlife habitat</td>
<td>5-10 acre drainage area, min bedrock depth 3', min watertable 2', CD soils, avoid excessive water level fluctuations, 1/3 runoff volume of 2yr storm</td>
<td>75% sediment, 55% phosphorus, excellent for trace metals, bacteria, and hydrocarbons, ox for bacteria**</td>
<td>development to regional, including urban if space available</td>
<td>high but effective</td>
</tr>
<tr>
<td><strong>WETLAND SWALES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>biofiltration swale</td>
<td>removes pollutants, reduces flow velocities, curbs/pavement storm sewer replacement, enhances infiltration slightly</td>
<td>15 acre drainage, erosion resistant vegetation, min bedrock depth 3', min watertable depth 2'; BCD soils, max slope 6%</td>
<td>65% sediment, 15% phosphorus, some effect on trace metals and hydrocarbons</td>
<td>small (p. std), street scape, to regional</td>
<td>low -- less than normal curb/storm sewer on average, $15-30 per linear meter; annual maintenance ~ $42 per linear meter</td>
</tr>
<tr>
<td>biofiltration swale</td>
<td></td>
<td>5 acre drainage, min bedrock depth 6', min watertable depth 10'; AB soils, max slope 6%, 5-7% size of impervious area draining to it, soil depth 4', several small interventions</td>
<td>75% sediment, 30% phosphorus, excellent for metals and hydrocarbons, some effect on bacteria</td>
<td>small (p. std), street scape, to regional</td>
<td>moderate</td>
</tr>
<tr>
<td>bioswale</td>
<td>to infiltrate the first half-inch of storm runoff from impervious surfaces, pollution removal</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
examples of the stormwater management ‘tools’ found in the chart above

source: water sensitive urban design, www.wsud.org
the developable zones of the Baima site should be thought of as self-contained stormwater parcels, retaining 100% of their runoff potential within their borders.

On average, 3% of the each individually measured area should be devoted to infiltration techniques to accomplish this.
Urban Networks and Systems

Qibao Neighborhood and Site 53

Sustainability reaches beyond simply dealing with stormwater. The urban setting of Site 53 provides many opportunities to link up and respond to its surrounding environment. Many systems and networks must influence the design of site 53, and it must also adapt to these regional networks pushed into new directions.

The following images and methods deal with the interface between site 53 and its larger Qibao neighborhood should be conceptually be thought about, seeking constant reinforcement between the two.

Located Context

This includes the allocation/siting of services and commercial activity, as well as proximity to the historical amenity of Qibao old town. Consider the location of public/commercial facilities to entice flow in and through the neighborhood, not just site 53.
regiona

CANAL SYSTEMS

Look at the extensive canal systems as a regional amenity - plan for ecological remediation that can immensely contribute to the values of adjacent properties. Use these as “green spines of the public realm” to connect separate sites. Work with local governments to remediate water to swimmable levels. These images to the left show both good and bad examples of canal treatments around Qibao.

The top left image is the intersection of the main canals between Old Town and the Pagoda Park to the east. These two areas should be connected. Furthermore, you can see that there is a path of desire connecting the north and south sides of Old Town that should be turned into a bridge that would also allow the tourist boats to pass through.

The next image down shows a very pleasant canal treatment west of Old Town. This demonstrates that it is possible to build pedestrian access in the canal itself which does not affect the privacy of the development.

The second image from the bottom is the path of the proposed greenbelt park along the canal at a section just north of Caobao Lu. There is an existing pathway that is well- utilized but it is private and not connected to the main street or to the development to the south.

The bottom image shows an excellent example of a canal pathway just east of the Pagoda Park. Note how it provides access while not connection while not affecting privacy in the developments.

Examine street sections and traffic flows to design a list of treatment types. Consider the separation of pedestrian/bicycle/vehicular modes at points of massive congestion (via pedestrian bridges, etc.). Coordinate stoplight systems at a much more advanced level.
BUILDING SYSTEMS
Our strategy for developing a building systems program for the sites was to create a toolkit of options that we could use for developing building systems for any primarily residential site. Our first step was to develop a toolkit of technologies. Through some basic research on building systems used in China and in other parts of the world, we developed some knowledge about different sustainable building technologies. These are presented in our toolkit on the left, and these same graphics will be continued through the building plans of the site. We did not include in-depth information about the different technologies, because each must be studied in depth in the Chinese context to determine if they would be right for each site.

Next we developed four key values that can be used to evaluate any building systems decision made about any site: energy conservation, water conservation, materials conservation, and flexibility. Next, we examined the different typologies used by Vanke to get some idea of what types of sustainable building typologies would be suitable in the Shanghai climate, we determined that roof space could be best used for rainwater catchment systems, and finally we developed some basic metrics to explore the rainwater catchment possibilities of different building typologies in Shanghai.
### The “Medium Road”
- Lessening site impact on the environment.
- Incremental steps toward sustainability.
- Looking ahead to resource constraints in 10 years.
- Make 25% of residential space convertible to live/work spaces.
- Provide options for future changes in unit size/amenities and overall site density.
- Design units for an electricity demand of 6000 kwh/unit/year or less.
- Integrate solar thermal energy collection on building facades.
- Reduce consumption by 1/3 by introducing low-water usage appliances.
- Recycle gray water for use in toilet flushing in all units.
- Collect rainwater on rooftops of high-rise and mid-rise units for landscape irrigation.

### The “High Road”
- Pursuing site autonomy.
- Reversing climate change.
- Looking ahead to resource constraints in 50 years.
- Provide clean industry and offices within the neighborhood for shorter commutes.
- Provide amenities for telecommuters like rentable on-site office space.
- Use building rubble and wood chips walls for constructing townhouse and villa units.
- Collect rainwater on rooftops of high-rise and mid-rise units for landscape irrigation.
- Use dry or composting toilets in townhouses, villas, and mid-rise units.
- Recycle and filter rainwater for potable household use.
- Use of photovoltaics integrated with rainwater catchment on rooftops.
- Integration of on-site wind turbines.
- Net energy usage of 2000 kwh/unit/year of less (cooking only).

### Materials
- Use 100% alternative concrete (low fly ash, etc.)
- Use pre-fabricated elements whenever possible to reduce building waste.

### Post-Occupancy Waste
- Provide recycling depots and on-site composting facilities.
- Provide on-site collection and processing of all recyclable or compostable waste.

### Construction
- Reduce consumption by 1/3 by introducing low-water usage appliances.
- Collect rainwater on rooftops of high-rise and mid-rise units for landscape irrigation.

### Energy
- Use 100% alternative concrete (low fly ash, etc.)
- Use pre-fabricated elements whenever possible to reduce building waste.

### Water
- Use 100% alternative concrete (low fly ash, etc.)
- Use pre-fabricated elements whenever possible to reduce building waste.

### Two possible programs for sustainability
values

The four values that we use for evaluating site systems are materials conservation, energy conservation, water conservation, and flexibility. Materials conservation refers to conservation and recycling of materials in both the construction process, and encouraging recycling once residents are on the site. Water and energy conservation are first about creating efficient units that do not require high inputs for comfort, and secondarily, are about integrating new alternative energy and water sources that reduce dependence on resources. Flexibility is key because buildings that can be used for a longer time do not require resource-intensive redevelopment as often.

building typologies

To begin to explore the building typologies used by Vanke. We then developed two hybrid typologies that would create variety for consumers, as well as had high unit efficiencies and long continuous façade areas — important to many sustainable technologies.

evaluating building typologies by our values

Our next step was to evaluate different building typologies by properties by their performance in accordance with our values, as is seen in the chart on the following page. This evaluation does not mean that one particular typology is “worse” than another, but that each has different constraints that may affect the particular mix of buildings one may want to put on the site. For example, units with a higher amount of floor area on the ground floor could be considered more flexible, due to their suitability for conversion to other uses. Villas are less efficient in terms of the number of people that can be housed on the site, but can be constructed with alternative materials that cannot be used in the construction of higher-density buildings, and because of their high percentage of roof area, provide fertile opportunities for rainwater harvesting. High-rises have less area for rainwater catchment, but the efficiency of plumbing infrastructure is much greater. Each of these trade-offs should be evaluated in the mix of the buildings on the site.

### Interesting Metrics for Traditional Building Typologies

<table>
<thead>
<tr>
<th></th>
<th>Hi-Rise</th>
<th>Mid-Rise</th>
<th>Walkup</th>
<th>Townhouse</th>
<th>Villa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floors (above grade)</td>
<td>18</td>
<td>12</td>
<td>6</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Units</td>
<td>72</td>
<td>48</td>
<td>24</td>
<td>16</td>
<td>2</td>
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<td>Short axis (m)</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>14</td>
<td></td>
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<tr>
<td>Long axis (m)</td>
<td>36</td>
<td>40</td>
<td>48</td>
<td>60</td>
<td>14</td>
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<tr>
<td>Roof area (m²)</td>
<td>432</td>
<td>480</td>
<td>576</td>
<td>720</td>
<td>196</td>
</tr>
<tr>
<td>Façade area (m²)</td>
<td>5184</td>
<td>3744</td>
<td>2160</td>
<td>1728</td>
<td>336</td>
</tr>
<tr>
<td>Long axis façade(m²)</td>
<td>1944</td>
<td>1440</td>
<td>864</td>
<td>720</td>
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</tr>
<tr>
<td>Assignable area(m²)</td>
<td>6609.6</td>
<td>4896</td>
<td>2937.6</td>
<td>2448</td>
<td>333.2</td>
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<tr>
<td>Avg unit area(m²)</td>
<td>91.8</td>
<td>102</td>
<td>122.4</td>
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<tr>
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<td>7776</td>
<td>5760</td>
<td>3456</td>
<td>2880</td>
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<tr>
<td>Total inhabitation</td>
<td>216</td>
<td>144</td>
<td>72</td>
<td>48</td>
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### Hybrid Typologies

<table>
<thead>
<tr>
<th></th>
<th>Walkup-Townhouse</th>
<th>Palanzina</th>
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<tbody>
<tr>
<td>Floors (above grade)</td>
<td>6</td>
<td>4</td>
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<tr>
<td>Units</td>
<td>24</td>
<td>8</td>
</tr>
<tr>
<td>Short axis (m)</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>Long axis (m)</td>
<td>60</td>
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<tr>
<td>Roof area (m²)</td>
<td>720</td>
<td>336</td>
</tr>
<tr>
<td>Façade area (m²)</td>
<td>2592</td>
<td>912</td>
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<td>Long axis façade(m²)</td>
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<tr>
<td>Gross area(m²)</td>
<td>4320</td>
<td>1344</td>
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<tr>
<td>Total inhabitation</td>
<td>72</td>
<td>24</td>
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Shanghai Monthly Rainfall Capture in Cubic Meters

<table>
<thead>
<tr>
<th></th>
<th>Hi-Rise</th>
<th>Mid-Rise</th>
<th>Walkup</th>
<th>Townhouse</th>
<th>Villa</th>
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<tbody>
<tr>
<td>Roof Area</td>
<td>432</td>
<td>480</td>
<td>576</td>
<td>720</td>
<td>196</td>
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<td>Avg. Rainfall</td>
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<tr>
<td>Jan</td>
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<td>Sept</td>
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<td>Dec</td>
<td>41</td>
<td>16</td>
<td>18</td>
<td>21</td>
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<tr>
<td>Total</td>
<td>385</td>
<td>428</td>
<td>513</td>
<td>642</td>
<td>175</td>
</tr>
</tbody>
</table>

Source of Rainfall Data: Shanghai Municipality Website

Water Usage for Different Building Types (in cubic meters)

<table>
<thead>
<tr>
<th></th>
<th>Hi-Rise</th>
<th>Mid-Rise</th>
<th>Walk Up</th>
<th>Town House</th>
<th>Villa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toilet water usage</td>
<td>5,400</td>
<td>3,600</td>
<td>1,800</td>
<td>1,200</td>
<td>150</td>
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<tr>
<td>Other water usage</td>
<td>24,840</td>
<td>16,560</td>
<td>8,280</td>
<td>5,520</td>
<td>690</td>
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<tr>
<td>Graywater recycled</td>
<td>22,356</td>
<td>14,904</td>
<td>7,452</td>
<td>4,968</td>
<td>621</td>
</tr>
<tr>
<td>Rainwater harvested</td>
<td>385</td>
<td>428</td>
<td>513</td>
<td>642</td>
<td>175</td>
</tr>
<tr>
<td>Shortfall</td>
<td>7,499</td>
<td>5,256</td>
<td>2,628</td>
<td>1,752</td>
<td>219</td>
</tr>
<tr>
<td>Piped water required</td>
<td>8,549</td>
<td>5,992</td>
<td>2,996</td>
<td>1,997</td>
<td>250</td>
</tr>
<tr>
<td>% Demand met on-site</td>
<td>75%</td>
<td>76%</td>
<td>79%</td>
<td>83%</td>
<td>95%</td>
</tr>
</tbody>
</table>

Assumptions:

- Total per-cap Usage: 140
d- Graywater/cap (m³): 115
- Blackwater/cap (m³): 25
- Annual Rainfall (mm): 1200
- Recycling efficiency: 0.9
- Rooftop capture eff: 0.75
- Piped water leakage: 0.15
- Shang per cap usage: 653

The facades and especially rooftops of buildings are important components for many sustainable interventions. Roofs can be used for green roofs, for solar water heating, and for rainwater catchments, and often a combination of the three. Due to the heavy rainfall in Shanghai and Shanghai's particular shortage of freshwater, we felt that rainwater catchment would be the best use of our rooftop space. The table below shows the rich possibilities for rainwater catchment in different building typologies.
BAI MA
The Bai Ma site is located in the district of Songjiang, on the Southeast outskirts of Shanghai, X km from the city center.

Although currently a quiet suburban area, the site is located along a major growth corridor being planned by the municipal authorities. Commercial expansion and a planned increase in transportation infrastructure could lead the area to a major increase in density, as the population of Shanghai continues to spread and expand across the city.

Along with its proximity to Shanghai, the site is located near the growing new town of Songjiang city, home to several universities, as well as an industrial zone that has successfully drawn several electronics manufacturing facilities. The site is only a few kilometers from the growing town of QiBao, where the other site considered by this studio is located.

Although now an area of formless residential sprawl, we believe that the increased attractiveness of the area will probably cause the area around Bai Ma to look more like Qi Bao in the coming years. Our plan attempts to respect the current suburban environment of the area, while anticipating a rapid shift toward a more urban context.
The Bai Ma site is located about 20 kilometers from a station on the planned high-speed train line between Shanghai and Beijing, and approximately 7 kilometers from the nearest Shanghai Metro station. Because the area is of low density, it can only support extremely limited bus service, leading to a “last mile” problem for those who commute by public transport. With higher population density, the site and the surrounding area will probably be able to support improved transit links to the subway, similar to those found around Holiday Town.

Bai Ma is also poised to accept be attractive to the increasing number of Shanghai residents who drive. The site is currently outside the Xth Ring Road, and will be located near what will be a major thoroughfare between a new proposed highway and the Ring Road.

The site itself is bisected by a major roadway, leading the site to often feel like two distinct parcels. Whether to consider these two parcels separately or to bridge this gap is one of the major challenges that the site
**immediate surroundings**

The Bai Ma site is a greenfield development built on land that until recently contained a farming village. To the North of the site is new housing built independently by local farmers, to the South of site is and to all other sides, there is either planned or existing villa-style development.

The area is a patchwork of development from different developers, built in radically different styles. The developments are all gated, and do not relate to each other at all. The only commercial services within walking distance are found at a nearby farming village that will soon be relocated for more villa development.

Another interesting feature of the site are the series of agricultural canals that run through the entire area. The canals connect to a major navigable waterways, making them a possible conduit for connections between communities, recreation, and possibly, transportation.
PROCESS

Through the course of this semester, this studio has planned the Bai Ma site through a three step process:

Identification of site and current plan (Vanke Scheme) challenges and shortcomings

Preparation and evaluation of a plan that could be enacted immediately, providing moderate improvements within the existing framework (Enhanced Vanke Scheme)

Preparation of a flexible, phased development plan that resolves the challenges of the Yanke and Enhanced Vanke Schemes (Phased Scheme)

The Vanke Scheme is typical of suburban housing development plans in Shanghai. It provides context for subsequent schemes, as well as a baseline of sustainability by which to measure the schemes’ improvements. The Enhanced Vanke Scheme serves two purposes. First, it provides obvious improvements to the Vanke Scheme that can be easily implemented. It does not involve long-term evaluation of the site or serious reconsideration of the Vanke scheme. Second, it provides a benchmark for a more thoughtful, progressive development plan for the site (Phased Scheme). The Phased Scheme is a long-term approach to the development of the Bai Ma site that more aggressively pursues ecological, economic, and equitable sustainability. It responds to real estate values and resource scarcity in its timing and technology. The studio’s Program Group recommendations for site systems, building systems and technology, and community were used to evaluate and shape the Enhanced Yanke and Phased Schemes.

Phase I

- Soil Remediation
- Waterways Restoration
- Managed Open Space
- Infrastructure
- Retail, Rental

Market Trigger: 2x real estate values

Resource Condition: 24 Hr Water Service
- Electricity Costs @ 2x

Phase II

- Continue Remediation, Restoration
- Increase Density, Activity at Center
- For Sale, Partial Build Out
- Additional Retail
- “Middle Road” Systems

Market Trigger: redevelopment in surrounding area

Resource Condition: 24 Hr Water Service
- Electricity Costs @ 2x

Phase III

- Full Site Build Out
- High Density For Sale
- “Middle Road” Systems

Full Site Build Out
- High Density For Sale
- “High Road” Systems

Full Site Build Out
- High Density For Sale
- Majority of inputs generated on-site
THE VANKE SCHEME

Vanke purchased the Bai Ma site and inherited the existing units on the Northwest corner of the site from another developer. With Vanke’s complete build-out plan, the site would have a population of about 6,100 residents, 3,700 square meters of retail, 8,360 square meters of community space (including a kindergarten), and approximately 35% of the site reserved as open space. The Bai Ma units are targeted at lower-middle-class households.

SCHEME SHORTCOMINGS

The Vanke scheme could be improved in several ways. Although over 100 units have been sold, only about a dozen are occupied. Because of the end of the speculative market, the new customers for Bai Ma are potential residents looking to move in immediately.

The site poses several challenges, and, as designed, as several shortcomings, including:

» The site is marketed at a demographic that does not yet have high car ownership, yet there are poor transportation connections to nearby retail options and Shanghai.

» Extensive bicycle infrastructure is provided outside the site, but there is no infrastructure for internal bicycle circulation.

» The hard boundaries around the site make it unattractive from the outside, and decrease resident connections with nearby areas.

» There are few retail options in the surrounding area, and there is no town center in the development, increasing the sense of isolation in the environment.

» The underground parking is threatened by the high water table.

» Although the developer considers the site a single development, there is little connection between the two sides of the development.

» In our interviews, at Holiday Town, many residents felt a sense of community within their small group of buildings. Due to the monotony of the site plan, there are no “subcommunities” within the current Bai Ma scheme.
ENHANCED VANKE SCHEME

Our first step in looking at the site was to develop a scheme that kept the basic metrics of Vanke’s scheme, but made some improvements to the shortcomings noted previously. With these shortcomings in mind, we developed what we called the “Enhanced Vanke Scheme.” While not an ideal plan, this initial strategy for looking at the site this way allowed us develop a few ideas about what could be easily changed.

The Enhanced Vanke Scheme provides an immediate alternative to the Vanke Scheme. It makes obvious and easy-to-accomplish improvements to site systems, buildings, and community.
APPRAOCH TO PHASING

Phased plans often use chronological benchmarks, or triggers, to initiate phases. Within the framework of China’s fast-growing economy, increasing energy demand, extensive greenfield development and urbanization, stratifying society, and its emerging role in global markets, it is difficult to predict appropriate years at which to initiate phases at Bai Ma with any certainty. Instead, real estate values and resource pricing have been used as demand indicators to initiate phases. (This approach is in line with Real Options Theory valuation of the development rights.)

starting out

Phase I would be undertaken immediately to invigorate the existing Bai Ma community and begin soil remediation and waterways restoration. Given that current sales are slow and Vanke does not have to pay property taxes, it is reasonable to assume that they could delay full development of the site. This would allow for remediation and restoration work, as well as appreciation of land value.

leveraging market conditions

Phases II and III would be triggered by market conditions in the surrounding area. Using market conditions and financial indicators to initiate subsequent phases would allow Vanke to avoid slow sales and lower-than-expected prices. This is a significant shift from the Vanke Scheme, which relies on investor speculation for sales and has faltered under recent government regulations that limit speculative investments.

responding to resources

Once a phase is triggered by an economic condition, current resource availability and pricing would determine the technology used to develop the housing needed to respond to market conditions. If resource the outlined resource criteria are met, more aggressive “high road” technology is implemented. The Phased Scheme outlines one site plan per phase, with sufficient flexibility to accommodate all levels of technology.

utilizing the building systems toolkit

The Building Toolkit, created by the Building Systems Program Group, outlines low and high road strategies, and provides specific technologies to achieve each strategy (the “tools”). These tools have been pulled from the toolkit to illustrate the technologies employed in each phase.

Phased Scheme

The Phased Scheme that follows demonstrates the most resource-restricted scenario.

Phase I

Resource Condition: 24 Hr Water Service
- Electricity Costs @ 2x
- UNMET

Market Trigger: Two times the current Bai Ma real estate values is comparable to current real estate values outside Qi Bao Town.

Phase II

Resource Condition: Further Limited Water Availability, Prohibitive Electricity Costs
- UNMET

Market Trigger: redevelopment in surrounding area

Continue remediation, restoration
- Increase Density, Activity at Center
- For Sale, Partial Build Out
- Additional Retail
- “Middle Road” Systems

Phase III

Resource Condition: 24 Hr Water Service
- Electricity Costs @ 2x
- MET

Full Site Build Out
- High Density For Sale
- “High Road” Systems

Redevelopment of the surrounding low density housing will signal that the market is ready for higher density housing. Vanke should initiate this phase as soon as nearby redevelopment begins to avoid the possibility of a saturated market later on.
phase one

Phase I responds to Bai Ma’s lack of identity and inability to draw residents by creating a central node without over-building. The development of a town center along the east-west arterial road is prioritized as a way to define a Bai Ma identity.

The town center includes a vibrant court where an urban waterscape interfaces with the clubhouse (community/athletic center). Wide, patterned pedestrian street crossings connect this active area to retail and services on the southern side of the site. The first retail buildings are large enough to accommodate a grocery store and have a significant street presence. Visible surface parking makes access easy for non-residents, increasing the customer base. Urban water re-emerges on this side, creating a more pleasant central area.

This new commercial center is supported by a variety of additional housing types that make Bai Ma attractive to a variety of homeowners and renters. As part of the town center, studios, similar to the A-Nesting building at Holiday Town, reinforce the urban street character.

The retail buildings are engineered to facilitate additional floors in anticipation of future demand for office space and housing. The retail and studio buildings wrap around structured parking.

Undeveloped land, held as an investment for later development, can be leased for sustainable agricultural uses. Remediation work on the canals and surrounding area will be initiated for current and future open space.

<table>
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<tr>
<th>phase one</th>
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<td>flats</td>
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<tr>
<td>studios</td>
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</tr>
<tr>
<td>commercial</td>
<td>12,000</td>
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<tr>
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<td>6,500</td>
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<table>
<thead>
<tr>
<th>phase one</th>
<th>total square meters</th>
</tr>
</thead>
<tbody>
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<td>42,370</td>
</tr>
<tr>
<td>commercial</td>
<td>12,000</td>
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<tr>
<td>units</td>
<td>292</td>
</tr>
<tr>
<td>residents</td>
<td>877</td>
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</tbody>
</table>
phase one massings

site systems

In Phase I, the site plan that will carry the site through future changes is established. The canals are remediated and cleaned to prepare for their role as recreational spots and stormwater management features. Site infrastructure, such as future roadways, are laid out. After this basic infrastructure is established, the undeveloped part of the site can be leased back to farmers for sustainable agricultural practices, including the cultivation of bamboo or poplar to be used as biofuel.

The road infrastructure is developed with two goals - creating easy access for vehicles moving between residences and the outside of the site, and minimizing interference with the canals. Automobile connections between residential units on the site are discouraged through a road system that does not provide arterial automobile connections between the quadrants of the site. Intra-site transport is expected be by walking or by biking. Residents that choose to drive between different residential units on the site will be encouraged through this street design to use the public roads outside the site, maintaining a quiet, private atmosphere inside.

In addition to road infrastructure, the future energy infrastructure of the site is also established. Along with roads, the infrastructure for cooling and heating through a regional boiler system is developed. The boiler can burn biofuels, but can later be converted to other fuels. Although with the limited build out of the site regional cooling and heating will not yet accrue economies of scale, creating the infrastructure at this stage looks forward to the time in the future when this becomes more feasible with increased density, and eventually to a time when Vanke can act as a regional provider of heating and cooling for the entire local area.

Landscaping is provided by cultivated fields of poplar or bamboo that can be utilized as biofuels.
Buildings in phase 1 are designed for maximum flexibility. The town center is designed with a structure capable of supporting additional residential towers above. Roof systems are designed to be green spaces in the future.

Rental units are clustered around the town center. The 4-walk up low rise was chosen the main housing building type. Its flexibility lies in its appeal to all ages of occupants, proximity to green space and parking, and ample outdoor spaces. Its utilization of passive ground coupled cooling, natural ventilation, high thermal mass make ensure that it uses less energy for heating and cooling. The balcony system offers passive solar access and summer time cooling, while the roof system is set up for rainwater collection. Because there are no elevators or required mechanical ventilation, the stand by energy required is low.

The infrastructure is laid into place for the distribution of hot and and chilled water from a central plant. On-site treatment of sewerage begins in biofiltration berm zones on the western site perimeter.
Phase One Massings

Community

Phase One is a critical step in creating a sustainable community at Baima. The town center’s retail and services may need to be subsidized initially, as they are at other Vanke developments. The early buildout of convenience retail, such as food stores, and services for the surrounding area, are important pieces to creating a sense of place that draws in residents and attracts customers from other nearby developments.

Transportation will continue to be a concern. Ample parking should be provided as car ownership and use is expected to increase in the short term. Alternatives, such as shuttle service to mass transit and car sharing should also be provided. Perimeter bike routes will meet up with the existing bike lanes on major roads. This will initiate a cycling hierarchy that will encourage local biking.

Open space, both landscaped in its final form and as leased agricultural land, must be promoted as an attraction and valued by residents. Vanke can use the open space as a lifestyle marketing tool, and as an educational tool to promote sustainability.

The key concern with security is to maintain the appearance of a distinct secure site that meets residents’ psychological needs. This can be done with light fences and keyed gates along the canals and landscaped burns along major roads. Car entrances can be equipped with card-reader access and guard gates allowing flexibility between these two systems, as well as the potential to remove both. (See drawing in Phase Two.)

Bus stop centrally located to serve retail and community spaces. Cooperative community shuttle connects to other developments and subway.

Services programming should respond to the Baima population. Vanke can use surveys at Baima and other developments to determine specific resident needs and ensure that residents will participate in services provided. Phase One is an excellent opportunity for Vanke to find and/or train a professional service provider.

Studio apartments targeted at students from nearby colleges, young professionals, and older parents locating near children and grandchildren.

Two story convenience retail with surface parking to attract through traffic. Destination services such as healthcare clinics and local community council office located on the second floor.

Programming at clubhouse to be determined by resident need and guided by community programming recommendations.

Decorative, textured paving slows traffic and indicates pedestrian right-of-way.

Perimeter bike path connects to arterial bike lane.

Children’s outdoor area with separate play equipment for toddlers and older children to encourage physical development. Small hard surface areas for ball games. Benches for parents.
Phase II is triggered by a doubling of the real estate values in the Bai Ma area. It primarily adds housing on the northern side of the site. A small amount of commercial space is added to expand retail opportunities.

Housing continues to maximize solar access, and is organized around the improved canals and open quads. The combination of flats and rowhouses accommodates multi-generational families that wish to live close to each other, but not in the same unit. The live/work units along the east-west arterial are targeted towards young professionals and entrepreneurs. These households help create a vibrant atmosphere near the town center and may eventually move into flats or rowhouses as their families grow.

Building clusters are loosely bounded by internal streets and parking areas. Each building cluster shares a small, more private open space, and has access to a canal. These clusters promote community interaction on a smaller, more intimate scale, which should be considered in the design of individual buildings and entries as well.

The new commercial space completes the urban waterscape courtyard with leisure retail. Restaurants and coffee shops can provide outdoor seating. The proximity to the clubhouse and athletic fields allows parents and grandparents to watch children at play.

A diversity of open spaces provides a wide variety of recreational options for residents. The meandering path on the center island of the western canal provides public access through the site during the day without compromising resident security. It passes through the town center as it connects the northern and southern canals. The paths and open space along the northern portion of the western canal are landscaped to provide a tranquil walking experience. Outdoor seating and tables are provided for small gatherings and games, which are popular with the older generations. An extended green can be used for tai chi and larger gatherings, and transitions to the urban waterscape and athletic fields. As the canal emerges from the town center on the southern side of the site, the surrounding area provides play structures and open spaces for children.

<table>
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<tbody>
<tr>
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<tr>
<td>flats</td>
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<tr>
<td>live/work</td>
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<tr>
<td>commercial</td>
<td>4,100</td>
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<table>
<thead>
<tr>
<th>phase two</th>
<th>total square meters</th>
</tr>
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<td>residential</td>
<td>198,370</td>
</tr>
<tr>
<td>commercial</td>
<td>16,100</td>
</tr>
<tr>
<td>community</td>
<td>6,500</td>
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<tr>
<td>units</td>
<td>1,368</td>
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<tr>
<td>residents</td>
<td>4,104</td>
</tr>
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</table>
In Phase II, some of the land leased for agriculture is brought into development. The site systems are enhanced to respond to the increased density of the area by introducing a public pedestrian walk through the western side of the site, connecting the retail town center with the canals to the North and South of the site. The privacy and security of the residential areas is ensured with a separation of this path from the residential areas using the water feature itself, creating a sense of privacy and a sense of public vibrancy at the same time.

As the canals become major focal points for the development, Vanke should be leading the way in working with other developers and district officials in actively managing the water quality of the canals, and preserving their use as open space. This development preserves a 50-meter setback from the major canals. By being the first developer to take this step, Vanke can show leadership in developing the canals as major amenities, and should lobby government officials and create partnerships with other developers to monitor water quality, create connections between developments, and ensure public access within 50 meters of the canals.
Phase two massings

Building systems and typologies

Phase two adds more of the 4 story walk-up and row house building types. A key feature of both of these is the balcony zone which is designed for reconfiguration. By utilizing a steel structure in this area, components of the building façade may be reconfigured at a later point. Building occupants may choose to fit-out their balconies in a variety of ways. For example, one owner might choose to purchase a glass solarium, while another may prefer a screened-in porch with wood shutters. The increasing cost effectiveness of owner installed and operated solar thermal and photovoltaic façade panels are also accommodated in this system. As technologies become more affordable, panels can be purchased from a manufacturer under contract with the development to provide façade-integrated panels for harvesting solar energy.

The balcony zone also allows for plant life to be incorporated directly into the façade of the buildings. Plants offer a natural shading system and cooling effect (through transpiration) for the units beyond.

In phase II the central mechanical plant begins to integrate biomass as a fuel source for generating hot water, and chilled water. The chiller energy consumption is reduced by the utilization of a ground source heat exchanger integrated into the wetlands of the site.
Phase Two builds on the community infrastructure of Phase One.

Additional landscaped quads provide new opportunities for residents to enjoy the outdoors. There are specific areas for young and old children, as well as walking paths and outdoor seating for seniors.

The town center expands in square footage. Distinct pedestrian crossings, at traffic lights, allow shoppers to easily cross between the two sides of the street. Second floor services, including the local Community Council, health care, and management offices are above ground destinations. The urban waterscape is enhanced by sidewalk cafes, which provide parents and grandparents places to rest and watch their children at play on the athletic fields.

Inter-development coordination can be strengthened through cooperative shuttles that stop at a number of developments as well as services, shopping, and transportation. Inter-development athletic leagues and events, organized through the clubhouse, can also promote interactions.

Recreational bike paths along the canals enhance larger community connections, and options for physical activity. Opportunities for alternative transportation are increasingly important and appropriate as density increases and energy resources decrease.
Full site build out is achieved in Phase III. The original, existing housing is replaced with more efficient, higher-density buildings. Additional floors of housing are added above retail buildings to expand housing options, and to create more of an urban feel.

High rises, responding to the higher density of the area, are located on the northeastern edge of the site to preserve existing sunlight penetration. Luxury triplexes, along the northern and the southern canals, provide high-value, private units. The live/work lofts in the center of the site may be converted into retail, depending upon demand.

Because of increasing density, a bus rapid corridor may enter the arterial road running through the site. Planning for a major BRT station on the site can solidify the role of the site as a major hub of retail and recreation in the area. Due to increased pedestrian traffic, an overhead crosswalk may become necessary, connecting the bus station with retail, residences, and open space across the street.

The school is located on the northwestern corner of the site. This location is a private atmosphere for learning, and avoids traffic and access conflicts with the residential development. The nearby path connects the school to the town center and clubhouse, as well as providing pedestrian and bicycle connections to homes and open space. The canal near the school can be used for educational purposes and will include an interpretive center and boat rental.

The canals become active recreational waterways through docks and overlooks provided on each quadrant of the site. The dock at the southwestern quadrant, near a site entrance, is developed as the most active, public node, with possibilities for cafes and boat rental. Other nodes can be established as the popularity of the site as a water recreation destination increases.

<table>
<thead>
<tr>
<th>phase three</th>
<th>sq. meters added</th>
</tr>
</thead>
<tbody>
<tr>
<td>townhomes</td>
<td>10,000</td>
</tr>
<tr>
<td>rowhouses</td>
<td>40,000</td>
</tr>
<tr>
<td>highrise flats</td>
<td>50,000</td>
</tr>
<tr>
<td>flats</td>
<td>80,000</td>
</tr>
<tr>
<td>commercial</td>
<td>6,000</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>phase three</th>
<th>total square meters</th>
</tr>
</thead>
<tbody>
<tr>
<td>residential</td>
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<tr>
<td>commercial</td>
<td>22,100</td>
</tr>
<tr>
<td>community</td>
<td>6,500</td>
</tr>
<tr>
<td>units</td>
<td>2,609</td>
</tr>
<tr>
<td>residents</td>
<td>782</td>
</tr>
</tbody>
</table>
Density in the form of high-rise development is added to the new buildings on the Eastern side of the site and in the core, maintaining sun exposure for earlier buildings, and creating more of an urban feel in the town center. Low-density units near the canals become high-value, private units ideal for large families. A bus rapid transit corridor becomes possible with the added density. A major station at the Bai Ma site solidifies the development’s role as a major hub of retail and recreation in the area.

At this stage, increased density on the site, as well as in the surrounding neighborhood, makes regional cooling/heating extremely cost-efficient due to increasing economies of scale, and creates the potential for expanding service to other nearby developments. At this point, Vanke will be in an ideal position to provide heating and cooling to nearby residences, capitalizing on an increasing demand for comfort from residents as overall living standards increase.

Hi-rises are placed on northeastern side of site to allow maximum sunlight to other units.

Bus Rapid Transit stop along new, high-density corridor New pedestrian traffic demands possibly require an overhead crosswalk to the retail across the street. (photo: State of Maryland website)

View looking South: urban water feature creates a hardscape plaza area perfect for coffee shops, elderly recreation, leading to more natural canal environment further along the canals.

Canal dock becomes an active node, inviting possibility of water transport between communities.

School has its own entrance to separate development and school traffic.
phase three massings

building systems and typologies

energy

The hi-rise building type is added in phase III. The building systems accommodate enhanced natural ventilation through the incorporation of air inlets and open vestibule spaces. Stand-by energy is conserved by using stack ventilation, low horsepower elevator systems, and daylight in building common corridors.

In some locations the hi-rise building type is built directly above existing commercial space. In this case areas behind the buildings are converted into construction staging areas. The construction sequence for later is integrated into the initial site plan.

Triplex luxury villas are added in the areas adjacent to the green belt. These lower building types ensure that sightlines from taller buildings to the canals on both the north and the south are maintained.

If it is economical to do so, a combination-fuel turbine is added to the central mechanical plant. This element adds the possibility of on-site electrical power generation with utilization of the waste heat produced in the process for building heating and cooling systems ( cogeneration). Two new bio-filtration berms are added to the eastern perimeter of the site.
Phase Three realizes full build out and a robust development and area community.

The school is located to take advantage of the canal and dock as a learning resource. Its separate entrance reduces traffic strain on the residential development. The main public path connects the school to the clubhouse, enabling students to move back and forth for activities during and after school.

A dock and interpretive center is built at one of the canal intersections, near the school. The other canal intersections can be built out to meet demand for small restaurants and boat rental. The canals, now clean, can provide both recreation and transportation.

The “wild” quad allows residents to retreat to a less manicured environment and, similar to the open space in Phase One, offers Vanke a highly marketable, unique amenity.
SITE SWITCH

bai ma site - qibao team plan

Goals of the plan

- Due South and SE (site perpendicular) orientation opens up new layouts
- Four entry points rather than two on the east-west axis
- Smaller phased zones within site
- Public/private test buildings on southern perimeter of northern parcel
- Public park corridor connecting north and south ends across canals and into external developments
- Use canals as walls, stormwater treatment and public amenity
- Earth berm parking along perimeter as a wall and stormwater treatment
- Maximize activity of central node on southern edge of northern parcel
- Develop combination of four, six and ten storey buildings
- Small scattered playgrounds
- Creation of neighborhoods
- Four entrances, six guard stations on northern parcel
- Higher midrise (8-10 stories) where possible around greenspace
- Integration of natural systems
- Protect and utilize healthy soils
- Maximize use of greenroofs, permeable paving, rainwater and greywater harvesting, target 100% onsite stormwater treatment
- Onsite greywater treatment and reuse for non-potable uses
- Develop basic commercial amenities onsite
- Provide spaces for bike parking
- Comfortable walking areas, especially along waterways
- Build such that new stormwater mitigation techniques can be added
- Discourage ubiquitous car ownership and use by encouraging alternative modal choice
Potential building-specific programming

Community Facilities/Commercial A: Overlap of community facilities that will also benefit the school. Examples of overlapping uses include study/game rooms, recreational facilities, internet facilities for school work, basement skate park.

Commercial A: Mixture of commercial, restaurants, and additional community facilities if needed.

Community Facilities/Commercial B: The existing buildings are very narrow limiting potential uses. Consider mixed uses here, including street facing restaurants with rear access to the inner patio (rather than a pool), a health clinic that can utilize the narrow building structure, and a security station, post office, or bank in the inner left building.

Links diagram

Key links highlighted in this diagram include:

- Frequent canal crossings, linking the site by water and accompanying pathways.
- Overlap of school, commercial, and community uses.
- Flexible design for potential future links to other sites using canals and greenways as circulation pathways.
- Frequent pedestrian crossings of the road dividing the site to serve as a traffic calming measure and aiding in unifying the two sections of the site.

Potential building-specific programming

Community Facilities/Commercial A: Overlap of community facilities that will also benefit the school. Examples of overlapping uses include study/game rooms, recreational facilities, internet facilities for school work, basement skate park.

Commercial A: Mixture of commercial, restaurants, and additional community facilities if needed.

Community Facilities/Commercial B: The existing buildings are very narrow limiting potential uses. Consider mixed uses here, including street facing restaurants with rear access to the inner patio (rather than a pool), a health clinic that can utilize the narrow building structure, and a security station, post office, or bank in the inner left building.
Create flexible zoning requirements

Sustainable developments are flexible, and able to respond to changes in real estate market conditions and resource scarcities. In this time of rapid urbanization, zoning regulations should be flexible enough to allow for rapid changes that allow an efficient use of resources.

Encourage appropriate landscape elements

Because of the wealth of cheap labor found in China and the subsidization of water, developers tend to want to create labor- and water-intensive landscapes. By choosing appropriate landscape elements and using water-saving maintenance practices, site water usage can be decreased by more than half without compromising the design or the aesthetic of the site. The “xeriscape” movement in the US promotes the creative use of landscape elements that do not require any net addition of water to survive in their habitat. In a sub-tropical climate like that of Shanghai, there are many options for plants that do not require additional water. The district can encourage indigenuous landscaping by using this type of landscape in prominent public areas, holding design competitions for the use of water-efficient landscape, and providing monetary incentives to developers. These one-time expenditures will yield continued water savings over time.

Encourage district-level power generation

In large residential districts, new towns could collaborate to produce energy at the district level, and even to sell power back to the municipal grid. Municipal governments should allow developers to sell electricity.

Recycle at the household level

Informal recyclers collect and recycle glass, paper, and cardboard throughout Chinese cities. However, in gated new communities, this type of recycling is less convenient for homeowners. The district can step in by either picking up recycling at a household or block level, or by licensing existing informal recyclers, working with developers to give them access to gated communities. Recycling services should be extended to local businesses as well.

Encourage regional open space systems

The canal system in the Soong Jun area should be developed as a regional waterway and green-belt to provide recreational and natural systems, and improve storm water drainage. A 50-meter setback on each side of the regional canals provides enough space for a green corridor and bike path. Requesting this space to be publicly accessible would create a regional network of recreational bike paths and healthy canals, as well as signature attraction for the region. Public access to the canals should be visible, clearly marked, and open during daylight hours. Plantings that can filter and remediate these natural systems should be chosen.

Building Systems

Require the use of more environmentally friendly concrete

Fly Ash, a by-product of coal burning power plants, can be substituted for energy-intensive cement in concrete, as can other industrial byproducts such as tire rubber and recycled post consumer aggregate. Concrete with these admixtures requires less cement and has greater insulation value and less weight.

Create an energy efficiency rating system for homes

Chinese developers are not encouraged to develop more energy-efficient units because, even though these units pay for themselves in energy savings over time, the increase in construction costs is borne by the developer, while the lowered maintenance cost would be enjoyed by the consumer. Chinese consumers do not have enough information to know how much money they would save by purchasing an energy-efficient home. Having a codified rating system would encourage developers to build more energy-efficient units that they could sell at a premium to consumers who can see exactly what their cost savings would be.

Allowing building codes flexibility for grey water systems

Grey-water re-use and rainwater catchment systems are some of the most inexpensive resource-saving improvements that can be made to a building. However, in many countries, these systems face regulatory hurdles because of outdated building codes that require redundant water systems from other sources. By reviewing building codes with greywater systems in mind, governments can make sure that they are not imposing extra fees on developers that want to create such systems.
Impose stringent disposal fees for construction waste

Some US states, such as California, require builders to submit a Waste Reduction and Recycling Plan during the permitting stage of building. If such a requirement were created in China, a developer that could create an efficient plan for recycling materials would have a significant cost advantage. Recycled building materials are competitive in price and quality with new materials, and are resource-efficient because they close the recycling loop while avoiding extraction of more resources. Online and regional markets for recycled materials exist in the US and in most of Europe, but are not yet well developed in China.

Community Development

Link developments to create a regional identity

Coordination and common requirements between different developments could create a more cohesive region. Soft boundaries between developments, using features like plantings, low fences, and berms reduce the visual and social severity of development edges, as well as extending view corridors. Multiple pedestrian access points to a development promote local pedestrian activity by diminishing the barriers between home and destination.

Security

Municipalities can utilize design regulations and review to reduce the use of fences and walls, particularly around areas designated for public use. They can also facilitate meetings between the management companies of neighboring development, as well as local police, to address safety and security issues on a district level.

Promote bicycle usage

Secure and convenient bicycle parking for residential and retail tenants is critical to maintaining China’s current rate of bicycle use; developers should provide covered bicycle parking for 30% of the residents and one space for every 100 square meters for retail (0.01).

Limit car usage among drivers

Car parking ratios can be used as a deterrent to car ownership, by requiring proof of dedicated parking in order to buy a car and additional parking fees, as is the case in Japan. Where the water table is low, underground parking can cause great environmental harm. District governments should encourage surface and structured parking where this is a concern. Car-sharing is increasingly popular in the U.S. as an affordable, convenient alternative to car ownership. Developers are often granted reduced parking requirements for including car share spaces and arranging service. This has great potential in China.

Promote bus usage

The bus is quite popular in China and developers must accommodate its service through curb cuts and signage. In addition, there are social and cost benefits to combining the shuttle services of individual developers into one or a few shuttles that service the community clubs, nearest subway station, and local grocery store(s).

Create a network of community facilities

A vibrant district has an array of community facilities and activities available to its residents. District planning and design review can discourage duplication and overbuilding, and thereby promote diversity. Public access requirements also promote social interaction and wider use of facilities. In addition to built facilities, sufficient open space is critical to a high quality of life. FAR and footprint maximums should be in place, and compatible with flexible zoning and building codes. An alternative is to set a minimum open space requirement for large developments (i.e., 30% of site retained as open space). A variety of open space programming ensures it is accessible to all; elderly and young children derive different benefits from open space and both should be accommodated.

Provide comprehensive services

Services, such as health care and education, that are of high quality and conveniently located promote active, competitive communities. Services should be located near public transportation. Co-locating a variety of services together can encour-
CONCLUSION

As a typical Chinese greenfield development, the development of Bai Ma can serve as an example for future developments by Vanke and other developers. Our approach, reflected in the development decision chart, was to create a process that is widely applicable to greenfields, taking Bai Ma as a specific example. This emphasis on process requires that the approach to development, as well as the application of methods and features, be sustainable. This was achieved through phasing, which gives the developer greater flexibility to respond to the market in terms of timing, product, and technology.

The work done by the programming groups earlier in the semester was used to guide the process and assess each phase. Community concerns, site systems, and building technologies were applied to the Bai Ma plan to create a site that has a strong sense of place and, at the same time, is connected to its surroundings.

This process also provides a framework to utilize local landscape features, such as canals, to promote community and environmental sustainability. It encourages building at a sustainable pace: building at a density that accommodates growth without flooding the real estate market. Overall, the aim was to provide a plan, specific to the Bai Ma site, that also provided a process for the sustainable development of large-scale greenfield development in China.
Qibao, like the rest of Shanghai and the rest of China, is at a turning point. Changing demographics and lifestyle are leading to massive shifts with both local and global consequences. While initially these changes may seem to be beneficial, they both come with high social, environmental and economic costs. If ignored, these costs can easily become crises that lead to a rapid downward spiral of excessive consumption and environmental degradation. These are non-trivial consequences. Pollution, diminishing resources, traffic congestion, and high energy costs have a negative impact on everyone. However, given the nature of the urban setting of Site 53 within the Qibao neighborhood, many of these obstacles can be overcome.

While there may be some short term economic gains that could be met by fueling this fire, ultimately they will be unsustainable. We have made the mistake in the west to follow this path, but it is not a prerequisite to development. Not only is it possible to avoid these problems, but it is possible to jump past them and come out ahead of the west and ahead of the competition. Sustainability can be economically profitable with lower risk.

Any developer must analyze market trends to stay ahead of the market and to try to predict future desires. This report takes traditional market research one step further to analyze future demands and needs, not just wants. It is possible to just ignore this report until the future scenarios we predict become a crisis. But why wait? The smart business sees developing trends and uses them to its advantage. By the time everyone else sees a market advantage, it is too late to lead.

A developer like Vanke needs to push beyond business as usual. A developer like Vanke needs to use its position in the real estate market to lead China into a prosperous 21st century. The design recommendations that follow provide a toolkit for leadership. Vanke need not follow them. But Vanke need not hold its place as the top real estate developer in China either. Some risk is always involved but resting on past successes is often riskier than doing something new. As we say in America: "you either lead, follow, or get out of the way." Which will it be?

**Chapter Overview**

This project deviates from the norm in that it begins with an in-depth analysis of present shifts in Chinese society and their effects on the future. Guidelines for the public and private sectors to partner to respond to these shifts are formulated from this analysis. The goals outlined in the guidelines form the backbone and the theory while the design, programming and policy recommendations provide specific, tangible examples of how these goals might be implemented. The designs bring the goals to life, but they should be viewed as examples of how to meet these goals, not as ends in and of themselves. The guidelines are intended as a template for future development in sites similar to Qibao. The purpose here is to develop principles for sustainable growth, not to develop designs per se.

There are several issues that have been addressed in this report. First, some of these ideas cannot be easily met by the developer alone. Integration of the public and the private sectors will be necessary in some instances. However, this should not be viewed as an obstacle so much as an opportunity. If Vanke tests out some new ideas and
then the Qibao government regulates that they be replicated in future developments, this gives Vanke the market advantage while also serving the public interest. Second, different goals are best met at different scales. This analysis goes from the macro to the micro level. Given our time constraints, not all levels have been analyzed in equal depth, but hopefully weaknesses in the Qibao site can be compensated with strengths in the Baima report and vice-versa. Finally, it would be ambitious to assume that all suggestions could be accomplished at once. This report assumes a phased approach that is spelled out clearly and feasible.

All attempts have been made to analyze and design with the particularities of the Shanghai context in mind. However, there are bound to be cultural misperceptions, imperfect data and incomplete understandings. It is assumed that allowances and reformulations will be made for any such oversight. This analysis has tried to avoid imposing western values and assumes that there is a Chinese way of doing things that must be taken into account. This final “translation” of the report is inevitable but is left to the interpretation of the developer and the Qibao government. Some examples of exceptional design from the local context have been included to demonstrate that foreign models are not necessarily required to meet the guidelines and recommendations of this report.

Vanke has the ability to catalyze and capitalize on the rapidly developing market for “green” building in China. In America, more than 1,400 projects were built between 2000-2004 alone, representing 1.65 million square meters of construction. A similar market is beginning to be developed in China. Vanke has an opportunity to lead China into a prosperous and sustainable future. Qibao has the ability to serve as a model for the future. Harnessing these ideas first will lead to a major advantage.

Regional Context Plan

The understanding of what Site 53 could become begins with its context within the surrounding region. The Qibao planning department has established a vision for the larger region, as displayed by these figures, with Site 53 lying at the center of entire Qibao district. This obviously creates opportunities for the site, but it also creates opportunities for Site 53 to push this neighborhood plans in even more positive directions. Suggestions for how this can be accomplished are made later in the chapter, and are based on the following analyses.

The interaction between different land uses can lead to design solutions for both Site 53 and its surrounding context, given its proximity to open space and water networks, amenities, and transit.
open space diagram

The open space diagram shows the distribution of open space in the Qibao region.

green space

There is no public green space in the immediate vicinity of Site 53. The private green space is primarily composed of the space between buildings required for minimum daylighting standards within each individual development. The large private green space on the east is loosely linked to the historic old town and requires a token fee upon entry.

plaza / hardscape

The large plaza located kitty corner from Site 53 is a part of a new government center. The cluster of plazas to the southeast of the site are distributed throughout the old town, and filled with people taking a break from the hustle and bustle.

recreational open space

The recreational open space is the track and field facility at the school. The school site is likely to switch uses in the near future, which has implications for this facility.

design goals

Create larger programmed open spaces within developments instead of multiple smaller parcels that are less useful and less frequented.

Link together public accessways through a comprehensive landscaping plan along the canal system and major arteries.
neighbourhood amenities diagram

The neighbourhood amenities diagram shows the zones of activity in the Qibao region.

retail / commercial

Ground-floor retail lines the major arteries in Qibao for the most part. In addition, there are hubs of commercial with large shopping centers. The Qibao township has grand plans for the intersection at the northwest corner of the site to be built in the image of Xiu Jia Hui, a major commercial center in downtown Shanghai. The combination of the ground-floor retail and the shopping hubs creates a commercial corridor along the major north-south artery.

institutional / cultural

This diagram calls out the relationship between the newly built government center and the school to the south that will be changing uses in the near future. These two institutional uses, in combination with the historic old town blocks create a parallel corridor of institutional and cultural uses on the eastern edge of Site 53.

design goals

Preserve the cultural corridor by maintaining the public nature of the school site when its use changes. At a minimum, preserve the view corridor between the government center and the gateway to the old town on either side of the school parcel.

Use Site 53 to connect the parallel commercial and cultural corridors.
site 53 circulation diagram

The circulation diagram displays the structure and disorder of the street system around Site 53.

street patterns

Primary roads are clearly defined, with one running more or less east-west and one running north-south. The secondary and tertiary roads are less consistent. Something close to a gridlike system exists, broken by the pedestrian road on the northeast edge of Site 53 and the Qibao Old Town. The private road network, determined individually by each development, has no connectivity except within individual developments.

congestion

Congestion is already significant at the proposed commercial center at the northwest corner of the site, as well as one block further north of Site 53. The primary north-south road will require mitigation to ensure accessibility of the site to other regional amenities.

design goals

» Avoid increasing congestion on primary roads: place vehicular entrances to the development on the northeast and southeast edges of the development.

» Provide safe pedestrian crosswalks, including diagonal access, at the proposed commercial center at the northwest corner of the site.

» Provide ample bicycle lane space on the primary and secondary roads.

» Sidewalks should be designed to accommodate heavier pedestrian flow after the opening of the subway stop.

» Increase connectivity between the site and regional amenities.
connectivity diagram

The goal of this diagram is to illustrate the creation of a small-scale, accessible, amenity-rich center with Site 53 as a focal point. This distinctive cluster of amenities should be connected with a network created of bicycle lanes, sidewalks, canal walks, and iconic nodes. The following steps outline the intended connectivity.

1. Site 53 serves as a connection from the subway stops to the cultural amenities of the Old Town.

2. Site and adjacent design should create a consistent, clear connecting route along the northwest edge of the site green and civic space at the northwest corner, and further to a future iconic structure at the intersection of the road and canal.

3. Attractively designed canal walks should then lead pedestrians and cyclists southeast to the existing pagoda and park.

4. Further canal walks leading west with connecting bridges draw traffic into the Qibao Old Town and existing landscaped canal walk leading southwest, back to the primary northwest-southeast road.

5. At the intersection, an attractive greenway should be designed.

6. Reconnection to the new subway stop.

If possible, greenways and walks should extend to create a more regional network.
moving forward from neighborhood analysis

In contrast with directions given for the Baima site, Vanke wanted the Studio to concentrate our focus on a regional plan for Qibao’s Site 53. Analysis of the surrounding neighborhood around the site was based upon site visits, a study of aerial photographs of the area, and information from the Qibao planning exhibit. While it was important to gain a thorough understanding of the surrounding context to develop a plan for the site’s role in the region, the conclusions that were drawn have a direct impact on the highest and best use for the site plan as well.

- Site 53 lies between two major Qibao corridors, one commercial and the other civic and cultural. The site can provide a valuable connection between these two district features by providing a connection through the site, as well as by creating attractive northern and southern edges to encourage crossover.

- Site 53’s location at the intersection of two future subway lines provides many opportunities for the development. For example, the high volume of pedestrian traffic will be favorable for commercial tenants, and should be taken advantage of. Taken in combination with the shopping centers in development at this intersection, this highlights the need for traffic and circulation management in the future.

- On a smaller scale, this analysis also revealed that there are few private developers that will dedicate valuable land to open space beyond what is necessary on a practical level. While these smaller spaces are still valuable, this indicates a need for larger planned open spaces in future development.
More Transportation Needs
Increased Construction Demands
Increased Consumption
High Resource Demands

Excessive Consumption
Worsening Pollution
Resource Depletion
Increasing Energy Costs

Demographics
Aging Population
Fewer Children
Later and Fewer Marriages
In-Migration

Lifestyle
Increased Leisure
Better Transit
Increased Comfort Levels
Higher Income

Environmental Degradation

SUSTAINABLE SOLUTION

flexibility
connectivity
water
energy
transit

qibao design guidelines
Design Guideline Development

The program is based upon a set of goals that evolved out of three months of in-depth analysis of current and developing demographic and lifestyle trends in Shanghai (see diagram on opposite page). The Qibao Design Guidelines matrix on the following pages shows the goals (highlighted in yellow and green) that were developed in response to these changing demands. Further analysis of these goals led to specific design approaches and policy recommendations (in grey and blue) that could be implemented in different manners and at different scales. Modification of LEED criteria (the American standard for “green” building) and case studies from Portland, Oregon and Brisbane, Australia have also been used to inform the recommendations.

In addition, the chart shows the push and pull dynamic between the public and the private sectors. The interests of the two parties are sometimes aligned, but at times in conflict. Lifestyle and demographic trends will combine to create secondary trends such as increases in transportation needs and energy usage. This will lead to general increases in demand across the board, and the government must be prepared to deal with the impact on scarce, and increasingly expensive, resources.

The approach is unique in that the designs are informed directly from the analysis of future scenarios. The designs are treated as possible methods of dealing with the scenarios in a sustainable manner rather than as ends in and of themselves. Though the design approaches suggested from these guidelines have been integrated into the design process as much as possible, the most important aspect is the goals, not the specific design and policy recommendations. Site 53 and the regional proposal are intended as exemplar models of ways to achieve these overall goals.

Some of the more detailed level goals, such as programming and architectural scale items have not been dealt with sufficiently in the design. This does not mean that they are less important, but that the studio was not able to design to that level of detail. Some of these goals will require programming or architectural specification in the design but they should not by any means be assumed to be any less important than the goals that were addressed in more detail for this project.

Some examples for how to hit these targets—particularly energy and water goals at the architectural scale—can be seen in the Baima section where the focus and expertise on these subject areas was stronger.

These guidelines are intended to serve not simply as a means of understanding the motivation for the designs in this document, but as a reference manual for future projects.

Please note that the icons below are used throughout to signify connection to the various overarching design goals as they are met in the project.

<table>
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<th>Public Sector (Approach)</th>
<th>Inc = Incentivize</th>
<th>Reg = Regulate</th>
<th>Mkt = Market-Driven</th>
<th>Mng = Management</th>
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<tr>
<td>Highest Level Goal</td>
<td>Sub-Level Goal</td>
<td>Design Approach</td>
<td>Policy Approach</td>
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Qibao Design Guidelines Legend
### Themed nodes of activity with concentrations of uses at transit hubs

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<td>Design transit station connection as focus rather than peripheral interest</td>
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<td>Use transit station connection as a gateway to the site</td>
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<td>Phase, locate and encourage a diverse mix of commercial amenities to create a sustainable economic core</td>
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<td>Locate retail and food service along major arteries</td>
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<td>Locate ground floor commercial along publicly accessible streets</td>
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<td>Max out building heights by vertically integrating uses along major arteries</td>
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<td>Encourage location efficient development</td>
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<td>Increase levels of commercial development around transit nodes</td>
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<td>Facilitate regular resident interaction through pedestrian-friendly internal circulation</td>
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<td>Ease physical conditions by providing adequate walkway, seating, and protection from the elements</td>
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<td>Create “shortcut” pedestrian- and bicycle-only pathways</td>
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<td>Create vehicle-free “safe zones” for children to commute</td>
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<td>Provide walkways with views that facilitate easy orientation and safety</td>
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<td>Control traffic speeds on internal streets where vehicles share the road with non-motorized traffic</td>
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<td>Design land use plans that create mixed-use pedestrian-friendly commercial hubs</td>
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### Safe, comfortable and enjoyable multi-modal circulation

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<td>Provide bicycle facilities (parking/station)</td>
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<td>Provide for car sharing or bike rentals</td>
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<td>Coordinate main pedestrian entrance with public transit (on northwest corner)</td>
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<td>Locate auto entrance(s) along non-arterial (eastern) edge</td>
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<td>Enable direct entrance to individual buildings from the street</td>
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<td>Require traffic impact assessments for all new developments</td>
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<td>Implement high tax (or other deterrent) on second car ownership</td>
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<td>Set/Lower minimum parking ratio requirement to 0.5</td>
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<td>Designate preferred parking and driving lanes for car share or alternative energy vehicles</td>
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<td>Require employees to develop rideshare or commute trip reduction programs</td>
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<td>Encourage businesses to subsidize public transportation options</td>
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<td>Encourage the development and use of bike stations at major transit nodes</td>
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<td>Reconfigure streets to include left turn lanes</td>
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<td>Construct pedestrian overpasses or underpasses at select busy crossings</td>
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<td>Prohibit parking on sidewalks where pedestrian traffic flow is impeded</td>
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<td>Remove pedestrian barriers on sidewalks (eg misplaced benches)</td>
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## Connectivity

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### Domestic Water: Reduce and Reuse

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<thead>
<tr>
<th>x</th>
<th>x</th>
<th>1st Reduce</th>
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<tbody>
<tr>
<td>x</td>
<td>x</td>
<td>Include composting/dual flush toilets pre-installed</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>Include waterless urinals and/or sensor equipped fixtures in commercial/office spaces</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>Provide low flow fixtures/educational materials at purchase to build-out units</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>Permit and encourage and/or require composting/waterless urinals in commercial use</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>Develop programs to educate and hand out low-flow fixtures free to residents</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>Require 20% reduction of domestic water use in new constructions, 10% for retrofits</td>
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<thead>
<tr>
<th>x</th>
<th>x</th>
<th>2nd Reuse</th>
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<tbody>
<tr>
<td>x</td>
<td>x</td>
<td>Utilize greywater reuse for toilets, irrigation (requires filtration)</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>Permit and encourage and/or require greywater reuse</td>
</tr>
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</table>

### Stormwater: Reduce, Mitigate and Reuse

<table>
<thead>
<tr>
<th>x</th>
<th>x</th>
<th>1st Reduce</th>
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<tbody>
<tr>
<td>x</td>
<td>x</td>
<td>Develop water efficient landscaping</td>
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<tr>
<td>x</td>
<td>x</td>
<td>Use timers and drip hoses for landscaping</td>
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<tr>
<td>x</td>
<td>x</td>
<td>Require minimum 50% reduction in landscaping water usage on new construction</td>
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<thead>
<tr>
<th>x</th>
<th>x</th>
<th>2nd Mitigate</th>
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<tbody>
<tr>
<td>x</td>
<td>x</td>
<td>Include rainwater filtration systems for drinking/showers, otherwise use for irrigation</td>
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<tr>
<td>x</td>
<td>x</td>
<td>Consider green roofs (note: roofing angle and materials, overlap/conflicts with other roof uses)</td>
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<tr>
<td>x</td>
<td>x</td>
<td>Utilize pervious paving</td>
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<tr>
<td>x</td>
<td>x</td>
<td>Consider bioswales</td>
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<tr>
<td>x</td>
<td>x</td>
<td>Constructed wetlands (canals)</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>Develop Tradable Stormwater Credit program</td>
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<tr>
<td>x</td>
<td>x</td>
<td>Increase FAR for rooftops that infiltrate onsite</td>
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<tr>
<td>x</td>
<td>x</td>
<td>Provide pollution reduction exemption for rooftops that infiltrate onsite</td>
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<tr>
<td>x</td>
<td>x</td>
<td>Require 70% removal of Total Suspended Solids (TSS) from 90% of avg. annual rainfall</td>
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<td>x</td>
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<td>Require submittal of operation and maintenance plan for stormwater mitigation</td>
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<td>x</td>
<td>x</td>
<td>Require onsite stormwater mitigation (rate, quantity and treatment)</td>
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<td>x</td>
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<td>Establish codes for onsite wastewater treatment</td>
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<td>Develop a program to restore canals to swimable levels</td>
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<th>3rd Reuse</th>
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<tbody>
<tr>
<td>x</td>
<td>x</td>
<td>Consider rainwater harvesting (note: roofing angle and materials, overlap/conflicts with other uses)</td>
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<td>x</td>
<td>x</td>
<td>Permit and encourage rainwater harvesting</td>
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</table>
### Flexibility

**Maximize overlap between connectivity, aesthetic, recreation, stormwater uses**

<table>
<thead>
<tr>
<th>Action</th>
<th>Timeframe</th>
<th>Notes</th>
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<tbody>
<tr>
<td>Design spaces with open floor plates</td>
<td>now</td>
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<tr>
<td>Design for multipurpose rooftop usage</td>
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<tr>
<td>Include gymnasiums adaptable for multiple sports (basketball, badminton, volleyball)</td>
<td>now</td>
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<tr>
<td>Provide lobby-type spaces and plazas that can accommodate tables and chairs for everyday social uses as well as cultural events</td>
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<tr>
<td>Provide programming that lasts throughout facility hours, and hours that accommodate all user types.</td>
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<td>Hire specialized staff to plan and lead programming and partner with firms specializing in facilities maintenance and programming</td>
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<tr>
<td>Provide operational support for sites that provide cultural recreation</td>
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<td>Develop design review of planned facilities to minimize duplication of existing district facilities.</td>
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**Adaptable spaces (timescale = later)**

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<tbody>
<tr>
<td>Design 2-3 BR units that can be converted to 1-2 BR units with more open/office space in the future (same size, different layout)</td>
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<td>Develop flexible, modular shells that can accommodate establishments of different sizes and uses over time</td>
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<tr>
<td>Develop flexible “SoHo” space to accomodate shifts between residential and commercial demand, ensuring that market volatility is tempered</td>
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<td>Encourage Live/Work uses through zoning, policy</td>
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### Energy

**Conserve and generate renewable energy**

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<tr>
<td>Take into account 20 degree obstruction angle</td>
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<tr>
<td>Consider living walls</td>
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<td>Maximize shared walls</td>
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<td>Assess passive solar façades for heating and lighting needs</td>
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<tr>
<td>Consider green roofs (note: roofing angle and materials, overlap/conflicts with other roof uses)</td>
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<td>Consider super insulation</td>
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<td>Take into account cross ventilation</td>
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<tr>
<td>Include high albedo materials on pavers and roofing materials (mitigate heat island effect)</td>
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<tr>
<td>Require 40% energy reduction in new constructions, 30% for retrofits, incentivize for higher targets</td>
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**Generate**

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<tr>
<td>Consider solar thermal water heaters</td>
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<td>Consider wind power (vertical axis)</td>
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<td>Consider thermal store</td>
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<td>Consider ground coupling</td>
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<td>Require 5% onsite energy generation in new constructions, incentivize for higher targets</td>
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**Verify performance**

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<td>Require measurement &amp; verification (additional commissioning)</td>
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<td>Require post-occupancy evaluation</td>
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qibao overview recommendations

This diagram shows how the design goals could be implemented on various sections of the area. Metro stations are marked, as are major roads (red), canals (blue) and greenspaces (green).

transit

- Mixed-use nodes at transit stations with concentrated uses: each station can be a hub of activity though concentrations of development type need not be identical. For example, one node such as Site 53 may be focused on commercial with some residential. Another may be primarily industrial with some commercial.
- Location efficient development: site complementary uses nearby one another (eg schools near residential)
- Efficient mobility: encourage alternative transportation options to the single-occupancy vehicle to reduce congestion and pollution

connectivity

- Encourage connections between district-wide amenities such as Site 53 and Old Town
- Clean up and develop canal systems as connective elements

flexibility

- Multi-functional, smaller block sizes can accommodate a variety of uses and adapt to change over time

water

- Use extensive canal system to become integrated stormwater management system
- Vegetated canal network can become water purification system
- Permeable pavers, greenrooves, native plantings, and low-consumption landscaping reduce demand for treated water and mitigate stormwater runoff
- The greenspace transition in the north-east was reconsidered. The final version calls for keeping the greenspace as planned by the government by the highway but adding a smaller park to the west near the canal. This maintains an ecological corridor for habitat to the east while providing proper siting for a stormwater mitigation system. It also increases the value of the park land along the canal and surrounding real estate.

energy

- Transit positioning, walkable block size, efficient amenity locations, and functional natural systems lead to a less energy dependent population
Phase I Recommendations

Problem: Disconnection

Proposed metro stations are well-located at 10-15 minute walking intervals from each other. Most areas of town will be within a 15 minute walk to a nearby stop. Major circulation routes are also appropriately distanced. However, the number and connectivity of smaller feeder roads are inadequate due to large block sizes, leading to congestion on major roads. The town is otherwise ideally positioned for development and connection to the broader Shanghai region.

Extremely large private developments break up the connectivity of the town as they do not let traffic or pedestrian flow through. This forces flow of movement out onto major circulation streets and creates inactive internal streets within developments. Developments do not take the broader region into consideration which reinforces problems surrounding their borders.

Resolution: Break Up the Block Size

Start with the easy gains. Bring small circulation routes through existing superblocks where currently feasible with no or minimal demolition of existing structures. Create a greenway along canal routes near the central transit hub that integrates vegetated treatments to purify the canals. Redevelop light industrial sector to the northeast of Site 53 as a park close in to the central city and surrounded by commercial. Connect it to the Old Town via the new canal network.
Phase I Recommendations (Detail)

This diagram shows exactly how the area would be affected by this new change. Grey buildings are new. Black buildings are existing. Site 53 is the RTKL plan.
Phase II: Pushing the Idea

This diagram shows how existing Qibao block sizes match up with block typologies from around the world. Note how much larger they are than nearly all other cities. Sizes that have been suggested and implemented into the more progressive design at left have been marked with a check mark.
site layout options: 
- commercial/residential split (left)
- urban blocks (right)

**Pros:**
- Easily implementable from the beginning with no other agreements with adjacent land uses.
- Enables public ‘service’ road to penetrate site.
- Logical and no cultural or financing structure change required.

**Cons:**
- Maintains a ‘private development’ feel.
- Less opportunity for new typologies.
- Not as many circulation possibilities.

**Pros:**
- Increases connectivity and flow to site’s surroundings.
- On street parking potential.
- Flexible for different building types.

**Cons:**
- Would require a cultural and financial adjustment.
- Only works if adjacent sites link up as well.
- More traffic control measures needed.
Moving from the regional scale of the Qibao neighborhood to site 53 begins with an analysis of the RTKL proposal.

It suggests a secondary pedestrian commercial street running parallel to a major street creating a clear separation between commercial and residential zones. While this plan uses buildings as walls, it limits the vertical mixing of uses and confines the land uses to their areas.

Taller residential towers approaching the 45 meter height limit are placed on the southeastern edge of the site, which is closest to the mostly one and two story structures of Qibao old town, instead of along the busy street edges where transit is available. The heights of these structures will create a stark and overwhelming contrast between the two developments, representing a lack of contextual responsiveness.

The separate realms of public and private space are reinforced in this plan, which follows the status quo of 'gated communities.' Our studies on the following pages begin to dissect these points and imagine new ways of density massing and blurring the boundaries between public and private while still maintaining a comfortable and safe environment.
Our group approached parcel 53 as a transitional site between a major commercial intersection with a bustling metro stop, a group of residences, and historic old town Qibao. Rather than route metro traffic through the site, we propose the interior of the site as a private, residential space. The valuable corner near the metro, the highest-value retail real estate, is reserved for high-density retail, with a hotel nearby, the tallest commercial building, which becomes the architectural focal point of the block. A public plaza on the Western side of the site becomes a busy node as a junction where hotel users, those walking to the residential area, and shoppers from the nearby retail use mix. Raised green spaces on top of structured parking behind the hotel and the retail become semi-private parks where hotel guests and residents can relax, and workers at the office buildings on the northern side of the site can eat lunch.

The plan envisions four types of travelers arriving via the metro – workers who will appreciate the proximity of the offices, residents, shoppers who will continue on down the western side of the site, already facing a major retail corridor, and visitors to historic old town Qibao. These visitors will be routed through signage to walk east from the metro, around the corner, where some type of architectural marker and the park across the street signal their entrance to the old Qibao district. The low-density retail on the eastern side of the site mirrors old town Qibao both architecturally and through its use, and extends the old city into the more modern urban fabric.

One road is cut through the center of the site. The road is public, but will not be highly visible from the street, maintaining a quiet, residential character. The yellow pavilions in the center are used for mainly non-retail community programming, like community mailboxes, a visitor entrance, activity rooms, and a small shop.
In addition to the planning for program, the site design also views sustainability through designing an energy- and water-efficient site. In order to maintain airflow on the site, allowing summer cooling and mitigating the possible effects of local air pollution on such an urban site, the site plan uses staggered residential towers. These towers also create some corners of sunlight even in the darkest winter afternoons (the time period used for our shadow study). High surfaces are used for rainwater catchment, in accordance with Building System programming guidelines.
The work done by the Baima team during the switch period provided the initial impetus for re-focusing the design at the site level. These diagrams show the design process that the studio underwent on Site 53 after the switch period.

1: The first four plans are somewhat more conservative. They follow on the idea to break up the size of the block typology into more “Manhattan” style blocks with commercial on the west façade and residential on the more “interior” eastern section. This was abandoned because the spaces between the buildings were rather dead, unprogrammable spaces and the roads didn’t connect any existing network. Instead, they seemed more likely to cause traffic problems along Qixing Lu.

2: The next three plans look into making the obvious connection between the main intersection and Qibao Old Town. There is a pedestrian street cutting diagonally across the site with two service roads that meet in the back. This idea was rejected because it was decided that the only vehicular entrances should be along the east side of the site to minimize congestion on the major artery. Also, there was a need for more development on the site due to a recalculation of predicted demand with regard to the design guidelines.

3: The final iteration is a combination of two designs. The diagonal pedestrian path is maintained while pedestrian access to the park exists on the eastern façade. Two anchor points draw people into the site (hotel on the northwest corner and theater/community center on the southeast). Public and private are blurred in this model and walls are all but done away with in favor of commercial frontages. Private open space is exists in the interior spaces. In order to meet increasing programmatic requirements in accordance with the scenario analysis and design guidelines, the height limits have been pushed by five meters on certain buildings.
PROGRAMMING

land use

The scenario and resulting design guidelines are used to determine the specific programming and square meter requirements for the final design of Site 53.

The baseline model incorporates Vanke specifications, meeting existing demand and relevant for the current urban context. Consideration of the scenario, and the goals in the toolkit responding to that scenario, result in some changes in the square meter allocation to specific programming of land use. The new square meter area devoted to land use based on scenario conditions were compared to Holiday Town and Shanghai standards, to determine whether outcomes are realistic, taking into account they consider future, changing needs and restrictions.

The baseline Vanke model, summarized in the table to the left with a version with hotel and a streamlined version, account for the needs of an estimated population of 1035 as well as additional users from outside of the development. The population estimate comes from the proposed units times an average number of three people in each unit. The scenario model assumes a slightly smaller population of 963, due to demographic and lifestyle trends and resulting increased demand for smaller units and lower average number of people per household.

Consideration of scenario impacts results in the second table to the left. The land use programming in red text has changed. Changes are summarized below and in the accompanying charts on the opposite page. The result of these changes is a very dense site with an FAR of 3.43:

changes in land use allocation

- Increased commercial allocation (to accommodate changes in lifestyle):
  - movie theater and flexible civic auditorium space that can be used for the public or the community
  - anchor restaurant
  - small dining
  - health center
  - children’s areas
  - leased shops
  - live/work space

- Shift in residential unit allocation (to accommodate changes in demographics):
  - number of three-bedroom units reduced by 75, redistributed to smaller units
  - larger sizes for each type of unit (increase of 10 square meters per unit)

- Additional service requirements (to accommodate changing needs due to demographic and lifestyle trends):
  - space allocated specifically for a larger community council space, which has a more challenging task of addressing community needs in a more public development, and a health clinic
Redistribution of Land Use/Programming

Scenario Model

Vanke Model

Residential Programming

Number of Units

- 3-Bedroom Units
- 2-Bedroom Units
- 1-Bedroom Units
- Studio Units

Total Square Meters

- 15,000
- 12,000
- 10,000
- 8,750
- 7,500
- 6,000
- 4,500
- 3,000
- 1,500
- 0

Vanke Model

- 83,640
- 62,900
- 0

Scenario Model

- 87,175
- 110,500

Commercial Programming

- Hotel
- Live/Work
- Shops Leased and Condos
- Kids Courts
- Health Clubs/Salons
- Restaurants/Food Courts
- Movie Theater/Auditorium
- Department Store

Square Meters

- Vanke Model
- Scenario Model
parking

The following section analyzes the outcomes of recommended square meter allocation after applying the scenario model and resulting design guidelines to parking for automobiles and bicycles. To promote sustainable development, vehicles are accommodated somewhat, but car sharing, and alternative modes of transportation are encouraged through the parking allocation.

Residential parking:

Residential parking allocation was reduced to .6 parking spaces per unit, supportable by the high accessibility of the site.

As recommended in the design guidelines, a certain percentage of parking spaces should be reserved for shared parking spaces. An example of a for-profit company providing car sharing services is Zipcar, www.zipcar.com. In this business model, members pay a yearly fee and then when needed, reserve cars online for specific times. Car usage is paid for by the hour, and gas is included. This model works well for leisure and shopping trips, but would not be useful for commuting. Incentives should promote car pooling, and amble bicycle parking and design promoting linkages to regional amenities will all create less need for vehicle ownership at this development.

891 bicycle parking spaces are accommodated at a ratio of one per unit. More, rather than less bicycle parking spaces should be constructed if possible. In addition, residents should have discounted use of the on-site bicycle station, which provides protected parking, lockers, a café and other social space, a repair center, and bathrooms with showers, for members’ use.

Commercial/public Parking:

The U.S. Institute of Transportation Engineers (ITE) Trip Generation Manual (http://www.ite.org/tripgen/index.asp) is used to determine parking demand created by the commercial and recreational land uses. This manual contains datasets of trips generated for certain types of land uses in the U.S. Formulas are created using regression analysis that can be used to determine trip generation for specific square footages. Of course, this method of determining parking demand at Site 53 is flawed in that it is based on U.S. studies, and will therefore be somewhat inaccurate for Shanghai land uses. However, it provides enough of an estimate for this purpose.

ITE formulas produce estimated vehicle trips. When other transportation modes are present (subway, pedestrianism, and cycling), the number of vehicle has to be transformed into person trips based on average vehicle occupancy (we used 1.2). The resulting person trips then have to be distributed to the estimated mode share. In this case, we used Xijiahe mode share, as reported in a working paper entitled “Rail Transit Shaping Urban Travel and Land Use: Evidence from Shanghai, China” by Haixiao Pan and Ming Zhang:

- 2% auto (.4% motorbike)
- 70% transit (52% subway and 17% bus)
- 10% walking
- 18% bicycle (3.26% powered bicycle)

Once the trips are redistributed on this mode share, the highest volume day is considered for the maximum parking demand on a give day. The trips for that day are then divided by how much originates from the different commercial and office land uses. Those generated trips are then adjusted by a scaling factor, which takes into account that a number of trips occur at different times of the day and therefore can use the same parking spot over the course of the day. The adjusted number of parking spaces required by the existing public-oriented land use on Saturday, the highest use day, is 665. At 28 square meters per spot, 18,620 square meters is required for parking spaces for the public.

This analysis also yields an estimated 1,128 bicycle parking spots, after adjusted using a different scaling factor. 330 of these required spaces are accommodated in the bicycle station, and at least an additional 800 spots should be provided. Once again, this is the bare minimum number of bicycle parking spaces that should be provided.
The Qibao Building Massing as Proposed

The following design for Site 53 applies the design guideline tool kit through the use of the scenario programming. The resulting design differs from the RTKL proposal in the following key ways.

1. The FAR is 3.43.
2. The retail to residential ratio is 1.1:1.
3. The design considers the context of a larger regional connective network.
4. The “gated” effect is achieved through use of commercial as barriers and card access for security, creating more overlap between land uses.
5. Vertical and horizontal connections provide more public/private crossover in mixed use spaces, linking residents to more public amenities without sacrificing the sense of community.
6. Porous boundaries provide various access points for different users.
7. Parking design is clearly defined.
8. Sustainable features are incorporated, such as green roofs, building orientation, and water treatment.
Three major program components, residential, commercial, and parking, are integrated to create a more overlapping, connected program design. Residential is coded as yellow, commercial as red, and underground parking as blue.
The central characteristic of the ground level is a walkway cutting through the center of the site diagonally from the subway to the Qibao Old Town. Stores, shops, restaurants, and landscaping create a vibrant public commercial corridor. At one end of the corridor, where pedestrians exit from the subway section, the distinctive architecture of the northwest corner canopy draws pedestrians and cyclists in. The other end, the southeast corner of the site, is marked with a visually compelling community center and theater. Another noteworthy characteristic of this design is the lack of traditional walls. Instead, as previously mentioned, the “gated” effect is achieved through commercial walls horizontally and vertically (with residential on top of commercial), with privacy of residents protected by card access.
The Qibao Ground Floor - Circulation Diagram

- Pedestrian System
- Retail Circulation
- Residential Circulation
- Parking Entrance / Exit
- Subway Exit

The Qibao Ground Floor - Public and Privacy Diagram

- Private Space
- Public Space
Underground parking for vehicles minimizes conflicts between pedestrians, cyclists, and cars. In addition, the great majority of bicycle parking is provided underground. Private card access creates safe resident bicycle parking, and public racks are provided for visitors.

Underground parking is divided into several parts accordingly to the previously mentioned programming; there are two residential parking lots with elevators that provide direct access to residential buildings. A small amount of commercial parking is provided by shared parking spaces, which residents can use in the evening.

There are two direct connections to the subway. The northwest entrance provides access to retail with two and three-bedroom apartments on top. The subway entrance on the northeast edge of the site has secure card access to single and senior apartments.
Single Units / Senior Units
Food Court
Beauty Salon
Movie Theater / Auditorium
Shops
Restaurants / Bars
2-3 Bedroom Apartments
Public Family Space
Green Roof
2-3 Bedroom Family Apartments
Public Family Space
Green Roof Garden
Single Units / Senior Units
2-3 Bedroom Family Apartments
2-3 Bedroom Apartments
2-3 Bedroom Apartments with Single Units
Semi-public amenities for communal resident use are on the bridge connecting the two residential sections and in the semi-public space within the residential buildings. The goal of such placement is to preserve the Lilong community feel, an idea called “under the same roof” in Chinese, on a modern, urban site.
sections

The first section cuts through the building canopy over the subway plaza on the northwest corner of Site 53. The canopy is designed to be visually appealing with green roof setbacks, drawing pedestrians into the commercial corridor and providing a clear view to the commercial uses along the corridor and the community center/theater at the southeast corner of the site. This first section also illustrates the vertical program elements. The sections on the following pages further illustrate program and design interaction.
Shops / Restaurants
Underground Parking
2-3 Bedroom Apartments
Restaurants / GYM Serve for Residents
Shops / Restaurants
Underground Parking
Roof Garden
The Qibao 3-D Parking and Vertical Circulations Diagram
Problem streets:

- Lack of feeder roads
- Narrow sidewalks
- Congestion
- Dangerous, busy intersections
- Insufficient bikeways
- Sidewalk parking
solution streets

PEDESTRIAN PATHWAYS  ACCESSIBLE COMMERCIAL  CANAL AS PLACE

DANGEROUS, BUSY INTERSECTIONS  BIKE PARKING  MULTI-MODAL CIRCULATION
regional phasing strategy

The completion of Site 53 is phase one. However, improvements at the regional level should occur simultaneously and over time, creating a sustainable development core for the Qibao neighborhood.

phase 2

Most public circulation happens along the major roadway corridors of Qibao. It is imperative that these roadways are viewed as a networked public system, with major traffic and streetscape improvements to make them safe, effective and enjoyable. The canal system provides an opportunity for a second-tier of circulation networks, joining up with the roadways at key points. In contrast to the urban edge experience of the streetscapes, a regional, publicly-accessible canal network would provide a different, more park-like experience for the pedestrian to move through Qibao. When combined with larger open spaces along the way, these interconnected public canal systems can provide both aesthetic benefit and attract development. All of this depends on improved water quality, which should be pushed from the regional level all of the way through the designed detail stage, and should be pursued as soon as possible.

phase 3

What is currently a vast area of temporary and ad-hoc industrial uses can be envisioned to become a major shift in development in the Qibao neighborhood. The development can be centered around a large public park with recreation fields that becomes a catalyst for new progress in this area. Further expansion of open space networks will continue in areas such as the school site directly adjacent to Site 53.

phase 4

The corner of Site 53 will become a major central business district hub incorporating the principles of sustainable development. Small block sizes, intricate public circulation networks and large structures will become a dense core of mixed-use activity. The area becomes the heart of the neighborhood, with all of the circulation networks established in previous phases connecting it to other areas in the region.
CONCLUSION

At the heart of this analysis is the proposition that these goals cannot all be met by the private sector alone. The public sector will need to be involved to provide oversight, incentives and, in some cases, to regulate market developments to guide the market along. The guidelines suggest which options might be best suited to achieve certain goals but have purposefully been left as suggestions with options rather than dictating one way or another to proceed. In this fashion, it is hoped that those with the best sense of the specifics of the tools and tactics at their disposal will make wise executive decisions based on our suggestions.

This is not meant to be restrictive to those in the private sector, but rather to encourage and provide support for leaders in the development field such as Vanke. If Vanke follows these design guidelines, it will provide positive examples that this can be done successfully, thus pushing the public sector to implement regulations and incentives for the future. At this point, Vanke will have a leading edge over the competition and will prosper from its foresight while simultaneously encouraging progressive, sustainable growth.

It is the firm conclusion of this design team that China is at a tipping point. Development is rapid. The consumption demands of hundreds of millions of urbanizing Chinese are increasing exponentially. Resource demands and pollution are both rising in unison as actual resource supplies are diminishing. Decisions that are made now, particularly in a city such as Shanghai, will have major ramifications for the environment and the health of citizens both locally and globally.

The suggestions in this manual are not intended to limit development, restrain economic growth, or otherwise impede or discourage China’s progress into the 21st century. On the contrary, these suggestions will enable Qibao to serve as a model for how Shanghai might predict and subsequently overcome many of the challenges that are currently or will shortly be facing America and other developed nations. Using these design guidelines as a toolkit for future developments will give Qibao the leading edge over the rest of Shanghai, over China, and over America both economically and environmentally.

As energy prices continue to rise, pollution and traffic become worse, the family structure continues to shift and become more prosperous, Qibao will be prepared. Planners and designers from this era will be viewed as prescient and full of foresight rather than with their eyes on shortsighted economic or political gain. In the current situation, it is urgent that we act quickly and decisively in a manner that “meets the needs of the present without compromising the ability of future generations to meet their own needs.” With the insightful collaboration between the public and private sectors, these plans and guidelines offer a blueprint for change; a blueprint for a prosperous, green future.
CONCLUSION
conclusion

The MIT-Vanke Shanghai Studio on Sustainable Development was conducted over the Spring semester of the 2005-2006 school year as the second half of a year-long program examining sustainable residential development in Shanghai, China. The first semester research course focused on the development of guiding principles with respect to community facilities (including open space), site systems and building systems. An examination of future trends in China, and Shanghai in particular, gave the students a sense of the context within which these principles would be applied. The second semester Studio applied the values of economic, environmental, and equitable sustainability to two Vanke-held sites in different stages of urban development in the suburbs of Shanghai: Baima and Qibao.

process

The students in the Studio brought an outside perspective to contemporary Chinese development. Our “fresh eyes” assessed Vanke’s projects, other residential developments, and the physical context without the benefit or prejudice of the full cultural and historic context. We faced a number of challenges including:

- Linguistic difficulties in communicating with development residents and municipal officials, and in translating documents.
- Limited access to resources within a rapidly changing regulatory climate.
- As well as opportunities:
  - Perspective to recognize good examples within China (it is not always necessary look outwards), such as mixed-use development, vibrant street life, and a high level of density. There are promising signs in the public-access treatment of the canals around the Qibao old town, and these principles can be applied more broadly across the region.
  - The previous chapters lay out recommendations to Vanke, as well as to local governments, on ways to address sustainability through specific technologies as well as through values and approaches to regional and site planning. The development process is larger than an individual developer, and Vanke can play an important role in working with the government to implement more sustainable initiatives on a regional level.

A project such as this one can never really be completed. We hope that our work will continue to evolve both here at MIT and in Shanghai through Vanke’s development and research work. In particular, the Studio would have liked the opportunity and resources (access to data) to do additional research and planning work on transportation, and region-specific performance of technologies such as green roofs. In addition to these topics, we encourage Vanke to undertake the following steps as they continue to promote economic, environmental and equitable sustainability:

- Analyze the marketability of sustainable features and approaches
- Use resident surveys as a tool to understand consumers and inform future developments
- Educate residents and homebuyers about the need for and benefits of sustainable approaches to bring sustainability into the mainstream consciousness
- Undertake additional community development work
- Encourage regional policies that promote sustainability and community connections through public/private partnerships.

China is at a turning point. Emerging demographic and lifestyle trends need to be taken into serious consideration. Decisions made now will affect the environmental sustainability of Shanghai, China, and beyond for generations to come but they will also affect the economic sustainability of Vanke. Taking the risk to try something new is always difficult, but the risk of not trying something new at this point may be riskier. Sustainability should be viewed as an opportunity and not as a constraint. Vanke has the ability to use this situation to its advantage to partner with local governments and to use its market position to push for change. Developers in America have discovered ways of making sustainable development not only technologically feasible, but have also managed to find ways to increase their revenue stream above and beyond their baseline targets. This Studio feels that China is also at a tipping point in this regard. The market is just opening up. The time is ripe. The ideas in this document provide a starting point. It is now up to Vanke to take advantage of this work and build on it to create a prosperous and healthy China— and a prosperous and healthy business model— long into the future.
## LEED-NC Version 2.2 Registered Project Checklist
<< enter project name >>
<< enter city, state, other details >>

### Sustainable Sites 14 Points

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## Project Totals (pre-certification estimates) 69 Points

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<tr>
<td>Silver</td>
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<td>39-51 points</td>
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<td>Platinum</td>
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continued…

[MIT | SUSTAINABLE RESIDENTIAL DEVELOPMENT IN SHANGHAI]
Urban Municipal Canal Restorer
Fuzhou, China

Fuzhou, a city of 6 million people, empties their commercial wastewater and sewage into 80 kilometers of canals that run throughout the city before emptying into a large river. The polluted canals are a health risk for the city's inhabitants and threaten the livelihood of fishing communities downstream.

A 500-meter canal named Baima, considered one of the worst in the city, had extreme problems with odor and floating solids created by the influx of 750,000 gallons per day of untreated domestic sewage. Rather than re-piping the polluted water to a remote wastewater treatment facility, the city government sought an affordable and low-maintenance treatment system within the canal itself.

In 2002, John Todd Ecological Design collaborated with Ocean Arks International to design a restorer for their Chinese partners on the Baima canal using 12,000 plants composed of 20 native species. Built with a walkway down the center, the restorer has met water quality goals and created a desired recreation area for the neighborhood's residents.

| Design Treatment Standards and Preliminary Results for Restorer |
|-----------------------|----------------|----------------|
| COD (mg/l) | 480 | <50 |
| BOD (mg/l) | 240 | <30 |
| NH3 (mg/l) | 40 | <15 |
| TSS (mg/l) | - | - |
| Reduction | 92% | 92% | No data |

A recycle line fixed to the underside of the Restorer prevents short-circuiting of wastewater entering the canal near the dam and recycles the bacteria to the head of the canal to re-seed the processes upstream. An anoxic zone at the top of the canal allows for denitrification. The fine bubble aeration system distributes air along the canal from blowers located on a central floating barge. This low-intensity, uniform distribution both aerates the water and forces it to roll past the biologically active zone surrounding the plant roots as well as the artificial media. Beneficial bacteria are automatically dosed into the canal at the mid-point and at the recycle line. Bacteria species were selected specifically for their ability to aid in sludge and grease digestion as well as nitrogen removal processes.

The Restorer system has met the goals set by the City of Fuzhou. The Restorer has successfully reduced odors, eliminated floating solids, and drastically improved the aesthetics of the neighborhood. The clarity of the canal's water has increased from less than 6 inches to several feet. Water has already reached secondary effluent standards for several parameters. The high quality effluent from the Restorer canal reduces negative impact on downstream aquatic ecosystems.

www.jtecodesign.com
Brewery Block 4
Market-rate speculative office building goes LEED

Location: NW 11th & Couch and NW 12th & Davis
Building Type: Class-A commercial office space, retail
Construction Type: New construction
Area: 241,170 ft² (usable area)
Project Scope: 10 stories
Project Cost: Not available
Completion Date: May 2003
Ratings & Awards: LEED Silver

Summary:
Brewery Block 4 is one of five blocks redeveloped as part of an effort to revitalize the old Blitz-Weinhard Brewery District downtown Portland. The Brewery Blocks successfully incorporate historically significant buildings, brewery遗址 such as two 4,500 gallon grain towers and new construction to form an environment that is reminiscent of the area’s industrial past yet promising of a sustainable progressive future. The building provides market-rate, Class-A commercial office space while boasting 23.5% electrical energy savings per year, a product of an integrated design approach that calls upon a variety of green measures to achieve this efficiency. Block 4 demonstrates the benefits of coupling sustainable design and construction with district planning in an effort to create a more symbiotic relationship between the built and natural environments.

Project Highlights:
- Pre-development ecosystem
- District cooling plant
- Alternative transportation-friendly location and design
- Rooftop and envelope photovoltaics
- Extensive green roof
- 23.5% more energy efficient than code
- Construction waste recycling
- Tenant manual

Pre-design
At the inception of the Brewery Blocks project, the developer was determined to pursue an agenda of maximizing green, high performance features throughout all of the buildings. An integrated design/construction approach was deemed essential to meeting this requirement. The entire design and construction team was convened at the beginning of the building project and participated in two, one-day eco-charrettes. A LEED-accredited sustainability consultant led the eco-charrettes and the purpose was to bring the team together around a common set of objectives in achieving the highest possible standards for sustainable development. More specifically, construction project manager Kevin Cadin notes that the eco-charrette provided the opportunity to go through the LEED criteria, learn how to specify green materials, and identify construction protocol procedures necessary to achieve a LEED rating. Cadin also indicates that this experience was invaluable for making the construction process run smoothly. “You can’t do it after the fact; it’s too late.” The developer used The Natural Step principles as the framework for their sustainable efforts and LEED as the metrics for determining their progress. It was decided to pursue LEED certification early on.

Keys to Success - Pre-design:
- Strive to integrate sustainability into project conceptualization and objectives
- Hire a LEED/sustainability specialist to assist the project team in formulating a common goal and the means by which to achieve that goal
- Use pre-established guidelines and rating systems to structure and measure a sustainable building program

Design
The multi-block scale of the Brewery Blocks development coupled with Brewery Block 4’s strategic design enabled the incorporation of a blend of technologies and simple sustainable measures. From the unique treatment of the building’s stormwater runoff to the occupant’s ability to simply open a window, Block 4 demonstrates the benefits of designing for positive interaction between the building’s occupants, the natural environment, and the surrounding neighborhood. The design team was expanded to include an energy modeler, solar design expert, sustainability consultant, and commissioning agent. The Natural Step, PGE Earth Advantage, and LEED were used as design guidelines and helped facilitate an integrated design process.
District Cooling Plant

Block 4 draws its chilled water from a high efficiency district cooling plant located on top of Block 1 that serves all of the Brewery Block buildings. The centralized system produces chilled water in bulk via evaporative cooling and is much more efficient than individual point of use chiller plants or air conditioners, which would typically be used in a comparable facility. An outside air economizer and variable speed pumps on the cooling tower render the system demand-responsive and contribute to the related energy savings. The system also enables the use of a "low temperature" air distribution system that delivers colder then typical air to the building and subsequently reduces the overall size of fan systems and ductwork. All of the Brewery Blocks buildings are currently served by the plant's two machines totaling 3,700 tons of cooling and a future build-out capacity up to 10,000 tons leaves the potential to serve a portion of downtown Portland as well. The district cooling plant and related strategies were designed using energy modeling and account for roughly half of the building's total energy savings.

Garage

A garage ventilation system for the underground garage was designed to work at half of the code ventilation rate (from 1.5 CFM per sq ft. to .75 CFM per sq ft.). This allowed for smaller fan systems and reduced energy consumption. The system was further enhanced by making it variable volume in response to actual carbon dioxide levels in the garage.

An innovative underground parking garage lighting system was installed using induction luminaires. These luminaires have a prolonged lifespan of 100,000 hours versus 2,000 hours of the more typical HID lighting and reduce the watt density from 0.30 watts per square foot to 0.13 watts per square foot. Additionally, these luminaires are capable of instant-on/retrofit to existing luminaires, as no additional cabling or lamps are required to provide emergency egress illumination in the event of power failure. All of the walls, columns, and ceilings in the entire parking structure are painted white to further increase illumination efficiencies.

Alternative transportation

The Portland Streetcar and two different bus lines travel right through or adjacent to the building, allowing quick and easy access to downtown and the MAX light-rail line that serves all of Portland. Secure bike storage and full-service bike commuter locker rooms with showers and over 100 lockers are provided in the parking garage. These features are all designed to increase pedestrian activity, encourage bike commuting, and reduce auto use.

In addition to pedestrian amenities, ample bike parking and transit access, there is also a parking stall reserved for a Flexcar carshare vehicle located along the east side of Block 4 on NW 11th Avenue. As more residents and office tenants move into the Blocks, a space for one additional Flexcar car may be made available.

Live, work, play

The Brewery Blocks are designed to attract and serve a diverse mix of people and to successfully integrate public transit into daily life. The five blocks have been planned as an all-flour live/work/play mixed-use environment. Ground floor retail with a mix of shopping, entertainment and dining establishments and people-friendly streetscapes keep the streets active and safe. The streetscape and building frontage is designed to be pedestrian-friendly as well as to complement transit facilities. These features make the Brewery Blocks a safe and affable conduit linking downtown Portland and the East River.
Indoor environment

Block 4 is designed to facilitate the creation of a healthy and productive workspace. The building’s core and shell systems create the capacity for tenants to have more control over their immediate environment while realizing significant energy savings.

Manually operable microclimate controls provide each individual control of their personal thermal comfort. Tenants can manage the amount of airflow entering their workspace by simply adjusting the diffusers embedded in the raised access floor. Operable windows further increase tenant’s environmental control, access to fresh air, and provide a connection to the outdoors.

Only low-toxicity, low-VOC paints, sealants, carpets and adhesives were used in Block 4. Senior Project Manager Dennis White indicates that “Some materials, specifically paints and other low VOC finishes do not have the durability of their more polluting counterparts. This is changing as more products come on line.” Smoke control in the buildings is based on the use of operable windows, using a “smoke reservoir” configuration, which eliminates the need for smoke exhaust fans and allows for downsizing generators.

Flexible floor plans enhance the ability to adapt to the tenant’s changing needs and materials that are easily recycled during tenant changes and building modifications were specified where possible.

Keys to Success – Design:

- For multi-building developments, install a high-efficiency centralized cooling plant
- Specify an air economizer and variable speed pumps on any cooling system
- Integrate a “low temperature” air distribution scheme that reduces the overall size of fan systems and ductwork
- Design a garage ventilation system that reduces the required ventilation rate and subsequent energy demand
- Install a carbon monoxide monitor to regulate garage ventilation
- Locate near public transportation and provide alternative transportation accommodations
- Create a live/work/play mixed-use environment that promotes 18-hour pedestrian activity
- Design the building envelope to render the sun and rain an asset to the building’s operation and occupants
- Install an evapotranspiration and filter the building’s stormwater reused
- Specify low-flow fixtures throughout the building to reduce overall building water consumption
- Design easy-to-use manually operable climate controls
- Specify low-toxicity, low-VOC paints, sealants, carpets and adhesives
- Design flexible floor plans and specify recyclable materials to accommodate tenant changes

Construction

The multi-block nature of the project enabled the developer to construct the Brewery Block buildings simultaneously and take advantage of related efficiencies. For example, minimizing duplication among construction crews, deliveries and staging substantially reduced the amount of time, energy and transportation going into the project.

A minimum of 20% of all materials used came from local and regional sources. This includes materials such as concrete, masonry, paints and wood products, among others. Products and materials with high amounts of recycled content were of priority and utilized whenever feasible. Over 25% of all construction material used in the project contains recycled content.

The project successfully recycled 95 percent of construction waste because an aggressive commingling recycling program and tracking system was established prior to construction. Construction Project Manager Kevin Cady notes that putting the plan into practice required that the information trickle down to the subcontractors. “You have to inform them and put them along, ultimately it’s up to the general contractor to ensure that objectives are realized”. Typically, the general contractor is responsible for tracking C&D waste recycling and gathering the necessary documentation from the subcontractors to earn the relevant LEED credit. In addition, over 94% of all demolition waste was sorted, salvaged and recycled during the process of decommissioning the old brewery complex.

An indoor air quality (IAQ) management plan was implemented during construction to prevent contamination of the building’s HVAC system. This entailed up-front planning for sequencing materials installation among other efforts and will earn the LEED IAQ credit.

A sustainability/LEED consultant was engaged after the design process to structure a LEED program for the developer. LEED had been used as a framework to inform the design but a consultant was necessary to properly manage the LEED process. Project consultant Scott Lewis notes, “The project team has precise time demands and if nobody has the responsibility of tracking the project it all falls off the table. It’s not a priority for them, it’s an added duty.”

Building commissioning of all mechanical and electrical systems was employed throughout the project to not only satisfy LEED points but also to ensure that the building systems operate at peak efficiency. In general, Senior Project Manager Dennis White points out that “Our construction schedule was never impacted by any of the green features, this is not an issue if it’s addressed up front.”

Keys to Success – Construction:

- Contract with a local salvage materials firm to perform a pre-demolition salvage
- Plan and schedule construction activities to minimize duplication among construction crews, deliveries and staging
- Integrate preferences for local and regional materials and materials containing recycled content into the specifications
- Establish an aggressive commingling recycling program and tracking system prior to construction
- Communicate sustainability objectives and responsibilities to all subcontractors prior to construction
- Design an indoor environmental quality management plan prior to construction
- Engage a LEED accredited professional consultant to structure a LEED program for the project
- Commission all mechanical and electrical systems during, and after, construction

APPENDIX
Operations & Maintenance

Heating & Cooling

HVAC low-flow night flushing control sequences restore the thermal storage capacity of the building's mass with naturally cooler nighttime air, which delays the start-up of mechanical systems the following day. Wider temperature setpoints relax the environmental criteria in common spaces and sub-metering of chilled water, natural gas, and electricity encourages energy efficient tenant practices.

Measurement & Verification

Block 4 is participating in the Oregon Climate Trust’s carbon retirement program. Under the program, the developer signs over its “carbon credits” to the Trust in exchange for extensive measurement and verification of the building’s actual energy performance. Credits are calculated based on modeled energy savings beyond Oregon Energy Code and the associated reduction in CO2 emissions from the power source. The data will be helpful in determining the effectiveness and cost impacts of the energy efficient features by comparing how actual energy use compares with expected performance. It will also assist building owners in making necessary system adjustments to promote optimum building performance.

Property Management

The property management firm hired by the developer designed a comprehensive operations and maintenance program that will substantially reduce the ecological impact of the building throughout its useful life. The firm commissioned a consultant and worked with local NSD Zero Waste Alliance to research the most economical, effective and environmentally-friendly cleaning products and ended up contracting with a local supplier. In addition to increased indoor environmental quality, this substantially reduced transportation costs, related pollution, and supports the local economy. Cleaning products used inside and outside the building are all readily biodegradable and contain no or low VOCs.

In an effort to implement a janitorial service that balances both economics and environmental quality, the firm issued a points-based RFP that weighted equally sustainability efforts and costs. Respondents were required to understand the firm’s philosophy concerning sustainability and explain a janitorial program that would perform in line with these objectives while remaining cost-effective. The proposals resulted in some creative programs that included strategies ranging from composting to tenant education. In the end, a firm was selected whose program includes a contractual agreement to do ten hours of recycling consulting with each tenant, among other elements. This effort involves educating the tenant about what materials can be recycled and developing a user-friendly program to encourage occupant participation.

Other measures taken by the firm to encourage the tenant to take advantage of the sustainable capabilities of the building are a building newsletter, frequent visits concerning new opportunities (such as recycling organic waste), and contrived recycling.

The property manager notes that all tenants have responded positively when approached with the opportunity to expand their recycling program. Such active participation not only diverts waste from a landfill but also saves money because of varying fee structures for solid waste, recycling, and yard (organic) waste.

Use of proper cleaning products alleviates liabilities such as sick building syndrome and absenteeism while bolstering worker health and productivity. In the end, the property manager indicates, “The justification for a cost-effective, environmentally sound operations and maintenance program is there.

Keys to Success - Operation:

- Flush the building with cooler nighttime air to restore the building’s thermal storage capacity and delay the start of mechanical systems
- Relax environmental criteria in common spaces
- Sub-meter tenant utilities
- Develop a tenant manual to promote sustainable tenant improvements that take full advantage of efficient core and shell systems
- Retire carbon credits in exchange for measurement and verification of energy conservation measures
- Communicate sustainability objectives and specific requirements to property management firm up front
- As a property management firm, integrate sustainability objectives into RFP language

Costs & Benefits

High Efficiency Central Chiller

The high efficiency low temperature air distribution system generated cost savings in the form of a reduction in the overall size of furnaces and ductwork. The system’s bulk production capacity and heightened efficiency will also garner substantial operational savings throughout the building’s lifetime. More specifically, modeling results indicate that the combination of the central chiller plant, variable flow chilled water, wider deadband setpoints in common areas, night flushing, and low temperature air distribution create the capacity for the building to save 535,245 kWh per year compared to a baseline code-compliant building.

These savings account for 56% of the building’s total potential energy savings based on the installed energy conservation measures. Assuming a rate of $.07/kWh, the building will reap $37,450 in annual energy cost savings. Furthermore, these energy conservation measures eliminate roughly 536,000 pounds of carbon dioxide emissions per year, which is equal to the amount of carbon dioxide emitted from 1,465 cars or 1 ton of gas.

Lighting

The integration of daylighting, daylight dimming controls, and improved glazing will yield 417,230 kWh in annual energy savings compared to a baseline code-compliant building. This integrated lighting design strategy accounts for 4% of building’s total annual energy savings and is projected to produce $25,200 in annual energy cost savings based on $.07 kWh energy rates. It also eliminates over 417,000 pounds of annual carbon dioxide emissions, which is equal to the amount of carbon dioxide emitted by over 1,150 cars or 1 ton of gas.
Ecoroof & Manhole Filtration System

Rainwater slowly infiltrates the ecoroof and is gradually released to the City’s storm sewer system instead of running off all at once. This reduces the building’s potential contribution to combined sewer overflows, which result in the dumping of raw sewage into the Willamette River. The remaining water will be used via evapotranspiration and evaporation. The total amount of water handled by the ecoroof annually is approximately 320,000 gallons based on 36” average annual rainfall in Portland.

The “downstream defenser” will earn the project the LEED stormwater treatment credit and has removal efficiencies of 90% for sediments and 30% for phosphates.

FAR Bonus

Block 4 earned a 3:1 FAR bonus for covering the building’s podium (setback) with an ecoroof and a 40:1 FAR bonus for installing bike storage, shower, and locker facilities in the garage. Both strategies also earn LEED credits for urban heat island reduction and alternative transportation. A restrictive covenant preserving a neighboring historic armory allowed the transfer of that site’s development rights to the other buildings on the property. In the end, the ecoroof, bike accommodations, and historic preservation enabled the developer to add three floors to the building’s tower (an extra 45” in height).

Buildings with ecoroofs may also receive a stormwater fee reduction from the City in the near future.

Photovoltaic System

Total annual output of the photovoltaic system is expected to be 21,500 kWh. This “free” energy will yield $1,500 in annual energy savings assuming an energy rate of $.07/kWh.

LEED

Block 4 anticipates earning a LEED Silver rating.

Incentive Funding

State of Oregon’s Office of Energy Sustainable Building Program: $223,755 LEED Silver (or $312,456 LEED Gold) in BESC tax credits

PGE’s Earth Advantage Program: funded energy modeling

Northwest Energy Efficiency Alliance: funded development of tenant manual and funding construction waste management coordination

City of Portland, Office of Sustainable Development’s Griffin Program: funding for LEED certification

Energy Trust of Oregon: PV panel funding, also currently assisting with funding an interactive kiosk in lobby

Bonneville Environmental Foundation: partner in PV project

**COMBINATIONS**

- **Elementary School**
  - Service radius: 500m
  - Located in one neighborhood
  - Entrance should be located on the neighborhood street
  - Should be reached within 8-10min walking distance
  - Should not be reached without crossing major street
  - Should not be located next to the main street

- **Kindergarten**
  - Service radius: 300m
  - 2-3 kindergartens in one 800m-1000m area
  - Entrance should be located on the workplace
  - Should be reached within a comfortable walking distance (300m)
  - Should not be reached without crossing major street

- **Middle School**
  - Service radius: 1000m
  - Not every site need to have one
  - Should be located in one neighborhood
  - Located on the boundary of the site
  - Entrance should be located on the main street
  - Close to the bus stop
  - Should not be close to core commercial

- **Leisure and Recreation**
  - Located on the edge of the site
  - Close to the main street
  - Located on the boundary

- **Core Commercial**
  - Service radius: 500m
  - Located in a major area
  - Located on the main street
  - Close to the bus stop
  - Should not be close to education facilities

- **Bus Stop**
  - Usually one or two bus lines reach this kind of developments
  - Located on the main street
  - The bus line must be close to the development
  - Should be within 300m walking distance

- **Restaurant, Bank, Post Office, Gas Station, Clinic**
  - Located on the main streets
  - Close to the bus stop

- **Small Commercial**
  - Service radius: 300m
  - Located in the neighborhood streets
  - Should be reached within 300m walking distance

**HOLIDAY TOWN SITE**

**CITY GARDEN SITE**
### Size and Boundary Design Guideline for Walled Residential Compound in Peripheral Urban China

**Source:** Na Sun, SMArchS Thesis, MIT 2006

#### Boundary Design Guideline

**Wall**
- Solid:
  - Brick, concrete, stone, wood, planting, advertisement
- Porous:
  - Metal fence, timber fence, porous masonry wall
- Transparent:
  - Glass wall

#### Landscape
- Plants
- Canal
- Slope
- Sidewalk

#### Low Accessibility
- Neighborhood park
  - Program: picnic, sitting, walking, playing chess, sports field, playground
  - Surfaces: hard pavement, soft pavement, mixed pavement
- Plaza
  - Program: sitting, walking, performance
  - Surfaces: hard pavement, mixed pavement

#### High Accessibility
- Public amenities
  - Serve several developments
  - Middle school, core commercial, post office, bank, gas station, restaurant, bar, neighborhood club, clinic
- Serve one development
  - Kindergarten, elementary school, retail, laundry, barber shop, parking, community council

#### Public Amenities
- Serve several developments
- Serve one development

#### Safety / Porosity / Accessibility
- Be used in some outer boundary, keep out of bad external view or noise.
- Be used in most of the boundary. Allow
- Be used in some special place, e.g. en-
- Could be used with wall boundary. Dense and high plants could be used individually
- Could be used as boundary individually. Usually use the natural water feature.
- Usually used in the boundary where has natural height difference, or there is some
- Only used individually when the security condition is very good. Usually combine
- Semi-public open space. Usually located in the center of the development. Next to one or two inner streets. Could be entered from
- Urban public open space. Usually located in the outer boundary. Connect the outer streets and public facilities. Could be en-
- Located in the outer streets. Serve several neighborhoods. Open to the outer streets. Don’t have access to the compounds.
- Located in the inner streets. Serve one neighborhood. Open to the inner streets. Most of them don’t have access to the com-

Diagram: Base of Semi-Walled Residential Compound

- Commercial Plaza
- Wet Land
- Urban Park (High Voltage Belt)
- Canal
- Landscape Corridor
- Neighborhood Park
- Inner Shopping Street
- Bus Line

Product: Base of Semi-Walled Residential Compound

- Elementary School
- Kindergarten
- Commercial Service
- Leisure
- Green
- Water
- Entrance
- Middle School

Proposal of Holiday Town

Proposal of City Garden
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Alice Thatcher
Kristy Savage

Master in City Planning, 2007
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Lillian Lew-Hailer
Tegin Leigh Teich
Timothy Terway
Ezra Goldman

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Master in Landscape Architecture (GSD)
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