William Rees and Mathis Wackernagel addressing the concept of the ecological footprint to realize that there is much more to do. The ecological footprint is an indicator of the combined ecological effects of per capita consumption and population growth. It measures how much of nature’s carrying capacity we use to feed, house, and otherwise maintain ourselves. Footprint analysis starts with the observation that all consumption of energy and materials and all discharge of wastes requires a finite amount of land or water area for resource production and waste disposal.

This area can actually be estimated for a country, a community, or an individual household using information about how much food, energy, water, and other resources are used by a given population and how much of that is turned into waste that ends up on land or in the water. Although we do not have ecological footprints for the people living in Village Homes, we do know that in the United States, the average ecological footprint is twenty-five acres per person, as compared with Bangladesh, where it is one acre per person. The collective footprint of the 9.5 million people of sprawling Los Angeles County is at least forty times larger than the country itself and, in fact, larger than the entire land area of California.17 Thus, in terms of long-term sustainability, we in the West have much work to do in modifying our commuting habits, changing our lifestyles, improving technology, and changing the methods and politics of land use planning.

Chapter 8

Designing with Nature for People: A Sustainable Approach to Urban Design

Previous chapters have documented society’s past failure to take the environment into consideration when building communities. The results bear repeating: polluted water and air, agricultural land and animal habitat paved over by development, and a dependence on nonrenewable forms of energy and other resources. However, there are ways to accommodate the human population in communities that both preserve the natural environment and better meet people’s physical and social needs.

The key to sustainable development lies in having planners and engineers understand and work with nature and human nature rather than habitually trying to overcome them. Experience shows that collaboration with nature is less costly and more effective in the long run. In this chapter, we suggest some comprehensive urban design elements of communities designed with nature for people. Based in part on our experience with Village Homes, they integrate into an urban form the considerations that are important to sustainability and the human spirit. First, we consider the garden city as a more sustainable urban form of development and examine its basic building blocks: garden village neighborhoods and town centers. Next, we look at circulation systems. Finally, we address landscaping and drainage.

Urban Form: Revisiting the Garden City

As discussed throughout this book, we advocate a modular rather than a piecemeal approach to planning based on the garden city model. Again, a garden city is not equivalent to a legally incorporated city; rather, it is a planning unit that can either stand on its own or be a part of a larger city or urban area.
The two most important features of the garden city pattern are (1) heavy emphasis on pedestrian and bicycle traffic and (2) a high degree of self-reliance. As noted in chapter 7, both of these have important implications for size. The garden city must be small enough that distances are suitable for walking and bicycling, but at the same time it must be large enough to satisfy most of its residents' needs within the community, providing food, energy, and a variety of jobs, housing, goods and services, and recreational and social opportunities. These two requirements set fairly definite upper and lower limits on the size and density of an appropriately designed garden city or village. It should not be larger in area than about four square miles, and if it is to support regional light-rail transit, it needs to be quite compact, particularly in the town center. A site larger than this requires two garden cities, each one separate and complete in itself, even though the two may be adjacent.

A garden city should be made up of garden village neighborhoods—each large enough to provide some commercial and professional services-surrounding a town center. The garden city should have the following features:

- A core area offering a wide range of goods and services and a public transit stop located within one and one-fourth to one and one-half miles of all residents
- A concentration of higher-density housing within one-half mile of the core area
- An internal circulation pattern emphasizing and giving direct access to pedestrian and bicycle traffic and minimizing human contact with automobile traffic
- Land set aside for agricultural use
- Provision for commercial and industrial enterprises that would provide work for a high proportion of residents
- A mix of housing types that includes affordable housing for all income groups
- A full range of primary and secondary schools
- A full range of recreational opportunities
- Street design and general planning to minimize costs and energy demands for construction and maintenance of roads, sewers, and the like
- Use of locally available renewable energy sources and energy conservation measures to make the garden city as nearly energy self-sufficient as possible

- Ecologically sound patterns of agriculture, waste management, and resource use (including water use)

This list of features is not intended to be final or exhaustive, and not every garden city will achieve all of them with great success. Not every element of the theoretically ideal town will be possible or appropriate in every garden city. The basic point is simply that designation of a garden city should be a clear statement of general planning intent to make development address the whole range of planning problems humanity faces and to do whatever is possible to solve them.

Garden Village Neighborhoods

The garden village neighborhood is a vital component of the garden city. Unfortunately, the neighborhood has gone almost totally unrecognized as an important element in the design of urban environments. This is surprising because the neighborhood should be as meaningful a social unit as are the individual home and the city. The neighborhood should provide for a certain set of functions, and the diverse elements of the neighborhood should be put together in such a way as to accommodate those functions. Just as a home is designed with certain rooms where family members can go to be alone and other rooms that accommodate group activities, so should the neighborhood be designed to offer opportunities for both privacy and community.

Just as we have strongly advocated specific, well-defined garden city units, we advocate well-defined and comprehensively designed neighborhoods within those cities. A good neighborhood will offer security and privacy and will enhance residents' feelings of identity yet satisfy their needs for diversity and a sense of community. The neighborhood can be merely a site where houses are located, with very little interaction among households, or it can be a more cohesive unit in which a great deal of interaction takes place. It can be a social living environment similar to the villages, tribes, and living groups that humans have been part of for thousands of years. It can be the kind of living environment for which we are genetically adapted—one that allows us the opportunity to more easily satisfy our basic social needs of identity, security, and community and that gives us the social experiences that help us learn to better relate to other individuals.

It seems clear that in comparison with primitive societies, modern society is lacking in quality of human relationships, primarily because it is structured so that people can get along without much communication or cooperation. This is obvious in suburbs, where each household owns a separate
lot surrounded by a fence, and all public facilities, shops, restaurants, offices, theaters, and schools are in another part of the town, so there is no spontaneous contact with anyone in the neighborhood.

In such settings, people tend to find human contact in substitute activities: through lodges and country clubs, churches, and popular causes. Some people do fairly well this way, but most of us do not realize how much time and effort go into creating the interaction that only a few decades ago arose naturally from the things people did in groups to satisfy basic material needs. Rather than meeting our neighbors while walking our dog in the neighborhood park, we must make an appointment to have dinner. Because today’s contrived interaction is not essential to the people involved, it has a different quality, and because it takes more time, we tend to do it less.

The importance of making our neighborhoods conducive to a spirit of cooperation and mutual support, rather than one of isolation and mutual distrust, cannot be overemphasized. Our state of mind and even our physical health are profoundly affected by the social climate of our neighborhood environments.

Consider the example of Roseto, a borough in Pennsylvania. Until very recently, Roseto was a small, close-knit Italian American community based on Old World cultural patterns. The community coped with crises and problems as a whole, providing a great deal of emotional security to its members. A study completed in 1978 by the University of Oklahoma found that the people in Roseto had a remarkably low death rate, especially from heart attack, and that very few of them suffered from emotionally related illnesses.

In recent times, Roseto has grown from a close-knit village into a typical suburban town “complete with Cadillacs, swimming pools, country clubs, and heart attacks.” Researchers now say that the sources of social and emotional security are being lost and so is the unusually good health of the residents.1

Undoubtedly, there are elements that are essential to a community in order for it to continue to function well over time. The following sections examine elements that appear to be needed in the support of an ongoing, well-functioning neighborhood community: appropriate scale, clear boundaries, commonly held land, reliable sources of revenue, security and safety, privacy, and diversity.

**Appropriate Scale**

Just as large and small towns have both advantages and disadvantages, so do large and small neighborhoods. In a very small neighborhood, there is not as much diversity, but it is easier to know all the people well. Larger neighborhoods offer more diversity and can become stronger economically, but as they get bigger, they lose the feeling of community.

Author Kirkpatrick Sale, in his book *Human Scale*, presents a number of arguments indicating that 500 people is an optimum number for a neighborhood community in order to have social harmony:

Anthropology and history both suggest, as we have seen, that humans have been able to work out most of their differences at the population levels clustering around the “magic numbers” of 500–1,000 and 5,000–10,000.

For the first, John Pfeiffer notes that anthropological literature indicates that it is when a population reaches about 1,000 that “a village begins to need policing,” and as we have seen, the Dinka villages, like villages in most stateless societies, hold about 500 people on average and almost never more than 1,000. (Rough figures for the village sizes in some other stateless societies: 100–1,000 for the Mandavi, 50–400 for the Amba, 300–500 for the Lugbara, 200–300 for the Konkomba, 400–500 for the Tupi.) Evidently in these face-to-face societies, where every person is known to every other—and presumably every idiosyncrasy, sore spot, boiling point, and the final straw—it is comparatively easy to keep the peace and comparatively easy to restore it once broken. Confirmation comes from the New England towns, the great majority of which were under 1,000, where harmony was the regular rule and “concord and consensus” the norm; from the Chinese villages of all periods until the most recent, with rarely more than 500 people, where traditional law of many varying kinds operated independently of dynastic decrees: from Russia, where the traditional mir, with seldom more than 600 or 700 people, was the basic peace-keeping unit for more than a millennium, each with its own version of customary law and all without codification or judicial apparatus.2

On the basis of our experience of living in Village Homes, we agree that the optimum number is 500 people or about 150 homes. When the neighborhood consisted of fewer than 100 households, there seemed to be a lack of individual diversity and resources, and as the number of households approached 200, it seemed that the residents had more difficulty knowing a significant number of their neighbors. At that point, the sense of community seemed not quite as strong.
threat, but once the threat is gone, the community spirit may gradually dissipate. For example, a suburban neighborhood where we once lived was threatened with a poorly planned adjacent development. As residents organized to fight the development, some very pleasant side effects occurred. There were neighborhood potlucks, parties, and organized games in the park. Suddenly, everyone seemed to know everyone else and the neighborhood grew warmer and felt safer.

But once the external threat was gone and the neighboring property was satisfactorily developed, the parties, the fun, and the sense of togetherness gradually disappeared. There was no longer a compelling reason to keep us coming together. However, when community members have control over land and common food production, they have the opportunity to develop meaningful social relationships through working together on something worthwhile.

Any number of experiences with community gardens have shown that the gardens are not only good for producing food; they are also good for developing a sense of community. Self-help housing projects also tend to foster group cohesiveness because of the mutual aid required by the building process.

We once visited an older neighborhood in Portland that had a small park situated among the homes. Previously, the area had been overgrown with weeds and was a hangout for drug dealers. However, at some point, the neighbors had decided to take over the property. They cleaned it up and planted roses. The drug dealers went away, and a sense of neighborhood ownership and pride is now there instead.

Because Village Homes is organized into clusters of eight houses that, in addition to their separate lots, share a common area consisting of about one-fifth to one-fourth acre of land, small groups can accomplish even more at the community level, including sharing a common orchard, an outside entertainment area, and spaces for small children to play. While participating as members of both the overall Village Homes community and a common area, we have observed that some people (10 to 20 percent) do not participate at all (yet most of them seem pleased to be part of the neighborhood). Sixty to 80 percent of the people participate in community activities in varying degrees, and another 10 to 20 percent are very active in all areas of the community. Varying levels of participation are to be expected because people’s need to interact socially and to participate in or lead groups and activities will vary.

The key point is that in Village Homes, shared property continues to provide places and reasons to get together. Twenty years after construction of
the development, there is still a strong sense of commitment to carry on the
traditions of a harvest party, Christmas party, and Easter party. In addition,
there are several impromptu potluck get-togethers on an almost weekly basis.

We do not advocate in any way the exclusivity that comes with gated
communities and their fenced clubhouses and private pools. Community-
owned property can be there for the enjoyment of all, as are the Village
Homes playing fields, which host young soccer players from all over the city,
and our bike paths, which connect with neighborhoods on either side of us.

When towns and cities are broken down into smaller neighborhood
communities, many more people who would like to have leadership roles get
such an opportunity. And although the degree of interaction stimulated by
the Village Homes design does expose the inability of some members of the
population to work together in social situations, this can benefit these peo-
ple by giving them an opportunity for personal growth.

REVENUE
For a neighborhood to be able to carry out common projects, it needs not
only land but also revenue. This can come from donations or assessments or
from income from a business source. Assessments are the traditional method
of raising money in condominium-type projects. They pay for the construc-
tion, management, and maintenance of a multitude of different recrea-
tional amenities and open space, including pools, craft rooms, and social centers.
Assessments are much like taxes, and even though they allow people to have
more control over their condominium development, they are not desirable
if other sources of revenue can be found. In Village Homes, ongoing revenue
from the lease of land and buildings owned by the homeowners’ association
and from the sale of almonds reduces the financial burden on individuals.

In less fortunate communities, revenue might appropriately come from
foundations or social service funds. This is the case with the Mutual As-
cistance Network of Del Paso Heights, a distressed neighborhood in Sacra-
mento, California. The county and city were pouring enormous amounts of
money into the area with very little benefit until a neighborhood-based non-
profit organization was formed that provides far more cost-effective and
responsive programs to address the needs of neighborhood residents. This
community now has the resources it needs to help itself.

The city of Seattle maintains a Department of Neighborhoods whose
mission is to preserve and enhance the city’s diverse neighborhoods and
empower people to make positive contributions in their communities. The
cornerstone of the Seattle effort is a program of matching funds now offer-
ing more than $3.5 million per year to neighborhood residents or businesses

for neighborhood planning, organizing, and improvement projects. Any
group may apply for funding but must provide a 50 percent in-kind con-
tribution or cash match. This requirement has worked to ensure that projects
are a joint effort of numerous participants within a neighborhood.

The matching fund program has resulted in exemplary neighborhood
improvement projects and partnerships between neighborhoods and schools.
Although the city devotes significant resources to these efforts, the cost-effec-
tiveness of this approach to neighborhood revitalization is enormous, pro-
viding both social and economic paybacks. Since the program’s inception in
1988, more than 1,000 matching fund projects have been completed, and
their success has resulted in continuing increases in the amount of general
fund monies allocated to this program. The enthusiasm and spirit of the
neighborhood residents participating in this effort is infectious.

Where people have resources to manage and improve their neigh-
borhoods, there is a sense of connection and pride that leads to happier,
empowered, and more responsible residents and safer neighborhoods. The
programs in Sacramento and Seattle eliminate the dismal view of govern-
ment as a vending machine—put your money in and get the services out—and
leads to more responsible, happier citizens and stronger neighborhood

communities.

SECURITY AND SAFETY
Security and safety are important elements in every neighborhood, yet many
neighborhoods in the United States are becoming increasingly prone to the
ravages of burglars, rapists, vandals, and so on. The usual response is to keep
the children close to home and to keep guard dogs or install special locks or
security systems.

Several researchers, however, have discovered that urban design can have
an effect on crime prevention and that neighborhoods following certain lay-
outs are statistically more likely to be safe places to live. In his book Design
Guidelines for Creating Defensible Space, architect Oscar Newman points out
that one cause of crime is the failure of residents to control surrounding
open space, where intruders, if unchallenged, can commit criminal acts.
Planning decisions regarding public, semipublic, semiprivate, and private
spaces can be made that tend to further recognition of neighbors and out-
siders and to encourage residents to assert their dominion against unwel-
come persons. If a space is clearly designated as private or semiprivate, resi-
dents will act to protect it, whereas a “public” space is always seen as
“someone else’s” responsibility. This is not to say that all public parks are bad,
but often they do have to be policed.
Another key to designing crime-free spaces is enabling residents to see what is going on in the open space around individual dwelling units. Newman contends that too many contemporary housing designs fail to provide for surveillance of the space that is crucial for residents' security—the nearby open space.

Newman also comments on street widths, noting that a wide street becomes a public space, ignored by the neighborhood, whereas a narrow street is psychologically assimilated into the neighborhood. In the latter case, residents are more likely to halt a speeding car or admonish a misbehaving pedestrian. Streets in Village Homes are narrow and are dead-end. In this situation, streets become less public and more controlled because the number of persons who may legitimately use them is limited.

The cluster commons in Village Homes are designed using several techniques to ensure that residents can exert control over adjacent open space. Homes have windows and decks for outdoor living that overlook the common space. Residents have planned and maintained their commons, they have a vested interest in the spaces, and they have every right to protect these areas from intruders. Even the more public greenbelts are less vulnerable to vandalism than an adjacent neighborhood park. Residents pay directly for maintenance of the greenbelts; they have played a part in hiring the gardeners; and they may have participated in planning or building a pool, play structure, or orchard. Therefore, they have a direct interest in defending the open spaces around them. The space is perceived of and is Village Homes territory, not public territory.

The design techniques for provision of safety and security described here work equally well in the inner city. An appropriately designed moderate-income housing development in San Francisco called St. Francis Square provides an instructive example.

St. Francis Square is located in the middle of a high-crime area in the city, yet the residents consider it a fairly safe place to live and to raise children. A number of planning elements have contributed to this. First, the 300 units in three-story buildings are grouped around three landscaped interior courts, and all units have a view of this open area. The apartments are arranged so that groups of six units share a common entry, and each unit has a private garden or balcony. In this way, St. Francis Square provides semipublic space (the courtyard), semi-private space (the entry corridor), and private space (the apartment and garden or balcony). Second, the residents do not rent their apartments; they own them through membership in a cooperative. An active co-op association controls and manages the jointly owned common space. A strong sense of community is apparent in St. Francis Square that results from membership in the co-op and participation in community-wide social events and work parties. Even though the rates of street crime in the area surrounding St. Francis Square are very high, the majority of residents feel safe walking in the interior courts at night. It has been reported that if a person is attacked at night and calls out for help, the neighbors respond and the culprit is caught or runs away.

A sense of community is another important variable in the safety of a neighborhood. Where neighbors know and care about one another, they will also act to protect their fellow residents from a suspicious stranger. Neighborhood watch programs have been shown to reduce burglaries by as much as 37 percent. Similarly, researchers at Harvard University reported that rates of violent crime in communities in which residents watched out for one another and for their neighborhood were as much as 40 percent lower than in neighborhoods where such relationships were not as strong. Race and income were not factors in neighbors' willingness to get involved. Some affluent neighborhoods had a poor sense of community, and some of the poorest had a strong one. "It's a social phenomenon," said the study's director, Felton Earls, a professor of psychiatry at the Harvard School of Public Health. "It happens when people are in the street, when people are speaking..."
to each other and when there are activities that bring people together. It feeds on itself.26

Crime rates in Village Homes are said to be the lowest in the city of Davis. Research indicates that it is apparently not just the delineation of spaces into semipublic and semiprivate areas that allows Village Homes to be relatively free of crime. The things we have done to offer places and reasons for people to come together has created that sense of community that results in good neighbors and a safe environment.

**Privacy**

It is very likely that physical privacy is essential to the development of a sense of community in our culture. It has been observed by anthropologist Edward T. Hall and others that where physical barriers do not provide enough privacy, social barriers develop as substitutes.7

In a crowded apartment house with poor sound insulation between the walls, neighbors often make a point of not getting to know one another so that they can maintain distance through social barriers if not through physical design. In her graduate research at the University of California, Judy observed this social withdrawal or "hiding," which gives the harassed individual the privacy he or she so badly needs.

Occasionally, we meet individuals who seem to have relinquished their privacy in favor of a more communal lifestyle. This arrangement rarely lasts very long. Soon, the freshman deserts her crowded dormitory for a quiet apartment off campus or the commune member leaves to find a place of his own. For a lasting community spirit to develop, it seems essential that group members have an opportunity for privacy.

When designing Village Homes, we believed it was necessary to provide plenty of opportunity to satisfy the need for privacy. Every home has space for a fenced, private yard. Sound insulation is installed between common-wall units. Large expanses of windows either are screened or face courtyards or open space. The Homeowner's Association appointed design review committee monitors new construction to ensure that future additions will not detract from any individual's ability to maintain privacy. No second-story window may face another's private yard.

**Diversity**

In chapter 3, we identified diversity as a necessary component of a well-functioning human settlement; it is just as much a necessary component of a well-functioning neighborhood. Unfortunately, modern neighborhoods have been growing less diverse. Just as we have moved toward large-scale farming exemplified by rows and rows of a single crop, we have moved toward neighborhoods that segregate people of similar social class into endless vertical and horizontal rows of housing units, separated from the shops, workplaces, schools, parks, and civic facilities essential to daily living.

It has been demonstrated that children suffer from neighborhood homogeneity. A study in West Germany compared the reactions of children living in eighteen new communities with those of youngsters living in older, more diverse German cities. The children in the new communities did not like their living environments very much. According to the New York Times, in the new towns, "amid soaring rectangular shapes of apartment houses with shaded walks, big lawns, and fenced-in play areas, the children for whom much of this has been designed apparently feel isolated, regimented and bored."8

To maintain an appropriate level of diversity, neighborhoods should incorporate the following:

- Housing for people of various income levels
- Space for field games
- Natural play areas
- A large party or meeting facility
- Spaces for informal gatherings, such as a well-placed bench under an appealing tree
- Recreational facilities such as a swimming pool, a basketball court, and an arts and crafts center
- Agricultural production
- A small commercial center including a neighborhood store, a restaurant, and small shops and offices

Although all these items need not be included in every neighborhood, designers would do well to remember that a more diverse neighborhood will be more full of vitality.

A neighborhood functions well when people feel that they are safe and can rely on help from others. It functions well when people can grow in their ability to get along and work out their differences. It functions well when, through participation in community activities, including work and fun in groups, people experience the inner warmth and fullness that come from feeling that they as individuals are part of the community and that the community as a whole is part of all humanity. All neighborhoods should be designed to accommodate these functions, for when they are not, part of the human potential may be lost.
Neighborhoods can also play an important role in creating a participatory democracy. Mark Hatfield, former U.S. senator from Oregon, said:

We must return to a scale of government which is comprehensive to our citizens. . . . To date, the centralization of government has destroyed community self-management and citizen participation.

We must reverse this trend and develop our cities along the lines of neighborhood government and inter-neighborhood cooperation.  

The Town Center

The town center has the potential of being a friendly and exciting place for the people who work, shop, find entertainment, or reside there. It ties a group of neighborhoods together and provides an environment of diverse activities that contrasts with the outlying neighborhoods.

Most towns and cities in the United States have lost most, if not all, of the essence of the town center as it existed in many places in the middle of the twentieth century. With sprawling growth, people are moving farther and farther from the town center. Peripheral shopping centers have sprung up away from town centers, reducing the economic viability of businesses in the town’s core. People visit their town center less frequently, thereby reducing their feeling of belonging to the town.

The shopping center serves as a place to purchase goods and services, but for the most part, it fails to function as a town center for the area it serves. This is partly because as the name implies, the shopping center is just for shopping; it lacks the range of activities and facilities found in a real town center. It is not a workplace, except for the shop personnel, nor a center of local government; nobody actually lives there, and there are no schools or public recreation areas. Aside from a few restaurants, there is little or no space for leisure or socializing. There are no plazas or civic spaces.

The shopping center also fails to function as a town center because it is oriented to automobiles. Acres of surrounding land, in a prime location for needed nonshopping facilities, are taken up by parking lots. Even where other facilities exist nearby, they are typically separated by busy streets and long stretches of barren parking lots, quite inhospitable to pedestrians.

To function well as a town center, an area should have shops, businesses, restaurants, sidewalk cafés, theaters, schools, compact housing, a transit stop, and professional and governmental offices. It should also have open spaces in the form of parks, plazas, bowling greens, and so on. It must also be very compact, without large parking lots, blank walls, or vacant parcels interrupting the flow. With this variety of elements, it can be an exciting and vibrant place to be, to live, and to meet people, as well as a place to shop and do business.

As far back as 1953, Lewis Mumford wrote:

Above everything else, a city is a means of providing a maximum number of social contacts and satisfactions. When the open spaces gape too widely, and dispersal is too constant, the people lack a stage for their activities and the drama of their daily life lacks sharp focus. Like every other amenity, public open spaces and private gardens must be scaled to the whole for which they are planned.

This vision of the town center depends partly on good design, partly on a lively diversity of activities, and partly on size. Also very important is the absence of speeding automobiles. Eliminating or reducing the size of automobile traffic lanes as well as large surface parking lots will make the area more compact and thus easier to get around in on foot with no need to be alert for cars. Undistracted by their noise, motion, and brightness, strolling pedestrians will be better able to appreciate the sights, sounds, and smells of human activity. The air will be cleaner, and the atmosphere of the street will

Downtown Santa Monica, California, has eliminated automobiles, but the lively, mixed-use area attracts thousands of visitors. (Photograph courtesy of Local Government Commission)
be calmer and quieter, more conducive to browsing, to striking up a conversation, or to settling down on a bench to rest and just observe.

The town center seems to function better if it has its own neighborhood community. People can live there in flats above businesses, in small apartments, and in town houses. These alternatives offer a perfect situation for people who want to live in an area of higher density. Senior citizens who may no longer drive and young unmarried individuals are particularly drawn to downtown living. A few merchants or craftspeople may even combine their places of business and their living quarters. This sort of mixed use adds to the liveliness and homeliness of the downtown area and makes it a safer place because people are present at all times of the day and night. Members of the downtown live-in community need many of the same facilities as do those in the outlying neighborhoods, though in some cases they can use the larger facilities designed to serve the whole town. Since compactness is of the essence, some facilities, such as community gardens and playing fields, are not appropriate within the town center itself, though they might be provided adjacent to it.

Establishments requiring much space and relatively little contact with the public, such as automotive sales and service facilities, major industries, and the city equipment yard, should more logically be located toward the outer part of the town rather than at the town center.

Revitalization of town centers in existing urban areas and construction of town centers in areas with new urban growth are major goals of sustainable planning that can result in increased richness of people’s existence. Fortunately, there is increasing activity in this area today. Both large and small communities throughout the United States are beginning to work on bringing back their downtowns.

Hayward, an older city adjacent to Oakland in the San Francisco Bay Area, provides an example of the rewards of such efforts. In 1992, Hayward’s mayor, Michael Sweeney, was lamenting the decline of the place that was his own hometown. Families and middle-class residents in general were leaving the community, leading to an economic decline that was visually apparent. The city’s streets were clogged by traffic, particularly at commute time, and the downtown area had deteriorated. The solution Sweeney conceived to address these problems had had time to be implemented and tested. It is working.

Sweeney’s idea was to take advantage of the fact that there was a train stop for the San Francisco Bay Area Rapid Transit District (BART) not far from the center of town. The site was dominated by surface parking, and though it was adjacent to Hayward’s Main Street, it was disconnected. No train commuter would think of walking downtown. Sweeney led the development of a plan to turn the area around the train stop into a civic plaza and mixed-use center, tying in an existing library and post office. The city has completed several elements of the plan, including a beautiful new city hall, a bus mall, and eighty-five town houses. Still to be built are more office space and housing at the site and a structured parking lot with retail establishments at street level. Private investors are building a supermarket in the area, along with a multiplex theater and additional housing. The developer of proposed upscale housing expressed confidence that downtown Hayward will be a great neighborhood. Both the expense of owning a car and the unpleasantness of traffic jams are now avoidable for those who live in this great new neighborhood, and the city of Hayward has regained its heart.

The new urbanism movement has spurred the inclusion of neighborhood and town centers in a number of new large-scale residential developments. For instance, at Haile Plantation near Gainesville, Florida, a developer is completing a new, one-third-mile-long Main Street as the town center of a 1,700-acre master-planned community. The developers waited until about 1,000 homes had been built so that they had the critical mass of people needed to support the undertaking. The results have been excellent. The attractive narrow, tree-shaded downtown street is lined by more than forty buildings, including shops, a corner grocery store, a dry cleaner, a post
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Producing something greater socially, culturally, and economically than the sum of its separated parts. After ignoring her advice for many years, the residents and leaders of many existing communities and the planners and developers of many new ones have decided she was right.

Circulation and Layout

Circulation systems within U.S. cities have traditionally been based on a grid pattern, with residential streets connected to larger arterial streets. Streets are designed for both cars and bicycles, which generally leaves the bicyclist at a disadvantage. Pedestrian walkways are along the sides of most of these streets. The pedestrian must cross the path of automobiles at every block and be subjected to noise and exhaust fumes. Because of the inability of the grid system to handle heavy flows of long-distance, high-speed through traffic, freeways are often added as a city expands.

In some instances, this works well, particularly where through traffic has been rerouted around a city to avoid interference with local traffic. It has not worked well, however, where expanding adjacent development has put more and more traffic onto neighborhood streets as people live farther and farther from the town center. Increased traffic flow on residential streets has tended to destroy older neighborhoods unless measures such as traffic calming and street closure have been implemented.

Where freeways have been built to accommodate commuter traffic, their presence has encouraged the continuation of sprawl by permitting developers to build in locations with access to freeways that are not yet congested during commuting hours. As building proceeds, the freeways gradually become more and more clogged for seemingly endless miles. This has led to commuters spending billions of frustrating hours in slow-moving lines of traffic, not to mention the resultant enormous drain on energy supplies.

Public transit systems should replace freeways as the major form of transportation in the future. (It is critical that we start planning now for the end of cheap gasoline rather than planning our transportation system around a resource that we know will not last.)

However, for public transit to work a community must be fairly compact. The closer people live to a train or bus stop, the more likely they are to use it. If the train or bus is a short and pleasant walk away, people will leave their cars at home and climb aboard. Transit service also must run frequently so that people do not have to stand around and wait.

To support frequent bus service, the general rule is that there must be a residential density of at least seven units per acre over an area of one-half
square mile. For very frequent bus service, a community needs at least eight units per acre. To support light-rail service, a community should have forty-three units of housing per acre within one-eighth mile of a station and ten units per acre in the next one-eighth mile. These figures are based on behavioral patterns during an era of very cheap gasoline and might be expected to change when gas prices inevitably rise.

To make bicycling and walking convenient means of transportation, a balance of residences, places of employment, entertainment facilities, and establishments offering goods and services must be provided in a compact scale and design that make these forms of transportation safe and pleasant. In order to create enjoyable pedestrian routes that are free of dangerous exhaust fumes, we believe it is sometimes preferable to keep automobile and pedestrian paths separate. At the same time, access for emergency vehicles must be available to all buildings, as must access for transport of items that cannot easily be carried.

The most obvious way to separate automobiles and people, and in fact the one used in Radburn, New Jersey, and in some other garden city plans, is to make all streets in the town feed outward to a peripheral ring road rather than inward. Bicycle and pedestrian paths, on the other hand, run inward from each neighborhood to the geographic center of town, where the transit stop and the commercial and civic facilities people visit most often are located. Vehicle access to the town center can be provided by a single service road bisecting the town and connecting at both ends to the ring road. With such a circulation system, one can reach any point in the town by automobile or travel between any two points, if necessary, by driving out to the ring road and around to the appropriate street entrance. This route is fairly indirect, however. Direct routes are reserved for bicyclists and pedestrians, for whom distance is more crucial. To keep these distances practical, the size of the town should be limited to four square miles or less. There should be higher-density development within and immediately adjacent to the town center. Around the town center can be neighborhoods of about 500 to 1,000 people, each surrounded by a greenbelt consisting of agricultural areas, parks, playing fields, and natural areas. It is interesting to note that the residents of Columbia, Maryland, a community designed along these lines, drive thirty fewer miles per month than do residents of neighboring communities. Studies of European garden cities show similar results.

Laying out a community in this way creates an automobile-free living environment. The plan also lends itself easily to other design solutions, such as the creation of distinct neighborhoods adjacent to open spaces where food supplies can be grown and where, if conditions permit, treated wastewater can be used for subsurface irrigation. The plan makes it simple to incorporate natural drainage systems because there is open space adjacent to all buildings. The interconnection of open spaces allows for continuous waterways.

This basic pattern, a version of Ebenezer Howard's garden city, appears somewhat rigid in the accompanying conceptual drawing but can take on a limitless variety of forms based on terrain and other design constraints and concepts.

The Village Homes subdivision offers just one example of how automobile access can be provided for every home while maintaining a generally automobile-free neighborhood. (The Davisville project described in Chapter 10 demonstrates how to accomplish this on a larger scale.) Because private yards have been created on the street side, we have been able to eliminate traditional fenced backyards and turn the property behind homes into a common open space—which then provides space for the bicycle paths and footpaths (as well as the channels that make up the natural drainage system).

Another important consideration in laying out the streets and paths of a neighborhood is that all structures should be able to take maximum advantage of the sun for space and water heating. Streets should be curved to avoid
the somewhat undesirable visual effect of straight rows of houses all facing south. As in Village Homes, curved streets allow the houses to be staggered yet still maintain a southern orientation.

A couple of additional points seem important to the general layout of a neighborhood designed to reduce automobile traffic. Very small commercial centers should be located adjacent to or within each neighborhood so that daily needs can be met by walking. The variety and number of these should be based on the design of the local neighborhood as it grows and residents determine what their needs are.

In lieu of sidewalks on the street, 6-foot-wide paths can be used between groups of houses. This width seems to work well in Village Homes. The paths can lead into 8- and 10-foot-wide collector paths designed to carry more traffic.

In the more centralized parts of a town, heavily used arterial paths should probably be 12 to 24 feet wide. If automobile traffic gets to be heavy at intersections, stop signs or possibly a traffic circle may be required.

Street width can be drastically reduced in a development that encourages pedestrians and bicyclists because of the reduction in use of automobiles. Since the 1960s, street-width standards in the United States have become
responding area—with an emphasis on the safety and enjoyment of the pedestrian rather than facilitation of high-speed traffic. Burden’s suggested street widths are as follows:

- Trail for nonmotorized access: 8 to 14 feet
- Alley providing access to the rear of a property: 10 to 12 feet
- Lane providing access to single-family homes: 16 to 18 feet
- Residential street: 26 feet
- Avenues connecting town centers and neighborhoods, with parking: 48 feet
- Main street with parking: 36 feet

Although it is very difficult to get along without an automobile in today’s world, which is designed for automobiles rather than for people, it would not be so in a world designed primarily for pedestrians, bicycles, and mass transit.

### Appropriate Uses of Landscaping

Historically, our ancestors first exploited and then learned to manage the plants in their environment to meet important human needs. They used plants for food, fiber, and fuel and for protection from sun and wind, to hedge cattle in and enemies out, and to define social spaces. They also learned to manage plants to delight the senses with color and fragrance, the sound and movement of windblown foliage, and the order and complexity of natural forms. We believe that these pleasures go deeper than mere aesthetics; we believe they reflect the fact that human perceptions and responses are genetically tailored to the natural environment and to living things, and therefore such environments nurture people. Humans learned to manage their landscape environment to meet all these needs simultaneously in an integrated way.

The word landscaping has different connotations today. Both as generally practiced and as taught in most schools of landscape architecture, landscaping has little to do with protection from climate and nothing at all to do with production of food, fuel, or fiber. Its aesthetics often reflect fads. This kind of landscaping can be a wasteful practice.

To make landscaping an element of sustainable design, efforts must be made to rediscover the art of landscaping to satisfy diverse human needs simultaneously, making it an expression both of efficiency and of care for the ecosystem. In this section, we discuss in detail two aspects of this: landscaping for climate control and landscape productivity.
Landscaping for Climate Control

Plants are invaluable for controlling sun and wind and, in cold-winter climates, for controlling drifting snow. The most obvious example of wind control is a large-scale windbreak of tall trees that reduces wind speeds for long distances in its lee and for many times the height of the trees. But smaller plantings are also useful for more detailed control, either by moderating the wind’s force or by controlling its direction. Relatively small plantings near a building can reduce wind speed next to the building by diverting wind around or over it. Foliage against the wall of a building — tall shrubs or a trellis with vines — can further reduce wind speed to create a virtual dead-air space next to the wall, which significantly reduces heat loss through the wall in cold weather. Shrubs can also provide wind protection for outdoor living spaces and entrances to buildings.

In hot climates, proper landscaping can improve ventilation of buildings by means of plantings planned for detailed control of wind direction. Landscape architect Robert F. White’s studies at the Texas Engineering Experiment Station, published in 1945 and often reproduced, show in detail how various combinations of trees, shrubs, and hedges planted beside or upwind of a building can increase or reduce airflow through the building, change patterns of circulation within the building, or even reverse the direction of flow. This knowledge can be particularly valuable in locations where wind directions are fairly regular. Around Davis, for example, because of the north–south orientation of the Sacramento Valley and its relationship to the Carquinez Strait air corridor, the summer breeze blows predictably from the north in the morning and from the south in the evening. In hilly areas, wind patterns may be more complex, but they are still fairly predictable in any one spot. Thus, landscaping for ventilation control calls for a familiarity with the patterns around each house that is available only to someone who lives there.

Where summers are warm, shading is an important goal of landscape plantings. Good shading can keep temperatures comfortable both indoors and outdoors. It can also save energy by reducing or eliminating the need for artificial air-conditioning. In the paragraphs that follow, we discuss shading in some detail because it can be particularly complicated around houses that use solar energy.

Everyone knows that it is more comfortable to be in the shade on a hot day because one’s body is directly heated by solar radiation when in the sun. What is not so obvious is that lack of overall shading raises temperatures throughout the neighborhood, even in the shady places. Unshaded pavement — in streets, parking lots, patios, and walkways — is particularly troub-

blesome in hot climates. Pavement is often dark colored and therefore absorbs more of the radiation that strikes it than do lighter surfaces. It does not cool itself by evaporation of water as vegetation does. Moreover, its mass stores heat during the day, so it remains hot well into the evening. A study conducted in Davis by the University of California showed that ambient temperatures are as much as ten degrees lower in neighborhoods where streets are well shaded than in those where street shading is poor. Studies carried out in Sacramento by the Local Government Commission have confirmed this finding.

Streets, parking lots, and other large paved areas such as school playgrounds should not be designed without consideration of how they can be shaded. In Village Homes, we made streets easier to shade by eliminating parking lanes on either side and substituting intermittent angled parking bays with four parking spaces each. Thus, shade trees could be planted between bays or between a bay and a private driveway, separated only by the two travel lanes, with a total width of only twenty to twenty-six feet. This narrow street width allows us to completely shade the street with a tree canopy in summer.

Another design method — common in older neighborhoods and newer

Narrow, tree-shaded streets help keep Village Homes residents cool without the use of air conditioners.
ones designed according to new urbanist principles—places trees in a landscaped buffer between the sidewalk and the street. This requires green edges of six feet or more on each side and street trees with foliage broad enough to create a double canopy, although the city of Seattle has had success with three-foot planting strips for certain tree species. Even a four-lane street can be completely shaded by putting a median strip in the center and planting it with trees.

Trees can also be used to make streets safer. Comparisons show that traffic on many tree-lined streets moves ten to fifteen miles per hour slower than does traffic on streets not lined with trees. Moreover, there is a direct correlation between traffic speed and seriousness of accidents. 19

At the same time, however, trees must not substantially shade rooftop solar heat collectors or south-facing windows that function as solar heat collectors in winter. As discussed later in this chapter, deciduous trees can provide shade in summer, when solar space heating is not needed, because they lose their leaves in the fall and allow sunlight to reach the collectors or windows through the bare branches. But some deciduous trees do not lose their leaves early enough in some climates. Collectors used for domestic water heating work year-round, so they must never be shaded. Thus, shade plantings require careful planning. Landscape designers must be familiar with leaf-fall dates and growth patterns of various species in the local climate and must be able to use them creatively to provide shade or sunlight where and when it is needed.

In addition, advice by the neighborhood group as a whole concerning landscaping on private lots is necessary to make sure that plantings on one lot do not shade a neighbor’s solar collectors. This can be accomplished with a provision for solar rights in the Declaration of Covenants, Conditions, and Restrictions (CC&Rs) of the subdivision or by local ordinance or state law. Village Homes has a section on solar rights in its CC&Rs:

Whereas, that certain Declaration of Covenants, Conditions and Restrictions was recorded on October 31, 1975, as instrument No. 15574, in Book 1166, Page 385 of official records.

Now therefore, the lot owners and the declarant Village Homes, do hereby modify said Declaration of Covenants, Conditions and Restrictions as follows:

SOLAR RIGHTS

All south-facing glass and solar space heating collectors in each house shall remain unshaded from December 21 to February 21 between the hours of 10 AM and 2 PM (solar time), except as provided herein.

All roof-top solar hot water collectors on each house shall remain unshaded each day of the year between the hours of 10 AM and 2 PM (solar time), except as provided herein.

Shading caused by the branches of deciduous trees shall be exempt from this restriction.

Shading caused by original house construction, or fences built within six (6) months of occupancy shall be exempted from this restriction only upon special approval of the Village Homes Design Review Board.

Homeowners may encroach upon their own solar rights.

The Board of Directors of the Village Homeowners’ Association shall have the authority to enforce this restriction.

It is particularly crucial to shade windows from direct sunlight during summer because any sunlight that falls on them enters the building and immediately turns into heat. Indoor curtains or blinds help little unless they are light in color to reflect solar radiation and fitted to the walls to prevent heat from sneaking into the room. Most of the light that strikes curtains or blinds turns into heat just as it would if allowed to cross the room and strike
the opposite wall. Once the sun’s energy passes through the glass, it is in, and it will raise the temperature of the room.

With thoughtful planning, deciduous shrubs and vines can shade windows as effectively as artificial shading devices such as awnings, and they can do it much more cheaply and attractively. Such vegetation is particularly valuable for shading south-facing windows used for solar heating because the foliage provides more shade in fall than it does in spring, when leaves are just beginning to form. Therefore, it can be arranged to shade the windows in fall, when the sun is lower in the sky but the weather is still warm, and admit sunlight in spring, when the sun is at the same angle but the weather is cool. A fixed awning or overhang used for the same purpose would give too much shade in spring or too little in fall.

**Landscape Productivity: Food and Fuel**

Landscape spaces in our towns and suburbs today are almost entirely unproductive. This is a relatively recent development; a few centuries ago, it was quite common for each house to have its own garden, fruit trees, and vines. Small fields, forests, orchards, and vineyards surrounded towns so closely as to be part of the immediate landscape. The pattern still exists in many small old European towns.

This was a very efficient use of land. The same pieces of land provided both the space needed for growing food and fuel and the pleasant public and private outdoor territories needed for human activity, interaction, and comfort. Productive trees, bushes, and vines performed the same functions as do the unproductive ones now generally used in landscaping: providing shade, wind protection, and privacy; defining spaces; and creating a pleasing atmosphere by echoing the natural environment in which humans evolved.

Our present neglect of productive landscaping is wasteful in a number of ways. It not only wastes land but also wastes the energy and resources used in transporting and marketing agricultural products. It wastes fertilizer (which requires additional energy if chemically produced) and water where irrigation is required. It also wastes human labor. Unproductive landscaping requires about as much labor from the homeowner as does productive landscaping, but at the same time it requires others to work to produce the food elsewhere and to process and distribute it.

Suburbanites accustomed to purely decorative landscaping tend to assume that vegetable gardens are unsightly. A sprawling, neglected garden can be an eyesore, but in a relatively dense residential area where lots are small and garden space is at a premium, gardens are less likely to be neglected. With the garden right under the window and on public display, there is no reason to think that the homeowner will neglect its appearance, any more than he or she would neglect the appearance of a purely decorative yard.

As described in chapter 2, we reversed the typical neighborhood pattern in Village Homes by encouraging people to put their fenced private yards on the side of the house facing the street and requiring them to leave the yards on the other side open to a narrow common strip between the two rows of lots. The common strip is managed collectively by the homeowners on either side. People tend to do their gardening on the part of their lots facing this common strip or, by mutual agreement, on the common strip itself. Some groups of homeowners have developed very creative ways of integrating vegetable gardens with individual or communal patios or children’s play areas. Because they are on the “public” side of the houses, owners tend to keep their gardens as well maintained as people in a standard subdivision keep their front yards. In fact, they experience similar social pressure from their neighbors to keep these publicly visible areas neat.

Nut trees, fruit trees, and fruiting shrubs and vines present no more neatness problems than do unproductive landscape plants. With their diverse sizes and growth habits, one or another of them can be used in almost any landscaping situation. Apple, filbert, fig, and apricot trees, with their spreading growth patterns and different sizes, are suitable for shading patios of various sizes. Trees with a more upright pattern—plum, cherry, and pear—are good for protection from the afternoon summer sun. In mild-winter climates, citrus trees, which do not lose their leaves, can provide a year-round windbreak or visual barrier. All of these trees are available in dwarf and semidwarf varieties that can be used in landscaping like medium-sized or large shrubs. Other species, such as blueberries and currants, grow naturally as shrubs. The smaller fruit and nut trees can be planted in rows and pruned flat to form a unified hedge or tall barrier, or they can be trained in the very flat and formal espalier style, hugging a fence or shading an east or west wall. The bramble fruits—raspberry, blackberry, and boysenberry—can be trained on supports to make a high or low fence. There are also plants considered primarily ornamental, such as crab apple and jujube, that bear edible fruit.

Grapevines are exceptionally versatile. In virtually any climate, some variety of grape can be grown and eaten fresh or made into raisins or juice. Grapevines can be trained on supports to make a low fence or on a vertical or overhead horizontal trellis to provide shade just where it is needed. They are particularly suitable for summer shading above the south-facing windows of a passive solar house. Kiwi vines (Chinese gooseberries) can be equally
useful in appropriate climates, and their sweet, egg-sized fruit are a special delicacy.

Public areas can also be landscaped with productive plants. In addition to the varieties already mentioned, the larger nut trees, such as walnut and pecan, can be used for large-scale shade. In Village Homes, we have allowed wild cherries, *Prunus* species, and blackberries to grow wild along some of the landscape’s natural drainage channels and in other areas. Tiny orchards and vineyards here and there in residential areas provide a bit of openness and relief from the continuous pattern of houses and lots.

It is important to realize that in many climates, the urban landscape is capable of producing food in economically significant quantities. In these days of large-scale mechanized agriculture, it is easy to write off as insignificant the yield of a peach tree here, two grapevines here, and a half dozen tomato plants there. But 100 peach trees scattered through a neighborhood of 1,000 persons are as productive as 100 trees in a one-acre orchard, and 1,000 such neighborhoods can produce as much as a one-acre peach orchard. Moreover, those neighborhoods need not produce peaches alone; they may also have space for apples, pears, plums, apricots, and cherries; for nuts and berries and grapes; and for a wide variety of fresh vegetables in season.

An important advantage of neighborhood agriculture is that it allows for a healthy ecological balance that cannot be maintained in large-scale, single-crop plantings. Because plantings of any one species are small and separate, they do not encourage pests of that species to build up a large population, and they make it harder for pests and diseases to spread. This makes it possible to avoid costly and environmentally destructive pesticides and to use natural controls instead. In Village Homes, orchards and vineyards are no larger than half an acre and are located next to landscaping that harbors enemies of their pests. For example, blackberries planted near vineyards harbor the *Anagrus* wasp, which preys on the grape leafhopper. Thickets are provided for birds that feed on insects, and small ponds allow insect-eating toads to complete their life cycles.

With the proper pollution control devices, firewood for heating and for generation of electricity may be an important part of our energy supply in coming years, and we could save additional energy by growing the trees near where the wood will be needed instead of hauling it for long distances. This makes it reasonable to consider forestland as a possible element in urban landscaping. Large and small woodlots could be placed in and around a town for firewood production, located so as to serve as windbreaks and harvested and replanted on a rotating basis. While the trees are growing, the
woodlots could provide space for play, walking, jogging, picnics, and contemplation and serve as wildlife refuges. It would be possible to get away to the woods for half an hour at any time without driving great distances—or any distance at all.

In Davis, citizen activists have proposed that the city government create biomass forest areas around and within the city using eucalyptus, black locust, and other fast-growing species, interspersed with one- to twenty-acre organic truck farms. These areas would serve as buffer zones to protect the city from the drift of toxic agricultural chemical sprays.

Using Natural Drainage
The drainage of water from the land is an intricate process and an integral part of the ecosystem. It affects and is affected by the materials and contours of the ground and the living things in and on the ground, particularly plant life.

At the same time, however, natural drainage and the ecological communities related to it are a rich and satisfying part of humanity’s subjective environment—aesthetically, sensually, and psychologically. It is subtly stimulating and comforting to experience the movement and sound of water in its great variety, flowing through almost-level fields, making its way along tiny creeks or swales, rushing down steeply inclined streams or over falls or rapids, or flowing smoothly and silently in deep, winding channels. The animal and plant life in these waterways and along their banks is endlessly fascinating. Every reader must have at least one memory of peaceful hours spent near naturally flowing water.

As a society, in building our towns and cities, we have done little or nothing to preserve natural drainage for either its aesthetic value or its ecological value. We have filled in existing waterways and have built so that runoff is collected immediately in street gutters and sent to underground drainage pipes or sewers. The natural streams we could not get rid of we have channeled into pipes, and then we have covered the pipes with dirt or asphalt. As the waterways have been destroyed, so have the plants and animals that lived along them. The accelerated storm runoff created by our propeity to channel rainwater rather than let it be absorbed into the ground creates enormous engineering problems, requiring huge holding ponds and, where sewers are used for storm drainage, oversized sewage plants.

After going to all the trouble and expense of eliminating natural waterways and wildlife habitats, we incur further expense in trying to build sterile substitutes back into our cities. We build fountains and fake pools and streams that use pumps to circulate the water. Some are bare concrete; others include plants and naturalistic landscaping, but because they are created by humans rather than by a balanced ecological process, they usually require constant maintenance. The very best one can say about these efforts is that they are a little bit better than having no running water at all.

Constructing a natural drainage system in a development like Village Homes, which has greenbelts running between the buildings, is simple. Lots are graded so that the streets and houses are higher than the creek running behind them. The water runs off the streets and houses and down into the creek. The system is engineered to hold more water than that expected in a 100-year storm, but walkways and vegetation along the creek and in the greenbelt will not suffer if they are covered by water on rare occasions. In a town center, the system is the same. Buildings are two-sided: one side faces the street, and the other is enhanced by the beauty of a nicely landscaped creek. Small dams can be constructed throughout the drainage system so that water can be held and the flow slowed during times of rapid rainfall. Mosquito fish are a necessary addition if water remains standing for more than three days, to ensure that mosquito larvae are eaten before they have a chance to hatch.

Maintenance of natural beauty and preservation of wildlife habitat are
only two of the reasons for taking advantage of natural drainage systems. Doing so can also reduce costs, conserve water, reduce flooding problems, and actually increase property values.

Storm drains are expensive to build, operate, and maintain. Great savings can be realized by relying instead on human-made surface drainage swales and any natural waterways existing on the site. Because the water does not drop below ground level, no pumping station or energy is required to pump it back up. Blockages in a surface drainage system merely raise the water level instead of stopping the flow and are easily spotted and removed, whereas in a subsurface system they can put a storm sewer completely out of action and be difficult to find and clear.

Natural drainage also allows the ground to absorb and retain water, which is particularly beneficial in areas that have light annual rainfall. In California's Sacramento Valley, for example, the ground can absorb an entire winter's rainfall without becoming saturated to a depth from which the roots of grass, shrubs, and trees can recover the water. Therefore, any rainwater that can be made to soak into the soil instead of running off means an equivalent reduction in watering requirements during spring and fall. Native plants can often survive with no additional water at all. In wetter regions, water absorbed into the ground surface or into streambeds may eventually find its way into underground aquifers that supply water to wells. This is important because in many areas, the groundwater level is becoming alarmingly low as a result of increased pumping from wells for irrigation and domestic uses.

Modern drainage systems, on the other hand, tend to maximize runoff and carry the water to rivers or large streams or to evaporation ponds. Only in a few areas are recharge ponds used to get water into the ground and replenish the water table, and these do nothing to directly satisfy watering needs in the neighborhoods where the rain originally fell.

In areas with greater rainfall, natural drainage is valuable in evening out downstream flow rates. The many small waterways that contain water only during rains and for a few days afterward keep the water moving slowly and allow it to soak into the banks, where it is held and gradually released. Thus, rainfall reaches the larger streams gradually, over a period of many days. In neighborhoods where runoff is carried in street gutters and underground pipes, these natural delaying processes do not occur and rainfall reaches streams and rivers in a matter of hours. Storms produce sudden, heavy surges that can destroy small streams and create flooding problems in larger ones, requiring major artificial controls such as holding ponds and straightened channels. In towns where storm drainage enters the sewage system, these
surges require sewage plants with absurdly large peak capacities, and even then, unusually heavy storms may force the dumping of untreated sewage into streams, rivers, or bays.

One thing engineers tend to overlook is that a view of a creek or pond increases the value of a home or neighborhood. In Davis, water from our part of town was pumped into an evaporation pond—just a square pond with sides too steep to support any wildlife. When Michael was mayor, he suggested turning the pond into a wildlife refuge by creating natural-looking contours and planting the area with native grasses and trees. Now the ditch seems to have turned into a parking place for many birds on the Western Flyway, and we constantly enjoy the sight and sound of ducks and geese overhead. The pond is a great place to go for a walk, and homes that overlook the area command premium prices. Other neighborhoods have gotten the message, and several similar drainage–wildlife refuge projects now exist throughout Davis.

When we were in our mid-twenties and living in San Anselmo, California, we decided to build a house for ourselves on a lot that had a small creek running across the back. We bought the lot, and when we were getting the building permit, an engineer from the Department of Public Works apolo-

gized for the fact that the creek had not yet been replaced with an underground concrete pipe. When Michael told him that he preferred that the creek be left as it was, the engineer said that the city had a right-of-way across the property and would eliminate the stream sooner or later. During the time we lived in that house, we enormously enjoyed hearing the sound of the water and watching the deer that came to drink, the small trout in the pools in summer, and the steelhead spawning in winter. Fortunately, we sold the house before that wonderful natural amenity was covered over. Its loss definitely would have decreased the sales value of our home.

Village Homes and Davis are by no means the only place in the United States where natural drainage is being used successfully. Other communities are discovering the assets of natural drainage systems and uncovering previously buried or hidden creeks and streams. San Antonio, Texas, has for some time been taking full advantage of the stream running through the city by featuring it as a focal point of the community. Officials in San Luis Obispo, California, have enhanced their town center by doing the same. One can now dine on decks that overlook natural areas along the stream and enjoy walks on paths that line the area. Former Portland, Oregon, city council member Earl Blumenhauer, now a member of the United States Congress, has shared with us his public works efforts in Portland to return creeks to the light of day.

A combination drainage pond and wildlife refuge in Davis, California, has proven to be a major asset to the community. (Photograph courtesy of Local Government Commission)

A natural creek and drainage area runs through a park in Ashland, Oregon, enhancing the park's aesthetic value.
In conclusion, we believe that the garden city as proposed by Ebenezer Howard more than a hundred years ago provides an excellent framework for a more sustainable urban form. With the addition of everything learned in the twentieth century about designing with nature for people, it provides us with a fine blueprint for a more sustainable and successful twenty-first century.

Chapter 9

The Process of Creating Sustainable Communities

Designing a new garden city or garden village neighborhood or redesigning an existing urban area requires the integration of many different requirements into a land use plan. The critical roles of aesthetics and citizen participation must also be considered. And most important, the plan must be implemented.

Earlier in the book, we examined the importance of location of the site: its climate, its proximity to other settlements and to natural resources, the availability of water, and the potential for dispersion of air pollution. We discussed analysis and mapping of the site's existing drainage patterns and natural aesthetic features and examination of its soil types, solar orientation, endangered habitat, and so on, to determine which locations are best suited to various uses: agriculture, forestry, sewage recycling, buildings, roads and paths, and parks. We discussed how these factors should determine the overall size and density of settlement the site can support.

We also looked at conceptual notions of what a settlement should ideally be like and how it should ideally be laid out—appropriate size for efficient government and a good social atmosphere, appropriate patterns of circulation, proper relationship between public and private spaces and between living and working spaces, and so on. We described a variety of technologies from which to choose—different ways of handling sewage, different ways of producing energy, and different materials and methods for constructing buildings.

At this point, however, theory and analysis can go no further. Successful integration of all these factors into a harmonious, elegant site plan depends on a designer or design team's creative ability and intuitive perception of comprehensive solutions. In the end, the design of a sustainable human envi-
Designing Sustainable Communities
Learning from Village Homes

Judy Corbett and Michael Corbett

Foreword by Robert L. Thayer

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