community. The traditional garbage service is now a community resource recovery process

D Clustering strategies

Clustering strategies for residential developments achieve increased opportunity for interaction through effective densification adjacent to community amenities and greenways. Density is an essential element of community urbanity and civility. Without reaching a reasonable density in any urban area, it is difficult to justify the efficient utilization of urban resources and services. The more people share community facilities, the more amenities and services can be provided in an economically and socially justifiable way. Increasing density to 12–18 dwellings per acre (30–44 per hectare) also creates pedestrianization and makes public transit more viable. Two of the existing and proposed clustering plans are illustrated in Figure 12.17 and the critical **clustering design strategies** for densification are summarized below:

1. **Peripheral infill is achieved in areas where larger side yard setbacks occur between the dwellings. In many suburban areas,**

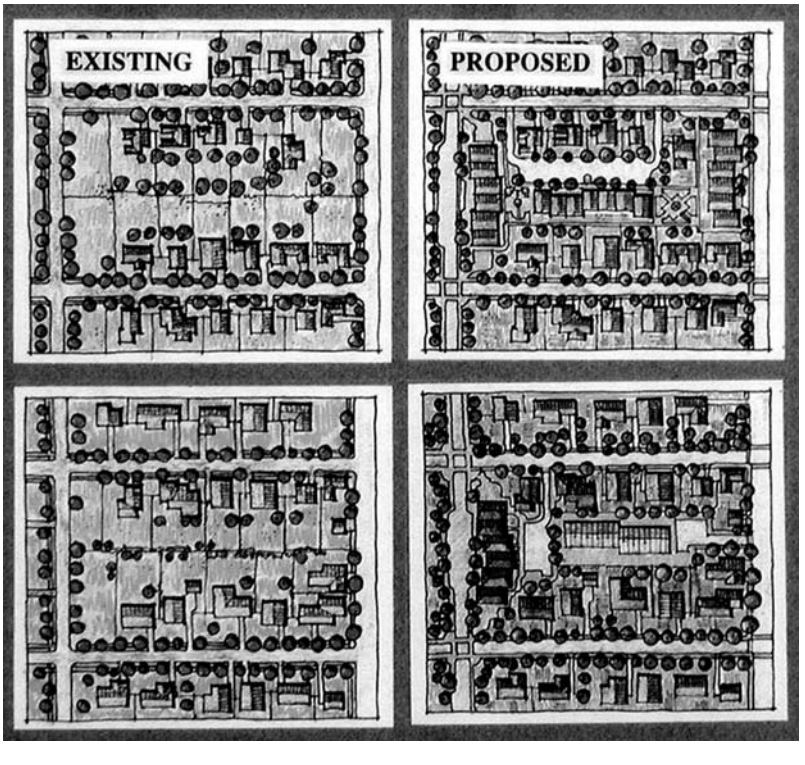

Figure 12.17
Pullman's residential cluster alternative plans (existing and proposed) showing densification and pedestrian priority streets.

setback and side yard regulations consume 30–40% of the street frontage. To increase the efficiency on such underdeveloped lots, new infill units and/or greenhouses are provided between and in front of the existing units. Each greenhouse could be commonly shared by the two families or owned by one. This arrangement increases the land use and energy efficiency, and creates a well-defined internal semi-private garden space in the back of the units to be used either collectively or subdivided individually

2. Internal and external block densification is applicable to larger blocks where the combined backyards can internally accommodate new townhouses, apartments, greenhouses and parking. Careful consideration is given to preserve family privacy and territoriality as well as provide spaces for social interaction in the clustered grouping of families
3. External expanded block and communal greenhouses can also occur by utilizing wide or redundant streets between two blocks. This densification can increase efficiency and enriches the communication and social interactions between the clusters. Additional developments could be built between these blocks, including communal playgrounds, gardens, and greenhouse structures
4. Internal unit densification can also accommodate many of the changing domestic needs of the family. In this situation, the house is subdivided internally or expanded to accommodate new members of the family. This is not a new practice. In many regions across the world, families have comfortably lived in one house for generations. Also auxiliary apartments within units are very common in most countries and provide for viable alternatives to increase affordability and the efficiency of residential areas

E Dwelling unit strategies

Dwelling unit strategies (new, infill, and renovated) reach a high level of land and energy conservation, optimizing the use/reuse/recycling of renewable resources of the sun, wind, water (grey and brown), food, and fibre. 'Design Guidelines for Sustainable and Affordable Residential Developments' can be found on our web site (Bartuska and Kazimee, 1999; Kazimee, 2002). The critical **dwelling unit design strategies** are summarized below and illustrated in Figures 12.18 and 12.19:

1. Household cost for energy dramatically decreases due to the shift to renewable energy sources and the following conservation measures:
   (a) Zoning ordinances require the residential plots to be oriented for solar access saving on average 20% of the energy used for heating and cooling
   (b) New state energy standards (quality of construction, higher levels of insulation, and solar benefits) conserve an additional