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INCREASING RESIDENTIAL DENSITY IN THE INNER CITY

ROBERT A. CRANE 1984

ABSTRACT

INCREASING RESIDENTIAL DENSITY IN THE INNER CITY:
THREE DEVELOPMENT SCENARIOS
by
Robert A. Crane

A Master's Degree Project
Prepared in partial fulfillment of the requirements
of the M.E.Des. degree in the Faculty of Environmental Design,
University of Calgary

Project Supervisor: Dr. Walter Jamieson

Residential density has important links to several aspects of urban life of interest to planners, including: (1) the effect of the built form on human comfort, health and behavior; (2) efficiency in the use of resources; (3) the economic and political forces which determine urban density patterns and influence the formulation of public policy.

It is assumed that a municipal government has adopted a policy of increasing density in the inner city. Three scenarios are developed within a study area in Calgary:

(1) High dwelling density. A 100% increase in dwelling density is effected through small-unit high-density apartment redevelopment.
(2) Family-oriented accommodation. Stacked townhousing infill is employed to achieve a 50% dwelling density increase.
(3) Selective redevelopment/infill. A variety of housing forms, both family- and nonfamily-oriented, is applied on a site-specific basis, which also results in a dwelling density increase of approximately 50%.

The fine-grained approach to planning used in these scenarios represents a departure from broader and more conventional methods of planning for the inner city.

Scenario 1 results in the highest dwelling and population densities, but Scenarios 2 and 3 produce population densities which are not substantially lower, employing only half the number of new dwelling units. These density policies can assist in meeting additional municipal goals, but may undermine others. From the perspective of the existing neighborhood, most of the impacts of the density increases are negative. In formulating density policy, it is therefore important to balance municipal efficiency concerns against considerations of the quality of the physical and social environment of the neighborhood.

Key Words: apartment / density / housing / inner city / neighborhood / redevelopment / residential

The University of Calgary

INCREASING RESIDENTIAL DENSITY IN THE INNER CITY: THREE DEVELOPMENT SCENARIOS

by

Robert A. Crane

A Master's Degree Project

Submitted to the Faculty of Environmental Design

in partial fulfillment of the requirements for the degree

Master of Environmental Design (Urban and Regional Planning)

Faculty of Environmental Design

University of Calgary

June 1984

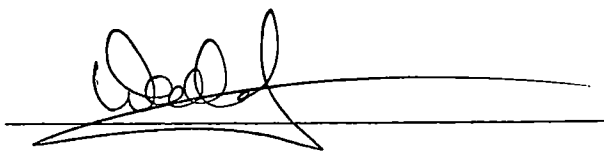
THE UNIVERSITY OF CALGARY

FACULTY OF ENVIRONMENTAL DESIGN

The undersigned certify that they have read, and recommend to the Faculty of Environmental Design for acceptance, a Master's Degree Project entitled

Increasing Residential Density in the Inner City:
Three Development Scenarios

submitted by Robert A. Crane in partial fulfillment of the requirements for the degree of Master of Envrionmental Design.



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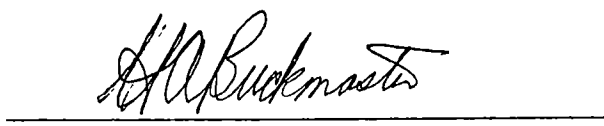

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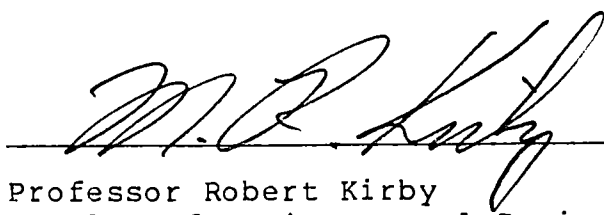

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ACKNOWLEDGEMENTS

I wish to acknowledge and thank several people who have helped me in completing this project. First are the members of my committee--my supervisor, Dr. Walter Jamieson of the Faculty of Environmental Design, Dr. Harvey Buckmaster of the Department of Physics and Mary Axworthy of the City of Calgary--whose support and constructive suggestions throughout the process were much appreciated. I am also grateful to Glenn Lyons of the City and Jim McKellar of Environmental Design for critically reviewing parts of the document and providing helpful information and comments.

The graphics for this project were provided by Sylvia Harnden, to whom I extend special thanks. Fellow students John Alley, Larry Franklin and John Mahoney also provided valuable technical assistance in the production of graphics and text editing.

Further, I wish to acknowledge the assistance I received from the staffs of the City of Calgary Planning Department and City Clerk's Office, the Alberta Bureau of Statistics, Statistics Canada and the Calgary Board of Education.

Finally, I would like to express my sincere thanks to the Canada Mortgage and Housing Corporation for the research scholarship which supported this project.

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INTRODUCTION

Residential density has long been a subject of interest in the field of urban planning. It has been related to questions of health and human satisfaction with the environment as well as efficiency of urban form in such issues as the consumption of land and energy. In the inner city, density is a primary issue in disputes arising between developers attempting to replace the existing housing stock with higher densities and citizens' groups concerned with preserving the quality of the residential environment. In Calgary, as in other cities, the interests of communities can differ from those of the city as a whole and the density question has become a matter of political debate (Donnelly 1982). This project will examine this debate and develop and evaluate strategies by which higher densities might be achieved in an inner city neighborhood, giving consideration to both municipal and neighborhood objectives.

In Chapter 1, the relationships between density and other factors which interest urban planners are examined. First is the effect of density on human health and satisfaction with the residential environment. This includes a discussion of some of the major works which influenced the development of density standards and an overview of the research which links density with social and psychological well-being. Second, the relationship between density and the efficiency of the urban system is investigated. There are several aspects of efficiency--the consumption of land and other limited resources, the costs of commuting and providing municipal services and the convenience of urban

residents in conducting their affairs. Third, the political and economic forces which influence density patterns are discussed. Traditional theories of location and neighborhood change are presented and examined. This is followed by a discussion of the differing economic and political interests at work in the inner city, which often generate planning issues.

Chapter 2 provides definitions of density, discusses its measurement and the means by which it is regulated. The factors which constrain density--legislative factors such as bylaws and building codes and physical site factors--are also discussed. The chapter concludes with a summary of prototypical housing forms and the density ranges usually associated with them.

In Chapter 3, some options for increasing density are investigated. Three scenarios are developed, each of which demonstrates how development may occur given a particular set of policy assumptions. These assumptions reflect various approaches to the density issue in the inner city which a municipal government may adopt. A study area within the Calgary inner city neighborhood of Sunnyside is defined in order to illustrate and assess the effects of the scenarios.

The three scenarios are evaluated in Chapter 4. The first criterion is actual density achieved, both in terms of units and population. Several other criteria are employed to assess the suitability of each scenario in terms of community and city-wide objectives.

Planning for older neighborhoods on a fine-grained and site-specific basis is a new and largely untested approach within the profession. The 'blanket zoning' of larger sectors within a city or neighborhood remains the most common implementation technique. Few precedents or examples of more detailed and selective planning are available, and planners are only in the pioneering stages of developing methodologies for going about it. This project explores some of the opportunities and problems associated with this type of planning in light of municipal and neighborhood goals which may sometimes conflict with each other. The project concludes with observations on the density issue in view of the scenarios which were presented.

CHAPTER 1
THE ISSUE OF DENSITY IN URBAN PLANNING

Density, the ratio of population or buildings to land area, and the regulation of it have been a matter of concern to planners since the profession was first established. The interest in control has generally not been an end in itself but due to the fact that 'residential density has clear and discoverable relations with other dimensions' of urban life (Lynch 1981, p. 264). This chapter begins with an examination of some of these relationships and their implications for urban planning. This is followed by a brief survey and discussion of the theory relating to urban density patterns and the forces which bring them about. The analysis then focuses on the economic and political forces operating in the inner city in particular and the nature of the debate over residential density which they produce. The chapter concludes with a consideration of some of the implications which the conflict has for planning in inner city areas.

Density regulations are now a common component of the controls governing development and use of land in urban areas. They have been invoked for many specific purposes, including (Research Committee 1955, p. 289; Sussna 1973, p. 3):

- To provide proper sanitary conditions.

- To secure sufficiency of air, light, open space and general amenity.

- To control problems of congestion and exploitation of land through overintensive use.

- To provide for convenience of travel within the city.

- To provide a sensible basis for planning municipal services, schools, etc.

- To influence housing costs, either to protect property values (lower densities) or to lower housing costs (higher densities).

- To preserve the distinct character of neighborhoods.

For the purposes of this discussion, these concerns have been reduced to two general categories:

(1) The effect which population density has on human health, comfort and satisfaction with the residential environment.

(2) The effect of density on the efficiency of the city, expressed in such indicators as ease of movement, costs and resource utilization.

Health and Livability

The effect which population density has on physical and mental health became a major concern with the emergence of the industrial cities in the nineteenth century. These cities were typified by large districts of workers' tenements in which people were tightly packed without adequate sunlight, ventilation or recreational space. The air was polluted with smoke from nearby factories and sanitation was primitive. In response to these conditions, urban reformers advocated the building of new towns where workers could live in healthy environments. The control of density was an important element in the plans for most of these towns. The most influential reformer was Ebenezer Howard, who founded the Garden City movement in Great Britain at the turn of the century. Howard and his followers envisioned a community in which people would be housed in detached cottages at an ideal density of 8 to 12 units/acre (20 to 30 units/ha). Higher densities were seen as acceptable in individual sectors of the city, but overall a density of 12 units/acre was considered optimal (Reiner 1963, p. 145; Unwin 1971, pp. 319-20) [1]. This was based on the premise that every family has a right to adequate light, privacy, gardens and open space, and that density control should be used as a means of preventing overcrowding and equitably distributing people on the land (Drover 1974, p. 17).

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[1] Gross density figures. Gross density is discussed in Chapter 2.

The Garden City, and especially the concept of private house and garden, has had a tremendous influence on the planning of communities in this century. There can be little argument that the Garden City presented a vast improvement over the industrial city, but it represents only one possible solution. Many of its features are highly desirable but not essential for either physical or mental health. For example, there is no objective reason that some form of multiunit structure cannot provide a clean and comfortable living environment (as opposed to a cottage) or that private gardens must be provided for people to grow their own food. Increases in density are feasible without detrimental effects on the population but it is difficult to define an upper limit at which density becomes unhealthy. This can be said not only of the Garden City but of other schemes which have been proposed for healthy living environments.

Another person who significantly influenced the planning of communities was Clarence Perry. He stressed the importance of a living environment conducive for raising children, 'group life' and the preservation of social values (Perry 1974, p. 25; Reiner 1963, p. 62). His 'neighborhood unit' was based on the optimum catchment area of an elementary school and density was related to children's walking distances. Given a neighborhood's optimal population, a net density of 11 units/acre (28 units/ha) could be achieved. This gave legitimacy to the common lot size of 40 x 100 feet (12 x 30 m), even though this was the maximum possible size and a more compact community was feasible using his cri-

teria. Perry conceded that variations in his plan were possible but that 'they involve sacrifice of some of the convenience and advantages underlying the standards and requirements which have been set up for a model urban local community' (1974, p. 56).

Howard's Garden City and Perry's neighborhood unit are singled out only because they have been more influential in urban planning than other ideal communities which have been proposed. Other proponents of such schemes differ widely on what constitutes an ideal density--from Wright's Broadacre City at 0.5 to 1 unit/acre (1.25 to 2.5 units/ha) to others of up to 100 units/acre (250 units/ha) (Reiner 1963, pp. 144-45). That these figures vary so widely is evidence that personal and cultural values are significant determinants of what constitutes a healthy and livable urban environment. Because there are so many variables to consider in determining an ideal density, it is an extremely complex problem. For example, some of the hazards originally attributed to high density have been alleviated by advances in sanitation and public health practice. Because of this complexity, 'The justification for instituting ceilings is generally based on a rather restricted understanding of one or more phenomena' (Reiner 1963, p. 139).

Since the first zoning ordinance in 1916, density standards have been incorporated into legislation controlling land use in virtually all municipal jurisdictions in North America. Especially with the advent of rapid suburbanization following World War II, both planners and the public have had an image of an ideal living environment influenced by such models as the Garden

City and the neighborhood unit. Another significant influence was a handbook prepared by the American Public Health Association entitled Planning the Neighborhood (1960; first edition 1948). In new neighborhoods consisting of single detached dwellings, the Association advocated low net densities in the order of 5 to 7 units/acre (13 to 18 units/ha), and set out numerous yard, spacing and coverage requirements which formed the basis of many local zoning bylaws and ordinances. Again, it is difficult to differentiate between those standards necessary for safety and hygiene and those which merely enhance satisfaction with a neighborhood. Yard area requirements are a case in point. For detached and semidetached dwellings, the Association recommends that children's activities be accommodated in private yards, but for multifamily dwellings, a common play area is deemed adequate. This leads one to suspect that such standards are related more to the expectations of the market than on objective health requirements.

The original intent of density control as seen by the urban reformers appears to have been overshadowed by other concerns: 'Questions of fair distribution were set aside and density regulation became a mechanical device to support the tastes and preferences of consumers in a residential land market' (Drover 1974, p. 17). Through large-lot zoning and exclusive single-family districts, neighborhoods with densities lower than Howard's and Perry's developed. They were often less organized settlements with larger private yards and more land devoted to the automobile, and have been disparagingly referred to as

'sprawl'. Zoning has been commonly employed to exclude lower-income people, who are confined to more congested areas of the city (Blumenfeld 1971, p. 172; Drover 1974, p. 17). This creates a widely divergent pattern of settlement containing very dense and very sparsely-populated sectors.

In 1938, sociologist Louis Wirth criticized the state of modern urban life, which he blamed partly on density: 'The close living together and working together of individuals who have no sentimental and emotional ties foster a spirit of competition, aggrandizement, and mutual exploitation' (1968, p. 56). The social, psychological and physical effects of density have subsequently been the subject of inquiry of numerous researchers, especially since the early 1960s [2]. Many have attempted to establish correlations between high densities and physical and social pathologies and satisfaction with the environment. The results have not been decisive. While some claim that high density is significantly related to individual and social disorder and predict dire consequences for densely populated areas, others claim there is no relationship. Furthermore, the studies, especially those concerned with pathologies, have been criticized on at least three other grounds. First, many of the experiments

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[2] See, for example, Baldassare (1979), Booth (1976), Calhoun (1962), Freedman et al. (1971, 1972), Galle et al. (1972), Hawley (1972), Hutt and Vaizey (1966), Lewis (1976), Michelson (1977), Mitchell (1975), Newman (1972, 1981), Plant (1960), Rapoport (1975), Rodgers (1982), Schmitt (1966), Stokols et al. (1973), Wilner et al. (1962) and Zehner and Marans (1973). The major studies are critically reviewed by Fischer et al. (1975), Schindeler and Homenuck (1973) and Gad (1973).

were conducted with rats and other animals and the transferability of findings to human living environments is questioned. Second, many of the pathologies which have been attributed to density may only be coincident with it (Fischer et al. 1975, p. 410). For example, density, social pathologies and satisfaction with the residential environment are strongly linked with economic status, i.e. poor people tend to live in more dense environments and have more social problems. It seems more reasonable to suggest that poverty is the root of many of these problems and density is merely a reflection of it.

Third, many of the studies examine the effects of crowding rather than density. Rapoport (1975) and Rodgers (1982) define density as an objective measure of people or dwelling units in relation to space. Crowding, on the other hand, is a negative perception of excessive density which can be influenced by many factors of which actual density is only one (Rapoport 1975, p. 134). Two environments of equal density may be perceived differently, depending on a number of other conditions, including:

- The internal density of one's own dwelling unit. The fact that a person feels crowded in his or her own home (because of too many persons per room or rooms which are too small) was found to be more strongly related to perceptions of crowding than was the objective density of the neighborhood (Rodgers 1982, p. 82).

- Physical factors such as the height, bulk, spacing and juxtaposition of buildings (Rapoport 1975, p. 136; Beck et

al. 1975, p. 56). High density buildings are often seen as hostile because of designs which belittle the individual (McLaughlin 1976, p. 90).

- The degree of unwanted interaction of 'sensory and social overload' to which a person is exposed. This may be in the form of too many interpersonal encounters, noise, traffic, etc. (Rapoport 1975, pp. 134-41; Beck et al. 1975, p. 56).

- The lack of privacy (Rapoport 1975, p. 141).

- The degree of choice one has as to the type of environment he or she lives in. Poorer people may find density more stressful if they do not have the economic option of finding less dense accommodation.

Rodgers found that satisfaction with the residential environment was influenced more strongly by factors of perceived crowding than the objective density of the environment (1982, p. 84). Some environments may be dense but not perceived as crowded while other, less dense environments may seem more congested. Still, on average, perceptions of crowding are likely to be heightened in denser environments.

What can be learned from these crowding and density studies is summarized by Fischer et al. as follows (1975, p. 411):

- Density is disliked and makes most people feel uncomfortable.

- Density reduces local social interaction.

- Density is associated with pathology but does not necessarily cause it.

- The effects of density are dependent on individual, situational and cultural factors.

Thus the effects of density on health and livability have not been conclusively demonstrated. While high densities are perceived as less favorable there is no conclusive evidence that they cause social breakdown. Moreover, it is suggested that some of the negative perceptions of high-density environments may be mitigated to a degree by 'design manoeuvres' which minimize the occurrences of unwanted interaction and sensory overload (Beck et al. 1975, p. 56; Rapoport 1975, p. 147).

Although high density is commonly perceived as having many negative social and psychological consequences, it is possible to make a 'matching list' of positive consequences (Hawley 1972, pp. 525-26). For instance, while high-density environments may place more demands and controls on an individual's behavior, they may at the same time present opportunities and stimuli which would not otherwise be available. Supporting this double-sided view of density, Rapoport suggests that, if sensory overload is considered a danger inherent in high-density environments, sensory deprivation is an equal danger in low-density environments (1975, p. 154). Low densities can produce lifestyles dependent on long commuting times and feelings of isolation (Chermayeff and

Alexander 1963, p. 69; Whyte 1968, p. 337). On the other hand, it is argued that higher densities can generate a diverse and vital social atmosphere (Jacobs 1961, Chapter 11). Indeed, certain density thresholds are necessary in order to make some activities viable, retail trade for example (Sussna, 1973, p. 3). However, if the effects of density are largely perceptual as is suggested above, Jacobs' vital neighborhood is likely only partially due to its density. Other factors such as building form and 'desired interaction' (or exposure to a cross-cultural mix of people) may also contribute to the vitality of an area.

Efficiency

Another facet of urban systems in which density plays a key role is that of efficiency. This is closely related to the health and livability question but its emphasis is on city form and its effect on the consumption of resources, rather than health and psychological effects on residents. However, to the extent that health and hygiene constitute costs both to the individual and society, they have a bearing on the efficiency of urban form.

While the efficiency of urban form has been discussed as long as the health question, it emerged as an issue of public concern in the period of postwar suburbanization. Low density suburbs were criticized for wasting resources and imposing heavy demands on the metropolitan region, the costs of which were not always borne by those who benefited. The list of costs of suburbanization includes the following (Blumenfeld 1971; Diamond 1976;

Jensen 1966; Lynch 1981; Schreier 1977; Stone 1973; Sussna 1973; Whyte 1968):

- The suburbs consume vast areas of land. While land is technically a renewable resource, once it is converted to urban residential use it almost never reverts to previous uses. The loss of this land, particularly if it is good agricultural land, has been a cause for concern.

- Low densities increase the costs of providing services to neighborhoods. First are the capital costs for streets and public utilities such as water, sewer, gas, electricity and telephone, and the costs of maintaining these. Second, municipal services such as police and fire protection and garbage and snow removal become more costly at lower densities. Third is the demand for new public facilities such as schools, libraries and hospitals. Such facilities may have to be duplicated at levels which do not achieve economies of scale in order to serve low-density areas.

- Sprawl increases the distance between residence and workplace. This imposes numerous costs, first to the residents themselves in terms of increased travel times and second, to taxpayers as a group for construction of expressways. Energy and pollution costs are also a major factor.

- Dependence on the automobile for nonwork trips is also a

consequence of low densities. Because these densities cannot economically support high levels of transit service, more trips within and between neighborhoods must be made by car. As noted above, facilities are more widely dispersed, discouraging walking or transit use.

- Space heating requirements are higher for single detached units than for other housing forms.

- Costs are imposed on the older residential areas between the suburbs and the downtown employment centre. Where extensive exclusionary zoning is employed in the newer suburbs, the demand for multiunit housing is steered toward redevelopment of the inner city. This can reduce its environmental quality and displace existing residents [3].

These criticisms have generated attempts to calculate the costs associated with various levels of housing density. The most ambitious attempt at this type of accounting was commissioned in the early 1970s by three agencies of the U.S. federal government and reported in a document titled The Costs of Sprawl (Real Estate Research Corporation 1974a; 1974b). The study considered three neighborhood types--'low density sprawl', 'high density planned' and a 'combination mix'--each employing a dif-

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[3] The degree to which this is a fault of exclusionary zoning is not certain, since there are strong economic factors which make the inner city attractive for redevelopment in any case. These factors are discussed in the next section.

ferent mix of five housing types. A wide range of both capital and operating costs was considered, including the costs of the residences themselves, land, services and community facilities. In addition, environmental effects, such as pollution, noise and water and energy consumption, and personal effects, such as the use of discretionary time, travel time and crime, were included in the calculations. The researchers concluded that 'economic and environmental costs (as well as resource consumption) are likely to be significantly less at higher densities to house and service a given population', but indicated that some personal costs may increase with denser developments (1974a, pp. 15-21). It was also noted that, while the costs of development increase with density, the number of units which can be accommodated increases at a faster rate. This lowers the total cost of the higher-density neighborhood for a given population.

While The Costs of Sprawl confirmed what most of the critics of low-density settlements have been saying, care must be exercised in interpreting the results. As noted above, only three neighborhood prototypes were examined and these consisted of only five housing types. It is clear that numerous other combinations and alternative layouts are possible and would yield varying results. The larger context of the city in which the neighborhood is located is also of considerable importance. For example, the extent to which city employment is centralized or dispersed throughout the metropolitan area will make a difference to the costs associated with commuting. In addition, many of the factors considered, such as psychic costs and crime, are difficult

if not impossible to estimate and monetize. All things considered, however, the study still gives a useful indication of the relative efficiency of high- and low-density environments.

In similar but less comprehensive studies, Ludlow (1953) and Stone (1973) attempted to determine the most efficient housing form. These deal mainly with capital and operating costs to occupants, with less emphasis on the external costs which were examined in more depth in The Costs of Sprawl. Both support the assertion that per capita costs decline as densities are increased but conclude that a maximum level of efficiency is eventually reached. Building at densities which exceed this threshold will not substantially reduce per unit costs and may actually increase them [4]. This occurs partly because construction costs rise as more complex technologies are required to build higher buildings. Wood-frame construction is usually replaced by reinforced concrete and elevators must be installed. Another reason that costs begin to rise with higher densities is that more space is required for such facilities as parking, roads and recreational space, and buildings must be placed further apart to allow adequate sunlight penetration. These costs do not always deter the construction of high-density buildings, however. Some may be borne by the public and do not enter into the individual investor's balance sheet. Building as many units as possible on a given area of land may still maximize net revenue to a

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[4] This phenomenon is confirmed by Steyert, whose study was limited to high-rise apartments (1972, pp. 98-99, 150-54) and by Stein, who analyzed energy costs per unit (1977, p. 87).

landowner, even if the cost per unit rises with density. This is possible in cases in which the costs can be recovered through higher rents (Steyert 1972, p. 140). Stone concludes that the optimum level is reached at a neighborhood density of 30 persons/acre (75 persons/ha), with housing in the 2- to 3-storey range (1973, pp. 245, 253). Ludlow provides the following ranking of housing types from lowest to highest consumer cost (1953, p. 133):

(1) row flats
(2) row houses
(3) semidetached houses
(4) detached houses
(5) 3-storey walk-ups
(6) elevator apartments

One aspect of the efficiency debate which the planner may encounter is the desire of urban governments to encourage those densities which maximize the revenue/cost equation to the municipality. Unfortunately, there is not a great deal of guidance available on this subject. The studies which have been done (Kentridge and Oliphant 1972; Curtis and McCuen 1975) disagree as to the extent to which high-density developments can benefit municipal finances. Some of the advantages attributed to high-density structures merely shift costs to neighboring jurisdictions. For example, it is claimed that high-density housing creates less of a demand for schools because of the low ratio of children (Curtis and McCuen 1975, p. 114; Earsy and Colton 1974, p. 60), but a proportionally larger demand must then be

accommodated by another, lower-density municipality or neighborhood.

While higher density may appear economically attractive to urban governments it must be recognized that household demands within a city are diverse and cannot be met by a density range which is too narrow. If higher density is seen as a goal, it should be implemented with the objective of retaining as much choice for individual households as possible (Kellestine and Nabatian 1979, p. 98). Comparing densities achievable through a high-rise apartment building with those of 3-bedroom bungalows is meaningless if the two do not represent real alternatives for a given household.

To summarize, it appears that the low densities found in most suburban developments are less efficient than higher densities. However, there appears to be a threshold density above which per unit costs increase. While efficiency is an important objective in urban planning, it must be tempered with considerations of comfort and livability discussed above. Just as an overemphasis on space requirements for livability can lead to inefficiency, 'undue emphasis on the efficiency factor could serve to re-enforce the pressure of the land speculator and building developer in overcrowding the land beyond the point where desirable living environment could be provided' (Ludlow 1953, p. 117). The optimal use of land would involve the accommodation of livability factors in the most spatially efficient way.

Economic and Political Forces

Perhaps the most compelling reason for a planner's interest in density is its political nature. There exist in the city certain economic and political forces which produce proponents for and against high-density redevelopment in older inner city neighborhoods. In order to effectively plan for these neighborhoods, the planner must contend with the actors and the issues they raise regarding redevelopment and density. It is therefore important to understand the processes which bring about conflict over density issues. The foundations for such an understanding can be acquired through two fields of inquiry--(1) the study of the neighborhood life cycle and (2) intraurban location theory.

The Neighborhood Life Cycle

In the 1920s and 1930s the human ecologists at the University of Chicago developed the concept that urban neighborhoods have natural life cycles based on demographic change and the aging of housing structures. Burgess hypothesized that cities grow in concentric rings outward from the central business district (1967, pp. 50-53). As the housing in each ring ages, it depreciates in value and experiences changes in occupants. The original residents move to newer and better housing and are replaced by households of successively lower incomes. This phenomenon, which became known as filtering, was attributed to the concepts of invasion and succession, borrowed from biological theory. Each zone was seen to expand outward into an area of less intensive use, and that area then adapted to the new use.

As a consequence, population density was seen to be highest near the centre, declining outward with distance from the CBD.

Hoyt modified the concentric zones theory, hypothesizing that density was differentiated by sectors which tended to cluster around transportation routes, although their proximity to the city centre was also a factor (1939, p. 76). Hoyt maintained the succession and filtering notions and noted that the value of a property was not only a function of structural aging but also had something to do with the perceived quality of the neighborhood itself. He noticed that, as lower income classes begin to infiltrate a neighborhood, there is a sudden decline in all property values and the transition is accelerated by the flight of the existing residents (1939, p. 121). This effect of surrounding uses on the value of a property is today called the 'neighborhood effect'.

The neighborhood life cycle was elaborated upon by Hoover and Vernon, who described a five-stage process (1959, pp. 192-205):

Stage 1--Residential development in single-family houses at the periphery of the metropolitan area.

Stage 2--Apartment development, replacing older single-family homes and increasing the overall density of the neighborhood.

Stage 3--Downgrading or slum-invasion stage, in which old housing is adapted to greater densities than it was originally designed for, resulting in overcrowding.

Stage 4--Thining-out stage, characterized by falling density as families age and average household sizes drop.

Stage 5--Renewal, in which obsolete housing is replaced by

> new multifamily structures. The new housing does not significantly increase the density of the area and often decreases it. Public intervention in the form of urban renewal was the main driving force in this stage.

Several subsequent neighborhood typologies and models of change describe the same basic process (Birch 1971; Public Affairs Counseling 1976; Lachman and Downs 1978).

The distribution of population density over space and time is presented in neighborhood life cycle models as a function of three factors. Density is first considered a function of the structural aging of housing. It rises in older neighborhoods when they filter down to lower socioeconomic groups. Because of household budget limitations, these groups tend to make more intensive use of the structures than their previous occupants (i.e. more persons per dwelling, more dwelling units per structure). The oldest neighborhoods are located closest to the city centre and therefore density is expected to be highest near the centre and to decrease outward toward the periphery. Second, density is considered a function of the family life cycle. A new neighborhood experiences a higher density while children are at home, followed by an 'empty nest syndrome', in which only the parents remain. This is noted in Stage 4 (reduction of densities in slums) but it occurs in every housing type, including the single-family dwelling. It is the implicit impetus behind Stage 2 of the cycle (transition from single-family dwellings to apartments), as empty nesters leave the family home. Third, raising density is not seen as a significant motivational factor in the renewal process and density is not significantly altered by it.

Building age and condition are more important considerations.

Intraurban Location Theory

Urban economists have attempted to explain spatial differentiation in density through the location preferences of households (Alonso 1964; Muth 1969). In choosing a location for residence households are assumed to consider two factors--accessibility to the centre of the city (which is assumed to be the centre of employment, shopping and most other activities to which people commute) and the amount of living space provided by the home. All households seek to minimize the cost of the trip to the central business district and maximize the amount of land they consume. Given a household budget constraint, the household will locate at a point which represents some tradeoff between these two desires. Because land near the CBD is valued highly by all households due to its commuting advantage, a household locating there will find land expensive and therefore consume a small amount of it. Land located further out is valued less by all households and therefore cheaper, but a household locating there will have higher commuting costs. As a city's population increases (or, more correctly, the number of households increases) higher commuting costs are associated with expansion at the periphery. This makes central locations more desirable, driving up the costs of these sites. This in turn necessitates housing which is less land-consumptive (or denser neighborhoods). The result is a density gradient which is highest near the city centre (where less space is consumed per household) and lowest at

the edge of the city (where households consume more space).

When the hypotheses of the neighborhood life cycle and intraurban location theorists are combined, their implications for residential density in the inner city are clear. While the existing stock of housing is deteriorating over time, its locational advantage relative to the growing city is improving. As the housing becomes obsolete or changes ownership at the end of a family life cycle, economic forces will tend to push toward redevelopment of these neighborhoods to higher densities. To a large extent, this seems to describe reality. However, the models make a number of assumptions and, in their simplification, leave out many factors which limit their predictive abilities regarding population density.

Neither the life cycle nor location theorists give a credible picture of the factors that enter into the household location decision. Collectively they identify four factors: (1) age of structure, (2) space preference and (3) accessibility to the CBD, all subject to (4) a household budget constraint. In addition to these, theorists and researchers have identified a multiplicity of other factors which households consider important in deciding where to establish themselves (Leven et al. 1976; Ahlbrandt and Brophy 1975; Auger 1979; Frieden 1964; Gale 1979; Hart 1980; Kern 1979; Lipton 1980; Meadows and Call 1978). These include:

(1) The physical characteristics of the dwelling itself, such as structural condition, modernity, architectural character and maintenance requirements.

(2) Accessibility to non-CBD-related facilities such as schools, shopping and recreation.

(3) The scope and quality of public services supplied by the municipality in the vicinity of the dwelling.

(4) Those characteristics which define neighborhood quality. These are often vague and perceptual but can be the most decisive element in the location decision. They include such considerations as perception of crime, neighborhood prestige, types of neighbors, attributes such as mature vegetation and some of the physical factors of the surrounding homes identified in (1) above.

The latter three elements are of particular interest in studying the relationship between household preferences and density. Those locations which are seen as most attractive by these criteria are likely to experience effects similar to those which are close to the CBD, i.e. high prices and more intensive use. Conversely, other neighborhoods may be viewed as undesirable and no intensification will take place despite their locational advantages.

As these factors suggest, lifestyle plays an important role in the household location decision. Besides looking for neighborhoods with good physical and locational attributes, households may also choose to locate near others who share similar interests and needs (Newman 1981, pp. 12-13). Families with children, for example, would prefer to live in neighborhoods with good support

structures--other families with children, safe play environments, schools and other institutional facilities. Other groups will also tend to congregate together, depending on their needs and lifestyle preferences.

Both of the models overstate the importance of the central business district in determining the location of households. Even in cities with strong CBDs, non-CBD employment constitutes a substantial proportion of the employment base. Thus it can be expected that density will be spread more evenly throughout the city, concentrating around employment subcentres as Harris and Ullman postulated with their multiple-nuclei concept (1945, pp. 14-16). But the extent to which the work trip dominates the location decision is itself questioned and it is suggested that the amenity and community factors discussed above will play an increasingly important role (Webber 1963, p. 47; Newman 1981, pp. 11-13).

Another factor which serves to counteract or at least retard the formation of higher-density areas near the centre is the nature of real property. Capital investments on land are immobile and durable, with lifespans of at least 25 years (Bourne 1967, pp. 24-25; Smith 1979, p. 541). This means that the existing spatial pattern of the city is set for long periods of time and that decisions regarding changes in use of single properties will be influenced by surrounding uses (the neighborhood effect). This influence is essentially a conservative one and new construction in developed areas tends to follow existing patterns unless the economic reasons to do otherwise are sufficient to

risk an investment (Muth 1969, p. 96).

The durability of real estate is a significant factor behind the empty nest syndrome in Stage 4 of the Hoover and Vernon model. Because of deep personal attachments, couples may tend to remain in the family home long after their children have left, even though it would be more economical to move to smaller quarters (McCarthy 1976, p. 66; Kellestine and Nabatian 1979, p. 45). Thus, in older neighborhoods where this occurs, household sizes tend to be smaller than in the suburbs, even though the density of households per unit is higher. (This is due to smaller lot sizes for single-family dwellings and the existence of more apartment buildings in older areas.) In the newer suburbs, homes are spread further apart but usually contain more occupants per dwelling because they are at an earlier stage in the family life cycle (Gober 1980; Chevan 1971; Moore 1972). This results in a more even distribution of population throughout the metropolitan area than is predicted by the models. However, as the newer suburbs advance through the family life cycle, densities can be expected to fall below those of the central area.

While the ecologists attribute the density pattern to 'natural forces' and the location theorists assume the operation of a pure market, it is obvious that government intervention plays a significant part in the process (Wolfe et al. 1980; Nefsky 1974; Mendelson 1976). Incentives and subsidies for home ownership, especially those which emphasize new construction, encourage low-density suburbanization at greater levels than might otherwise be the case. At the same time, rehabilitation

programs may counter market pressures for higher densities in older and more central neighborhoods. Taxation and roadbuilding policies tend to distort the market in favor of suburbanization. Wolfe et al. found that inner city residents pay proportionally higher property taxes than suburban residents because inner city property tends to be assessed at values higher than it is actually worth in the marketplace (1980, p. 363). The construction of urban expressways reduces travel times, allowing households to opt for more space further out without having to sacrifice accessibility. It may be argued that these interventions merely reflect the pressures of economic forces in favor of low-density suburbanization, but it is difficult to determine the degree to which they are a response to the preferences of the housing market and the degree to which they induce certain market choices.

The stabilization of population growth over the past decade has implications for the operation of the models. Increasing population was the force behind the expansion of the city perimeter. The increasing commuting distances which this created in turn increased the accessibility advantage of the inner city. At the moment, the stabilization of population is more than compensated for by an increase in household formation, as the postwar baby boom cohort enters the housing market. Thirty has traditionally been considered the milestone age for home purchase and the 1970s and 1980s are witnessing a huge population expansion in this age group (Bouvier 1980, p. 24; Alonso 1981, pp. 39-40; Robinson 1981, p. 17). By 1990, though, this cohort will

decrease in numbers and stabilization (or decline) of absolute population will dominate the metropolitan pattern. It is difficult to predict the effect that this will have on density. As Alonso, author of the most widely acknowledged work on location theory (1964), says, 'We have neither well-developed theories of how [decline] works nor practical experience in how to deal with it' (1981, p. 35).

The baby boom cohort has produced other anomalies in the urban spatial pattern. With the entry of women into the work force, the fertility rate has plummeted below the long-run replacement level (Alonso 1981, pp. 41-42). Average household sizes have dropped due in part to this decrease in the number of children and in part to other factors such as an increase in single and nonfamily living arrangements and a high divorce rate. Because households are smaller they require less space (especially play space for children) and the traditional suburbs hold less attraction. This, along with cost factors, has resulted in increased density in the newer suburbs as smaller lot sizes become more common. In addition, because so many households now have two income earners, accessibility becomes a more critical variable. An increase in household income means a larger demand for certain services such as daycare, laundry services and restaurants to replace activities previously done in the home. All of this suggests that many households will look for smaller units with lower maintenance requirements but also within easy access to these services. The inner city presents a favorable alternative for this sector of the housing market. Of course the tradi-

tional suburban choice will still apply to some households, but the proportion of these will likely decrease.

Finally, because the neighborhood life cycle models in particular are based on the experience of American cities, their applicability to the Canadian situation is restricted. These models are more appropriate to explain the development of slums and to justify the urban renewal schemes devised to eradicate them. The suggestion that neighborhoods are on some 'inevitable downward course' does not ring true in most Canadian cities where many central neighborhoods are still considered desirable places to live (Smith and McCann 1981, p. 551; Phillips 1976, pp. 16-17; Schliewinsky 1975, p. 5).

In his historical examination of Toronto, Schliewinsky (1975) found that as a neighborhood ages, there is not necessarily a linear process of decline but rather there are several directions in which change may occur. He identified fifteen neighborhood types using statistical indicators and assessed the stability of each over time. This was done by estimating the probability that the indicators would change sufficiently to place the neighborhood in one of the other categories. Some types of neighborhoods are likely to experience decline and redevelopment; some stabilize without undergoing significant change; some deteriorate to a point and then become stable ethnic enclaves, and so on. Smith and McCann (1975) found in Edmonton that some neighborhoods experience redevelopment without going through a previous phase of decline. Canadian research in this area is not well developed but there is enough evidence to indi-

cate that the usefulness of these models in explaining urban density patterns (in other countries as well as in Canada) is limited.

The Density Conflict in the Inner City

In spite of the many qualifications and caveats which must be applied to conventional theories, the locational advantage and aging of building stock remain economic factors which operate in favor of increasing residential density in the inner city. Yet, at the same time, other economic and political activities act against this. In many inner city neighborhoods there are two conflicting interests--the 'commercial interest' in favor of redevelopment and the 'founding' or neighborhood interest in favor of conservation and investment in the existing neighborhood character (Moore 1982, pp. 24-25).

Redevelopment

From an investment point of view, redevelopment becomes desirable when 'the individual owner's estimate of the anticipated income from a new structure' exceeds 'the cost of that structure, the costs of removing or demolishing the existing structure, and the income that would be lost by removing that structure' (Bourne 1967, p. 28). Two points must be stressed here. First, the decision to redevelop depends on the owner's expectation of the potential value of the site. This perception of its worth is dependent on the owner's interpretation of a number of indicators which may include expected trends in the neighborhood, the neighborhood's location and amenity features,

the potential rental or sale market, etc. The current appraised value of the land is also one indicator, but this value is itself only an estimate of the land's potential value. The site may have a higher or lower income-earning potential but this can be proven only when a development is actually undertaken. This is the nature of risk in the real estate industry.

Second, the redevelopment decision is a result of the economic obsolescence of a structure (i.e. the underutilization of land relative to its potential). Aging and physical deterioration of the structure are important only to the extent that they lower the value of the land in its present use. It is not necessary, however, for a building to be old or in a poor state of repair for it to be considered economically obsolete; all that is required is that some other use is potentially more profitable. These factors affect both the timing and location of redevelopment activity. In periods of fast urban growth (which can be caused both by absolute population growth and rapid household formation), a heavy demand for housing causes prices to escalate. As the location models predict, there will be a movement to use land more intensively to lower its component cost in the housing equation. This demand places a premium on the land value in some neighborhoods and may cause the existing homes to become economically obsolete before they have outlived their structural usefulness. The theoretical linear neighborhood life cycle of decline and renewal is interrupted and a 'truncated cycle' is observed whereby 'a sharp increase in demand . . . [places] unexpected pressure on favorably situated areas which

had not been experiencing the customary conditions of decline' (Smith and McCann 1981, p. 544). The economics affecting investment decisions are influenced by government policy, as well as market factors. Tax policy, for example, favors demolition over renovation. Of course, many neighborhoods which have progressed further in the life cycle, containing homes which are close to structural obsolescence, will also experience these pressures. This obsolescence may be a result of lack of maintenance, poor construction quality or age.

In either case, redevelopment demonstrates a neighborhood effect, degrading the values of existing structures in the neighborhood (Calgary Planning Department 1979, pp. 31-32). The externalities associated with the introduction of high-rises and other multiunit buildings can lessen the attractiveness of a neighborhood both to existing and potential residents of single-family dwellings. The value of the structure itself therefore depreciates relative to others in less disrupted environments. There is a shift to tenancy as owner-occupants vacate, selling their homes to investors or becoming landlords themselves (McLemore et al. 1975, p. 9; Moore 1982, p. 24). Landlords especially do not view maintenance as an economically rational activity because it is anticipated that structures will be demolished in the near future (Lowry 1960, p. 366) [5]. As more

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[5] Lowry hypothesized undermaintenance when neighborhood property values are declining and investment cannot be justified, but the same behavior can be expected when the value of a structure is declining relative to the value of a potential new use.

long-time residents leave, community organization, both formal and informal, dwindles, accelerating the decline of the social environment (McLemore et al. 1975, p. 9).

Given the existence of a demand, which determines the timing of redevelopment, a developer will survey the city for sites (both developed and undeveloped) with the highest potential profit. These are the sites which maximize the difference between potential income and those costs associated with redevelopment previously mentioned. Essential to the developer's assessment of potential income is the marketability of the location. Bourne constructs a hierarchy of factors which affect the location of apartment construction (1968, p. 218; 1969, p. 185). First are regional factors, i.e. location relative to regional centres such as employment, commercial and recreational facilities. These have already been discussed with regard to location theory. Second are neighborhood factors which relate to the quality of the local environment in which development is considered. These are useful in explaining variations in patterns of density hypothesized by the location theorists. Third are the characteristics of individual sites within the neighborhood. These are not as important in explaining overall density patterns of the city, except to the degree that a neighborhood contains enough available sites of a suitable size to be considered for redevelopment.

Given the importance of relative location within the city, several factors have been found to be prominent in the decision of where to redevelop. First, the developer is directed toward

the neighborhoods in which 'the framework provided by the existing spatial structure of land uses and buildings and the persistence of past directions of growth' already indicates a suitable atmosphere for redevelopment (Bourne 1969, p. 185). If redevelopment has already begun a market is seen to exist and other developers will look for sites in the same vicinity (Murphy 1975, p. 38; Styliaras et al. 1967, p. 138). There are several scenarios in which this may occur. In neighborhoods containing households which are fairly advanced in the family life cycle, a degree of conversion of single-family homes to two or more units may begin to take place. This may be a result of adjusted space or income requirements of owners or turnover of property to investors. In any case, conversion has the effect of testing the rental market of a transitional neighborhood and is taken as a signal by development interests (McCann and Smith 1978, p. 138). In other cases, a developer may bypass this conversion phase and redevelop a site because of its accessibility advantage, for example its proximity to a rapid transit station. If this venture is proven successful it will likely act as a catalyst for other developments. Because developers seek to minimize risk, they tend to follow established trends, locating in neighborhoods which have already shown a capacity for redevelopment (Bourne 1967, p. 174).

Closely related to existing development in a neighborhood are land use controls and the degree of community resistance to redevelopment. In the long run, zoning tends to reflect, not determine, the economic forces affecting neighborhood change

(Moore 1982, p. 33). Public policy adapts to changing economic and political environments [6]. In the short run, however, zoning and other land use policies of municipal governments are important considerations in the development decision (Bourne and Berridge 1973, p. 410; Goldberg and Ulinder 1976, p. 365; McCann 1975, p. 12; Kaiser and Weiss 1970, p. 34). Proper zoning for a development under consideration reduces uncertainty in the planning stage and lessens the possibility of extra cost associated with lengthy delays in the approval process. Developers 'abhor uncertainty' (Goldberg and Ulinder 1976, p. 368), which has increased with the rise of community groups opposed to redevelopment. Therefore clear policy statements from government regarding redevelopment in specific neighborhoods are welcomed (Carney 1970, p. 119).

The effect of zoning should not be overstated, however. It remains only one factor in the economic decision and, given strong economic reasons for redevelopment in a certain area, a developer will assess the political feasibility of an attempt to change the zoning. The degree to which a municipal government is seen to stand by its previous policy decisions is the measure by which a developer determines whether the effort is worth while. In Vancouver, for example, a survey revealed that 'developers do not consider the potential return from rezoning worth the time, expense and risk involved' in the process (Goldberg and Ulinder

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[6] Even those policy decisions which are taken on planners' initiatives without external political pressure are usually responses to changing demographic and economic situations.

1976, p. 365). In Toronto, on the other hand, it was found that the developer is more prone to 'seek out land that has a high probability of rezoning often by predicting the likely behaviour of planning officials and politicians' (Bourne and Berridge 1973, p. 410).

Those characteristics people use to define neighborhood quality (which were discussed previously) are of interest to the developer in marketing a project. According to the neighborhood life cycle theorists, redevelopment should take place in the most blighted sections of a city, but market demands for a quality living environment often push developers into more desirable (and higher income) areas. This has been found to be the case in Toronto (Bourne 1967, p. 174) and Edmonton (McCann 1975, p. 103) [7]. Although lot prices are higher, so too is the expected rental income. At the same time, neighborhoods which are characterized by visible decline may have a negative perception in the public mind. Consequently, 'redevelopers are simply not interested in an area that has a reputation for deterioration' (McCann and Smith 1978, p. 132).

The pattern which redevelopment takes can be summarized as follows:

> Among several local points which offer similar attractions for redevelopment, the one first selected depends upon the nature of zoning and community resistance to change. In other words, the mechanism which "triggers" redevelopment in one area rather than another is the

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[7] In Victoria it was found that apartment development focused more on lower-income areas with a decline in housing quality, but was attracted to amenities such as recreational and scenic areas (Murphy 1973, pp. 162-64; 1975, p. 38).

> ease of breakthrough in institutional constraints. Once selected, an area receives the concentrated efforts of redevelopers until its relative potential is exhausted. Activity then shifts to another location, and the process is repeated (Bourne 1967, pp. 174-75).

While clustering occurs around employment centres and traffic arteries, it also occurs in certain neighborhoods with high quality-physical and social environments.

Conservation and Reinvestment

Although redevelopment and reinvestment in existing housing stock are usually seen as opposites, the economic forces and processes by which they take root are almost identical. In the case of reinvestment, the individual homebuyer is the dominant actor, although developers are also involved to some extent. The homebuyer does not seek to maximize profit in the same sense that the developer does, but a similar concept applies. Households locate in homes and neighborhoods which maximize their satisfaction, an admittedly nebulous term determined by price and the other elements of preference previously discussed.

The decision to upgrade a structure is based on an assessment of the future value of both the property and the structure. If a neighborhood is undergoing redevelopment, the satisfaction level of living in a single-family home may be diminished. Many long-term residents will be unlikely to upgrade if they are contemplating selling in the near future, because the condition of the house is not a consideration in the sale of redevelopment property. If a neighborhood is declining through lack of maintenance or socioeconomic factors, it will degrade the value of an individual property, regardless of whether that property is

upgraded or not (Smith 1979, p. 544). Before upgrading, owners and potential owners must have some conviction (1) that they will not lose their 'satisfaction' (monetary or otherwise) through the neighborhood effect of decline and (2) that there is not a greater gain to be made by doing nothing and collecting higher profits from redevelopers.

Until recently, the elements of satisfaction (price and amenity) favored the suburbs over the inner city. Changing demographics, however, have now reduced this advantage. The heavy demand for housing in the 1970s caused suburban prices to escalate and inner city locations became comparatively attractive. Added to this are the reduced need for space, the location requirements of two-worker households and increasing preferences for homes and neighborhoods of historical and architectural interest (James 1981, pp. 139-46; Kern 1979, p. 129; Bourne 1978, p. 59; Gale 1979, p. 297). Reinvestment has been enhanced by government support for renovation (the Residential Rehabilitation Assistance Program) and community facilities (Neighbourhood Improvement Program) and an increased availability of mortgage funds from financial institutions (Smith 1979, p. 545).

Homebuyers look for signals of neighborhood's future in much the same way that a developer does (Leven et al. 1976, p. 42; Goetze 1979, pp. 11-14). The decision of a handful of 'pioneers' to renovate can trigger similar action throughout the neighborhood and attract new investors from outside. The designation of neighborhoods as NIP and RRAP areas can be a catalyst, as it implies they are 'viable economically and socially, strengthening

and improving the propensity to invest in the area' (McLemore et al. 1975, p. 1). Reinvestment too has a neighborhood effect. It improves the perception of an area, causing a new demand for homes for renovation to push up prices. As well, it can stimulate the construction of new low-scale infill housing. Interest in this type of housing is motivated by essentially the same factors that generate reinvestment activity (Barnard 1981, pp. 1.4-1.6).

Because the economic and demographic pressures favoring higher-density redevelopment tend to focus on the same neighborhoods in which conservation and reinvestment are concerns conflict over municipal policy in inner city areas frequently results. Commercial investors and neighborhood interests may look at the same community and get different readings on its future direction. Convincing arguments are presented both for permitting higher densities and for maintaining the neighborhood as it is. The planner is confronted with these arguments and is required to assess relative merits of each, together with consideration of other issues, in making recommendations to policymakers.

The case for higher-density redevelopment is usually made on the grounds of efficiency and cost. Redevelopment makes more intensive use of the existing infrastructure, lessening the need to duplicate it in the outer suburbs. This reduces costs to the city and the prospective homeowner (Battles 1976, pp. 2-3; Donnelly 1982). Those whose primary interest in a neighborhood is economic (whether developers or owner-occupants) are likely to

argue that the land is too valuable to waste on single-family housing. Denial of applications for higher-density projects is often taken as an infringement on the owner's right to realize capital gains from an investment.

Advocates of neighborhood conservation generally argue for the protection of viable communities and the positive environmental features of an area. They too make appeals on the grounds of protecting an investment; in this case it is the money and effort which the owner has invested in a place to live. High density is seen as destructive of the physical environment and residents are perceived as 'transients' or singles who do not participate in community activities.

The arguments of increased efficiency resulting from higher density are relatively easy to evaluate and are generally sound (keeping in mind there is an upper limit to the cost advantage inherent in higher density). Those arguments concerning the protection of investment are more open to doubt. While land designated for high-density development is logically more valuable than that designated for lower densities, zoning is not the only factor in land value. There must also be a market demand for use of the land at those densities. Some neighborhoods with high-density zoning attract virtually no redevelopment, while it is heavily concentrated in others (McCann 1975, p. 103). This is reflected in relative land prices. Sometimes residents who agitate for higher-density zoning have inflated expectations of what their property can actually command in the marketplace (Jamieson et al. 1976, p. 17). Advocates of high density on efficiency

grounds will be found in only a portion of those neighborhoods to which the argument potentially applies. Other neighborhoods, such as inner city upper-class enclaves and those so blighted that no investor is interested in them, will not likely be focuses of controversy. This is not to say that the planner should not investigate possibilities in these neighborhoods, only that political and market factors are also important considerations in density decisions.

The arguments against higher density on the grounds of neighborhood environmental quality are also clouded. A neighborhood's attractiveness or 'livability' is often as much a function of building scale and detail as it is of its density. The prejudice of residents against high-density 'intrusion' may be a response to poorly designed projects which do not respect a neighborhood's scale or character. Perceptions of social class are also influential. Long-time residents may have negative preconceived notions about the type of people who live in denser housing, some of which can be overcome once they are exposed to them (Battles 1976, pp. 23, 86; Donnelly 1982). Design and social factors are therefore considerations which are as important as density itself.

It therefore appears that a degree of compromise is possible between the efficiency and livability positions. The quality of a neighborhood can be retained through compatible redevelopment, although density and aesthetic factors will have to be traded off in considering each case. While the location of the inner city makes it a favorable focus for intensification of land use, all

neighborhoods in the metropolitan area can contribute to greater efficiency of urban form through higher densities (Myers 1979, pp. 5-6; Wrigley 1983, pp. 66-67).

If increasing residential density is seen as a goal, it must be carefully managed. In the past, clumsy use of the zoning tool has produced undesirable results. Exclusionary zoning in newer areas has forced a few inner city neighborhoods to bear the brunt of redevelopment activity at higher densities (Bourne 1969, p. 190; Moore 1982, pp. 33-34). The original character of many of these neighborhoods has been effectively destroyed as family-oriented dwellings are demolished, and not replaced in newer structures (Myers 1979, p. 9). Locational options for both family and nonfamily households become increasingly restricted--the former to the suburbs and the latter to dense apartment districts. High density zoning over too large an area ('blanket zoning') can also have detrimental effects (Ludlow 1945a, p. 5; Smith and McCann 1975, p. 36; Moore 1982, p. 24). In this case, the demand for redevelopment property

> . . . is fully accommodated on a few sites, so that those sites realize the increased price. For the remainder, however, both use and exchange value will fall, because the new use when fully supplied will produce no further price increases (there is no further demand), although its externalities will lower the environmental quality for the old use (Moore 1982, p. 24).

This deterioration may persist for long periods of time. A more sensitive approach is called for, which recognizes the individual qualities of each neighborhood and of sectors within neighborhoods. Within this framework, certain areas may be judged to be appropriate for total redevelopment while medium densities and

smaller scale infill may be more suitable in others.

Summary

It appears that residential density has some bearing on environmental quality and living comfort, but direct relationships are difficult to draw. They are complicated by factors of perception and variables such as poverty and social interaction. In addition, some of the problems associated with high densities may be mitigated by technological and design innovations. In terms of efficient use of resources, densities higher than those commonly found in most parts of North American cities would be preferable. However, there is an upper limit to the efficiency of higher density, and livability factors must be traded off as density is increased. This tradeoff is of particular significance in inner city neighborhoods in which there is a clash between economic interests favoring redevelopment at higher densities and resident interests favoring conservation of neighborhood character. Through proper management, it is possible to achieve higher densities while respecting neighborhood character and integrating redevelopment within it. In areas where context is less important, perceptual factors may be manipulated to achieve high densities while minimizing negative connotations generally associated with them.

CHAPTER 2
THE DIMENSIONS OF DENSITY

Definitions and Measurements

Residential density has been defined as 'a measure of one or a combination of three elements--people, housing units, or building area--in relation to a given area of land' (McKellar 1979, p. 7). Density is expressed in different forms for each of these elements which are summarized below.

Table 2.1. Measures of density

Population density	Dwelling density	Building bulk
persons/ha [ha/1000 persons; sq m/person] households/ha families/ha persons/unit rooms/person	units/ha rooms/ha bedspaces/ha rooms/unit	floor area ratio (FAR) [floor space index (FSI); plot ratio]

Population density is usually expressed in terms of persons per hectare (or acre), or inversely as hectares of land per 1000 persons. Measurements are made in terms of both gross and net density. Gross density includes in the calculation land occupied by residences as well as all adjacent roads, recreation facilities, parking space, nonresidential buildings and land unsuitable for building. Net density includes only land occupied by dwellings and accessory uses on residential lots such as private open space, driveways and service areas. Some net density calculations include a proportion of adjacent roads, playgrounds and other public space (American Public Health Association 1960, p. 37; McKellar 1979, p. 12). Several other measurements are

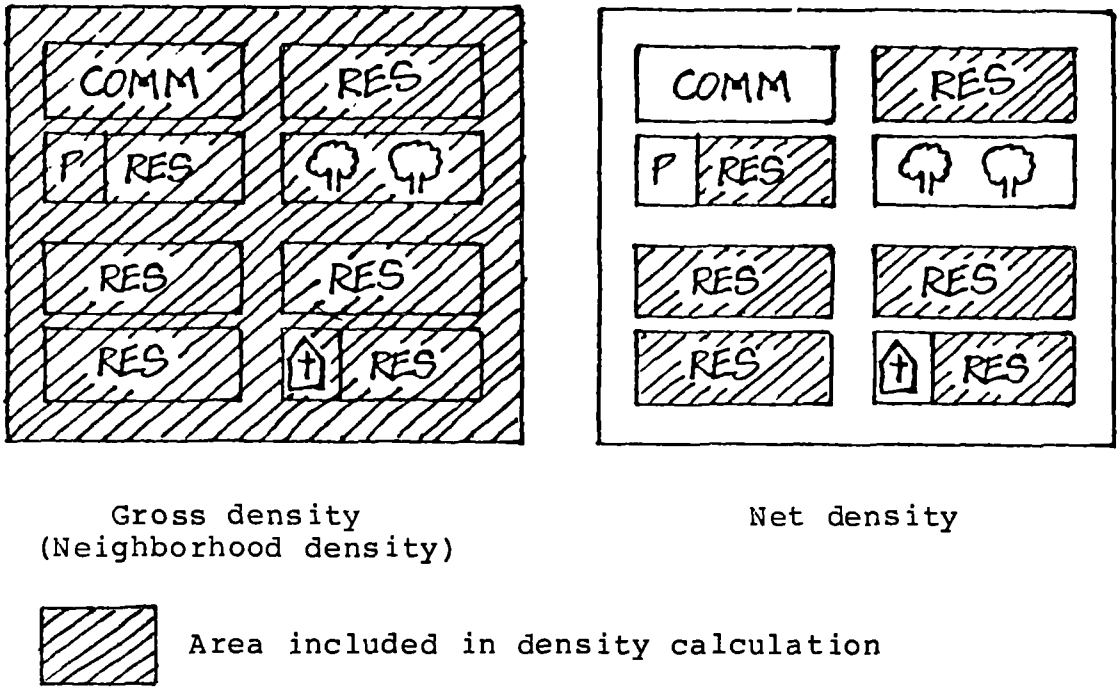

Figure 2.1. Gross and net density

employed to indicate specific aspects of population density. Among these are measurements of population groups (e.g. households or families per hectare) and measures of internal household density such as persons per dwelling unit or room (occupancy rate) and area of living space (square metres) per person.

Gross population density is a useful measurement for planning for long-term requirements of an urban area, such as infrastructure and facilities thresholds. In the preliminary planning stages for new residential areas, gross density target figures may be set which guide the allocation of residential and non-residential land in subsequent stages. Internal household density measures can be used as indicators in planning housing and social programs. However, population density has little value as a regulatory tool. Although population density figures are sometimes cited as control measures, they are usually derived from

dwelling density measures, as will be shown later in this chapter. Actual control over occupancy rates, that is, legislating the number of people who may live in a unit of a certain size, would likely be impossible to enforce and would be considered unacceptable government intrusion by most citizens.

Dwelling density is the ratio of dwelling units to land area (units/hectare; units/acre). This is also calculated in terms of gross and net land area. Gross dwelling density is another useful device in planning new residential areas and can be used in conjunction with planned population density. It is particularly valuable in setting out regulations and guidelines for planned-unit developments (PUDs) or 'clustered' housing. In these developments, a gross density is determined for a large parcel of land under single ownership, but the means by which it is achieved is a matter of negotiation between planning officials and the developer. Units may be concentrated in high-density clusters in one part of the parcel and communal open space provided in another, or more evenly spread throughout the site. However, in most situations in which owners have control over only a small parcel within an established neighborhood, net density is a more appropriate measure for regulating development. Net density applies only to this developable land area. It is also a more accurate basis for comparing neighborhoods than gross density which varies with the amount of nonresidential land area which happens to be included within a neighborhood's boundaries.

Dwelling density does not give as accurate a picture of the number of people an area of land is supporting as does population density because of variations in sizes of units. More fine-grained measures have been employed to relate dwelling density more closely to population, such as rooms and bedspaces per hectare and rooms per unit. These are sometimes used in conjunction with units/ha (or acre) measurements. Ideally, it would be desirable to take vacancy rates into account in relating dwelling units to population density. This can be incorporated into an evaluation of an existing neighborhood or project at a given time. However, in planning for future densities, it tends to complicate analysis because vacancy rates can be very volatile. Changes can be caused by a number of factors, many of which are difficult to control or even predict.

The third element of density, building bulk or massing, is the relationship between the total floor area of a building and the area of the lot on which it sits. It is expressed in terms of floor area ratio (FAR), also known as floor space index (FSI) and plot ratio. A floor area ratio of 2.0 means that the floor space contained in a building is twice that the ground area of its site. The building could take many possible shapes--a 2-storey building covering the entire site, a 4-storey building covering half the site, an 8-storey building covering a quarter of the site, etc. Gross floor area refers to all floor area in a building, including corridors and service rooms; net floor area usually refers to rentable floor space.

Factors Affecting Density

Regulations

There are numerous provisions in legislation, plans and regulatory codes which determine achievable levels of residential density. They control the size and shape of buildings through both explicit regulation of dimensions and implicit economic incentives to build in certain formats. Many are enacted ostensibly for purposes other than controlling density (fire safety and the provision of parking, for example) and their effect on it is incidental. Because density is multidimensional and affected by so many interacting variables, regulation is a complex undertaking.

Most of the discussion which follows centres on bylaw and code requirements governing development of individual land parcels which deal mainly with net density. However, it is first worth noting the impact that municipal policies have on gross density. Requirements for roads, parking and open space may often account for over half a neighborhood's total land area. This has a considerable effect on neighborhood density no matter what net densities are permitted on land designated for residential purposes. Programs for increasing density must consider these standards as well as the more obvious development controls (McKellar 1979, p. 13).

Regulatory measures which control density include the following:

(1) Maximum floor area ratio

This determines the total floor space that a developer can provide on a given lot size. FAR is used most successfully as a tool for regulating density of commercial developments in which office floor space is relatively undifferentiated. In residential developments, on the other hand, the size of unit is an important consideration and a wide range of dwelling and population densities is possible for a given FAR rating (Klein and Sears et al. 1974, pp. 116-17; Baird et al. 1975, pp. 6-7; McKellar 1979, p. 29; Myers 1979, p. 70). For example, a building consisting of a normal mix of units at conventional rental sizes may contain twice as many units as one with the same FAR which contains luxury rental or condominium units. Because FAR sets out only a maximum total floor space allowable for development, investors tend to maximize their returns by building a large number of small units rather than fewer large ones (Klein and Sears et al. 1974, p. 76; McKellar 1979, p. 29) [1]. FAR by itself is not a good mechanism for controlling height. At a given FAR, there is a wide variation in possible site coverage, which can produce buildings of many different heights. Although FAR limits can influence the heights of structures and the number

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[1] Developers' decisions will of course depend on other market factors.

of dwelling units they contain, the relationship is very indirect. It is therefore not a sufficiently precise measurement to control height and dwelling density, although it can be useful when applied in conjunction with other regulatory tools, such as those regarding height and maximum number of units.

(2) Maximum units per hectare (acre)

Legislating the maximum number of dwelling units that can be placed on a site of any given size is a common means of controlling density. The maximum units/ha limit is one of the most effective regulatory tools but it also has deficiencies. As with floor area ratio controls, legislating a simple units/ha count will not take account of differences in dwelling size and the variation in population which results. Although dwelling density limits affect building bulk, again the correspondence is not direct enough to employ them to control either bulk or height.

Attempts have been made to fine-tune dwelling density controls by grading them according to unit size and building height. Some jurisdictions regulate density in terms of the number of persons/ha that a site may accommodate. Standard occupancy rates for units of various sizes, based on existing local conditions, are specified to be used in calculating this density figure. Developers may then provide any mix of unit sizes as long as it converts to an allowable population density. This figure is only an approximation of the actual population density which will occur once the building and its accuracy is dependent on the occupancy rates that are used. Because it is derived from unit size and does not count the people actually living in the

building, it is not a true population density measure but, rather, a refined dwelling density measure (Myers 1979, p. 56). A similar method is to specify dwelling densities which are allowable for various mixes of unit types. For example, a maximum number of units/ha would be set for a mix of 40% bachelor, 30% 1-bedroom, 20% 2-bedroom and 10% 3-bedroom apartments, and different densities for other mixes.

Some graded systems of dwelling density control have been employed in the past with undesirable results (Myers 1979, p. 56). For example, there are cases where the allowable units/ha is higher for small units than for large units, which acts as an incentive to build projects consisting mostly of small units. Although this produces higher dwelling densities, it discourages the production of larger units which house more persons per dwelling. Sometimes the allowable units/ha is graded according to building height, permitting higher densities for buildings above a certain number of storeys. The intent of this appears to be to discourage developers from gaining density by using up more site area, which reduces the open space of the development. However, it acts as a tremendous incentive to build high-rises and, when combined with low coverage requirements, precludes high-density solutions in low-rise formats.

(3) Minimum site area per unit

This figure is the reciprocal of maximum units per site area and operates in the same manner. It is a particularly convenient measurement in low-density districts. The maximum allowable site area can be graded according to unit size and its effect is the

same as grading units/ha to unit size.

(4) Maximum height

Height restrictions impose an upper limit on the number of units that it is possible to build on a site. However, they are a very imprecise method of controlling density compared to dwelling density restrictions, which are more accurate. Height limitations can be of value in achieving other planning objectives, such as providing for adequate sunlight penetration and privacy, modifying perception of bulk and making development compatible with existing neighborhood features. Of course, in the process of achieving these goals, height limits do restrict dwelling density, but this should be seen as a consequence of the restrictions, not as the reason for implementing them.

(5) Minimum site area

Requirements for minimum site area (or parcel size) affect both dwelling density and building form. High minimums, especially for detached units, promote low density. Conversely, low minimum site requirements in areas where high density is permitted make land assembly easier and promote the use of high-rise forms.

(6) Maximum site coverage

Maximum coverage provisions stipulate the proportion of a site that may be covered by a building, and thus affect building form. These controls were conceived to prevent overcrowding of building masses and provide open space for residents. In the past, relatively low site coverage has generally been preferred,

so that high densities could again be achieved only through high-rise forms. The same is true of the next two types of regulations, open space and yard sizes, when high standards are applied.

(7) Minimum open space

This is another way of expressing maximum site coverage and its effect is the same. Some zoning bylaws specify the proportion of usable open space to be provided on site. Parking and service space must be deducted to obtain this figure. In the past, required open space has generally been stipulated only in quantitative terms, which has often resulted in developments containing large yards with little practical value. Open space is desirable but should be designed to meet particular needs such as recreation, passive enjoyment or visual relief. Otherwise it provides little value to the community to compensate for the loss of density which it requires. Qualitative requirements can be added to regulations to make effective use of this space, such as requirements for landscaping or children's playspaces.

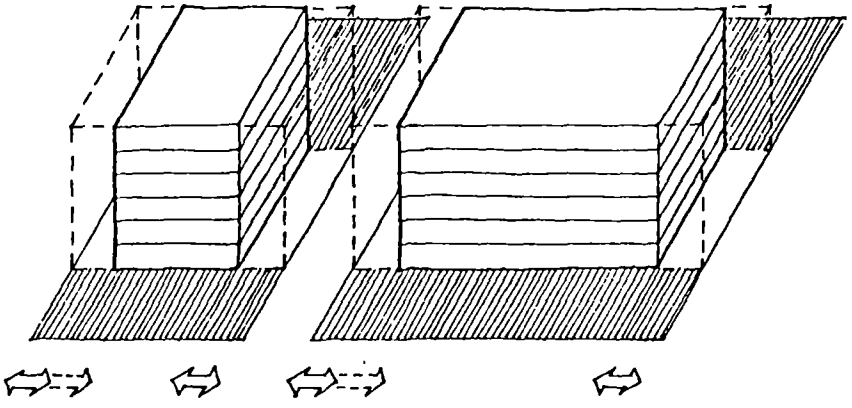
(8) Maximum yard sizes and setbacks

Yard sizes and setbacks are prescribed by land use legislation and building and fire codes. They serve several purposes, such as safety, ensuring sunlight penetration and enhancing the existing neighborhood character. Although the land set aside to meet these requirements is generally also used to satisfy those for open space, some yard requirements have a considerable direct impact on density and built form. The width of side yards

required by the building code is graded according to building height (higher buildings require wider side yards). Side yards are not required if side walls are constructed of noncombustible materials and without windows. Side yard widths are not graded according to lot size, which means that the land required for side yards at a given height is constant regardless of the length of lot frontage. In effect, this provides a density bonus for assembly of larger sites. Doubling the lot size, for example, will more than double the size of building that can be placed on it, as shown in Figure 2.2. As height increases, even larger bonuses are conferred on site consolidation. Wider side yard requirements provide a higher potential for increasing density by augmenting the site area. Some side yard requirements, notably in lower-density areas, are in excess of those necessary for safety reasons. These can be reduced, as the use of zero lot lines in new subdivisions has shown.

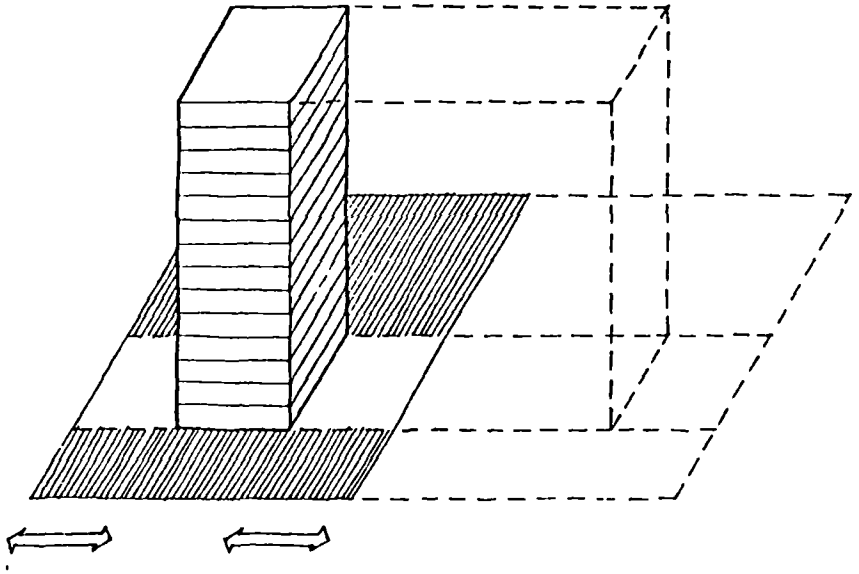
(9) Sunlight performance standards

In their simplest form, sunlight standards dictate that certain ground surfaces be free of shadows from surrounding structures for certain periods of the day and year. This is achieved by controlling development on adjacent sites so that it does not obstruct this light. For any given development site, these standards can be translated into height and setback limitations which place an indirect ceiling on density. The shape and size of the buildable 'envelope' is determined by sunlight standards based on the specified number of hours and days in which direct sunlight must be allowed to reach specified land areas. For example, the



Sideyard occupies
up to 1/3 of width
of narrow site for
Mid Rise Building Form.

Decreasing effect on larger site.



Up to 2/3 of width
of minimum site for
15St. High Rise.

Fourefold increase in building scale
possible on site only twice as large.

Figure 2.2. Side yards and density (from McKellar 1979, p. 36)

desire for substantial sunlight penetration in the winter in northern latitudes necessitates wide spacing of buildings or low roof lines because of low sun angles.

(10) Minimum parking space per unit

Parking is one of the major factors influencing density in multiunit developments. As the allowable density on a site is increased, it becomes more difficult to meet requirements for parking at grade. When parking space is not counted as site coverage, much of the area set aside for open space may be used for parking lots. When a floor area ratio of about 1.0 is reached, structured parking either above or below grade becomes a necessity (Myers 1979, p. 66). This is much more costly than at-grade parking and, consequently, higher densities are sought by developers in order to justify the expenditure. Buildings that are of medium density but require structured parking present cost problems.

The economics of building form is very sensitive to the number of parking spaces required per dwelling unit. If this number is too high, structured parking will become necessary at lower densities. Because this cannot be rationalized on cost grounds, developers will favor higher densities over those in the medium range. The required parking spaces per unit is normally graded according to unit size. High parking requirements for larger units may divert construction from family accommodation to

smaller units with lower requirements [2]. Requirements which are too low will, on the other hand, cause spillover parking problems in the neighborhood.

Site Characteristics

Apart from general land use and structural regulations, there are other physical constraints which affect the density that can be reached on any particular site. These factors may include access, the bearing capacity of soil, water tables, slope, vegetation and the arrangement and capacity of roads and utilities. The shape and size of the lot also determine how efficiently units can be placed on it.

User Requirements

Density is significantly affected by the spatial demands of households. Their locational requirements affect the distribution of density within the city, and demands for living space and amenities affect dwelling densities. Households can be divided into several groups which have distinct dwelling space requirements. The most important considerations in distinguishing user groups are household composition and lifestyle. Traditionally in North America, high-density housing has accommodated smaller households (singles, couples without children and elderly) while families with children have preferred to live in low-density detached dwellings whenever possible. These decisions are

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[2] An exception to this is the luxury condominium market, in which extra parking can be a good selling feature.

motivated partly by choice and partly by economic necessity.

Smaller households generally require less space, and a yard adjacent to the dwelling may not be as important as it is for a family. Other factors, such as proximity to employment, services and leisure activities, maintenance requirements and cost, may favor the choice of higher-density housing for this group. Some single and elderly persons also choose to live in places where there are others of similar ages and interests, which again tend to be multiunit structures.

The single-family house has long presented a strong attraction to a large group of households, and not exclusively those with children. Some of the elements which contribute to this positive perception have been identified by writers and researchers (Davis 1977; Diamond 1976; Myers 1979; Newman 1981; Pearson 1972; Schreier 1977; Vancouver Planning Department 1978):

(1) identity, expressed in an individual entrance and separate street address and the opportunity for personal expression on the outside of the home
(2) territoriality, in the form of well-defined private outdoor space which permits close supervision of children and fosters a feeling of security
(3) direct access and relationship to grade
(4) orientation to at least two aspects, allowing cross-ventilation and more sunlight
(5) acoustic and visual privacy
(6) convenient automobile access
(7) opportunities for social interaction

As will be seen later in this chapter, these features are not necessarily the exclusive domain of the single-family detached house but this is the form most familiar to these groups. In any case, because accommodation which is suitable for families requires certain features which consume extra space, dwelling densities are still inclined to be lower than for nonfamily accommodation.

Another factor which defines user groups is income, which a strongly influences demand for space and amenity. Urban location theory suggests that consumption of land for residential use increases with income (other factors such as travel time being equal). Thus, many of the wealthier neighborhoods tend to have larger lot sizes, and condominium apartment units tend to be larger than rental units (Myers 1979, p. 70). Sub-groups may be defined by other indicators such as lifestyle (for instance, the extended family common in some ethnic communities) and age.

Density and Housing Form

The dwelling density ranges that are associated with various housing types are given in Figure 2.3. As will be noted, wide variations are possible within many of the housing categories, depending on such components as lot size, unit size and mix within a particular development, calculation of open space and parking, etc. Appendix 1 provides a more detailed listing of density by building type as calculated in several density studies.

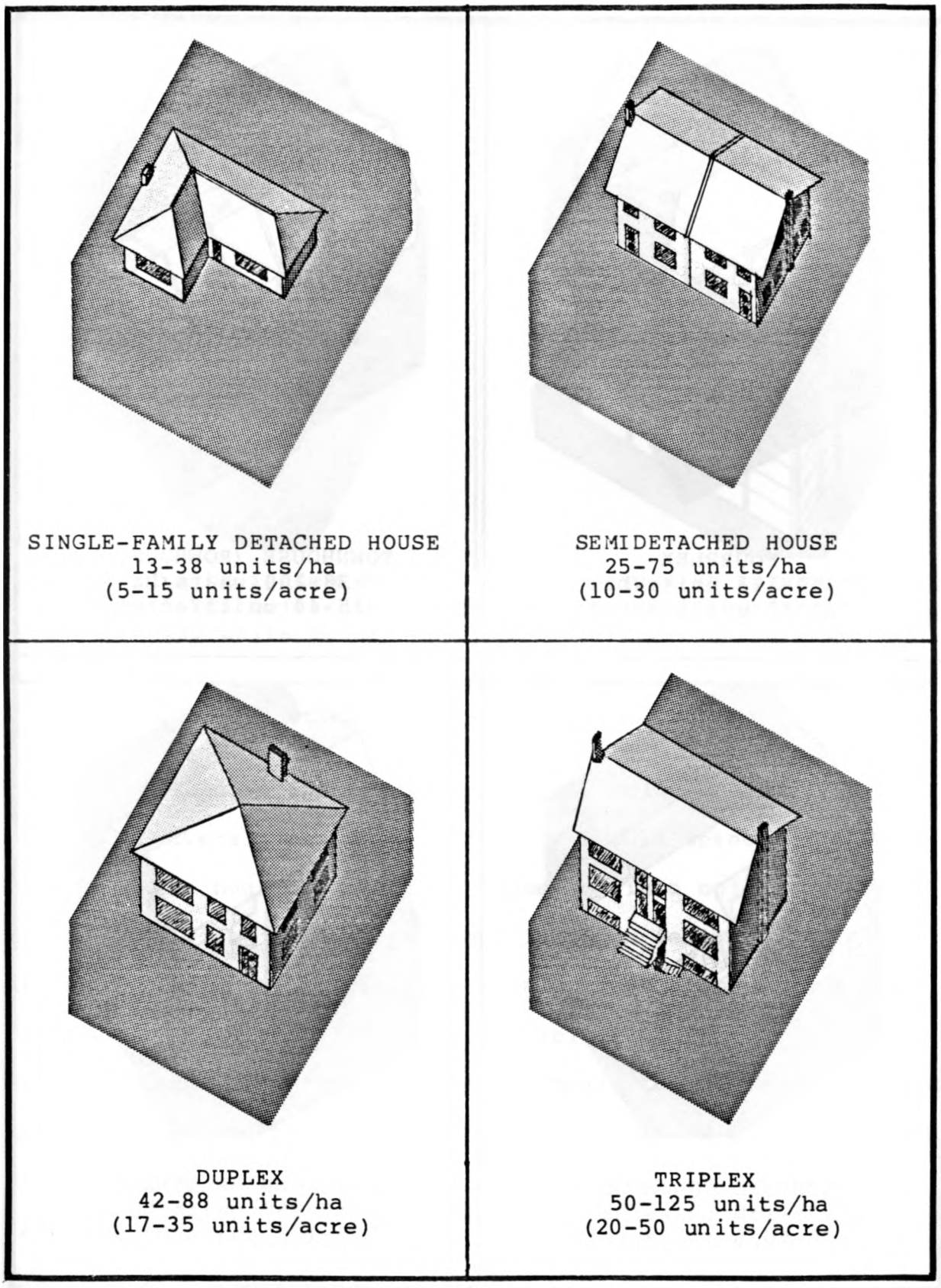
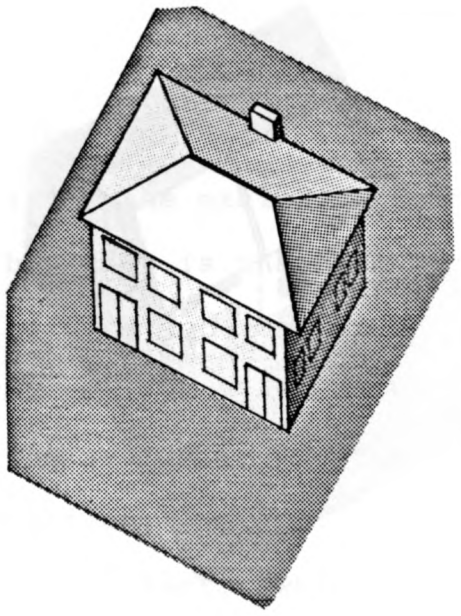
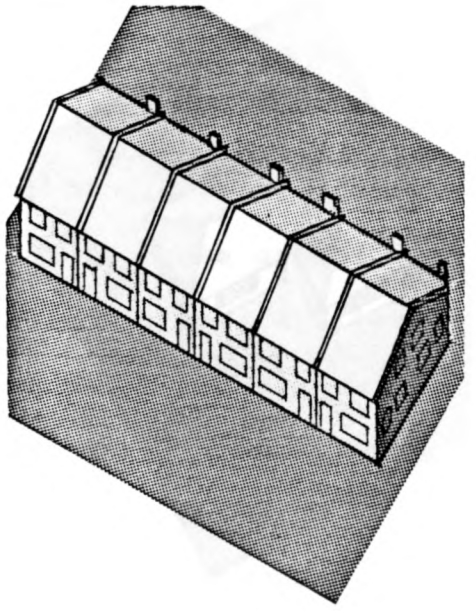


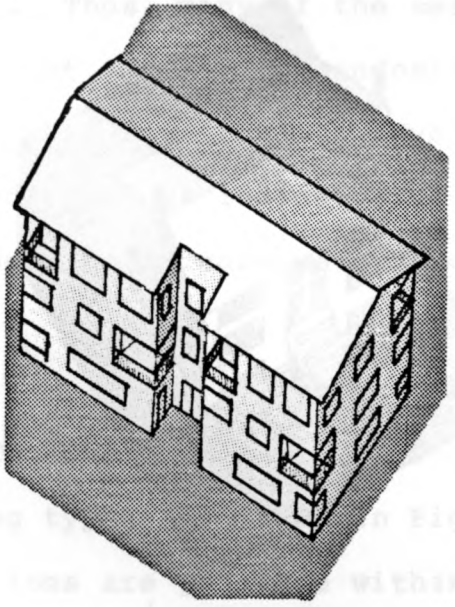
Figure 2.3. Density and housing form



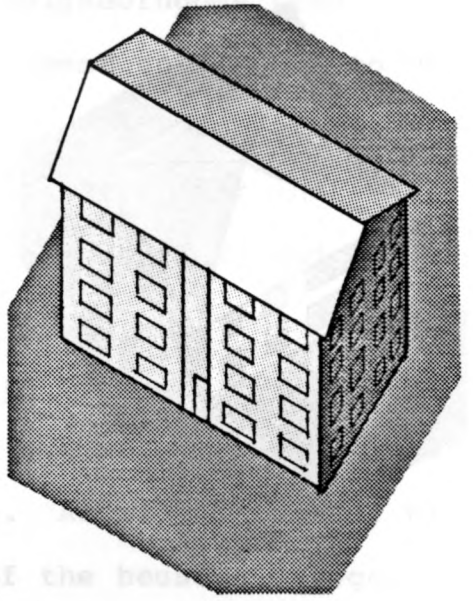
FOURPLEX
50-113 units/ha
(20-45 units/acre)



TOWNHOUSE (ROWHOUSE)
38-100 units/ha
(15-40 units/acre)

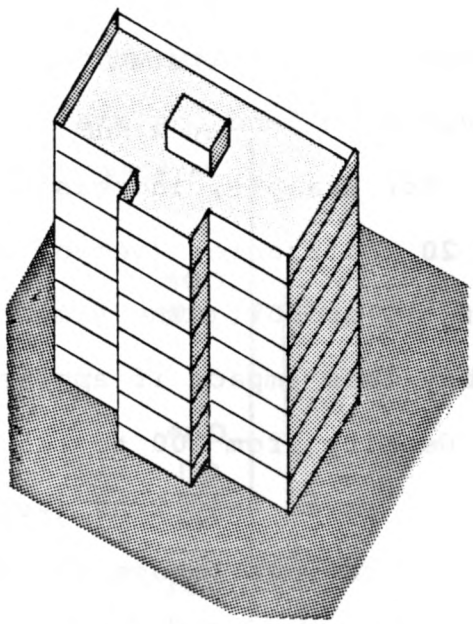


STACKED TOWNHOUSE
75-150 units/ha
(30-60 units/acre)

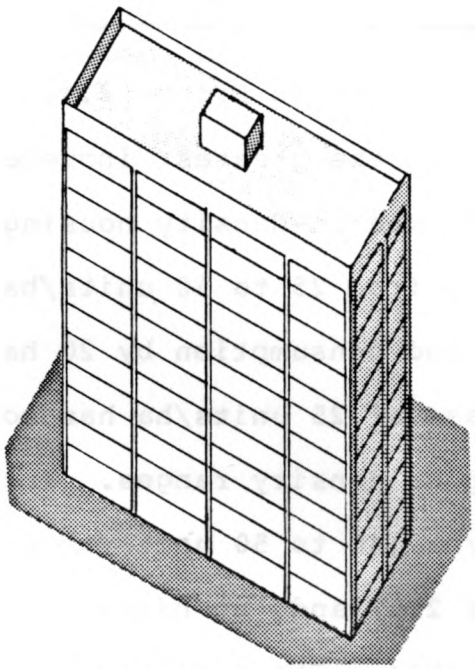


WALK-UP APARTMENT
63-250 units/ha
(25-100 units/acre)

Figure 2.3 (continued)



MID-RISE APARTMENT
125-325 units/ha
(50-130 units/acre)



HIGH-RISE APARTMENT
188-750 units/ha
(75-300 units/acre)

Figure 2.3 (continued)

As implied in the previous section, policies aimed at increasing overall residential density should acknowledge the fact that the housing market is segmented into unique household types, each with its own space and location demands. Housing in the highest density ranges serves only a few segments and may create aesthetic and social incompatibilities in some neighborhoods. At the same time, housing at medium densities may present an alternative to the most land consumptive form of housing (the single-family dwelling) with large increases in efficiency of land use.

As shown in Figure 2.4, the increases in density which result in the greatest incremental savings in land use are in the low- to medium-density housing range. For example, increasing density from 25 to 50 units/ha (10 to 20 units/acre) (vector a) cuts land consumption by 20 ha (vector b), or 50%. The same increase of 25 units/ha has considerably less impact if applied at higher density ranges. Increasing density from 100 to 125 units/ha (40 to 50 units/acre) (vector c) saves only 2 ha (vector d), or 20%, and, at higher densities, the savings become almost negligible. The declining benefits of increasing density are shown in Table 2.2 [3]. In terms of floor area ratio, 'densities above 1.5 provide very little additional advantage in terms of land use' (Diamond 1976, p. 16).

Building height is commonly equated with density but the relationship between them is not a simple one. As was mentioned in Chapter 1, increasing density on a site creates a need for more surrounding ground space for such uses as roads, parking and recreation. In the lower density range this can be accommodated by lowering the site coverage of the building and adding more storeys, but there is a limit to which coverage can be reduced. The addition of storeys beyond this limit must be supported by increases in site area, which lowers the total site density. If parking is structured and open space requirements are met off-

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[3] Table 2.3 shows that, if densities are increased by a constant percentage, the percentage savings remain constant but absolute land savings still decrease.

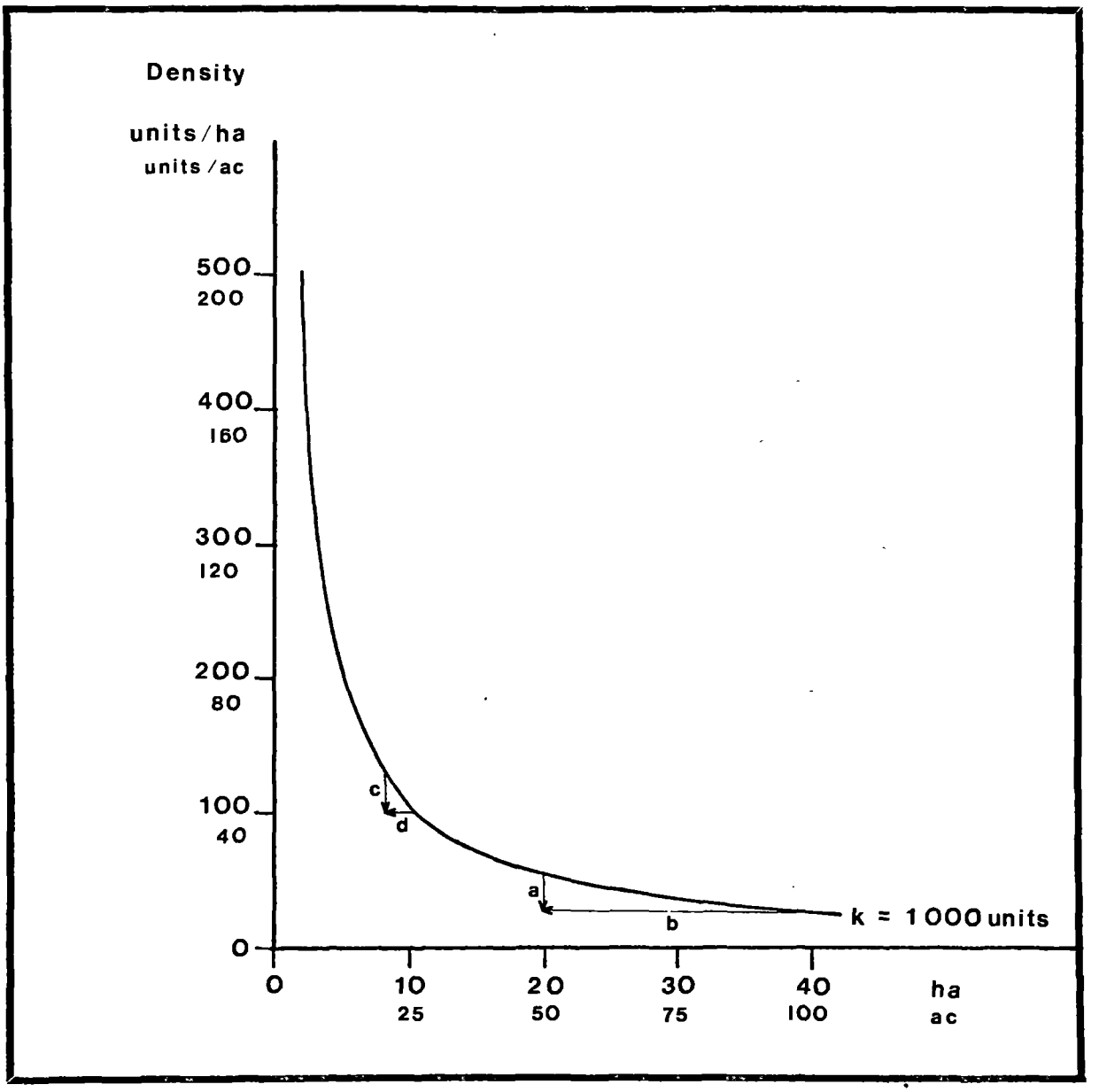

Figure 2.4. Residential density and consumption of land for 1000 dwellings (after Diamond 1976, p. 15 and McKellar 1979, p. 21)

site (or relaxed), the densities achievable by high-rise forms are very high. However, if standards for adequate sunlight are considered, tall buildings provide little density advantage over lower forms. This is because the spacing between buildings necessary to allow penetration of sunlight increases with

Table 2.2. Land savings from increases in density (increments of 25 units/ha)

(k = 1000 units)

Density increase (units/ha) from	to	Land saved (ha)	% savings
25	50	20.00	50.00
50	75	6.67	33.35
75	100	3.33	24.98
100	125	2.00	20.00
125	150	1.33	16.63
150	175	0.96	14.39
175	200	0.71	12.43
200	225	0.56	11.20
225	250	0.44	9.91
250	275	0.36	9.00
275	300	0.31	8.52

Table 2.3. Land savings from increases in density (increments of 100%)

(k = 1000 units)

Density increase (units/ha) from	to	Land saved (ha)	% savings
25	50	20.0	50
50	100	10.0	50
100	200	5.0	50
200	400	2.5	50

building height. Of course this is dependent on the site, its latitude and the specific performance standards adopted for sunlight.

As has been discussed previously, housing has been separated into two density extremes, each serving a distinct group of households. The single-family detached house has become a symbol of a particular lifestyle. Many of its features can be

accommodated in higher-density housing but few alternatives have been presented and the detached house remains a strong ideal in the public mind. On the other hand, the common perception of higher densities is one of building forms that cater only to a few users, mostly nonfamily households and families that cannot afford to buy a home. In the last decade, there has been a growing interest in widening the range of densities which can meet the requirements of specific user groups. It has been shown that, while the single-family detached house may epitomize the dwelling preferred by many households, most of its essential characteristics can be provided in denser housing (although they are admittedly compromised somewhat in the process). Diamond cites medium densities of 20 to 40 units/acre (50 to 100 units/ha) as a range in which reasonable alternatives to the single-family dwelling can be produced (1976, p. 17).

Summary

Net population density, the relationship between land and the number of people it accommodates, provides the most accurate indicator of efficiency of residential land use. For programs aimed at increasing density, it is a valuable criterion for post hoc evaluation of occupied projects. In evaluating projects at the proposal stage, population density can be estimated by calculating dwelling densities and multiplying by average occupancy rates. This method will be employed in evaluating scenarios in this project.

For the purposes of controlling density at the development stage, a mix of regulatory measures is necessary. A first set of controls is necessary to address the efficiency aspect of density discussed in the first chapter; a second set mainly addresses the livability aspect. First, a maximum net dwelling density can control the number of units and (within a margin of error) people which can be accommodated on any given site. In those instances where it is determined that it is desirable for new developments to accommodate a variety of household types, specific mixes of unit types could be attached to permitted dwelling densities. In addition, where it is deemed appropriate, guidelines specifying requirements for family-oriented units could be provided [4].

Second, in order to control building bulk and factors which affect the perception of density, controls affecting height, coverage, open space, setbacks and yard sizes should be implemented. The combination of these controls should be sufficient to deal with most issues relating to residential density and eliminate the need to use the less precise floor area ratio measurement. The dwelling density specifications can be flexible enough to permit a wide variety of building forms and designs. Controls over dwelling densities and unit mixes determine the total floor area to a degree. Some variation in floor area is still possible (due to differing unit sizes) but this is less than would be the

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[4] The accommodation of a diverse set of household types within a given area is not necessarily an end in itself. Its desirability would depend on the objectives for that area determined through the planning process.

case if no unit mixes were set out. The addition of the other controls, especially those over height and coverage, serves to regulate building bulk and compatibility with surroundings [5].

A third set of controls can be used to regulate externalities and the provision of amenities. These are not specifically directed at density control but do affect density. They include requirements for usable open space, parking and yard sizes and setbacks for purposes of safety, rights of way, etc. This control system provides a means of regulating all three types of density (population, dwelling and massing). As well, it can be used to encourage the provision of higher-density accommodation for specific household types, thus covering a wide spectrum of user groups.

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[5] This type of regulatory system was recommended in the Toronto Core Area Housing Study (Klein and Sears et al. 1974, pp. 116-18). The study proposed five regulatory measures: (1) units per acre, (2) bedrooms per unit, (3) units suitable for families, (4) height limitations and (5) commercial development regulations.

CHAPTER 3
THREE DEVELOPMENT SCENARIOS

In this chapter, the implications of a municipal policy of increasing density in the inner city are explored. It is assumed that a City Council has established a policy of increasing residential densities in inner city neighborhoods and that the scenarios are developed as a mechanism for illustrating different ways in which this could be implemented. Three scenarios are presented, each of which shows how development may occur under a particular set of policy objectives. These objectives are based on concerns which are commonly raised by community residents, planners and decisionmakers in the community planning process. A study area is defined in the Calgary community of Sunnyside in order to illustrate the effects of the three policies.

It is not the intent of this chapter to prepare a community plan for Sunnyside or to advocate a density increase within the study area. Rather, the scenarios are employed, as Chapin and Kaiser advise, to 'depict hypothetical development contingencies associated with particular combinations of objectives and their priorities [to] provide a basis for explicit consideration of differing assumptions concerning development futures' (1979, p. 344). The scenarios are used here as planmaking tools to assess the implications of alternative policies which have been advocated for the inner city by various interested parties. An attempt is made to develop policies into logical, consistent projections of the development which may occur as a result of their adoption. More specifically, the purpose is to compare a traditional type of redevelopment--using building forms and dwelling

types which many people have commonly identified with 'high density'--with alternative means of increasing density. Scenario 1 represents the more familiar form of apartment redevelopment; Scenario 2 emphasizes family-oriented housing and Scenario 3 is a more fine-grained mix of various structural and unit types.

The scenarios are illustrations of specific policy positions rather than plans which would result from a community planning process or models of particular planning approaches. This exercise assumes the application of policies determined at the municipal level to the study area in Sunnyside for the purpose of demonstrating the implications for inner city neighborhoods. The scenarios are very general in nature and, in determining potential patterns of development, a limited number of variables were used. Following the scenario stage, a more detailed planning process would be undertaken, giving closer consideration to many other factors in addition to density and involving a program of public participation. The resulting plan would most likely not be exclusively linked with a single overriding policy imperative. It is conceivable that it could include elements of all three scenarios presented here. The emphasis at the community planning level would be to assure that the types of development recommended are consistent with the objectives set out for the plan and are suitably located to minimize negative impacts. Through the formulation of these scenarios and a comparative evaluation of them (which follows in Chapter 4), this study will identify some of the factors relating to density that may be encountered in this process.

Sunnyside: Neighborhood Context

Inner city communities vary widely according to physical development and social patterns and, consequently, no single community may be said to be typical. Sunnyside is one of Calgary's better known inner city neighborhoods, and many aspects of its development history and population characteristics are common to other neighborhoods.

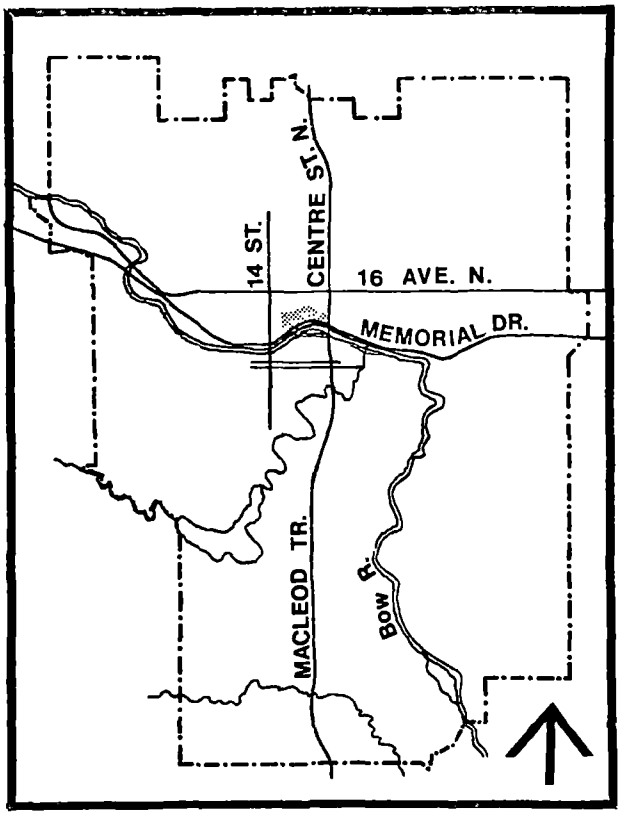

Figure 3.1. Sunnyside: Location

Location

Sunnyside is located directly north of the downtown area, across the Bow River. The river forms its southern boundary; the northern and eastern boundaries are defined by an escarpment and the western boundary by 10th Street North West, a major thoroughfare.

History of Development

The original development, which occurred in the period between 1900 and 1930, was dominated by two major housing forms. Two-storey homes were predominant prior to World War I and, after that, single-storey bungalows made an appearance (Calgary Planning Department 1978, p. 18). In 1952, as part of a city-wide policy, the land use regulations were changed to permit multiunit medium-density housing in much of the neighborhood [1]. Substantial redevelopment followed through the next two decades, while the community's family population dwindled as children matured and left home.

Community opposition to redevelopment was consolidated in the late 1960s and early 1970s, and eventually led to changes in municipal policy. A design brief (community plan) was approved for the area in 1977-78 and resulted in downzoning of R-4 (4-

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[1] The Interim Development By-law (4271) was passed in 1952. The Interim Zoning Guide, a map which accompanied the bylaw, is not included in City Clerk records and its application to Sunnyside is therefore not officially documented. However, Husband states that the bylaw applied R-4 (medium-density) zoning to Hillhurst-Sunnyside (1977, p. 43).

storey apartment) areas to R-3A (townhousing) [2]. Other parts of the neighborhood remained R-2 (single-family homes and duplexes).

Table 3.1 and Figure 3.2 trace the change in population which took place in Sunnyside roughly from the point of upzoning to 1981 [3]. The figures cast an interesting light on the upzoning policy, which was presumably based on the premise that increasing the number of dwelling units in a neighborhood will generate an increase in population. They show that, while the number of dwelling units increased in each of the five-year periods, population change was erratic, rising in some periods and falling in others. The net result was an increase in occupied dwellings of 52%, accompanied by a net population decline of 7%. A dramatic drop in the average household size of 41% occurred, due largely to the large number of apartments which replaced the single-family homes. The maturing of the child population during this period was also a factor.

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[2] In the Calgary Land Use By-law adopted in 1980, R-3A zoning was replaced by a new RM-2 designation. The provisions under this zoning are virtually the same as under R-3A.

[3] The data covers all of federal census tract 058 (1981), which is composed of Sunnyside as well as the community of Rosedale and part of Crescent Heights. Crescent Heights experienced development similar to Sunnyside's during the period, while Rosedale remained a predominantly single-family community. The census tract boundaries, which remained the same during the study period, are shown in Appendix 2.

Table 3.1. Population, occupied dwellings and household density 1951-1981 (1981 Census Tract 058)

	1951	1956	1961	1966	1971	1976	1981	Summary 1951-81
Population	6865	6885	6572	6112	6395	6104	6404	
Occupied dwellings	2150	2246	2282	2295	2565	2930	3270	
- Single detached	1490		1567	1502	1570	1460	1485	
- Apartment	655		557	793	1000	1465	1785	
Persons/household								
- Census tract	3.2	3.0	2.8	2.6	2.5	2.1	1.9	
- City average	3.3	3.4	3.4	3.4	3.3	3.0	2.8	
			% Change					
Population		+0.3	-4.5	-7.0	+4.6	-4.6	+4.9	-6.7
Occupied dwellings		+4.5	+1.6	+0.6	+11.8	+14.2	+11.6	+52.1
- Single detached			+5.2	-4.1	+4.5	-7.0	+1.7	0.0
- Apartment			-15.0	+42.4	+26.1	+46.5	+21.8	+172.5
Persons/household								
- Census tract		-6.3	-6.7	-7.1	-3.8	-16.0	-9.5	-40.6
- City average		3.0	0.0	0.0	-2.9	-9.1	-6.7	-15.2

Source: Census of Canada

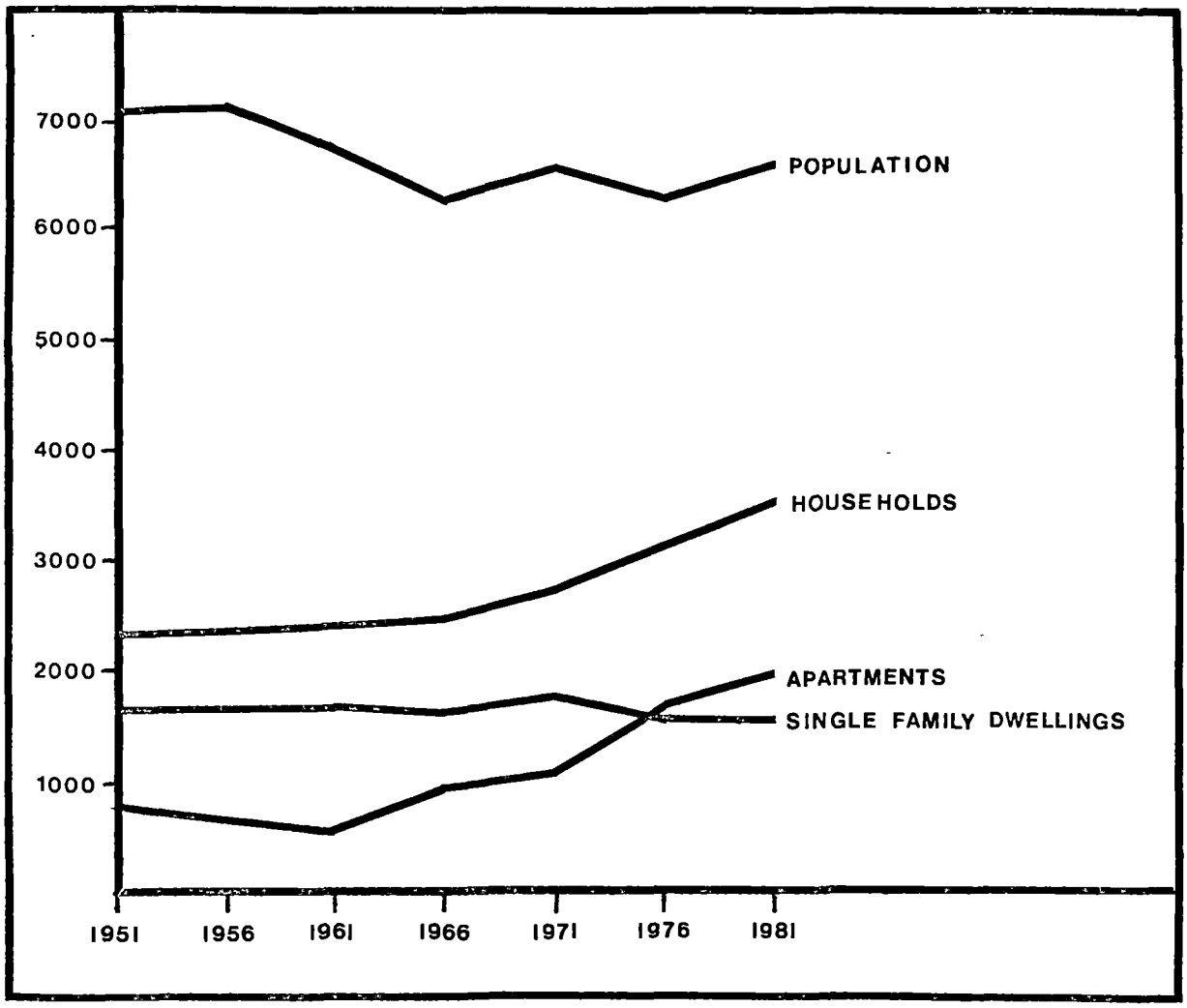

Figure 3.2. Population, occupied dwellings and household density 1951-1981

Socioeconomic Characteristics

Federal census data for Sunnyside [4] indicates a population characterized by a high proportion (63%) of adults aged 20 to 34, which is considerably above the city average. In contrast, the proportions of children (0-19) and middle-aged adults

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[4] Tables containing the data discussed here are found in Appendix 2.

(35-54) are much lower than average, while that of adults 55 and over is about average. Generally speaking, the population is better educated than average. Proportionally more persons are active in the labor force, reflecting the large number of single adults and possibly many working couples as well. The neighborhood's unemployment rate is twice the the city average, which may be partially explained by its high percentage of young adults. The breakdown of population by occupation conforms fairly closely to Calgary figures, but incomes are lower than average. This, again, is probably due to the large number of young adults in the work force who have not gained sufficient seniority or experience to command higher incomes. The higher unemployment rate is also a factor.

The proportion of nonfamily households in Sunnyside is well above the Calgary average and the absolute number of family households is declining. Within family households, the number of children is also falling. Added to this is a large proportion of unmarried persons, and all of these factors produce an average household size of 1.9 persons/household, considerably lower than the city average of 2.8.

Housing and Physical Characteristics

The majority of dwelling units in the neighborhood are apartments, with single-family detached homes accounting for just over one quarter of the housing stock. The number of townhouses and semidetached homes has recently increased rapidly, reflecting the zoning changes of 1978.

The proportion of land area occupied by single detached homes is larger than the proportion of units would suggest. This, coupled with the fact that many units classified as 'apartment units' are in converted single-family houses, results in a residential land use mix which is more evenly divided by area between single-family and multiunit housing forms. Building condition is generally very good, as is the condition of roads, sidewalks and other public areas.

Physically, Sunnyside is favorably located between the riverbank to the south and the escarpment to the north. These amenities, combined with the architecture and scale of the older homes and tree-lined streets, serve to define the neighborhood character and constitute an attractive residential environment.

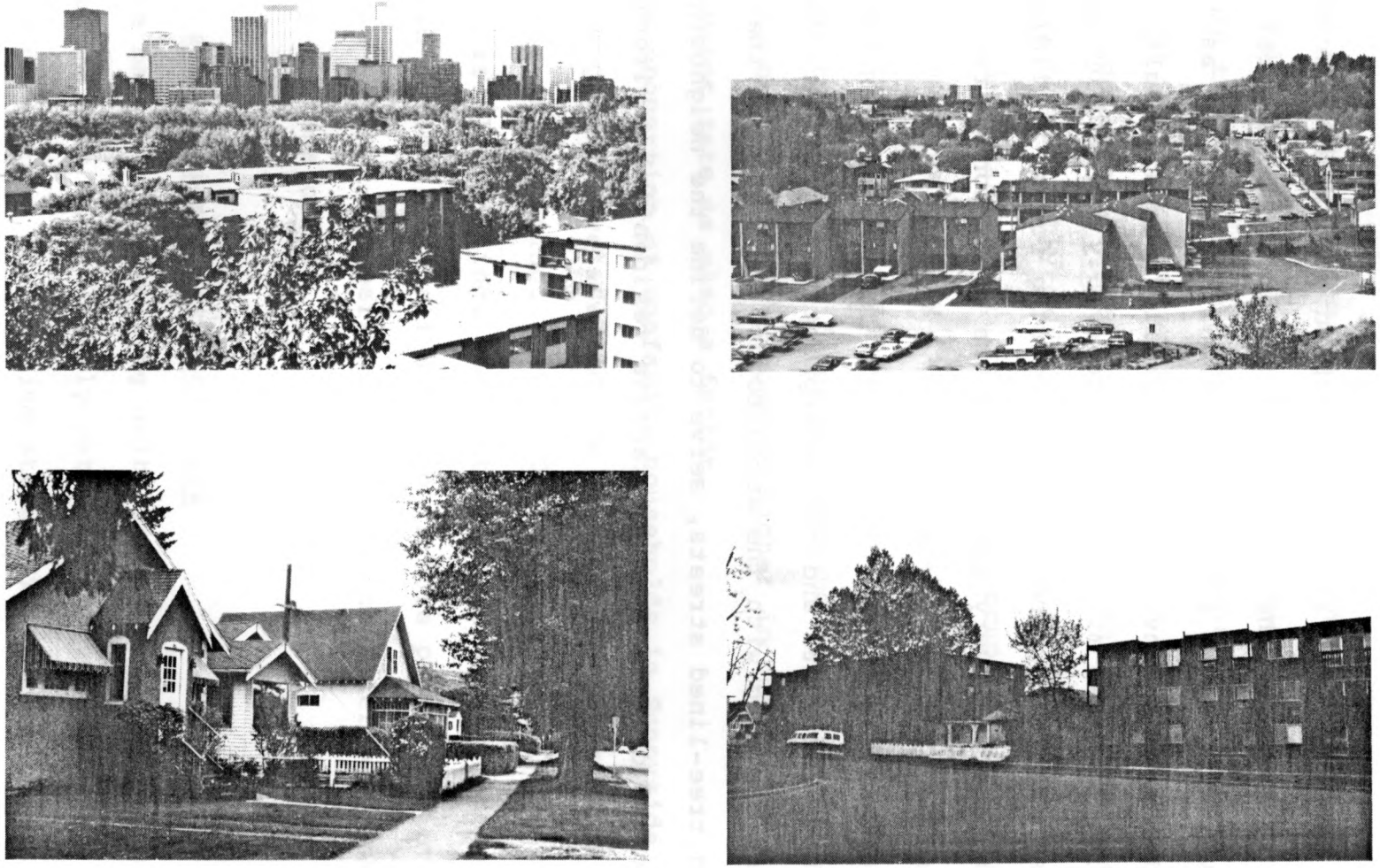

Figure 3.3. Views of Sunnyside residential area

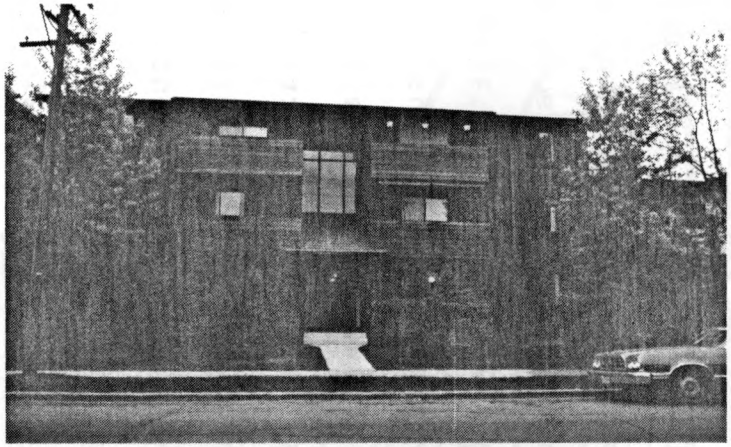

Figure 3.3 (continued)

Study Area

The study area chosen for the scenarios (indicated in Figure 3.4) comprises roughly the eastern half of Sunnyside. The boundary is arbitrary but encompasses a diverse mix of housing, predominantly 3-storey walk-up apartments west of 5A Street and detached housing to the east. The Sunnyhill Coop, a 3-storey townhouse development, is located on the extreme eastern edge of the community. This pattern of land use is recognized in the development of the scenarios, with the majority of new development being concentrated in the apartment districts, and conservation and infill strategies applied in the single-family district.

The net residential land area is 17.2 ha (42.4 acres) and is occupied by 1049 dwelling units containing a total population of 1946 [5]. Existing net dwelling density is 61.0 units/ha (24.7 units/acre) and the net population density is 113.1 persons/ha (45.9 persons/acre). Present land use policy (Figure 3.4) designates the western portion of the study area as a low-density multi-dwelling district (RM-2), which allows small scale development such as townhouses and fourplexes. The eastern portion is designated as low-density (R-2), which permits single detached and semidetached dwellings and duplexes. Full development under these regulations would result in a dwelling density of approximately 74.2 units/ha (30.1 units/acre), representing a 21.7%

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[5] Population and dwelling unit figures are from the 1982 Calgary municipal census.

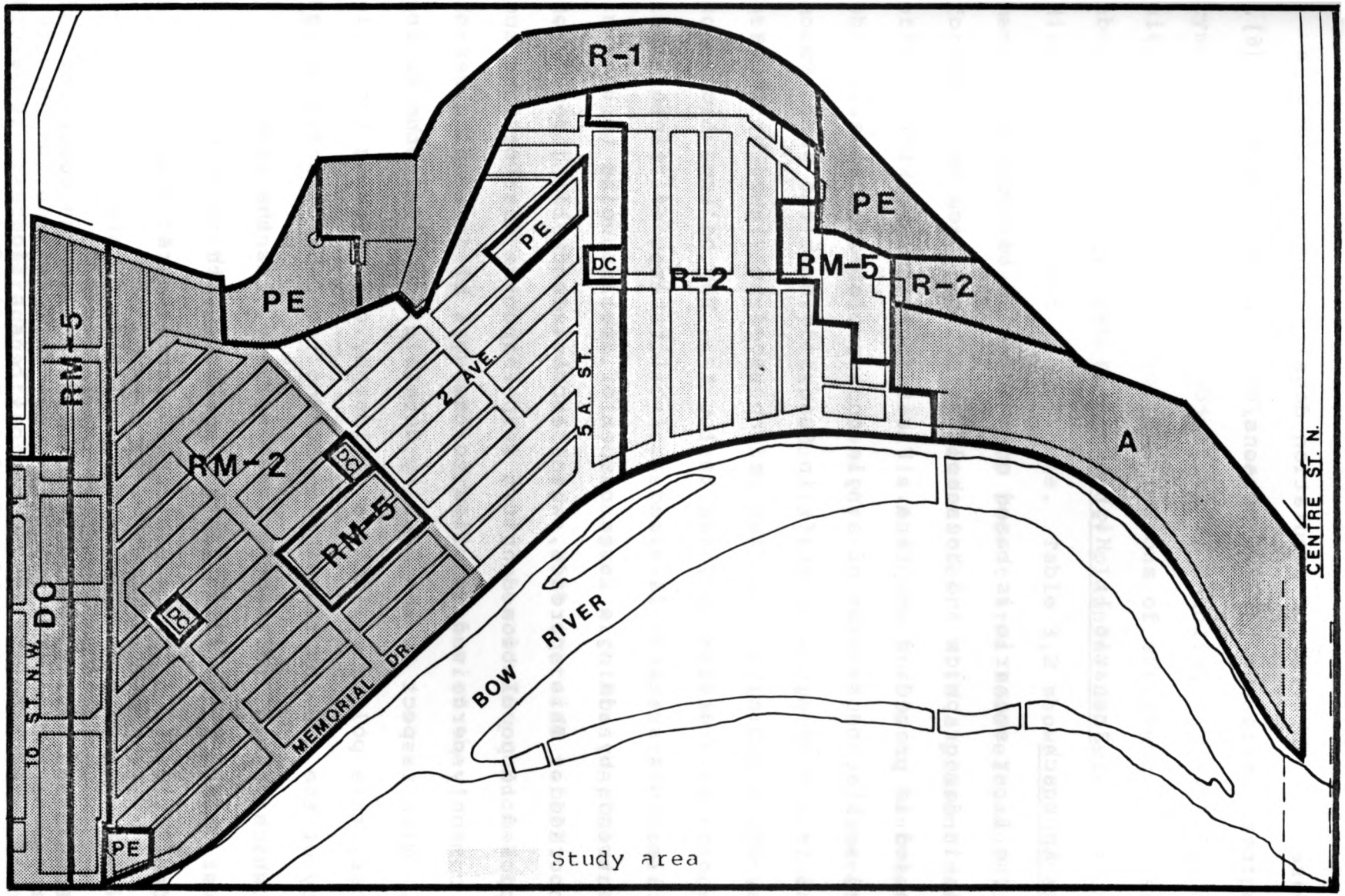

Figure 3.4 Present land use designations and location of study area

increase. In terms of population density, there would be a 34.3% increase to about 152.0 persons/ha (61.7 persons/acre) [6].

Scenario 1: High Dwelling Density

Policy Approach

The first scenario is based on a response to two major trends in demographics and household structure which have been discussed in preceding chapters. First is the nationwide trend toward smaller households of single and unrelated persons. Second is the demographic shift in Sunnyside over the past ten years, which indicates that the neighborhood is viewed by these households as a desirable place to locate. The policy which underlies this scenario is aimed at facilitating and reinforcing these trends by adding a large number of smaller units to the neighborhood. This approach, which emphasizes dwelling density, as opposed to population density, is perhaps the most obvious and most commonly perceived solution to the goal of increasing density. With respect to the density debate discussed in the first chapter, this policy reflects a philosophy of improving the efficiency of the city by reducing commuting time and cost and using land which is well located more intensively. At the same time, however, some of the 'livability' factors, which contribute to the desirability of the neighborhood, are also recognized.

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[6] Population density was determined using average occupancy rates of the various dwelling types in Sunnyside, which were calculated from the 1982 municipal census figures. These rates are shown in Table A2.12 in Appendix 2.

For the purposes of this scenario, it is assumed that policymakers have set out an objective of doubling the dwelling density of the study area, for the reasons of efficiency discussed above. In light of recent community planning decisions, such a directive is at least conceivable. Table 3.2 shows the recommended maximum densities in four recent Area Redevelopment Plans for other Calgary inner city communities. With a present density of 61 units/ha, the study area is most comparable to Bankview, which was given a potential density increase of 30%. However, in more recent decisions, City Council has shown an inclination to stipulate higher densities. This was evident in Lower Mount Royal and Sunalta, where the density was increased even though their densities were already substantially higher than other inner city neighborhoods. In comparison with Mission, Lower Mount Royal and Sunalta densities, a 100% increase to 122 units/ha (50 units/acre) in the study area would produce a lower density but may have a greater impact because of the neighborhood's lower initial density.

Building Forms and Locations

In this scenario, higher-density building forms are concentrated in the portion of the study area west of 5A Street, where a large number of apartments already exists. Addition of high-density buildings in this location would have a less disruptive influence on its surroundings than it would on the eastern section. In this lower-density precinct, more conflicts would be

Table 3.2. Approved maximum densities for Calgary inner city communities

	Bankview (1981)	Mission (1982)	Lower Mount Royal (1983)	Sunalta (1983)
	NET DWELLING DENSITY			
Initial units/ha	56.5	123.8	125.0	96.3
(units/acre)	(22.6)	(49.5)	(50.0)	(38.5)
Recommended maximum units/ha	-	301.3	204.0	-
(units/acre)	-	(120.5)	(81.6)	-
% increase	-	143.4	63.2	-
	NET POPULATION DENSITY			
Initial persons/ha	101.5	177.5	217.0	166.8
(persons/acre)	(40.6)	(71.0)	(86.8)	(66.7)
Recommended persons/ha	131.8	430.3	342.0	265.8
(persons/acre)	(52.7)	(172.1)	(136.8)	(106.3)
% increase	29.8	142.4	57.6	59.4

Source: Calgary Planning Department

likely to arise, such as incompatibility of building scale, loss of privacy, social and lifestyle differences between old and new residents, deterioration of single-family housing and a shift away from resident-ownership as a result of the speculative process. The objective of a 100% density increase can be met through concentration of apartment units in the west, allowing a strategy of conservation, renovation and infill at existing densities east of 5A Street. Although conservation is not a stated objective in this scenario, the presence of a mature, low-scale

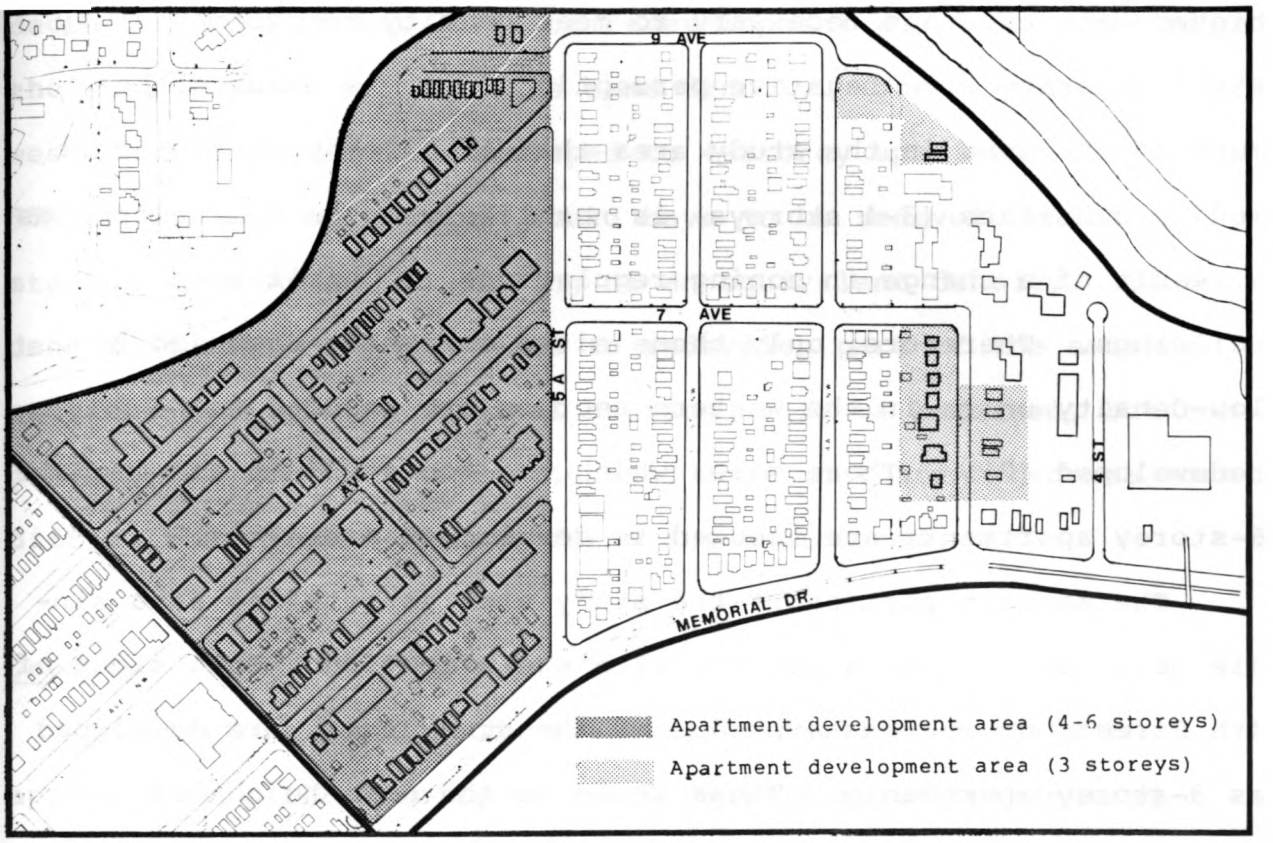

Figure 3.5. Scenario 1: High dwelling density

precinct within the neighborhood may be seen as an amenity by some people. Many apartment dwellers may prefer a neighborhood with some low-density housing to a homogeneous apartment area.

The dominant housing form used in this scenario is a 6-storey apartment building. At this height, the prescribed density objective can be satisfied while limiting the effects of shadowing and perception of density which are often associated with higher buildings. In addition, 6 storeys is considered the maximum height at which residents' visual and psychological relationship to grade can be accommodated (McKellar 1979, p. 34). This is not considered essential by some nonfamily households, but can help to lessen problems of shadowing and incompatibility

of scale which are often associated with higher structures. The higher site coverage necessary to meet density requirements may still generate some negative perceptions. It is assumed that most of the land in the study area that is already developed at medium densities (3-4 storeys) is not likely to be redeveloped as a result of a change in zoning regulations to permit 6-storey buildings. Therefore, only those sites currently occupied by low-density units in the western section are assumed to be redeveloped [7]. Those sites which are too small to accommodate 6-storey apartments are assumed to develop at 4 storeys.

The eastern portion of the study area is retained as a single detached housing district, with one exception. Both sides of 4th Street, on the eastern edge of the study area, are developed as 3-storey apartments. These would be the same height as the adjacent townhouses of the Sunnyhill Coop and would not significantly disrupt the single-family district. In addition, because the homes currently occupying these sites are on 50-ft. (15-m) lots, a substantial density increase can be realized with the loss of fewer homes than would be the case in other parts of the single-family district.

This scenario illustrates that a large increase in density can be achieved without a total change in the community. The same increase could be achieved with other building forms but, if

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[7] Since the density allowed by 6-storey apartments is near twice that of some of the walk-ups in the study area, some of these properties may be redeveloped. This is balanced against another assumption that some low-density land would not be redeveloped.

the 6-storey density in the west is lowered to any marked degree, a significant level of redevelopment would be required on the east side to maintain the same density. For example, if the western section were redeveloped to 4-storey apartments, about 55% of the eastern section would have to be redeveloped as stacked townhousing or housing of an equivalent density. If a denser housing form were used to redevelop part of the eastern section, more of the original housing could be retained, but compatibility between conservation and apartment areas becomes more difficult as higher-density forms are introduced.

Density

Scenario 1 would produce a maximum dwelling density of approximately 122.7 units/ha (50.0 units/acre), representing a 101.1% increase over present density. In terms of population density, there could be up to 212.7 persons/ha (86.3 persons/acre), an increase of 88.0%. These figures represent maximum possible densities. The densities which would be reached in actual development would likely be somewhat lower, as some parcels of land may not be redeveloped and others not developed to maximum potential density.

Scenario 2: Family-Oriented Accommodation

Policy Approach

In contrast to the first scenario, the second is based on a policy of countering the trend in the neighborhood toward small nonfamily households. While conceding that the highest densities can be achieved by large apartment complexes with small units, the supporters of this policy would assert that density can also be increased by accommodating households of larger sizes. To illustrate, in Sunnyside, average occupancy rates for single-family dwellings and row housing are 2.28 and 2.47 persons/household respectively, while apartments average only 1.64 (see Table A2.12, Appendix 2). Population density, rather than dwelling density, therefore becomes the more important measure of performance in this scenario. Concentration on family accommodation addresses some concerns expressed by residents and policymakers about the type of development which is appropriate in such inner city communities.

This policy is directed toward increasing the efficiency of land use by offering families an alternative form of housing to the traditional single-family home. As was noted in Chapter 2, the introduction of moderate-density housing for this sector of the housing market presents the greatest potential for conserving residential land. Thus, although the density increase in the inner city under a family-oriented policy may not be as high as under the apartment policy, it may have the effect of lowering the demand for new lower-density lots in the suburbs.

While this policy addresses the arguments for greater efficiency through higher densities, at the same time it recognizes the limits imposed on density by the family's more specialized housing requirements. As discussed in the second chapter, these include such features as direct access and relationship to grade, individual entrances and private outdoor play space. Based on a preliminary examination of the general density level which could be achieved across the study area using family-oriented housing forms, a target increase in dwelling density of 50% was set.

Building Forms and Locations

Of the generic housing forms presented in the second chapter, stacked townhousing is the densest form suitable for family living. Projects of higher densities have been shown to provide satisfactory environments for families with children but, as densities are increased, more features such as unit size and privacy must be compromised. On the other hand, lower density forms are generally preferred by families but, in this case, the density objective would have to be lowered, or a substantially larger number of units would have to be demolished. For this scenario, the stacked townhousing form is used because it can meet most families' requirements at a fairly intensive level of land use while remaining fairly unobtrusive in terms of perceived density. It is a suitable form both for redevelopment at the block level and for infill in a predominantly conservation area.

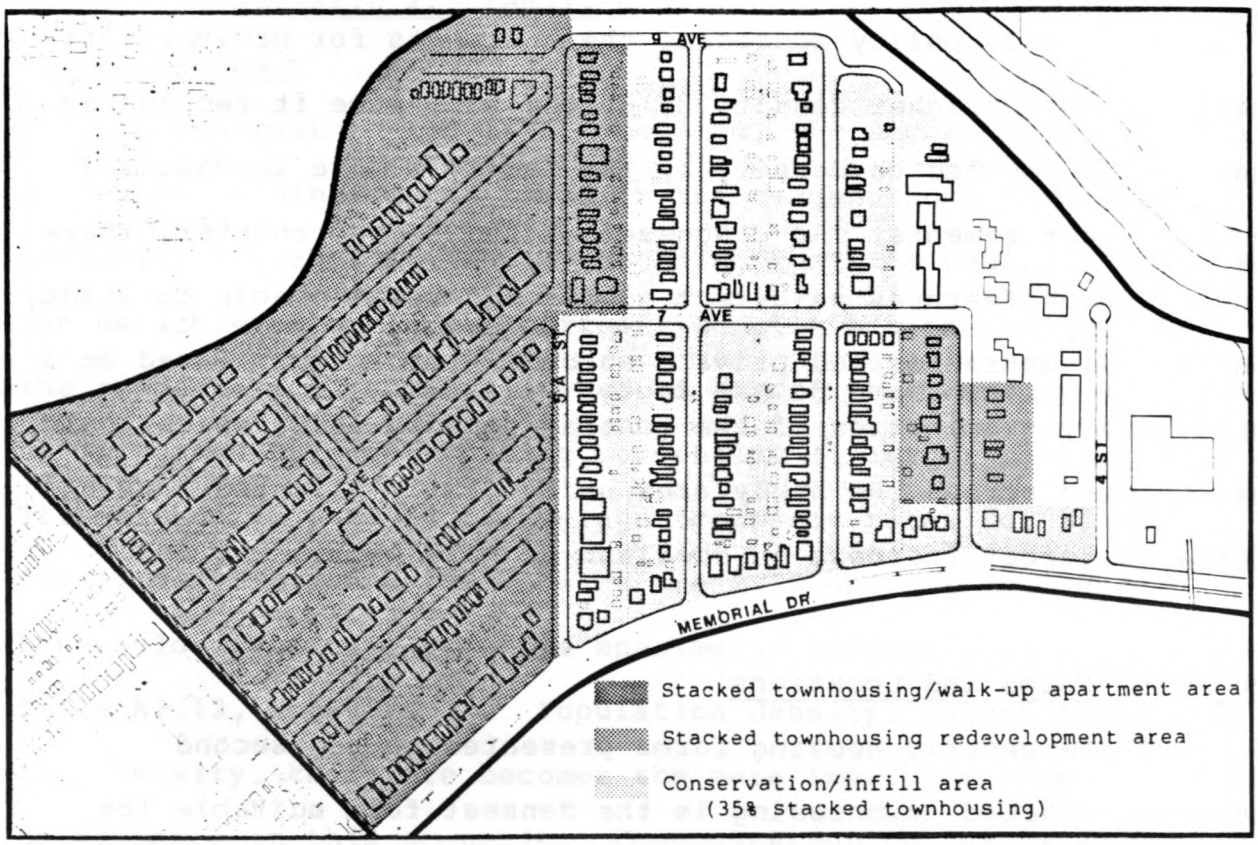

Figure 3.6. Scenario 2: Family-oriented accommodation

In this scenario, stacked townhousing is placed both in eastern and western sections of the study area. It is first allocated to developable sites in the higher-density western sector and next to the coop townhousing on the eastern edge. Although the west has already seen a high level of apartment redevelopment, it is not overdeveloped to the point where it is unsuitable for family units. In fact, some family-oriented row housing has been constructed there since the area was downzoned, and the implementation of the design brief has conferred stability on the remaining family precincts. Although in this scenario

all these areas in the western section are redeveloped at higher densities, their role as family subareas is maintained. Because the density of existing apartment buildings is already above that of stacked townhousing, they are assumed to remain as they are. As in Scenario 1, stacked townhouse redevelopment in the west aids in consolidating density where it already exists and also concentrates families around the school and playground.

Once these sites are assumed to be redeveloped, the residual density necessary to meet the target 50% overall increase is applied as infill to the eastern section. Although 2-storey townhousing is a preferable option here, it would require 65% of the area to be redeveloped, which effectively precludes this form as an infill device. Consequently, stacked townhousing infill, constituting 35% of this district, is employed.

Density

The potential dwelling density of Scenario 2 is 91.5 units/ha (37.1 units/acre), a 50.0% increase over the present. Population density could be increased by 62.5% to 184.3 persons/ha (74.6 persons/acre) [8]. Family-oriented accommodation is increased by 133.1%.

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[8] City statistics group townhousing and stacked townhousing together as 'row housing'. However, occupancy rates in stacked units are generally lower than in standard townhouses and, consequently, a subjective estimate of 2.2 persons/household was used in calculating population density.

Scenario 3: Selective Redevelopment/Infill

Policy Approach

The main concept of the third scenario is to give recognition to the unique attributes of individual sites and block faces within the study area and to determine densities which would be most appropriate for each. This is done with consideration of the role which each site plays within the context of the neighborhood, as well as its potential contribution to the objective of increasing the overall study area density. An attempt is made to provide for a mix of dwelling types within the scenario, although an emphasis is placed on family housing in view of the considerable extent of nonfamily apartment development which has already taken place in the neighborhood. As predominantly family-related housing would first be removed in order to create higher densities, the policy of this scenario is to replace it mainly with higher-density family housing. The desired effect of this would be to maintain a balance between large- and small-scale developments and between family and nonfamily households. particularly the western portion. However, in contrast to the second scenario, family-oriented redevelopment is not applied in a 'blanket' fashion. More accommodation is made for new apartment buildings and conservation of single-family homes.

This scenario attempts to strike a better balance between the efficiency and livability arguments than in the first two, in which density is the overriding concern. Densities are assigned to sites according to an evaluation of their context and potential. No predetermined figure is set for the scenario, except

that it must exceed the potential density under present land use regulations.

Building Forms and Locations

As the eastern section of the study area is predominantly single detached housing, a strategy of conservation and infill is followed in order to maintain as much of its present character as possible. Infill would consist of small projects of densities up to 75 units/ha (30 units/acre), as permitted in the City's RM-2 (low-density multi-dwelling) district. This provides for semidetached homes, townhouses and fourplexes at two units per 25-ft. (7.5-m) lot, or four per 50-ft. (15-m) lot. The scenario assumes that one third of the eastern section would experience this type of development, although its application would not be completely uniform across the area. A larger proportion of redevelopment would be appropriate near family-oriented amenities, such as the playground, to take better advantage of these facilities. Other clusters of higher-quality detached homes should remain intact.

The western portion of the study area is of a higher density, and a policy of consolidating most of the increase here was again followed. As in the previous scenarios, it is assumed that the higher-density apartment buildings in this area will not be redeveloped. On the remaining sites, a mix of several housing types is applied, according to particular site conditions.

(1) Family-oriented housing (townhousing, stacked townhousing, fourplexes) is applied on sites characterized by:

- proximity to other housing of a similar type (family-

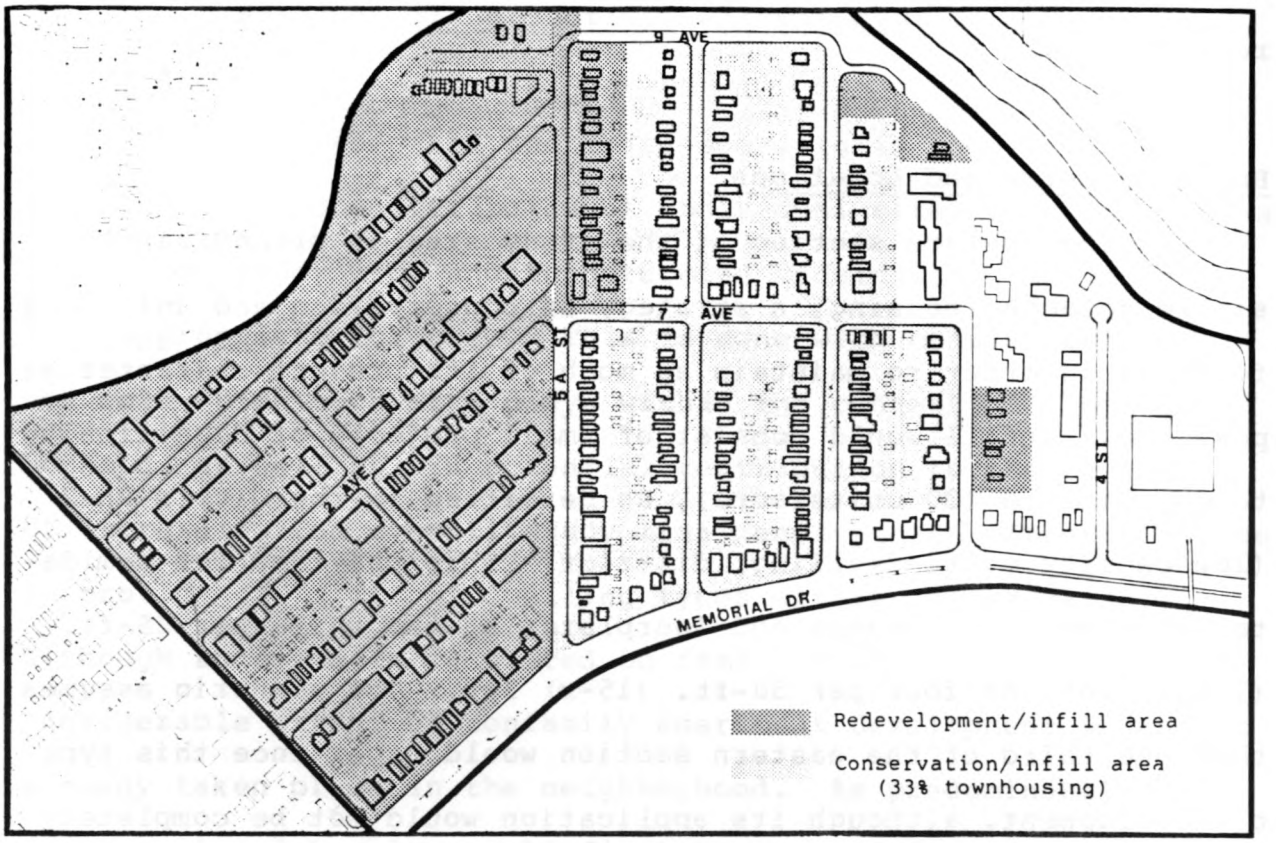


Figure 3.7. Scenario 3: Selective redevelopment/infill

oriented medium-density)

- proximity to enclaves of single-family housing
- proximity to child-oriented facilities such as the school, playground, other open space
- streets with relatively low traffic volumes.

(2) Conservation and lower-density infill (townhousing) is applied according to these guidelines:

- good quality individual housing
- aesthetic streetscapes characterized by housing patterns uninterrupted by incompatible building forms
- clusters of single-family homes which serve as family

enclaves

- proximity to child-oriented facilities
- 'locked-in' sites where density potential is marginal.

(3) Walk-up apartments are applied on a very limited number of sites with the following characteristics:

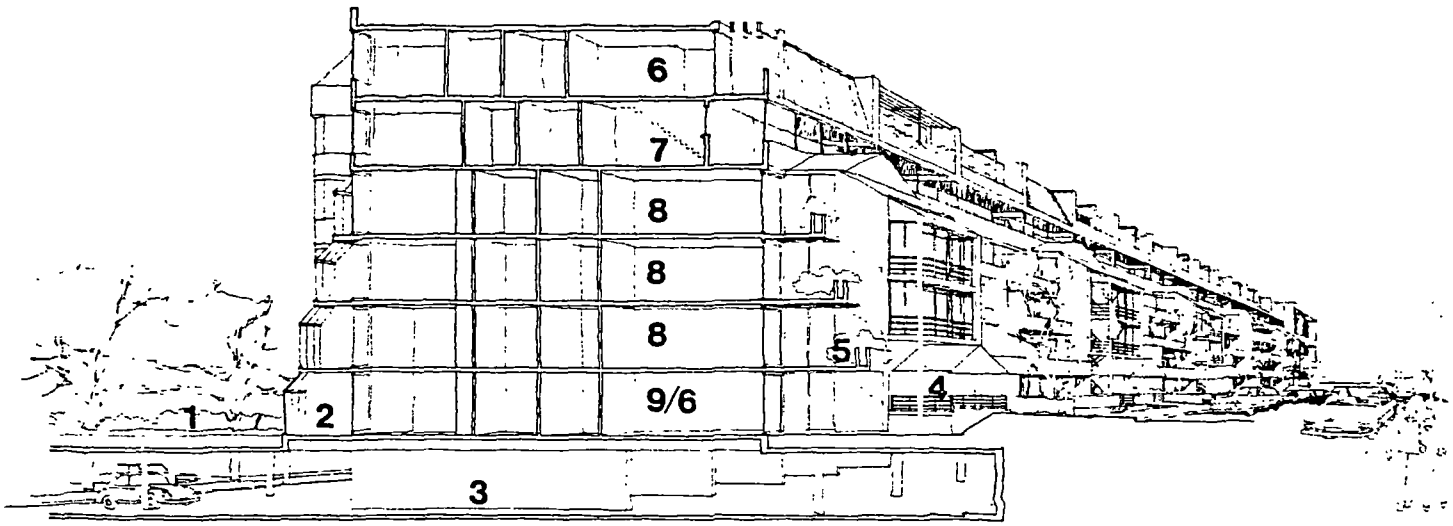
- close proximity to other apartment buildings
- 'locked-in' sites which are too small for multiunit housing of higher densities
- sufficient distance from lower-density forms to minimize shadowing impact
- on major collector streets, to provide best access and keep traffic away form more family-oriented streets
- lower existing housing quality, streetscape quality.

(4) Low-rise high-density prototype

This building form was developed by Barton Myers Associates for older neighborhoods in Edmonton (Myers 1979, pp. 104-13). As illustrated in Figure 3.8, the prototype is a 6-storey building, the first four floors of which contain direct-access units suitable for families, senior citizens and the disabled. The upper two floors are designated for nonfamily accommodation. The mix of unit types is as follows:

bed-sitter	15%
1-bedroom	32%
2-bedroom	45%
3-bedroom	8%

This produces a density of 301 units/ha (122 units/acre), providing a mixture of dwelling types at a scale which addresses some community concerns regarding redevelopment.



Sectional Perspective of Low-Rise High Density Prototype

1. *Private rear yards*
2. *'Greenhouse' bedroom windows*
3. *Underground parking*
4. *Entrance to glass-enclosed stairwell*
5. *Front 'porch'*
6. *1-bedroom unit*
7. *Bed-sitter*
8. *2-bedroom unit*
9. *3-bedroom unit*

Figure 3.8. Low-rise high-density prototype (from Myers 1979, p. 105)

In this scenario, the prototype is used in cases where the following factors apply:

- proximity to other apartment buildings
- minimal potential shadowing effects on lower-density structures, e.g. south of the escarpment and on corner sites
- on major streets, for reasons noted above
- lower existing housing quality, streetscape quality.

These guidelines are fairly elementary and, in an actual planning exercise, would be enriched through more detailed analysis and involvement of residents. However, the resulting scenario indicates some of the implications of this policy approach, which can be compared with those of the previous scenarios.

Density

Full development as outlined in Scenario 3 would produce a dwelling density of 94.2 units/ha (38.2 units/acre), an increase of 54.4%. Population density would be increased by 67.1% to 189.4 persons/ha (76.7 persons/acre).

Summary

The scenario densities are summarized in Table 3.3. It can be seen from this exercise that, once a municipal goal of increasing residential density in the inner city has beed decided upon, there are many routes that may be taken in implementing it. Which route is chosen depends on the policy orientation adopted by decisionmakers; for example, their degree of concern over family accommodation or conservation of structures. Once the overall policy approach has been decided, it places certain restrictions on the density objectives that can be set. As was seen in this chapter, a policy oriented toward families or substantial conservation necessitates a lower unit density objective than one in which these are not considered important. The summary table

Table 3.3. Summary of scenario densities

Scenario	Dwelling density			Population density			Family units	
	Units/ha (units/ac)	%Increase	Total units	Persons/ha (persons/ac)	%Increase	Total pop.	%Change	% of Total
Existing development	61.0 (24.7)		1049	113.1 (45.9)		1946		39.5
Current regulations	74.2 (30.1)	21.7	1277	152.0 (61.7)	34.3	2614	+62.8	52.8
Scenario 1 High dwelling density	122.7 (50.0)	101.1	2110	212.7 (86.3)	88.0	3658	-31.9	13.4
Scenario 2 Family-oriented accommodation	91.5 (37.1)	50.0	1574	184.3 (74.6)	62.5	3159	+133.1	61.3
Scenario 3 Conservation/ infill	94.2 (38.2)	54.4	1620	189.4 (76.7)	67.1	3249	+90.3	48.6

further illustrates the importance attached to the type of measures one uses to evaluate the success of a policy. Population density, for instance, figures much more prominently in the second and third scenarios than it does in the first. Such policy considerations have a fundamental effect on the final product of the process.

CHAPTER 4
A COMPARATIVE EVALUATION

In this chapter, the scenarios and the policy of increasing density itself are reviewed and evaluated from three perspectives. First, the impact of development on the city as a whole and its residents are discussed. The scenarios are evaluated in terms of seven major fields of concern to the municipality on which density policy may have some impact: (1) land use efficiency, (2) housing supply and distribution, (3) transportation, (4) parks and recreation, (5) schools, (6) utilities and (7) decentralization policy. Where applicable, they are discussed with respect to official City of Calgary policies, which are documented in the Calgary General Municipal Plan (Calgary Planning Department 1981b). Other concerns not specifically addressed in the plan are also considered. Second, the scenarios are discussed in terms of their impacts on the neighborhood and its present residents: (1) neighborhood scale and character, (2) traffic and parking, (3) social mix, (4) displacement and (5) equity. Some of the community concerns overlap with municipal goals, while others are mentioned in the Hillhurst-Sunnyside Design Brief (Calgary Planning Department 1978). Other impacts and issues which commonly arise in the redevelopment process are discussed. Finally, the scenarios are examined with regard to their feasibility, both in terms of implementation by the city government and the manner in which development would occur in response to these measures.

As mentioned in the introduction to the previous chapter, the scenarios were developed as prototypes for comparing density policies developed at a municipal level. The exercise does not simulate a normal planning process involving the participation of the community and consideration of many issues in addition to density. Therefore, no scenario is recommended for implementation. However, the discussion of the advantages and deficiencies of each is intended to clarify issues to be considered in the preparation of a community plan.

Municipal Concerns

Land Use Efficiency

Concern over the efficiency of land use in the city is a recurrent theme in the Calgary General Municipal Plan. It is reflected in policies relating to such matters as the consumption of agricultural land, the use of public facilities and transportation [1]:

> 33. Increase the density of residential development adjacent to main transit routes.
>
> 45. Ensure that greater use is made of public open spaces--e.g. by increasing the density of surrounding residential development and providing better public access to open spaces.
>
> 47. Review and monitor on a regular basis the consumption of agricultural land for urban development.

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[1] Portions of the general plan quoted in this chapter are from Table 2.1.1 (Policies Included in the Adopted Strategy) and Part 3 (Subject Plans) of the 1981 Office Consolidation (Calgary Planning Department 1981b).

The emphasis on increasing densities in order to improve efficiency is reiterated in more general policies relating to development:

> 2. Increase population densities in residential areas throughout the city by amending existing regulations and improving the design of housing layouts in order to reduce the wastage of land.
>
> 3. Encourage the relocation of low intensity uses in the built-up area to peripheral areas, and ensure that vacated sites are developed for more efficient uses.

Finally, with regard to the role of the inner city in promoting efficiency, the plan is explicit:

> 1. Increase population density in the inner-city.
>
> 4. Increase efficiency of land use in the inner-city --e.g. increased use of vacant and under-used land, infill and selected redevelopment.

All three scenarios represent a significant increase in the efficiency of land use. As stated in the second chapter, the number of persons a given area of land supports is the most precise indicator of residential land use efficiency. Table 3.3 shows that Scenario 1 produces the most satisfactory results in terms of population density, with an 88% increase over present population. Scenarios 2 and 3, at 63% and 67% respectively, provide somewhat lesser, but still significant increases [2].

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[2] These figures are based on current occupancy rates for various dwelling types in Sunnyside (see Appendix 3). For the purposes of comparison, these are assumed to be stable but, if the trend to smaller household sizes continues, the density calculation would be lower. However, Sunnyside's rate of 1.9 persons/household is already well below the Calgary average. Stabilization can be anticipated somewhere above the minimum possible size of 1.0.

Comparing absolute population densities illustrates the effectiveness of the overall strategies used in each scenario. It should be noted, however, that, although Scenario 1 achieves the highest population increase, it also requires the largest increase in the number of dwelling units. Scenarios 2 and 3, on the other hand, produce population densities just 10% below that of Scenario 1 with only half the number of new units. This indicates that the housing forms employed in Scenarios 2 and 3 are more efficient in terms of providing higher population density per unit. Fewer of these units would be required to house a given population than of the apartment units of Scenario 1.

Family-oriented medium-density housing forms are more effective in increasing population density on a per-unit basis, but apartments can achieve higher population densities by concentrating more units on the land. As well, the higher population density potential offered by townhousing and stacked townhousing is constrained by the extent to which these forms can be employed in an infill situation. For instance, if the population level achieved by Scenario 1 were made a requirement for Scenario 2 with stacked townhousing, 66% of the eastern neighborhood would have to be redeveloped in addition to the redevelopment in the west. Infill housing is intended to complement the original housing, not dominate it, and this limits the number of medium-density units that can be dispersed within a single-family precinct. In applying higher-density forms, compatibility is not as much of a consideration because they are applied as a redevelop-

ment strategy, rather than as infill. The replacement of existing housing is a foregone conclusion.

Housing Supply and Distribution

Several of the City's policies relating to housing are directed toward certain social and economic goals. For example:

> 9. Ensure that a greater variety of dwelling types is provided in all new developments.
>
> 16. Ensure that there is an adequate supply of rental accommodation for different socioeconomic groups in all parts of the city.
>
> 20. Encourage a more varied social composition in all parts of the city--e.g. avoid the concentration of social housing in few areas.

With specific regard to the inner city, the general plan recognizes and seeks to rectify the uneven nature of past development:

> 6. Ensure that the inner-city has a more balanced and stable population structure--e.g. promote a more varied housing mix and provide services and facilities that cater to families and children.

The reasoning behind these policies appears to be that a varied social structure throughout the city will reduce stigmas and prejudices against certain income groups, as well as against certain districts of the city where they may be concentrated. Exposure to a diverse mix of people may foster more tolerance. However, if certain groups are housed too closely together, conflict may sometimes be increased rather than reduced. Elderly residents, for example, may not appreciate the noise and disruption associated with children. Residents of detached homes may be concerned about the different lifestyles of the young, single residents of higher-density rental housing in addition to the

physical impact of the buildings. Some degree of concentration into small enclaves within a neighborhood is therefore desirable, as long as the opportunity for interaction is provided for (Newman 1981, p. 16).

Another advantage of diversity and dispersion of housing types is based on efficiency. People of various income classes and lifestyle preferences should be able to find suitable accommodation within a reasonable distance from the workplace or other facilities (schools and shopping, for example) which the household considers important. More generally, the policies suggest that an adequate supply of housing for all household types and income groups should be provided, and that a balance between ownership and rental, large and small units, etc. will help to meet this goal.

The extent to which each scenario satisfies the objective of social diversity is open to questions of interpretation. Scenario 2, with a family component of 61% of all units, goes furthest in reversing the imbalance between family and nonfamily households in Sunnyside, but some may charge that this in itself creates an imbalance in favor of family housing. Still, it is quite clear that this scenario and Scenario 3 (with 49% family units) provide a much more heterogeneous community than Scenario 1, which leaves only 13% family units.

One qualification must be noted regarding family units in all of the scenarios. Inner city townhousing has proved popular among childless couples and nonfamily households and a number of the units considered suitable for families in this study may

actually be occupied by these groups. It is difficult to overcome the traditional attraction of families to the suburbs, especially given the price of inner city housing. The townhouse occupancy rate in Sunnyside of 2.47 persons/household suggests that there has been some success in this area.

Achieving a diversity of income groups in neighborhoods such as Sunnyside, if considered desirable, is a difficult goal under any development scenario. The neighborhood's ideal location and physical attractiveness translate into high property values. Therefore, high-density development is likely to be in the form of condominiums or higher-priced rental units, and renovated homes and new townhousing would be oriented toward more affluent households. Without involvement by the public sector in providing housing for lower-income groups, all three scenarios would probably decrease the range of incomes within the community. The cost of developing this housing in the neighborhood, compared with other parts of the city, would discourage investment by public agencies or nonprofit organizations. However, if there were a commitment to locate some social housing here, it could be easily incorporated within all of the scenarios, depending on the target group for which accommodation is desired (i.e. Scenario 1 for nonfamily households, Scenario 2 for families and Scenario 3 for both).

With regard to the City policy of increasing the supply of rental accommodation, Scenario 1 is most effective. However, as previously mentioned, condominium ownership is becoming a popular tenure option in this neighborhood and may be applied to many of

the new units. The family-oriented housing of Scenarios 2 and 3 would probably be predominantly freehold tenure, although Scenario 3 also contains a significant number of apartment buildings which could contain rental units.

The general plan contains several references to conservation and rehabilitation of older homes, including the following policies:

> 53. In appropriate cases, encourage rehabilitation by reclassifying areas of rehabilitation potential.
>
> 56. In appropriate cases, encourage the establishment of public, private and joint rehabilitation projects.

Interestingly, the high-density scenario would permit conservation of the largest number of small-scale and older units in the study area. Roughly calculated, 220 units would be preserved in Scenario 1, 150 in Scenario 2 and 195 in Scenario 3 [3]. These are the minimum numbers of units that would be protected from redevelopment.

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[3] These figures refer to the number of units, not structures, as all units within duplexes, converted homes, etc. are counted separately. The count also includes recently built homes in the conservation/infill areas, along with older homes.

Transportation

Increasing residential density in the study area would have several impacts on the city's transportation system in light of stated policies such as those relating to transit:

T.24. Provide a high standard of public transportation service within congested areas such as the inner city and Downtown and in major travel corridors.

33. Increase the density of development adjacent to main transit routes.

The inner city is generally in a favorable position with regard to public transportation. In this instance, Sunnyside's location and layout are particularly amenable to meeting transit demands resulting from high densities. The northwest line of the Light Rail Transit system will be located on the western edge of the community, somewhere in the 10th Street traffic corridor. This will give rapid access to most parts of the city once the network is completed, although the advantage in terms of a shorter work trip would be negligible for those residents who work downtown. Bus routes would not have to be altered in response to increases in density, but all scenarios would necessitate an increase in the level of service. Scenario 2 would likely have the least impact, as a larger portion of the population would be children, whose activities would be mainly confined to the immediate neighborhood. Scenario 1, with the highest density and fewest number of children, would probably generate the most demand and Scenario 3 would fall somewhere between the two.

Increased automobile traffic caused by higher densities would have an effect both on the neighborhood itself and on commuters who pass through or near the neighborhood. Both are of concern to policymakers:

> T.33. In residential areas, ensure a safe, pleasant, quiet atmosphere by:
> . . . iv) locating high density developments where access can be gained from collector or major streets.
>
> 29. Decentralize as much new employment as possible along transit corridors in order to reduce traffic congestion in the downtown and inner-city.
>
> 37. Reduce the number of vehicles using inner-city areas by implementing appropriate traffic management schemes.

Increasing density in Sunnyside obviously increases traffic congestion, as residents join the flow of commuter traffic on major streets running through the neighborhood. The degree of impact would probably be similar to that on public transit demand, with Scenario 2 having the least and Scenario 1 the most. However, since the major traffic generator is the downtown employment centre, congestion would occur in the inner city no matter whether the population lives there or in some other part of the city. In fact, since the study area is within easy walking distance of downtown, the impact of higher densities on traffic congestion and transit demand would be lower there than in many other parts of the city. The increased use of local streets would impose higher costs on the city for maintenance and traffic management, but again these costs would occur wherever the population increase were to be accommodated. From the exist-

ing community's point of view, however, traffic impacts are quite important. These are dealt with under 'Neighborhood Concerns'.

Parks and Recreation

There are two major areas of concern to the municipality in regard to recreational facilities. First is the concept that facilities receive sufficient use to justify the cost of providing them:

> 45. Ensure that greater use is made of public open spaces . . . (quoted in full above)
>
> 52. Rehabilitate and improve existing community facilities in the inner-city in order to encourage greater use of them.

This is balanced against a second concern that sufficient facilities be provided to meet community recreational needs and demands:

> 43. Improve parks and recreation facilities in parts of the city that are relatively underprovided.
>
> PR.11. Develop a series of public open spaces throughout the inner city in order to provide interest and variety urban characteristics within this densely built-up area.

A recently developed set of City standards gives guidance in assessing the scenarios relative to these policies (Calgary Parks/Recreation Department 1983) [4]. Hillhurst-Sunnyside is classified as a mixed family/adult neighborhood for which a stan-

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[4] This study has generated some controversy and, as of this writing, it has not received official approval. However, it does represent an attempt to assess open space requirements in the inner city.

Table 4.1. Projected open space/population ratios

	Development in study area only		Development in all of Sunnyside	
	Population	ha/1000	Population	ha/1000
Scenario 1	5402	0.9	6937	0.7
Scenario 2	5103	0.9	6368	0.8
Scenario 3	5026	1.0	6225	0.8

dard of 0.8 to 1.1 ha of recreational open space per 1000 persons is set (p. 14). The Sunnyside portion of the neighborhood contains 4.8 ha of local recreational open space. Table 4.1 shows the ratio of open space to population for the whole Sunnyside community for the three scenarios. Two different sets of assumptions are used in this table. The first set of figures assumes that new development occurs only in the study area and that the remaining western half of Sunnyside does not undergo new development. The second set of figures assumes that the western half of the neighborhood is developed to densities comparable to those in the study area for each scenario. In this instance, higher densities could be accommodated within these standards, with the exception of Scenario 1 when densities are applied across the whole neighborhood. This falls short of the minimum by 0.1 ha [5]. Even at higher densities, underuse of primarily

---

[5] If, as a result of the development under these scenarios, Sunnyside were reclassified as 'predominantly adult (high density)', the open space requirement would fall to 0.5-0.8 ha/1000 persons, which is satisfied in all scenarios in both cases.

child-oriented facilities may occur, but it would only pose a problem in Scenario 1 which is oriented toward nonfamily households.

Schools

Educational policies are not contained in the general plan, as they fall under the jurisdiction of the Calgary Board of Education. However, some goals regarding schools in an overall municipal context can be surmised. The efficient use of school buildings is one such goal, which suggests that idle capacity in schools should be minimized. Efficiency is also partly determined by economies of scale which determine enrollment levels at which programs can be delivered most economically. Efficiency is balanced against a second goal of convenient access to educational facilities. This implies an attempt to minimize the distances students must travel to schools and the costs (busing, for example) associated with them.

At present, as shown in Table 4.2, all the public schools which now serve the study area have a degree of excess capacity. Estimates of the net increases in school enrollment are again shown in this table for each scenario for two hypothetical cases: (1) development confined to the study area only and (2) development across the entire neighborhood at the same level.

These increases could be easily absorbed by the schools presently serving the neighborhood, with the exception of high school enrollment in Scenarios 2 and 3, which would exceed the present capacity of the area school. If the scenarios were

Table 4.2. School capacity and projected enrollment increases

	Present excess capacity (students)*	Net change in enrollment (no. of students)	
		Development in study area only	Development in all of Sunnyside
Elementary	151		
-Scenario 1		-7	-15
-Scenario 2		+49	+107
-Scenario 3		+34	+75
Junior high	680		
-Scenario 1		-4	-8
-Scenario 2		+27	+58
-Scenario 3		+19	+41
High	47		
-Scenario 1		-5	-12
-Scenario 2		+42	+91
-Scenario 3		+30	+64

* Based on Calgary Board of Education enrollment figures for schools serving Sunnyside, as of September 30, 1983

extended across the entire neighborhood, this would necessitate some adjustments in the allocation of students to schools but these would not be serious, as another nearby school has a large excess capacity for both junior and senior high school. The junior high component of this school already serves the Sunnyside area.

As one would expect, the family-oriented second scenario makes the most significant use of the excess capacity of the schools serving Sunnyside. The third scenario also reduces the excess but in the case of both elementary and junior high school,

a fairly high underutilization rate remains in the area's schools. In an extreme case of high-density redevelopment without a family orientation, such as the first scenario, the absolute number of families and children can actually decline, resulting in decreased enrollments in all cases and making already underutilized buildings even less economical.

Although increasing density in Sunnyside under Scenarios 2 or 3 would not require building additional facilities, several costs would be imposed. Some renovation would likely be needed and additional staff, program and transportation budgets would be increased. If the population growth which takes place in the scenarios would occur elsewhere in the city (at the periphery, for example), these costs would probably be higher. It is less costly and more effective to enhance existing programs and facilities which have spare capacity than to duplicate them in new areas. Higher enrollments in inner city schools reduce the threat of closure and may permit the introduction of new programs which benefit old as well as new residents. The net effect on schools of redevelopment which accommodates family needs, in this case study at least, is positive.

Utilities

Increasing density to the degree assumed in the scenarios may necessitate upgrading or expansion of water and sewer mains and power lines, which are the responsibility of the municipal government. This can be financed through a levy on new construction so that the cost is capitalized into the cost of the new

housing and not borne by all taxpayers or utility customers. Similar arrangements apply to gas and telephones, which are provided by independent utility companies.

Decentralization

Decentralization of employment is a major concern of the general plan. In addition to Policy 29 (quoted above) are the following:

> 28. Encourage new office development to decentralize into selected areas through the amendment of land use classifications, the provision of infrastructure, the amendment of municipal tax structures, etc.
>
> 30. Decentralize more municipal services and employment outside the downtown. Where appropriate (e.g. where people-oriented services are involved), this decentralization should occur along mass transit routes.

Employment in Calgary is very strongly centralized in comparison to most North American cities. Although some benefits are derived from agglomeration in the centre, such as economies of scale in the provision of services, there are also negative impacts such as congestion and disruption of inner city areas. Decentralization is therefore pursued to counterbalance these effects. Although a policy of increasing density in the inner city does facilitate the centralization of employment, it is not a major force causing it. Higher densities are rather a reaction to the employers' decision to locate at the centre. This decision is based on factors such as proximity and access to other parts of the city. In Calgary, the downtown is a main drawing force for employees from all parts of the city and consequently

the existence of higher residential densities in the inner city is not a very significant factor in an employer's location decision. While it may influence the location of service and entertainment establishments to serve the inner city market, its overall influence on decentralization policy is minor.

Neighborhood Concerns

Many of the community's objectives and concerns concur with those of the city as a whole and are thus addressed in the general plan. There are, however, several others over which the neighborhood and the city as a whole may conflict, and some of more critical interest to the community than to others not directly affected. The concerns discussed here relate to Sunnyside in particular but would be similar in most other inner city communities.

Neighborhood Scale and Character

With the extent of redevelopment involved in all three scenarios, the scale and character of the neighborhood are naturally changed significantly, but the impact of the changes varies.

Western Section

In the portion of the study area west of 5A Street, Scenario 1 has the strongest impact. The change is not simply one of replacing the remaining detached homes with apartment buildings, as has been done in the past, but a complete change in building scale. At present, the influence which the walk-up apartments have on the perception of density is moderated somewhat by the

pockets of detached housing. Not only would this housing be removed in Scenario 1, but it would be replaced by apartments of almost twice the scale of the walk-ups. This would then become the dominant housing form in the neighborhood. The shadowing effect of these buildings on the street and on other buildings is the most extensive of the three scenarios. The density would be of such a magnitude that would make it very difficult to moderate the perception of density through design factors. The area would both become and be perceived as a high-density apartment precinct.

Scenario 2 would have a lesser impact on this western section because it is composed of a larger number of smaller projects than the first scenario. This permits a greater opportunity for variety through differentiation of design. The smaller size of stacked townhousing complements the scale of the apartments and is more amenable to detailing which replicates some of the features of the housing it replaces. Although the stacked townhousing is only 3 storeys high, the existing higher-density apartments are themselves only 3 to 3 1/2 storeys. The result is a neighborhood of uniform height which would be perceived as fairly dense in spite of possible regulations governing project size, facade articulation, separate entrances, etc. As well, the degree of shadowing associated with these apartments would be extended across the entire sector. Still, the density effects are considerably less than those created by the larger structures of Scenario 1.

The impact of the third scenario, while less severe than Scenario 1, is difficult to rate in relation to Scenario 2. In some locations, new development merely reinforces a dominant pattern of higher density, and character and scale are not significantly changed. The low scale of other parts of the study area would remain as it is. Other parts of the sector, notably where the low-rise high-density prototype is introduced, are more fully transformed. The shadowing impact of these structures is diminished in cases where they are adjacent to a south-facing slope. Some features of the prototype, such as family housing at grade level which continues the pattern of separate yards and entrances characteristic of single-family housing, lessen perceptions of density somewhat. Again, however, such factors have only limited capabilities for modifying perceptions in the face of such a large increase in actual density. The effects of townhousing and stacked townhousing infill in the rest of the sector would be comparable to those found in Scenario 2. Overall, the effect of Scenario 3 would be to transform the low-scale character of the area but retain many of the design features and variety of building form which exist in the present mix.

Eastern Section

Scenario 1 has the least impact on the predominantly single-family precinct east of 5A Street. Apart from the 3-storey apartment buildings placed near the Sunnyhill Coop, this sector does not undergo any new development, although this does not preclude replacement at present densities. However, the

edges of the district may suffer some decline in environmental quality due to shadowing and visual obstruction by the large structures immediately to the west in the high-density sector.

In contrast, Scenario 2 has the strongest impact on the eastern section. The use of stacked townhousing presents a problem when used as infill in this location because it represents a considerable increase in scale. Many of the houses are only a single storey and it is difficult to introduce a number of 3-storey structures without upsetting the character of the street. Redevelopment of the 4th Street block would, as in the first scenario, complement the scale of the housing coop and would not cause serious disruption of the rest of the neighborhood.

The impact of development in Scenario 3 is somewhere between that of the other two scenarios. Two-storey townhousing is a less dominating form and thus constitutes a more satisfactory infill strategy than the stacked townhousing of Scenario 2. A larger portion of existing housing is also conserved. Once again, the character of 5A Street would be changed by the higher density of the new developments to the west.

Traffic and Parking

The impact of the automobile which accompanies redevelopment has been a major source of concern to inner city communities. Sometimes the bylaw requirements for on-site parking for new developments have been criticized as inadequate to satisfy the needs of residents and their guests, causing spillover parking problems on adjacent properties. The actual parking needs of

residents may vary according to location in the city and the nature of the housing. On one hand, residents of multiunit inner city structures may be expected to have relatively low rates of automobile ownership because of closeness to the workplace and generally higher level of transit service. Lower incomes of apartment dwellers may also be a consideration. On the other hand, condominium residents generally have higher incomes which may be reflected in higher ownership rates. An important point in the implementation of any of the scenarios would therefore be to conduct a study to assure that parking requirements are sufficient to prevent spillover problems.

It is fairly easy to accommodate these requirements in higher-density buildings through structured parking, but lower-density forms, particularly stacked townhousing (and stacked townhousing to a lesser extent), present more problems. There is a very limited surface area available for parking, especially considering the requirements for at-grade amenity space. Any resultant spillover problem would be especially serious in an infill neighborhood where alternative off-street parking is not available for many of the older homes. Therefore, if it is assumed that adequate parking requirements are applied to the larger multiunit structures, Scenario 1 would have the lowest parking impact on the neighborhood and Scenario 2, with stacked townhousing, would have the highest. Scenario 3, with a mixture of high-density apartments and lower-density townhouse infill, would have a moderate impact.

The impact of increased traffic in all scenarios would be considerable. The number of dwelling units gives perhaps the best indication of the traffic that is generated, and Scenario 1 far exceeds the others on this count. Although development is largely localized in the western sector, significant increases in traffic could be anticipated on streets in the eastern sector and the rest of the neighborhood to the west which give access to this area. This increase would have an especially negative effect on lower-density areas with higher child populations. Scenarios 2 and 3, with about half the number of units, would generate much less traffic. However, a 50% increase is still very high and perhaps of more concern in these scenarios because of their larger family components.

Social Mix

The perspective on social mix taken by an established community differs from that taken by a municipality as a whole. While many inner city residents may agree in principle with the goal of social diversity, they are also concerned with maintaining a viable social structure in their communities. The core group of residents active in community affairs tend to be homeowners who have made an investment in the neighborhood as well in their individual homes. Redevelopment is seen as an aesthetic threat to the neighborhood but, as well, it may be perceived as introducing a different type of person who does not share their values or lifestyles. Most apartment dwellers have

not made the same long-term commitment to the neighborhood and tend to have more interests outside its boundaries and, therefore, their participation in community affairs and interaction with neighbors is lower than that of homeowners. Because apartment turnover rates are high compared to single-family dwellings, long-time residents may view apartment dwellers as anonymous and transient. Differences in lifestyle made evident through noise, traffic and other disruptions further lower tolerance levels [6].

This, coupled with characteristics of high-density architecture, may have a bearing on factors such as safety. When dwellings are oriented to the ground, a neighborhood is able to police itself better because the eyes of their residents tend to be focused on the street. Residents have a greater sense of security both of their property and of the person when they are on the street. This street orientation is lost in higher-density development and perceptions of security in the neighborhood are altered. In fact, a correlation between crime rates and building height and the number of units per entry has been observed by Newman (1981, pp. 92-93). He found that a family's feelings of possession, responsibility and control over their residential environment are higher when the size of the group sharing that environment is relatively small. As stated earlier, ownership of one's dwelling unit is a very important component, perhaps the

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[6] The existence of these attitudes should not be overemphasized, however. The Hillhurst-Sunnyside community, for instance, has been very active in providing social housing within the neighborhood.

most critical, in formulating these attitudes.

Existing residents may also be concerned that their community organizations would be weakened as a result of higher-density development. Memberships may decline and there may not be enough interest to offer programs or raise money. The notion of critical mass is also important to families with children. Residents seek to keep a large number of families in the neighborhood so that schools will remain open, recreational programs are available and their children can make friends.

Scenario 2 most successfully addresses these concerns in its emphasis on multiunit developments for families. Requirements for separate entrances and at-grade open space and smaller project sizes would help to foster a sense of territoriality and responsibility, and the larger child population increase the viability of child-oriented services in the neighborhood. Unfortunately, however, Calgary's limited experience with stacked townhousing in attracting families has not been encouraging. This may be due to the availability and cost competitiveness of more preferred housing forms or to particular design deficiencies in the present stock of units. Whatever the reason, this would be a major factor to overcome if this type of unit were considered for this area, for either rented or owned housing. The third scenario also has a significant family emphasis and the low-rise high-density prototype has more of a street orientation. However, the scenario also has a significant nonfamily component, and the increase in apartment units may reduce the sense of community in the area. The first scenario is prototypical of the

form of redevelopment which established inner city communities fear. Most of the objections discussed above, such as community interest, conflicts of lifestyle, perceptions of safety, would apply in this case but the scenario has one redeeming quality in that the eastern sector is left largely untouched. Still, complete redevelopment of the west may reduce the family population to such an extent that family- and child-oriented institutions in the neighborhood would no longer be viable. In all three scenarios, the number of homeowners would be reduced, both absolutely and proportionally, which may affect this group's stabilizing influence on the neighborhood.

Other resident objections to redevelopment are based on more emotional assumptions, especially if subsidized housing is involved. Some fears, such as higher crime rates associated with lower-income groups, may have some basis in fact, but most are generally not grounded on rational concerns but prejudice and perceived downgrading of neighborhood prestige.

Displacement

Many of the present neighborhood residents would be displaced in the course of redevelopment. In cases where redevelopment potential confers a higher value on land, older and lower-density structures become relatively less economic, eventually resulting in eviction of tenants and demolition. Resident owners are more inclined to sell, as higher-density structures begin to surround them and remaining homes are undermaintained in anticipation of redevelopment. However, in other cases, the prices

which developers offer for properties may be matched or even exceeded by those offered by potential resident owners, and redevelopment may not take hold. Assuming full development under all three scenarios, Scenarios 1 and 3 would produce substantial displacement, with the demolition of about 165 units. Scenario 2 would require considerably more demolition, about 220 units, to achieve the projected density.

Redevelopment may also have some disruptive effects on the areas designated for conservation. Residents may believe the quality of the neighborhood has changed too much and look for accommodation elsewhere in the city. Those living in the eastern single-family sector may view the changes on both western and eastern edges as a first step in total redevelopment and want to leave before the neighborhood deteriorates. They may be encouraged to sell to speculative buyers who also see this as a possibility.

Equity

A final point on which the community may take issue with municipal policy is the matter of equity, or fairness. In the past, inner city communities have fought against being targeted to absorb large population increases while populations in other parts of the city with already low densities continue to decline. It is argued that such a policy 'sacrifices' the inner city to redevelopment while newer suburbs are protected by low-density zoning. Two distinct and relatively homogeneous sectors result--lower-income and nonfamily households in the centre and middle-

and upper-class families in the outer ring. As has been stated before, a more equitable policy would see the distribution of redevelopment spread throughout more parts of the city so that higher-quality homes and neighborhoods can be preserved and no community is forced to undergo a radical transformation. Countering this argument is the undeniable locational advantage of the inner city. Both equity and efficiency considerations deserve recognition, which suggests a policy under which density is more evenly distributed across the city, with those areas of locational advantage (the inner city, transportation corridors) assuming somewhat higher, but not oppressive, densities.

Implementation Concerns

Market

The scenarios presented in this project depict maximum development potential under a particular set of guidelines. It is unlikely that these potential figures would ever be fully realized, as development is influenced by many factors apart from land use regulations. Housing market conditions are an important consideration, in terms of both the quantity and type of housing in demand at a particular point in time. The ability to consolidate lots for redevelopment is limited by negotiations between developers and owners and, over time, many residual parcels of land may be left which are too small for redevelopment. Therefore, although full potential densities are presented for comparison purposes, the actual level of development that would take place may vary in each scenario, depending on these market condi-

tions.

Market preferences are particularly important in the case of townhousing in the inner city. The market for such units is not especially firm in Calgary, and someone wishing to redevelop a 25-foot (7.5-m) lot has good reason to consider building a single unit, rather than a townhouse. The difference in profit between one and two units is not significant and there is less uncertainty and expense involved in marketing a single unit. From the customer's point of view, the price of a townhouse in this neighborhood is high compared to other parts of the city. It would thus appeal only to a limited number of households, many of which may prefer and can afford a single detached home in the neighborhood.

Stacked townhousing, being even less proven in the Calgary market, may also present a problem. Because of higher inner city land costs, it is not a low-cost option and may not compete well with alternatives. Families may be attracted to houses in suburban locations which offer more space and privacy. If the units could be marketed successfully, however, the potential profit would be more of an incentive to develop (at 6 units per 50 feet (15 m) of frontage) than is the case with 2-storey townhousing (at 4 units per 50 feet).

These considerations are especially relevant to Scenarios 2 and 3, which place a heavier emphasis on medium-density family housing. In Scenario 2, the marketing problem may be intensified in the western portion of the study area. This area is already occupied by a large number of apartment buildings and may not be

seen by families as a suitable place to locate.

The higher-density forms employed in Scenarios 1 and 3 are also subject to uncertainty. New units built in Sunnyside would probably be geared toward a more affluent market, and therefore larger than average, which lowers the overall density that can be reached. The low-rise high-density prototype of Scenario 3 is also untested in Calgary and may be subject to the same problems in marketing to families which are discussed above.

Neighborhood aesthetics is perhaps the major selling factor for housing in Sunnyside. In employing higher-density forms, there is a possibility that, as more redevelopment takes place in the community, its character will be eroded. As a consequence, the demand for housing there may drop, and the potential density of the scenarios may not be approached in reality. On the other hand, if it is felt that environmental quality has not been degraded by new development, there may be pressure from owners and investors to redevelop in those parts of the western section designated for conservation.

Administration

Adoption of the policies described in the scenarios would require a range of changes and additions to the regulatory structure used to control development. Aside from the political debates which will take place over whether density should be increased at all in any given inner city neighborhood and over the policy orientation that should be adopted, are administrative considerations to be taken into account once the policy is

chosen.

The strategy presented in Scenario 1 would require the least change to current land use regulatory practices. It could be implemented under a standard system of zoning or development control, which would include regulations governing maximum project density, maximum height, lot size and coverage, parking and setbacks. Some subsidiary regulations may also be necessary to moderate the impacts of the larger structures and reduce perceptions of bulk. These could include stepping back the upper floors, to permit more sunlight to reach the street and adjacent structures, and articulation of facades in order to break up the massing. No mix of unit types or maximum unit sizes would be prescribed in the first scenario, as family accommodation is not a consideration in the policy objectives. The regulations could be implemented within Calgary's Land Use By-law, with additional refinements set out in an Area Redevelopment Plan.

This type of regulation could also be applied to particular aspects of Scenarios 2 and 3. In Scenario 2, special guidelines should be attached to the standard regulations governing stacked townhousing. For example, particularly in the conservation/ infill area, the size of development should be limited to 15 m (50 ft.) to maintain a low-density single-family perception of the neighborhood. Slightly larger developments could be permitted on 'locked-in' parcels of land and on irregularly-shaped lots. Architectural guidelines, requiring such items as articulation of wall faces and rooflines and building forms and setbacks which complement existing patterns and preservation of

mature trees, would encourage development that would fit into the streetscapes. In addition, guidelines relating to requirements of families should be specified. These include separate entrances for each unit, private outdoor space with direct access and a minimum unit size (two or more bedrooms).

In Scenario 3, the low-rise high-density prototype would require several specific controls regarding such factors as height, unit mix, separate access, setbacks of upper floors and private outdoor space. The guidelines relating to stacked townhousing in Scenario 2 would also apply to this scenario. No prescribed unit mix would be required for other apartment buildings, as they would not be geared to families.

More detailed regulation and changes in the administrative structure would be required in order to meet other particular objectives in Scenarios 2 and 3. Both contain sectors where a prescribed mix of conservation and infill is stipulated. There are several possible options for dealing with this [7]. One would be to apply a development permit quota system, under which development permits for new infill at higher densities would be issued only up to the point where the desired percentage of the land has been redesignated (for example, 35% stacked townhousing in Scenario 2). A second method is the use of the transfer of development rights (TDR), under which the right to develop land at a certain density is conferred equally on all properties in the conservation/infill area. Owners who do not plan to

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[7] The control mechanisms mentioned here, and several others, are reviewed by Wrigley (1983, pp. 148-74).

redevelop their property can then sell their 'excess' density to a developer who consolidates the density bought from several lots onto one parcel of land. A third, more conventional option is 'microzoning' [8]. In this case, a priority list of those properties most suitable for redevelopment would be prepared, and the properties redesignated for the higher-density forms until the prescribed mix of conservation and infill was reached. Zoning for the remaining properties would not be changed.

Each of these methods would likely meet with some resistance from residents and developers and also from within the City's own administration due to complexities and unfamiliarity with some of the concepts. Microzoning and permit quotas may be labelled discriminatory because they apply to some properties and not to others. A degree of arbitrariness in such a fine-grained planning process is unavoidable and adjustments would have to be negotiated. The challenge would be to keep them at a level which does not damage the intent of the regulations. The permit quota system may cause a rush of applications for development permits by owners whose main interest is to increase the sales value of their homes but have no intention of selling in the foreseeable future. This could stifle desired redevelopment unless time limits are applied to the permits. As for the transfer of development rights, there is at present no formal system in place in Calgary for coordinating transfers and, because it has been

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[8] The term 'microzoning' is used in preference to 'spot-zoning', which implies an ad hoc basis of decisionmaking which is not founded on an overall policy for the area.

mainly limited to heritage conservation, there is little local experience to draw upon in applying it to a large redevelopment area. In addition, although the sale of density rights has taken place in Calgary, its legal status within existing land use legislation is not yet firmly established (Wrigley 1983, p. 174). Although these administrative problems can be overcome, they do represent obstacles that are probably at least as large as resident opposition.

Summary

Table 4.3 provides a summary of the performance of each scenario in relation to the items discussed in this chapter. The strategy used in the first scenario proved to be the most effective in achieving substantial increases in both dwelling and population density. Not surprisingly, the apartment structures make the most intensive use of the land designated for redevelopment. As tested in the study area, this was accomplished without necessitating the provision of more services, such as parks and schools. However, this high dwelling density policy would result in strong negative impacts on the neighborhood. The physical scale and character would be transformed, as would the social structure. This suggests that the application of this policy would not be appropriate in most types of inner city neighborhoods. It would apply almost solely in a situation where deterioration of housing stock and community interaction has occurred to such an extent that almost full-scale renewal could be contemplated. There are few such neighborhoods and, as indi-

Table 4.3. Summary evaluation

	Scenario 1	Scenario 2	Scenario 3
Municipal concerns			
- Increase population density	●	◐	◐
- Increase average household population density	◑	●	◐
- Heterogeneous population mix	○	◐	●
- Increase supply of rental accommodation	●	—	◐
- Preserve existing homes	◑	○	◑
- Minimize additional transit demand	○	◑	○
- Minimize additional automobile impact	○	◑	○
- Adequate supply of local open space	—	—	—
- Minimize additional education demands	●	◑	◑
- More efficient use of existing schools	○	●	◐
- Minimize cost of extending utilities	—	—	—
- Decentralization	—	—	—

Legend: ● Very good
◐ Good
— Neutral
◑ Poor
○ Very poor

Table 4.3 (continued)

	Scenario 1	Scenario 2	Scenario 3
Neighborhood concerns			
- Maintain scale and character			
- western section	○	◐	◐
- eastern section	—	○	◐
- Minimize parking impact	◐	◐	◐
- Minimize traffic intrusion	○	◐	◐
- Minimize social/ lifestyle conflicts	○	—	◐
- Minimize displacement of existing residents	◐	○	◐
- Equity	◐	◐	◐
Implementation concerns			
- Marketability	—	◐	—
- Ease of administration	—	◐	◐

cated in Chapter 1, they are not usually attractive to developers. Usually, neighborhoods with better physical environments are sought.

Development in the second scenario is more compatible with the social structure that exists in most inner city communities. The housing is also of a less intrusive scale and is very efficient in terms of population density per household. However, meeting the requirements of families limits the number of these

households that can be accommodated on a given land area. This strategy would be suitable for neighborhoods which already have significant family populations. In fact, it could be useful in bolstering these populations in areas where they are beginning to decline. In such circumstances, infusion of new families may be enough to keep schools with marginal enrollment rates in operation.

The third scenario is also more successful in terms of social and physical compatibility, although more emphasis is placed on the latter. Although it attempts to locate redevelopment in places which minimize its impact on its surroundings, it is not possible to avoid some negative impacts, given the level of the density increase. It is almost as effective as Scenario 2 in population density and, because some larger building forms are employed, it necessitates less demolition of existing lower-density housing. This strategy could be adopted in neighborhoods similar to those described for the second scenario. It would not be as effective in areas where higher family populations are the main priority, but would be more useful where conservation and the physical environment are of greater concern.

On a municipal level, increasing residential density in an inner city neighborhood such as Sunnyside can assist in addressing other policies and goals, such as more intensive use of existing schools and parks, a more diverse social pattern and an adequate supply of rental accommodation throughout the city. At the same time, it can interfere with other policies, such as encouraging conservation and rehabilitation of older housing, and

can impose additional costs resulting from increased demands for services. However, many of these costs are a function of population growth, regardless of whether it is accommodated in the inner city or elsewhere in the metropolitan area. Although higher densities generally increase the efficiency of municipal services by reducing per capita costs of operation, this does not hold true in every case. For example, the first scenario achieved the highest population density, but enrollment in neighborhood schools was actually reduced. The use of such facilities therefore is dependent on the type of households planned for, as well as their absolute numbers.

Increasing density has strong impacts on neighborhoods, and increases of the magnitude tested in these scenarios can produce substantial negative effects. These effects include the obvious physical impacts of large-scale structures on smaller-scale ones, but also the more subtle psychological perceptions of residents, which ultimately affect attitudes toward maintenance and reinvestment in their property.

In terms of market feasibility, townhousing and stacked townhousing present problems, in that they have not been a strong attraction for families to Calgary's inner city neighborhoods. Myers' low-rise high-density prototype may suffer from the same acceptability question. Single detached housing still exhibits a more proven market, and this would be taken into account by investors.

In addition to the political problems which would arise in these scenarios, administrative and regulatory changes would be required. Development permit quotas and transfer of development rights would involve administrative costs and may not be understood or accepted by the public.

All these factors would have to be examined by a municipal government in determining whether the advantages of increased density in the inner city are worth the costs (both social and economic) and effort of implementing such a policy.

CONCLUSION

Residential density has been a subject of considerable interest to planners because of its relationship with such factors as efficiency, conservation of land, environmental quality and conservation of neighborhood character. For the purposes of this project, these concerns were expressed in terms of an 'efficiency/livability' duality. Efficiency, as measured by the costs of transportation, servicing and the conservation of land, generally increases with higher densities. However, as densities are increased through redevelopment, costs are imposed on communities and residents, which lessen the overall efficiency gains. The relationship between density and livability, on the other hand, is a little less clear. The quality and comfort of the living environment are affected by density but are also dependent on design and perceptual factors. Studies have revealed that negative social conditions often coincide with high densities but the existence of a causal relationship is a subject of controversy among researchers. Personal preferences for denser or sparser environments and cultural norms further hinder generalizations about the relationship.

The policy respecting density which has been applied in North American cities has generally been very restricted in nature. Market forces and planning policy have shaped a city characterized by homogeneous sectors of high-density housing concentrated around the central core and low-density suburbs on the periphery. The movement to higher densities has been effective in accommodating only one type of household (smaller, nonfamily)

in only one part of the city. In order to broaden its effects, a residential density policy should be more equitably applied to various sections of the city and to diverse household types. Small density increases applied across the whole city can have the same net effect as larger ones applied to a limited section of the city, with fewer disruptive influences. Of course, the inner city's locational advantage and the age of its housing stock continue to make it a logical focus for higher-density redevelopment. However, considerations for overall municipal efficiency resulting from higher densities must be balanced against considerations for the role which particular neighborhoods can play in making cities more attractive and livable. Besides catering to specific segments of the housing market (some of which are less family-oriented), some inner city neighborhoods possess a unique character not found in newer neighborhoods. Preservation of this character can enhance that of the city as a whole. Increasing the scope of redevelopment activity on a selective basis to a larger number of neighborhoods would make it possible to provide a mixture of building forms of various densities in the inner city and permit the preservation of viable communities.

In order to develop policy which can be applied more broadly across various types of households, there should be a concentrated effort to determine the requirements and preferences of these households and ways in which they can be accommodated more efficiently (i.e. on less land). This especially applies to family-oriented housing which represents a significant potential

for reducing land consumption but, until recently, this has not been seriously studied. This presents opportunities not only for meeting goals of higher density but also for adopting a form of redevelopment which would be more compatible with many existing neighborhoods. Finally, in formulating density policy, it must be recognized that conflicts with other municipal and neighborhood goals may arise, and the policy may have to be adjusted accordingly.

Of the three scenarios presented in this project, the one which emphasized the placement of a large number of smaller units (Scenario 1) achieved the highest density, both in terms of dwelling units and population. The predominant housing forms employed in the other two scenarios generally produced higher population densities per dwelling unit; however, the restrictions which policy objectives placed on these scenarios (family orientation and integration with neighborhood character) limited the ultimate density that could be reached. These limits were imposed by the need for grade-related units and infill forms which would not diminish the amenities of their surroundings. Such constraints are less of a consideration in a sector which has been designated for redevelopment without a family or conservation orientation. However, as discussed in the first chapter, some discomfort and dissatisfaction with the residential environment has been associated with concentrations of higher densities. Design factors can reduce negative perceptions of density to a degree but, as actual densities are pushed higher, this becomes more difficult.

There are indications that further combinations and refinements of the scenarios presented here may help to accommodate multiple policy objectives. For example, the first scenario shows that concentration of high-density structures in one sector of a neighborhood makes possible the conservation of a large amount of housing in the rest of the neighborhood. As well, the density of Myers' low-rise high-density prototype, used in Scenario 3, is roughly equivalent to the 6-storey apartment used in Scenario 1. This suggests that a high-density scenario could contain a more significant family component than that of the first scenario without losing density.

In planning for the inner city, it is important to recognize that one is not beginning with a clean slate, but with the product of a long evolutionary process. Housing within an inner city neighborhood usually varies in states of maintenance, structural quality and tenure, reflecting the resources and expectations of owners. Processes of redevelopment have often been initiated, imposing new patterns of higher-density structures on the original settlement and creating new social structures. Access factors may make some parts of the neighborhood more or less suitable for higher density than others. In the process of planning at a fine-grain level, these variables and many others would have to be considered and weighted by the planner, within a context of extensive public participation.

Real problems in implementation would be likely to result from conflicts between conservation and redevelopment interests within neighborhoods. Inequities would be nearly impossible to avoid, as some properties would be permitted to redevelop while others would not. The basis for such decisions would often be quite subjective, and subtleties may not be appreciated by some residents. In short, while such an approach offers opportunities for sensitivity and diversity within a neighborhood, it also presents difficulties which may not be encountered to the same degree in more traditional methods of planning.

Increasing density in order to improve the efficiency of the city is a suitable goal which can be applied in most inner city neighborhoods. However, this should not be attempted independent of context. General density policy should be fine-tuned at the neighborhood level, taking account of the shape of existing development and social structures and determining housing locations and forms which are most appropriate.

APPENDIX 1
NET DWELLING DENSITY BY BUILDING TYPE

Storeys	Net units/ha (units/acre)	FAR	Open space (%)*	Reference
	SINGLE-FAMILY DETACHED HOUSE			
1-2	3-25 (1-10)			Newman 1981, p. 74
	5-28 (2-11)			Keeble 1964, p. 230
	13-18 (5-7)	0.3	70	APHA 1960, p. 39
	13-25 (5-10)			McKellar 1979, p. 40
	15-33 (6-13)	0.25	72-80	Myers 1979, p. 22
	20 (8)	0.24	76	Diamond 1976, p. 16
	SEMIDETACHED HOUSE			
1-3	20-30 (8-12)			Keeble 1964, p. 230
	23-53 (9-21)	0.4	68-74	Myers 1979, p. 23
	25-48 (10-19)	0.6	70	APHA 1960, p. 39
	30-40 (12-16)			Newman 1981, p. 74
	33-45 (13-18)			McKellar 1979, p. 40
	35 (14)	0.38	81	Diamond 1976, p. 16
	DUPLEX			
2	42 (17)	0.48	88	Diamond 1976, p. 16
	63-88 (25-35)			McKellar 1979, p. 40
	TOWNHOUSE (ROWHOUSE)			
2	25-50 (10-20)			Macsai 1976, p. 294
2	38-83 (15-33)	0.6	53-62	Myers 1979, p. 24
2	47 (19)	0.56	72	Diamond 1976, p. 16
2-3	45-95 (18-38)			Newman 1981, p. 74
2-3	50-75 (20-30)			McKellar 1979, p. 40
3	48-108 (19-43)	0.8	40-62	Myers 1979, p. 24
	TRIPLEX			
3	52 (21)	0.6	80	Diamond 1976, p. 16
	100-125 (40-50)			McKellar 1979, p. 40

* APHA and Diamond include all open space; McKellar refers to minimum landscaped area and Myers to usable open space.

Storeys	Net units/ha (units/acre)	FAR	Open space (%)	Reference
		FOURPLEX		
2	57-59 (23-24)	0.66	67	Diamond 1976, p. 16
2-3	50-75 (20-30)			McKellar 1979, p. 40
		STACKED TOWNHOUSE		
3	73-110 (29-44)	0.9	37-53	Myers 1979, p. 25
3	77 (31)	0.86	72	Diamond 1976, p. 16
4	86 (35)	1.14	72	Diamond 1976, p. 16
4	110-155 (44-62)	1.1	30-37	Myers 1979, p. 25
		GARDEN APARTMENT		
	60-90 (24-36)			Newman 1981, p. 74
	128 (52)	1.06	62	Diamond 1976, p. 16
		WALK-UP APARTMENT		
	95 (38)	0.7	50	Myers 1979, p. 26
	100-188 (40-75)	0.85-1.5	28-40	McKellar 1979, p. 41
3	56-94 (23-38)			Macsai 1976, p. 294
3	63-75 (25-30)	0.9	70	APHA 1960, p. 39
3	160 (65)	1.36	55	Diamond 1976, p. 16
3+	88-250 (35-100)			Newman 1981, p. 74
4	94-131 (38-53)			Macsai 1976, p. 294
4	138-288 (55-115)	1.05-2.2	20-42	McKellar 1979, p. 41
4	153 (61)	1.1	30	Myers 1979, p. 26
		STACKED TOWNHOUSE/APARTMENT		
4	140 (56)			Newman 1981, p. 167
	207 (84)	1.92	62	Diamond 1976, p. 16

Storeys	Net units/ha (units/acre)	FAR	Open space (%)	Reference
		MID-RISE APARTMENT		
	175 (71)	1.95	68	Diamond 1976, p. 16*
5	125-175 (50-70)	0.48	88	Macsai 1976, p. 294
5	145-188 (58-75)	1.4	30-40	Myers 1979, p. 27
6	88 (35)			Newman 1981, p. 167
6	156-219 (63-88)			Macsai 1976, p. 294
6	163-188 (65-75)	1.5	75	APHA 1960, p. 39
6	213-400 (85-160)	1.5-2.85	30-35	McKellar 1979, p. 41
7	125-188 (50-75)			Newman 1981, p. 75
8	255-300 (102-120)	2.2	30-70	Myers 1979, p. 27
		HIGH-RISE APARTMENT		
	222-296 (90-120)	1.78-2.62	82-87	Diamond 1976, p. 16
	250-625 (100-250)			Newman 1981, p. 75
9	188-213 (75-85)	1.8	80	APHA 1960, p. 39
9	338-538 (135-215)	2.05-3.2	35-50	McKellar 1979, p. 42
10	180 (72)			Macsai 1976, p. 302
12	235 (94)			Newman 1981, p. 168
12	588-800 (235-320)	3.25-4.5	40	McKellar 1979, p. 42
13	213-238 (85-95)	2.21	83	APHA 1960, p. 39
13	258 (103)			Newman 1981, p. 169
15	550-900 (220-360)	2.75-4.5	50	McKellar 1979, p. 42
17	308 (123)			Macsai 1976, p. 302
17	325 (130)	2.4	34	Myers 1979, p. 28
23	325 (130)	2.4	36	Myers 1979, p. 28
27	500 (200)			Macsai 1976, p. 302

* Stacked units

APPENDIX 2
A STATISTICAL PROFILE OF SUNNYSIDE

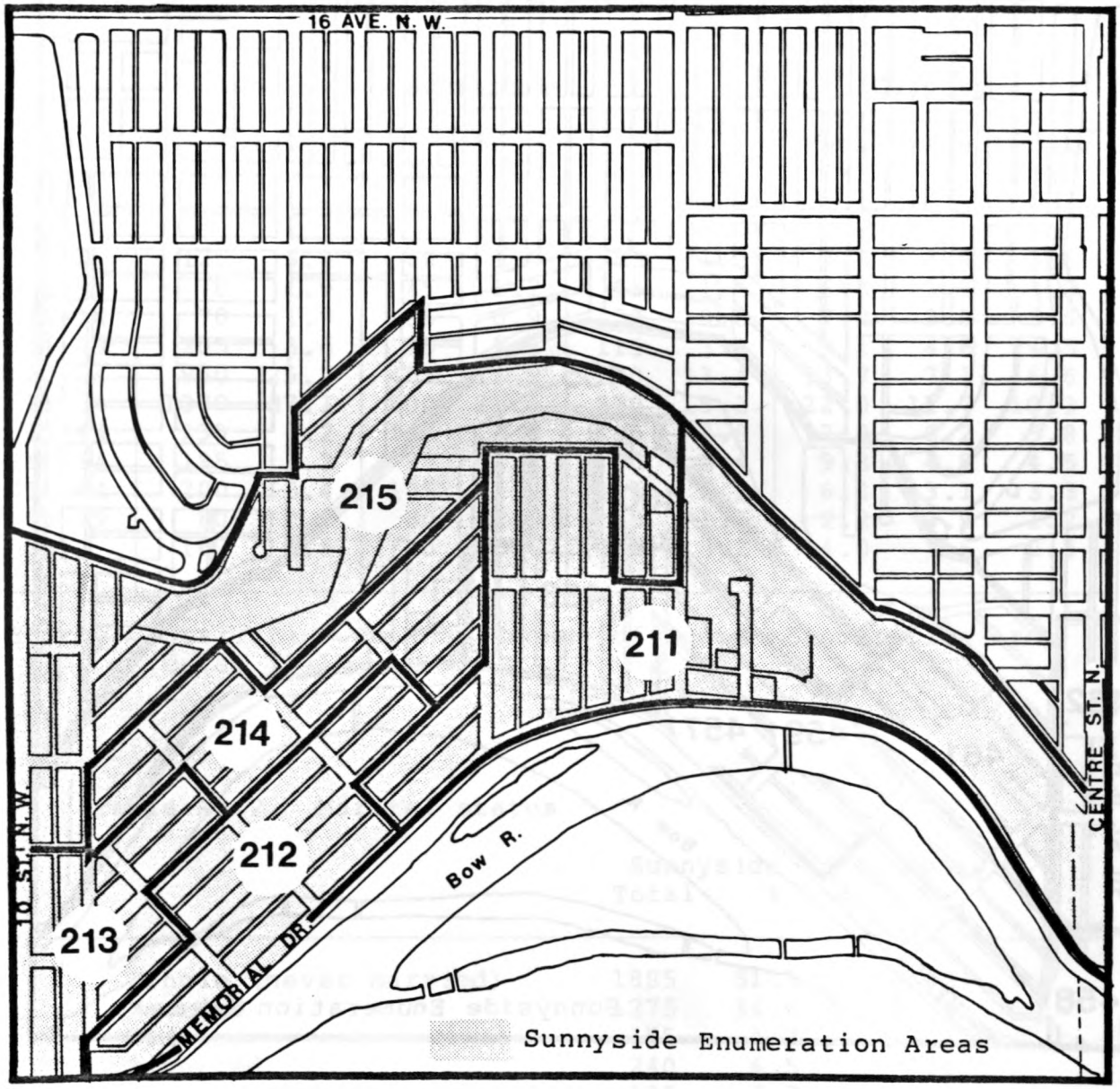

Figure A2.1. Census Tract 058 and Enumeration Area boundaries, 1976

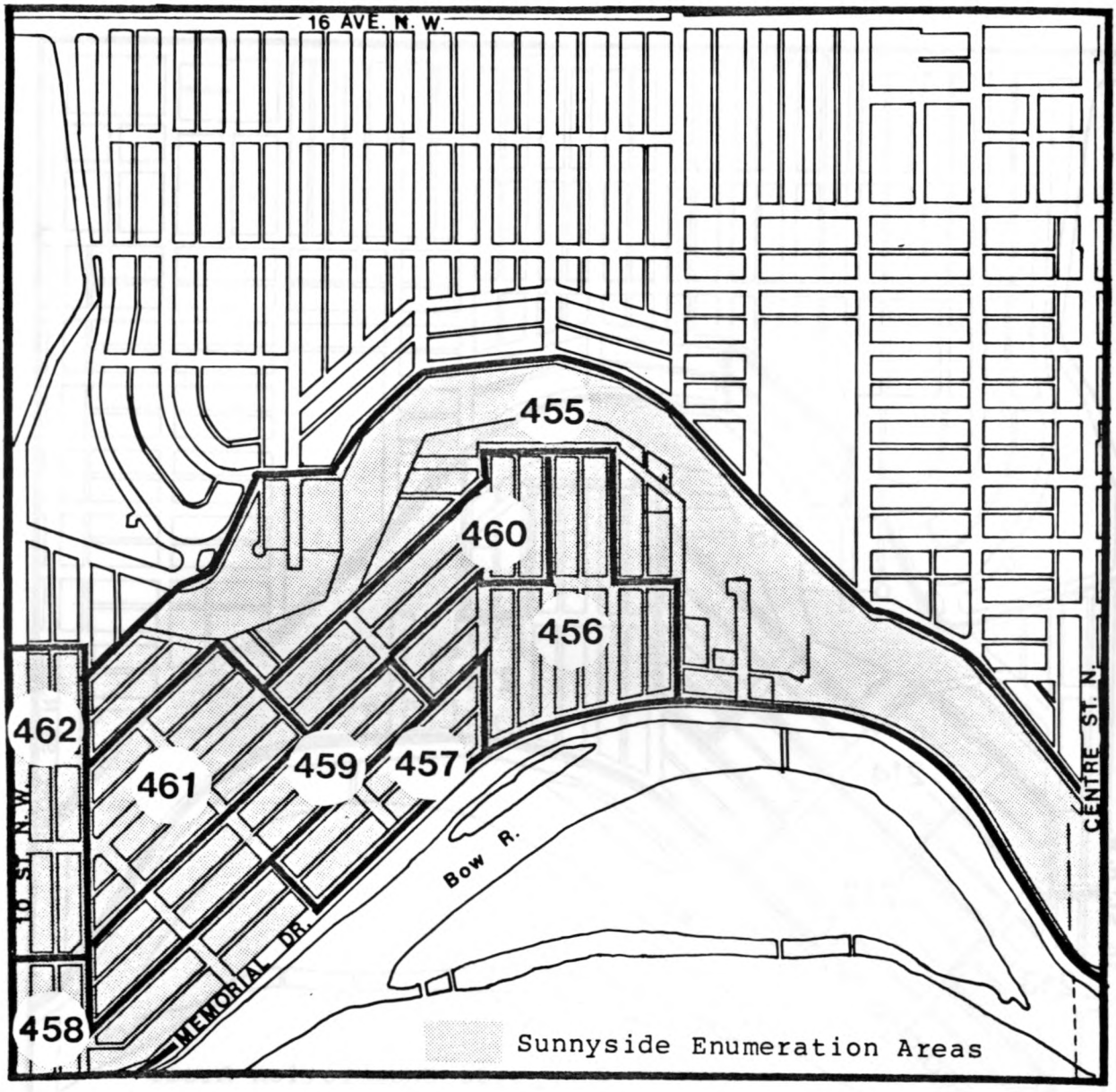

Figure A2.2. Census Tract 058 and Enumeration Area boundaries, 1981

Table A2.1. Population by age and sex

Age	Sunnyside						Calgary		
	Total		Male		Female		Total	Male	Female
	Pop.	%	Pop.	%	Pop.	%	%	%	%
0-4	125	3.4	60	1.6	55	1.5	7.5	3.9	3.6
5-9	70	1.9	45	1.2	55	1.5	6.8	3.5	3.3
10-14	70	1.9	35	0.9	30	0.8	7.2	3.7	3.5
15-19	205	5.6	95	2.5	115	3.1	9.1	4.6	4.5
20-24	950	25.7	455	12.2	500	13.4	13.7	7.1	6.6
25-34	1370	37.1	800	21.4	570	15.3	22.0	11.7	10.3
35-44	230	6.2	145	3.9	105	2.8	12.0	6.2	5.8
45-54	195	5.3	95	2.5	90	2.4	9.3	4.8	4.5
55-64	200	5.4	105	2.8	115	3.1	6.4	3.1	3.3
65-69	80	2.2	30	0.8	50	1.3	2.2	0.9	1.2
70+	180	4.9	60	1.6	120	3.2	4.0	1.6	2.4

Source: Statistics Canada, Census of Canada Enumeration Area data, 1981

Table A2.2. Marital status

	Sunnyside		Calgary
	Total	%	%
Single (never married)	1885	51.1	45.2
Married	1275	34.6	48.1
Widowed	155	4.2	3.3
Divorced	240	6.5	3.4
Separated	135	3.7	-

Source: Statistics Canada, Census of Canada Enumeration Area data, 1981

Table A2.3. Highest level of schooling

	Sunnyside Total	Sunnyside %	Calgary %
Less than grade 9	225	6.4	8.1
Grades 9-13	1065	30.5	39.7
Trades certificate or diploma	315	9.0	2.9
University/other without certificate/diploma	1210	34.6	36.2
University with degree	680	19.5	13.2

Source: Statistics Canada, Census of Canada Enumeration Area data, 1981

Table A2.4. Labor force activity

	Sunnyside	Calgary
Participation rate (population in labor force)	84.8%	75.7%
Unemployment rate	5.0%	2.4%

Source: Statistics Canada, Census of Canada Enumeration Area data, 1981

Table A2.5. Occupation

	Sunnyside Total	Sunnyside %	Calgary %
Professional/managerial	965	32.5	29.4
Service/clerical	1170	39.4	43.0
Industrial/trades	715	24.1	23.4
Other	120	4.0	4.2

Source: Statistics Canada, Census of Canada Enumeration Area data, 1981

Table A2.6. Total income

	Census Tract 058	Calgary
Under $6000	24.1%	27.0%
$6000-10,000	17.1%	13.8%
$10,000-15,000	21.8%	17.7%
$15,000 and over	36.9%	41.5%
Average income	$14,946	$15,775

Source: Statistics Canada, Census of Canada 1981

Table A2.7. Households by family composition

	Sunnyside					Calgary		
	1976		1981		%	1976	1981	%
	Total	%	Total	%	Change	%	%	Change
Family households	850	45.0	720	34.8	-15.3	74.5	70.1	+27.7
Nonfamily households	1040	55.0	1350	65.2	+29.8	25.4	29.9	+59.9
Total households	1890		2070		+9.5			+26.4

Source: Statistics Canada, Census of Canada Enumeration Area data, 1976 and 1981

Table A2.8. Families by child composition

	Sunnyside					Calgary		
	1976		1981		%	1976	1981	%
	Total	%	Total	%	Change	%	%	Change
Families w/ children	945	68.7	265	36.8	-72.0	69.0	65.1	+21.0
Families without children	430	31.3	470	65.3	+9.3	31.0	34.9	+43.8

Source: Statistics Canada, Census of Canada Enumeration Area data, 1976 and 1981

Table A2.9. Occupied private dwellings by tenure

	Sunnyside		Calgary
	Total	%	%
Owned	450	21.8	57.3
Rented	1610	78.2	42.7

Source: Statistics Canada, Census of Canada Enumeration Area data, 1981

Table A2.10. Occupied private dwellings by type

	Sunnyside					Calgary	
	1976		1981		%	1976	1981
	Total	%	Total	%	Change	%	%
Single detached	580	30.9	540	26.2	-6.9	59.2	55.4
Single attached	20	1.1	105	5.1	+425.0	10.8	15.2
Duplex	75	4.0	85	4.1	+13.3	5.7	5.0
Apartment	1200	64.0	1335	64.6	+11.3	24.3	24.4

Source: Statistics Canada, Census of Canada Enumeration Area data, 1976 and 1981

Table A2.11. Land use in Hillhurst-Sunnyside

Commercial		4.3%
Residential		37.1%
- Single family	13.5%	
- Other	23.6%	
Open space		47.7%
Other		10.9%

Source: City of Calgary, 1981

Table A2.12. Average household size by dwelling type in Sunnyside

Housing type	Persons/unit	Total units
Single-family	2.28	478
Converted	1.89	207
Duplex	2.45	20
Row house	2.47	118
Apartment	1.64	1393

Source: Calculated from City of Calgary census data, 1982

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