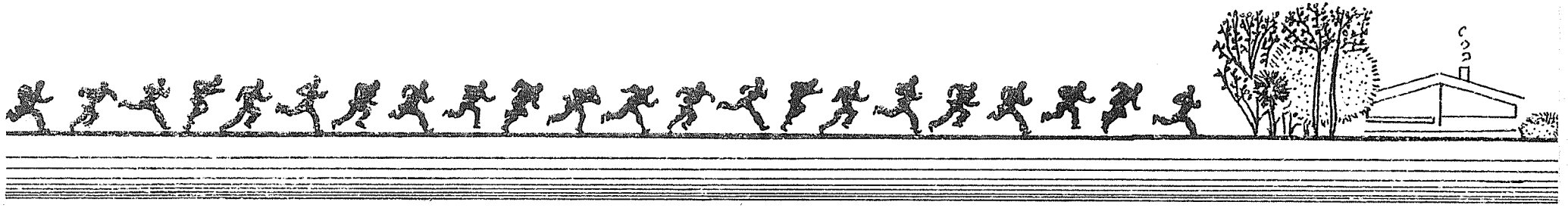

Suburbia, Suburbia..

the cost of discontinuous residential development

Suburbia, Suburbia . . .

The Cost of Discontinuous Residential Development

by

Masoud Reza Mozafari-Khalilabad

A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of City Planning

University of Manitoba

1977

SUBURBIA, SUBURBIA . . .

THE COST OF DISCONTINUOUS RESIDENTIAL DEVELOPMENT

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پیشکش به پدرم و به مادرم.

ACKNOWLEDGMENTS

The completion of this work would not have been possible without the encouragement and guidance of many people, people who I knew and those I had the privilege of meeting throughout the course of this research. I would like to take this opportunity to express my gratitude to all of them:

My advisor, Professor Basil M. Rotoff, whose ideas and suggestions helped the development of the topic, who facilitated the process of the research by addressing me to the right people, and whose technical advice was of substantial importance in many parts of my thesis;

My first reader, Dr. Gregory Mason, for the interest he has displayed, for generously giving his time, and for his ideas and inspirations which facilitated the completion of this study; and,

Dr. Kent Gerecke, my second reader, for his advice in approaching the problem in the process of this study, and for his encouragements in the last two years.

My very sincere thanks are also extended to Mr. Terry Holroy of the Manitoba Telephone System, Mr. Douglas Lockeed of Finance Accounting Utilities of the City of Winnipeg, Mrs. Coates of the Charleswood Community Committee Office, and Mr. George Pratt of Templeton Engineers, for without their co-operation, the research never would have been possible.

I can't forget Nevenka, whose sincere help alleviated the problem of communicating my ideas.

Finally, I would like to thank Catharine Souliere for co-ordinating my untidy notes into a typed document.

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The Westdale "theme" is one of quiet beauty, charming homes and modern conveniences. Here you may bring up a family free from traffic worries and unsettling clamor of city living. Westdale promises to stand as a landmark in community development . . . and you will enjoy the best of both worlds: suburban spaciousness and freedom . . . metropolitan services and facilities.

PARKLANDS LTD.

Developers of Residential Neighbourhoods

From advertising pamphlet

The extent to which North American cities are spread out is particularly obvious to people coming from other parts of the World. I, myself, found it puzzling to say the least: why is everything so far away, and why is the car such a necessity for the urban man, like a horse to a cowboy. This thought had potentially oriented my interest toward the subject of this thesis.

Statement of purpose.

The purpose of this thesis is to demonstrate the incremental cost of development borne by the community, where urban sprawl occurs in a discontinuous fashion. The demonstration will be performed by means of an experiment designed to estimate the potential savings to government[1], had the existing subdivision of Westdale been located at a hypothetical site, approximately 2.5 miles closer to the city core.

Problem

The peculiar growth of North American cities is visible mostly in the suburbs. The post-war suburbanization trend had a continual tendency toward discontinuous and low density residential development. This situation known as sprawl, creates an intermingling of open and developed pieces of land spread over large area in urban fringe and causes excessive expansion of cities which in turn affects urban life and urban resources. Areas of urban sprawl, due to their spatial arrangement, and location in relation to the rest of urbanized parts of the city, imposes incremental costs to their occupants, to the residents of the central city, and subsequently, to the economy of the city as a whole. These costs could be avoided by planned compacted urban development.

Hypothesis

It is proposed that the significance of economic losses to government due to locational decisions which produce discontinuous residential development to be tested by a hypothesis:

> "If suburban development follows a contiguous pattern, the government can save on the cost of providing urban infrastructure facilities".

Definitions

1. Saving: saving is defined as: a) the amount of capital which could be accumulated by not being used for covering the difference in the cost of providing the infrastructure facilities for a discontinuous residential development, and b) the benefit gained when having the opportunity to invest this money for other purposes.

2. Urban Infrastructure Facilities: in this study, urban infrastructure facilities refer to fire and police protection, school facilities, water supply and sanitary sewer services, telephone, hydro and street networks, and public transit system.

3. Contiguous Pattern: As opposed to scattered pattern of development, the contiguous pattern is defined as the gradual and uniform growth of an area, if that growth follows a planned orderly trend from an already established urbanized area.

Methodology

The intent of this study is to determine the distance-related incremental costs due to development of the Westdale subdivision at its present site. Since the Engineering Estimate Technique has been successful in the past in demonstrating variations in the cost of services with the development characteristics, this procedure will be incorporated in this thesis.

The general methodology applied with this technique is based on common engineering practice. In this case, the physical characteristics of various alternative developments are determined, and the required services (for example, size and length of water pipes) are based upon the physical characteristics of each development. The costs of services are estimated by calculating the related capital and operational costs on the basis of these physical requirements. Often one or more idealized hypothetical alternatives are used in this technique to be compared with the actual case.

In this research the following steps will be taken to approach the problem:

- A hypothetical scenario site is chosen as an alternative to the present site of the Westdale subdivision. The scenario is set up to closely resemble the characteristics of the Westdale subdivision in order to justify the cost comparisons.
- The interior characteristics, i.e., acreage, population, population density, socio-economic status, type and number of houses, pace of development and the level of services are taken as being identical for both sites.
- The similarity of topographical characteristics between the site chosen for the scenario and the site of the Westdale subdivision is adequate to allow the cost comparison. Indeed, these resulting cost differentials are significant enough to

compensate for probable minor differences.

- The site for the scenario is selected from the vacant parcels of land adjacent to the urbanized area which were available when development of the Westdale subdivision began in 1965.
- A design layout for the scenario is employed to relate this development to the existing urbanized area.
- The validity of scenario design will be evaluated by comparing the costs of water distribution systems in the scenario site and in the Westdale subdivision.
- The differential effects of the two alternative developments upon provision and/or extension of various urban infrastructure facilities are measured according to the percentage of each service being used by either residential development, or according to the conclusions which are derived from the review of existing documents, and from interviews with specialists in charge of the services in the area.
- The share of the total cost for the Westdale subdivision or the scenario is assumed to be equal to the extent of their influence on implementation of each project.
- A uniform dollar base of 1971 is used in all cost estimates in order to eliminate the inflationary effects and to resemble the real value of the money which has been spent in each year during the period between 1965 to 1977. The price indices used for this purpose are available in the quarterly "Report on Construction Price Statistics, Catalogue No. 62-008," published by Statistics Canada for the first quarter of 1977.
- The government's incremental costs due to provision of various infrastructure utilities are added up to represent the aggregate of the additional costs.

Following the above procedure, the total additional distance-related costs are identified. This amount then represents the government's cost savings if the distance between the Westdale subdivision and the urbanized area could be eliminated by having the scenario site developed instead. Finally, based on the assumption that the money saved could have been invested by government at the prime interest rate of Bank of Canada for each year, the opportunity costs to the government for not having this capital used in a better way will be calculated and will be added to the above sumation.

Limitations and Assumptions

Ideally, the logic of evalution of alternative situations is straight-forward. If two or more alternatives are similar in all respects but one, and differ in effectiveness, it is understandable to assume that one aspect in which they differ is accountable for the difference in effectiveness. When a hypothetical alternative is to be compared to the actual situation, the assumption of the characteristics of a real event identical to a non-existant one may be of doubt under practical circumstances. This fact can be counted as a major limitation in this study.[2]

The significance of results could perhaps be emphasized better if more than one alternative scenario had been compared with the Westdale subdivision. Due to time constraints, only one alternative is employed presently.

In the process of cost estimations, although logically, the existance of incremental costs for some particular services is obvious, the spatial nature of the service or lack of data prevent development of any cost estimation formula. For example, in the case of hydro, the existance of already installed regional transmission lines along the same distance from the two sietes causes an identical situation with respect to the transmission line length which represents the major cost differential element for the service. Police and fire services are two other examples where

the distance clearly affects the quality and the cost of these services, but lack of data and the manner in which these services are offered make cost calculations difficult. Although a more detailed discussion on the special characteristics of each service will be covered later in appropriate sections, it should be noted here that obstacles of this kind reduce the magnitude of the aggregate costs.

With regard to the required space for the scenario site, the land is selected from the existing intervening vacant land adjacent to built-up areas. To develop the model, it is assumed that land assembly was possible for the site.

Synopsis

The first chapter of this thesis will explore the nature and physical forms of sprawl, the economic and institutional factors initiating this phenomenon, as well as the social costs and government losses when suburban growth does not follow an orderly pattern. The problem will be further demonstrated by discussing suburbanization in relation to central city and the entire urban environment.

In Chapter Two, the development characteristics of the Charleswood suburban area as a whole, and the case study subdivision of Westdale in particular, are analized, and the government's distance related costs is providing public infrastructure facilities for the Westdale subdivision are estimated.

Chapter Three develops a scenario of an alternative hypothetical subdivision whose sociol-economical characteristics are identical to those of the Westdale subdivision, and which is adjacent to the urbanized area of Winnipeg. The related costs of providing the infrastructures for the scenario is estimated.

Chapter Four tests the proposed hypothesis by means of comparing the costs for the infrastructures at the two locations. The opportunity cost of the amount of increment is added up to the initial amount in order to represent the total amount of saving for government, if growth would follow a contiguous pattern. Finally, in Chapter Five the findings of the study is underlined and the policy options by which sprawl may be constrained is breifly outlined.

[1]In this content all levels of government (e.g. Municipal, provincial, federal) which contribute to the urban finance are refered to as government.

[2]Jack L. Franklin and Jean W. Thrasher, An Introduction to Program Evaluation, New York, John Wiley & Sons, 1976 pp. 62-63.

CHAPTER ONE

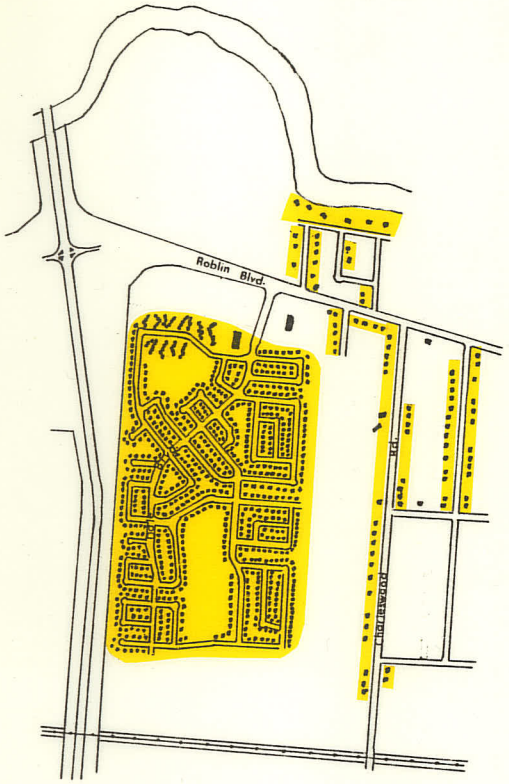
THE NATURE OF SPRAWL

The rural urban fringe is the area where land is in transition from agriculture to urban use and the residential development in the area is mostly of scattered and low density types. The term "sprawl" has been used frequently to describe the form of expansion of the cities in their fringe areas. Sprawl, defined by Geottmann as a "pattern of movement and use of space,"[1] is the modern urban phenomenon and an undersirable feature of the accelerated urbanization process. In the related literature, sprawl has been criticized for causing wastage of land; the size and location of unused land in the sprawled area make the future use of these sections difficult.[2] Urban sprawl is also known to be associated with unnecessarily high costs of both urban services and private transportation, as well as aesthetic problems and lack of public open space. This chapter will investigate the problem of sprawl by exploring the physical forms in which sprawl occurs and the economic and institutional factors which lead to this situation, by discussing the resultant social costs and government losses in provision of infrastructures, and by demonstrating the effects of suburban sprawl on redistribution of urban resources.

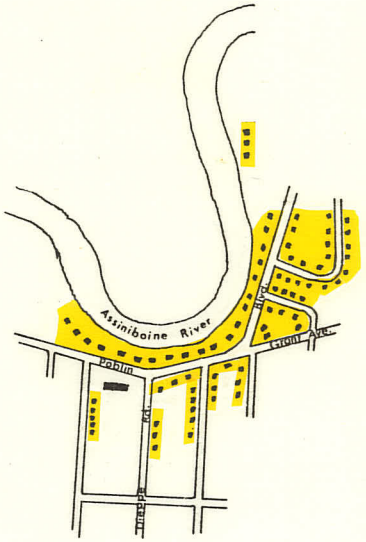
The Physical Pattern of Sprawl

A basic characteristic of a sprawled area is its very low density in comparison to the compacted areas of the city. The built-up pattern is noticeably heterogeneous and does not follow any disciplined order. Harvey and Clark characterized this phenomenon as follows:

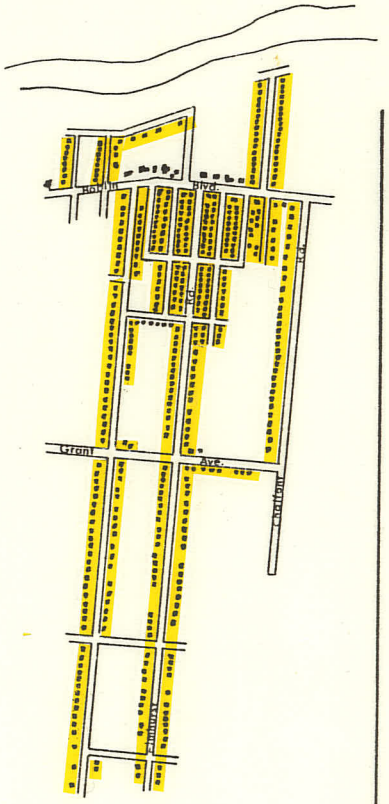
> Sprawl measured as a moment of time is composed of areas of essential urban character located at the urban fringe but which are scattered or strung out, or surrounded by, or adjacent ot undeveloped sites or agricultural uses.[3]



A. DISCONTINUOUS SPRAWL



B. LOW DENSITY SPRAWL



C. RIBBON DEVELOPMENT SPRAWL

PHYSICAL FORMS OF SPRAWL

MAP 1
CHARLESWOOD

400 0 800
FEET

Sprawl can be categorized in three major forms as follows:

1. Low density continuous development - This is merely excessive use of land, which creates a very low density residential form with houses built on large lots (Figure 1.B). The low density continuous sprawl may be ranked as the lowest order of sprawl and causing minimum harm.

2. Ribbon development sprawl - This form can be characterized as pieces of development which are compacted within themselves but extend axially, leaving the intervening areas undeveloped. This situation is usually seen along remote streets and highways in the suburbs (Figure 1.C).

3. Discontinuous sprawl - This type is also known as leapfrog sprawl. Here, the development pattern consists of discontinuous patches of urban use which are scatterd over a considerable area, with large skipped-over tracks of land in between (Figure 1.A). The built-up spots may be compact residential forms and/or a combination of the first two forms of sprawl. In the case of discontinuous sprawl, although the skipped-over parcels of land might eventually fill in, the degree of uncertainty created due to the lack of discipline in land use, the greater cost of extension of urban services and their inefficient use characterize this form of sprawl as the most undesirable form of urban expansion.

Economic and Institutional Factors Causing Sprawl

The market for suburban housing within an area may vary over short distances or over brief periods of time. A rapid increase in the demand for housing in an area tends to stimulate a corresponding response in developers, which in turn, produces a variety of discontinuous and unrelated developments. The nature of suburban land as a commodity contributes to a great ex-

tent in this situation.[4] At any given time, there are few buyers and few sellers for suburban land in the market. Lack of information about market conditions, the variations in the size of tracts of land, and diversity in the objectives of landowners and land buyers increase the time needed to reach the point of transaction between the parties. A tract of land with the ideal size needed for a particular number of houses in a particular location is difficult to find. To obtain an optimum parcel of land, the buyer must deal with separate tracts under different ownerships. It is a common phenomenon in land transactions that a buyer is obliged to buy a large tract of land when his actual needs can be fulfilled with a portion of that land. This applies to the seller as well.

To benefit from the booming market for housing in the area, each developer acts independently to purchase a piece of land and to produce some dwelling units for the market. Under this situation, the land becomes available on a discrete rather than a continuous basis. As the rate of growth in an area accelerates, the number of competitor firms increases in the market, and the fragmentation and random location of buildings become inevitable. The structure of land values also contributes to this situation. Developers, and subsequently, the home buyer does not pay the full cost of land development. It is subsidized by the government by a fixed charge due to an extension of services. In other words, government encourages the developer of the remote land by under-pricing, or by not equally relating the cost of extended utilities to their benefit.

Land speculation is another contributing factor to sprawl. Historically speculative prices of land have shown their effects on the discontinuity of suburban growth and premature subdivision development.[5] Speculation encourages scattered development when speculating owners hold their parcels of land in hopes for the future increased prices. Farmers and developers can also act as speculators by withholding their land from development and waiting for higher prices. When these landowners hold their land out of the current market, the developers, to avoid the speculating

prices of land close to existing built-up areas of the city, bypass these areas and leapfrog to remote tracts of land which are cheaper. This situation imposes an extra cost to society. A case study in the U.S. shows that when landowners gained an average increase of $129 per acre a year in the land value by holding their land out of the market, the resultant scattered subdivision development in the area generated a social cost of $1360 per acre a year.[6] Land speculation also accelerates the rise in land values by the initial increase in expectation of the landowner and the subsequent reduction in the effective supply of land for building. This, in turn, leads to more scattered development in the fringe area.

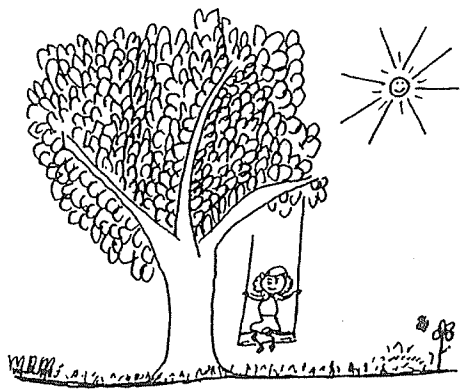
Public policy has also affected the sprawling pattern of suburbs. Acting through government on different levels, the decisions on the extension of urban infrastructures to one area or another contributes to sprawl by affecting the appeal of different area. Zoning, building codes and other related measures are also important elements in this issue. The area outside corporate limits becomes more attractive if there is less land use control than in the areas inside the limits. Land-use control and zoning regualtions my extend only to coporate limits or a little further. If the building standards and land use within the controlled area are more restricted, then the developer naturally moves outside the controlled area and contributes to the sprawl. The nature of these regulations, regardless of the extent of their application may also contribute to sprawl by failing to prevent heterogeneity in land use. The fact that zoning and other regulatory decision for public action may change under political circumstances shows the significant role of politics in suburban settlement. Public policy on housing in North America has been based on a low-density, single-family housing pattern, as opposed to the development of compacted multi-family dwellings in the city core.[7] This strategy, by supporting the idea of single-family homes as the primary characterisitc of the suburban environment, also contributes to sprawl.

Another differential element which affects the sprawling tendency of development is transpor-

tation modes. Motor vehicles permit an access to remote locations and allow cities to spread over large areas. The automobile gives more mobility within the cities and hence, a wider choice for the residence location in relation to work, shopping facilities and recreation. In this process, transportation costs, to a large extent, substitute for land value.

As mentioned in some literature, personal attitudes of landowners toward the future value of land, personal desires, and preferences such as estate holding, defective titles and covenants are known to affect the development of particular tracts of land.[8] The personal desires of some suburban sprawl occupants may also contribute to the heterogeneity of fringe development. Some buyers may seek a housing environment of a particular character. For example, an area separated from the main urban environment may be sought because it offers the amenities which suit particular personal values.[9]

Although sprawl is described here as a moment of time, and a static phenomenon, the concept of timing of development is important in the way that it affects the physical pattern of an area. Firstly, this is because a difference in the time span of development in an area produces a variation in the degree of scatteration.[10] Secondly, the urban fringe, which is the zone of sprawl, is a dynamic area, and in the long-run, the intermingling land within the sprawled area may fill in. However, the fundamental effect that sprawl patterns of growth may impose on the



location of public facilities such as schools, parks and fire stations produce a long-run incremental cost to society which may not be compensated for at any point in time. In this situation, even if the area completely fills in, the location of these facilities may not be optimum with regard to new characteristics of the area. In the following sections social costs of sprawl and the incremental costs which this phenomenon imposes on the government in provision of public infrastructure facilties will be reviewed.

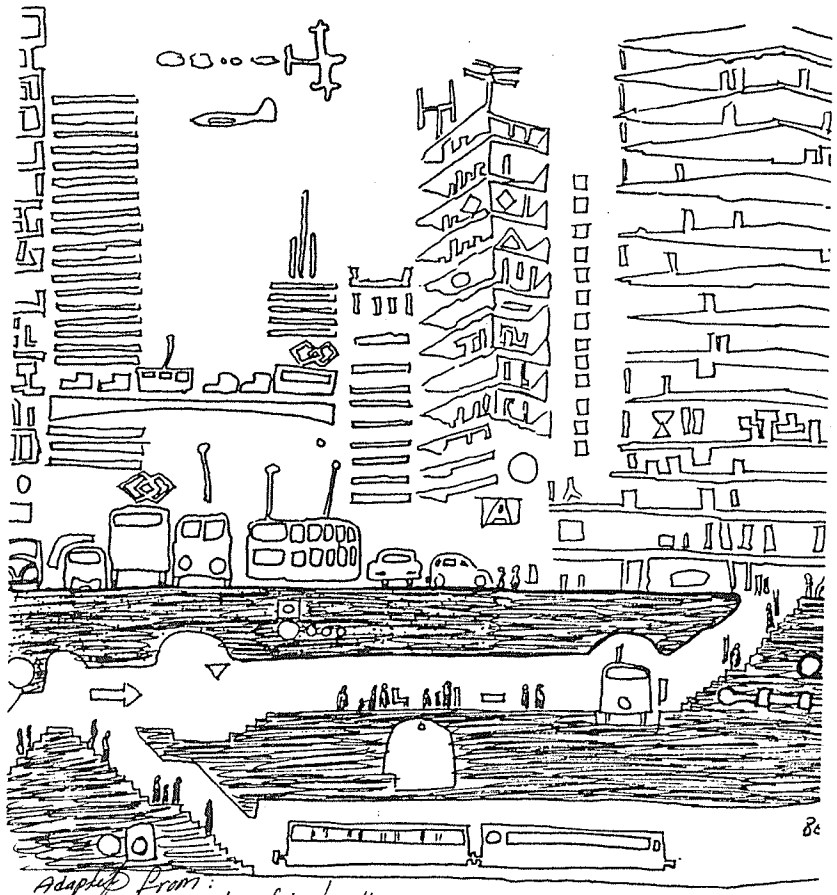
Social Costs

When a city expands over a great area in its peripheries, the scattered manner of physical environment and the imbalanced settlement of population throughout the urban area affect the quality and modes of life of the residents, both in inner parts and fringe areas of the city, causing losses which can be described as social costs. Individually, these costs may be small, but their aggregation amounts to a significant total value of losses. Most of the time, these losses, because of their implicit manner, are not recognized by people.

The provision of public transportation for denser planned developments is more desirable than for scattered populations of suburbs because the former can support this service more efficiently. Consequently, there is less need for private vehicles because the accessibility to public transit is greater in a compactly developed area. As dwellings scatter, density decreases and sprawl development becomes dominant, the distance between different elements of the living environment increases. Therefore, walking trips become short drives; these, in turn, become longer, public transit becomes uneconomical and people have to rely on the more costly private means of transportation. Families living in lower density or in discontinuously developed areas usually need more than one car to move about conveniently. The cost of maintenance of these additional vehicles

is then a burden on the budget of a remotely located family. In his study of a two-mile leapfrog development, Archer concludes that the operating cost of private motor vehicles represents a substantial portion of the total additional annual cost to the residents of that subdivision.[11] At the same time, travel time for the various family members differs substantially, and the losses with regard to the monetary value of travel time are significant.[12]

Types of development generate other social costs such as the negative effect on health and safety and personal behaviour malfunction (psychic costs), although this category of social costs seems to be more a function of housing type and socio-economic status of the residents.[13] There seems to be a need for more research on the type of development and the resulting personal behaviour.



Incremental Costs of Public Infrastructure Facilities to the Government

There is a considerable and growing amount of literature on the public sector costs attributed to urban sprawl. The capital and operational costs of providing infrastructure facilities is

one of major concern in this issue. The argument is usually that the government has to spend different amounts of its budget to provide the same level of service for a given population living in different types of developments. In other words, the cost per person and per dwelling unit is higher when development is of low density and/or of discontinuous form. When development is in the form of leapfrog sprawl, the additional costs are those which could be avoided had this population been accommodated in a subdivsion built adjacent to an urbanized area. Where the sprawl is of low density and in the large-lot form, the incremental costs are those which could have been avoided had a "desirable" density been employed for the suburban development.[14]

Isard and Coughin, using engineering technique, analyzed the cost variations of public utilities with density of development.[15] They calculated that the cost of providing sanitary and storm sewers and streets increases with lower density. This study assumed a constant cost per household for such services as fire protection and refuse collection, and ignored the differential effects of the location of development upon the cost. Dawing developed another study based on the variation in the cost of providing sanitary sewers with change in population density of residential area, as well as the change in the distance between the development site and the sewage treatment plant.[16] He concluded that a greater annual capital and operating cost is needed when distance from the plant increases, and when residential density is low.

In 1963, Bahl studied the incremental costs of a single-family residential subdivision, two miles away from built up area of the city.[17] He approached his cost evaluation by choosing an alternative hypothetical site adjacent to the urbanized area. Assuming identical characteristics for both hypothetical and actual sites, he concluded that any variation in costs must be a function of location. Archer developed a more recent and generalized cost structure based on Bahl's case study in 1973[18]. The incremental distance related costs that he presents for each year are those which are generated due to existing undeveloped intervening land during that year. He estimated

that the total annual cost generated by a two-mile leapfrog subdivision was $272,534 in 1962. This represents a cost of approximatley $220 per year, per resident, or approximatley $810 per year for each household. According to this study, from the incremental cost of $220 per person, per year, about 65 percent was imposed directly on the residents of the remote subdivision, mostly due to commercial delivery services and to the operation of private transport vehicles. The city subsidized the remaining 35 percent of the cost of providing public utilities.

A recent study on the effect of development characteristics on the costs of various public services was completed by the Real Estate Research Corporation.[19] The utilities covered in this study included telephone, electricity, gas, water, sewers, fire and police protection. A number of hypothetical subdivisions were compared in this study. An assumption was made that each subdivision was a part of the small independent community, and that the community costs are basically the same regardless of the location of the subdivision. The subdivisions were characterized with different types of housing and with various layouts. The study showed that all mentioned services increase in cost per household as density decreases. However, this study did not attempt to measure the ways that the location of a residential development affects the urban infrastructure facilities costs.

Based on available data presented by the Real Estate Research Corporation, Dawing and Gustely analyzed the distance-related costs of the public services.[20] Their estimate for police and fire service is based on the travel costs (distance) for each trip and on the number of trips between the neighbourhood and the station. The annual operation cost for police and fire services was estimated to be $0.30 and $0.60 a mile per vehicle, respectively.[21] The authors also commented that the distance decreases the quality of these services as well, due to the fact that the response time increases with the distance between the station and the event location. The total annual cost of providing services per mile in this case was estimated to be $68,498.

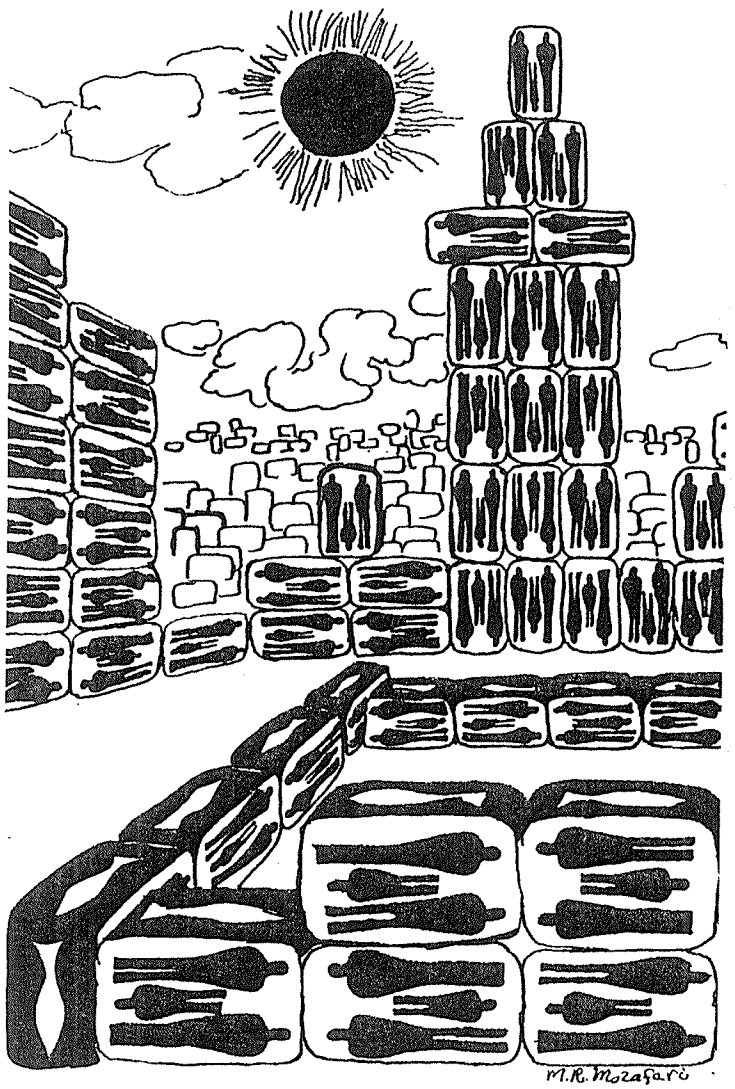
As the above discussion in the area of social costs and public infrastructure expences indicates, the cost of sprawl to people and government is substantial. In order to demonstrate the problem more explicitly, the effects of suburban sprawl on deterioration of central city, and subsequently on intensification of urban financial crisis is demonstrated as follows.

Exploitation Hypothesis

A common arguement in urban economics is that suburban areas, especially when their development is of sprawl form, consume a greater share of the urban government budget, thus causing inequity in redistribution of urban resources. In other words, peripherial residents are subsidized by the people who live in the central parts of the city. Although it is difficult to specify the degree of contribution of this phenomenon to the urban fiscal dilemma, its differential effects have been argued in the growing amount of literature on this issue.[22] City governments are looking for ways to release the burden of property tax from the general expenditure and from the consumer's share of the total budget. When central city areas function as the primary employment, commercial and cultural centres, a significant number of suburban residents will benefit from the inner-city provision of services such as police and fire protection and street pattern while they commute to the central area. Studies on this topic have shown that the amount of fiscal payment which commuting suburbanites[23] may be required to pay when they use the facilities in the core area, in the form of sales taxes, commuter taxes or user charges do not compensate for the benefits that they gain.[24] The negative externalities, such as congestion and pollution due to traffic which the non-residents generate in the inner city should be added to the above factors.

On the other hand, the continual expansion of the periphery of cities in the form of residential, industrial and commercial growth produce physical, social and financial problems for the central city. As people and capital move out to the suburbs, the tax bases in the core de-

teriorate. Businesses and other economic activities find it more profitable to locate themselves close to suburbs in regional shopping centres. As people and capital vacate the core for suburbs, people of low income status replace them. These circumstances lead to a decline in the economic potential of the central city, increase the crime rate and intensify the movement of remaining potential residents and industries to suburbs. The inefficient use of land and other resources, such as public utilities in peripherial areas, coupled with deterioration of the central city, increase financial crisis of the whole urban area. It is well known that for any given population, government's expenditure will be higher if the land area which has to be serviced is greater. However the suburbes which impose this extra cost on the government do'not pay their full share. People in suburbs consume more of the urban government budget, simply because it takes more resources.

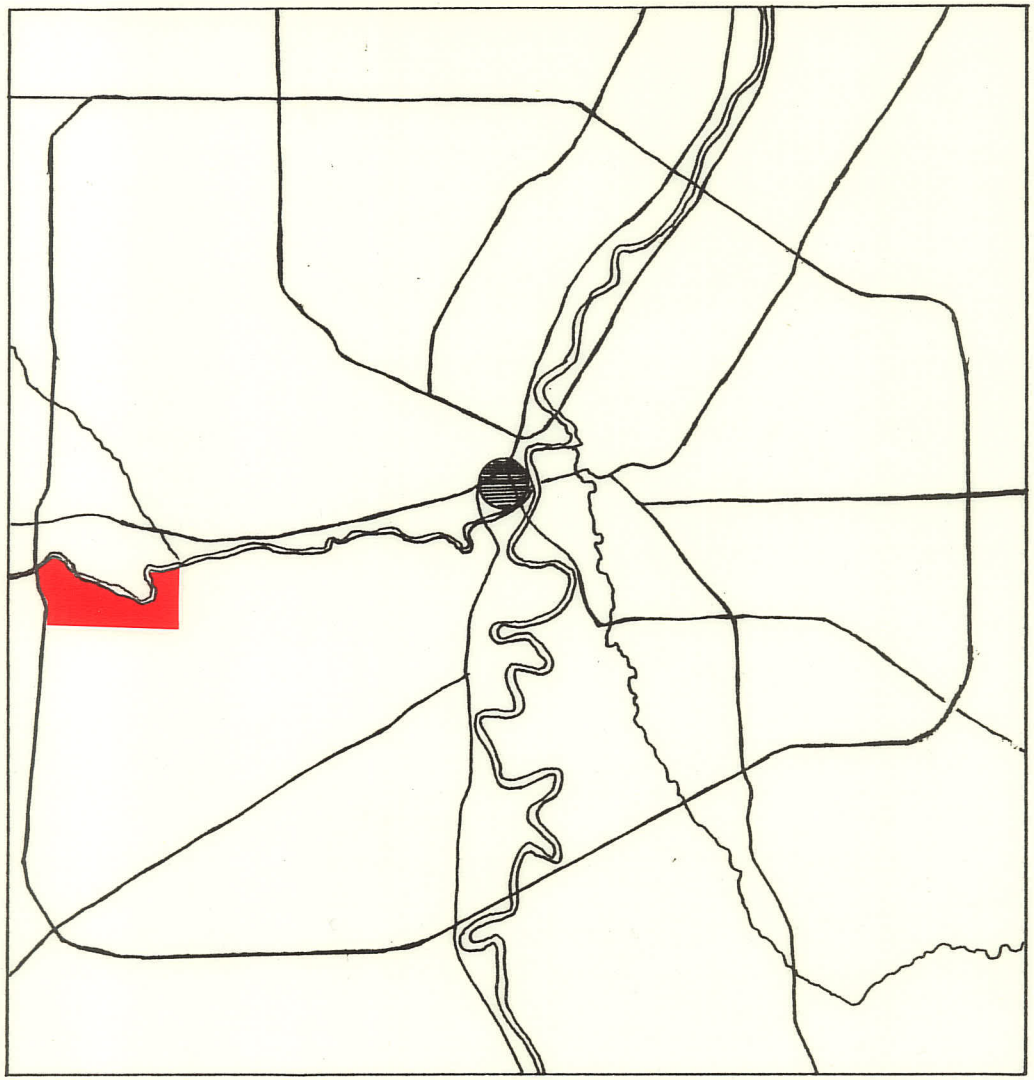


Conclusion

As it has been shown in this chapter, in the process of suburbanization sprawl poses the problem of deteriorating urban environment and

urban resources in various ways. This study will attempt to investigate the significance of the government losses in the provision of public infrastructure for sprawled areas. While some empirical studies do answer some important questions concerning the impact of sprawl on the utilization of different urban services, as it was demonstrated earlier in this Chapter, very little research with regard to distance being independent of density has been undertaken.[25] This study will investigate more of the ways and the degrees by which incremental costs are imposed on the government as a result of the variations in distance of public service consumers from the urbanized area.

The Charleswood suburban area in Winnipeg, Manitoba, as a whole, represents a clear example of sprawl development. The predominant land use in this area is a very low density semi-rural development with the exception of a few locations of urban-type development. In this thesis the government's distance related costs in provision of infrastructures for the particular discontinuously developed subdivision of Westdale, in Charleswood, will be investigated. (Map 2).



LOCATION MAP

LEGEND

DOWNTOWN

STUDY AREA

1 0 2 4

MILES

MAP 2

Footnotes

[1]J. Geottmann, "Urban Sprawl and Its Ramifications," J. Geottmann and Robert A. Harper, eds., Metropolis on Move: Geographers Look at Urban Sprawl, New York, John Wiley & Sons, Inc., 1967, pp. 4-6.

[2]Robert O. Harvey and W.A.V. Clark, "The Nature and Economics of Sprawl," Land Economics, February 1965, p. 2.

[3]Ibid., p. 2.

[4]It should be noted that we refer to the perception of land as a commodity in the North American Economic System.

[5]Marion Clawson, "Urban Sprawl and Sepculation in Suburban Land," Land Economics, February 1962, pp. 99-111.

[6]R.W. Arch, "Land Speculation and Scattered Development; Failures in Urban-Fringe Land Market," Urban Studies, 1973, p. 367.

[7]Ibid., p. 4.

[8]Marion Clawson, "Sprawl and Speculation in Suburban Land," Land Economics, February 1962, p. 105.

[9]R.O. Harvey and W.A.C. Clark, "The Nature and Economics of Urban Sprawl," Land Economics, February 1965, p. 6.

[10]Jack Lessinger, "The Case for Scatteration: Some Reflections on the National Capital Region Plan for Year 2000," Journal of American Institute of Planners, August 1962, p. 160.

[11]R.W. Archer, "Land Speculation and Scattered Development; Failures in the Urban-Fringe Land Market," Urban Studies, 1973, p. 368.

[12]M.E. Beesley in an article "The Value of Time Spent Travelling: Some New Evidence," Economica (May 1965) estimates the monetary value of travel time as one half of average hourly wage. In another study by A.D. Quambly, "Choice of travel Mode for the Journey to Work: Some Findings," Journal of Transportation Economic Policy (Vol. 1, 1967) concludes that the monetary value of travel time equals one-third of hourly earnings of a person.

[13]Real Estate Research Corporation, The Cost of Sprawl, 3 Vols. (Washington, D.C.: U.S. Government Printing Office, 1974), Vol. 2: Literature Review and Bibliography, pp. 56-60.

[14]The value judgement of desirable density for suburbs is a valid issue for further investigation. This issue will not be argued in this document.

[15]Paul B. Dawing and R.D. Gustely, "The Public Service Costs of Alternative Development Patterns: A Review of Evidence," Paul B. Dawing, ed., Local Service Pricing Policies and Their Effect on Urban Spatial Structure, Vancouver, University of British Columbia Press, 1974, p. 65.

[16]Ibid.

[17]R.W. Bahl, A Bluegrass Leapfrog, Lexington, Bureau of Business Research, 1963.

[18]R.W. Archer, "Land Speculation and Scattered Development; Failures in the Urban-Fringe Land Market," Urban Studies, 1973, pp. 367-372.

[19]Real Estate Research Corporation, The Cost of Sprawl, 3 Vols. (Washington, D.C.: U.S. Government Printing Office, 1974), Vol. 3: Environmental and Economic Costs of Alternative Residential Development Pattern at the Urban Fringe.

[20]Paul B. Dawing and R.D. Gustely, "The Public Service Costs of Alternative Development Patterns: A Review of Evidence," Paul B. Dawing, ed., Local Service Pricing Policies and Their Effect on Urban Spatial Structure, Vancouver, University of British Columbia Press, 1974, pp. 78-85.

[21]Ibid., p. 78.

[22]Paul B. Dawing, "Introduction," Paul B. Dawing, ed., Local Service Policies and Their Effect on Urban Spatial Structure, Vancouver, University of British Columbia Press, 1974, p. xiii.

[23]With regard to this issue a distinction should be made between those suburbanites who are within the administrative boundaries of a city, and those who are not. The earlier group, through general taxes, may partially pay for what they consume from the available services in the central city. The later commuters use central city facilities without any contribution to the expenses.

[24]Benjamin Chintz and Thomas G. Gowing, "The Impact of Local Public Consolidation on Urban Spatial Structure," Paul B. Dowing, ed., Local Service Policies and Their Effect on Urban Spatial Structure,Vancouver, University of British Columbia Press, 1974, pp. 267-268.

[25]It is true that lower density increases distance, but in the case of the discontinuous sprawl pattern, even if the remote subdivisions have a moderate density, the distance-related costs are borne when resources unnecessarily have to pass intervening parcels of vacant land.

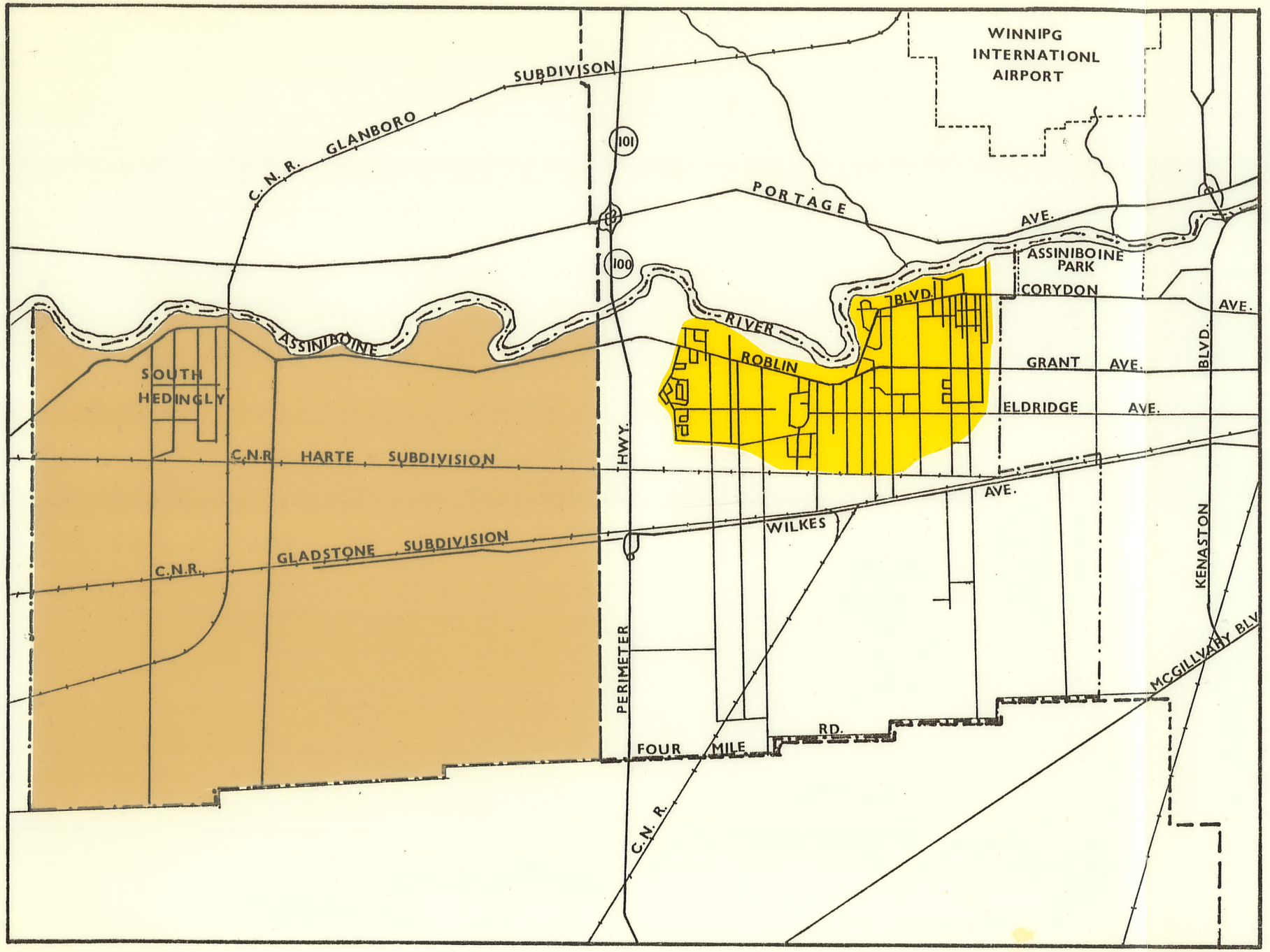
CHAPTER TWO

THE WESTDALE SUBDIVISION

History of Charleswood Area Development

The Charleswood suburban area is located in the southwest corner of the metropolitan Winnipeg area. It is bounded by the Assiniboine River on the north, Tuxedo on the east, Four-Mile Road to the south and the Rural Municipality of Cartier on the west (Map 3). Historically, Charleswood occupied a small portion of the original Hudson's Bay Land Grant called Assiniboia.[1] This grant was given to the Company to stimulate settlement in this area and to provide land for the production of agricultural goods for Winnipeg in 1857.[2] In the period from 1857 to 1913, the area was gradually permeated by immigrants. The economy of the area was based on the exchange of agricultural products and fur trading. Red River ox carts and paddle-wheel steamers were the main forms of transportation. In 1913 the portion of Assiniboia south of the river was established as the Rural Municipality of Charleswood. Later, in 1972, this municipality amalgamated into the City of Winnipeg administration. Historically, the population growth of Charleswood depended on two factors: natural increase and migration. Figure 1 shows the trend of population growth in Charleswood as compared to Metropolitan Winnipeg.

After World War II suburban living began to gain popularity. As a direct result of this phenomenon, Charleswood's population increased rapidly. In the meantime, the development of a Veterans' Land Act Project called Roblin Park contributed to the growth of the area.[3] The annual



CHARLESWOOD SUBURBAN AREA

LEGEND

- CITY OF WINNIPEG BOUNDARY
- CHARLESWOOD BOUNDARY
- ADDITIONAL ZONE
- URBANIZED AREA

MAP 3

CHARLESWOOD

3000 1500 0 6000

FEET

rate of growth dropped between 1961 and 1966 and accelerated again between 1966 and 1971 due to the Development of the Westdale subdivision.

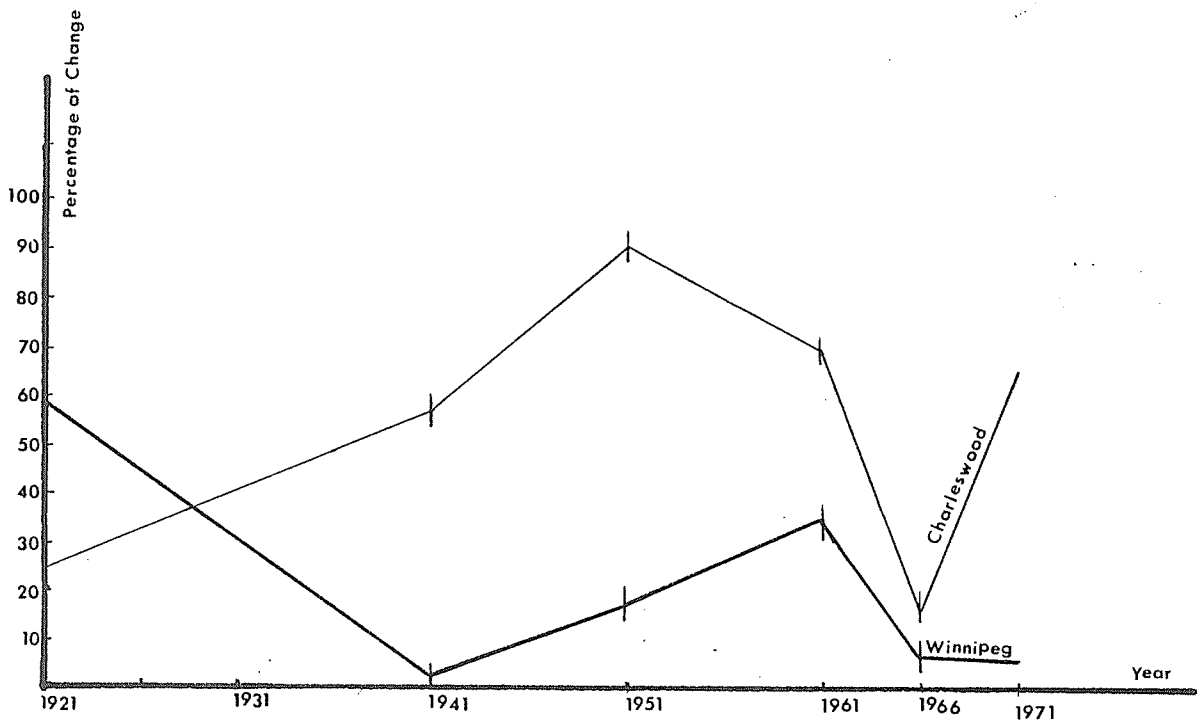


Figure 1 Population Growth Comparison - Charleswood, City of Winnipeg.

Source: Census of Canada, 1921 - 1971

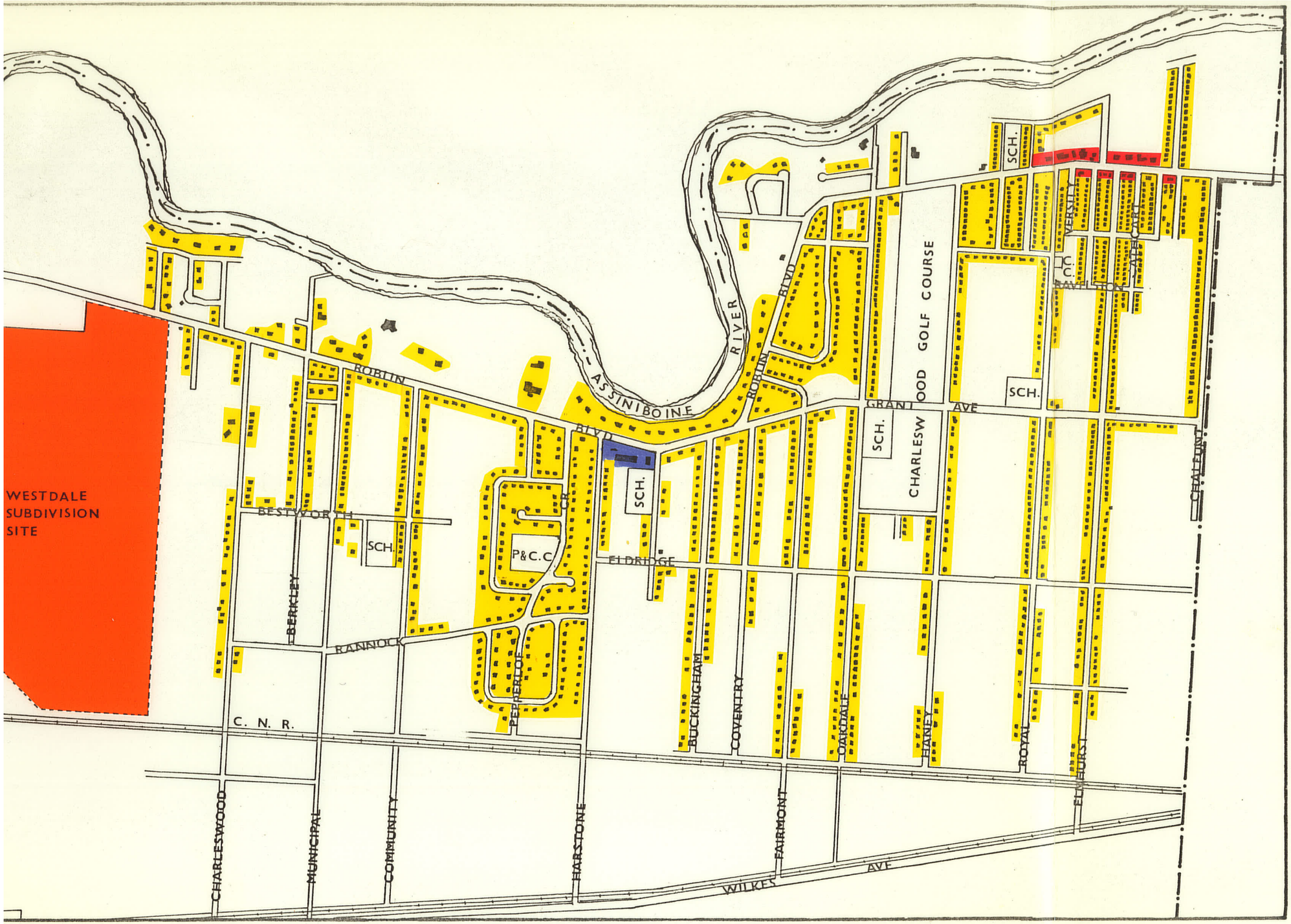
Physical Development Pattern

Prior to 1925, Charleswood residents occupied small portions of the area, and segmented residential developments were scattered throughout. In the period between 1925 and 1950, the developments in the form of large-lot housing occurred in the area between Roblin Boulevard and Assiniboine River with greater magnitude. At the south end of Roblin Boulevard, residential units appeared in the form of ribbon development sprawl. Long linear strips of housing were formed on streets such as Fairmont, Roud, Haney, Oakdale Drive and Charleswood Road. A more concentrated type of development was established south of Roblin Boulevard in the area known as Varsity View area and enclosed by Varsity View Drive, Ravelstone Avenue, Carthcart Street and Roblin Boulevard. In this period the Roblin Park subdivision was the only planned development in the area (Map 4).

From 1965, with the beginning of the Westdale subdivision development, the majority of residential development in the area occurred in this particular subdivision. Meanwhile, additional scattered housing and infilling in the form of construction of isolated dwelling units or by way of development of single bays or cul-de-sacs had appeared randomly throughout the Charleswood area.

Land Use

In 1971, the total area of Charleswood was 23,913 acres, of which 92.14 percent was undeveloped and vacant land.[4] The developed portion of Charleswood was mainly of low density single-family residential form with only one or two small industries. The residential use consumed only 3.95 percent of the total area with an average population density of 0.50 persons per acre.[5] This very low density may be due to the fact that the part of Charleswood extending into additional zones beyond the metropolitan boundary is predominantly agricultural with a few semi-rural housing clusters in Headingly South, and with the scattering of housing along the south bank of the Assin-



BUILT-UP AREA 1965

LEGEND

- CHARLESWOOD BOUNDARY
- RESIDENTIAL
- COMMERCIAL
- COMMUNITY SERVICES
- C.C. COMMUNITY CENTER
- P. PARK
- SCH. SCHOOL

MAP 4

CHARLESWOOD

400 0 800
FEET

iboine River. But even if the portion of Charleswood with in the boundary of additional zone being excluded, the density will remain as low as 1.25 persons per acre for the rest of Charleswood.[6] A commercial strip along Roblin Boulevard and a small shopping centre in the Westdale subdivision use 0.14 percent of the land for commercial facilities. Parks, schools, playgrounds, golf courses, cemeteries and community clubs occupy 1.37 percent, and industrial and public buildings,and public utilities 2.37 percent of the total land.

Sprawl in Charleswood

As the physical form and land use of the area indicate, Charleswood's development pattern combines all these sprawl characteristics,(as defined on page 2). While there are three areas of nearly-full development (Westdale, Roblin Park and Varsity View), the remaining development is spread over the rest of the area and is mainly separated by undeveloped tracks of land.

Interviews with planning authorities and reviews of the development policies applied in the area indicate that premature extension of essential public services such as water and sewers and poor co-ordination of development policy decisions have allowed the creation of the present circumstances. In the later stages of the growth process, unsuitable parcels of land, speculative prices and difficulties in land assembly due to a great number of landowners contributed to the intensification of the situation.

Development of the Westdale Subdivision

The Westdale subdivision is located in the western part of Charleswood suburbia. The site is surrounded by Roblin Boulevard in the North, Canadian National Railways to the south,and the Perimeter Highway in the west. Its eastern boundary lies 1,060 feet from the western limits of

Charleswood Road (see Map 4). Negotiations for development of the Westdale subdivision started in late 1963. In November of 1964, an agreement between Parkland Limited Development Company and the Rural Municipality of Charleswood was signed. According to this agreement, the developer was endorsed to develop a planned residential subdivision on 332.5 acres of land in the Charleswood area. The agreement allowed the gradual development of the project with a maximum of 300 dwelling units per year. The residential units were to be mainly of the single-family type with an average frontage of 68 feet. The developer agreed to provide the required services within the subdivision, whereas the Municipality, in turn, was expected to facilitate construction and installation of the regional public services such as water feeder mains where they are essential for this development.[7]

Development of land and construction of dwelling units in the Westdale subdivision began in 1965. Table 1 illustrates the pace of construction activities and types of dwelling units for each year during the development period. The main part of development was completed in the period between 1968 to 1974. During this period, more than 50 percent of all construction activities in Charleswood were concentrated in the Westdale subdivision.[8] From the total of 1652 dwelling units in the subdivision, 13.4 percent or 222 units are townhouses while the rest are single-family. The dwelling units are distributed throughout the subdivision with an average gross density of five units per acre. Although the lack of up-to-date data does not permit exact estimation of the population for the subdivision, the present population is estimated to be 4,500 people, based on the average family size derived from the census tract for 1971.[9]

When the development of the Westdale subdivision began, the residential development except for the two cases of Roblin Park (Veteran's Land Act subdivision) and Varsity View were scattered over Charleswood, leaving about 82.29 percent of land vacant or for agricultural use (Map 4). The decision of the developers on the choice of the present location for the Westdale subdivision,

having vacant land available in several other locations, therefore, should be explored.

As a result of intensive scatteration of residential developments, the vacant land in the eastern area of Charleswood (east of Oakdale) was segmented, unevenly distributed and under several ownerships. The value of land in this area was affected by speculative demands of the owners due to the immediate locations of the parcels of land and urbanized area. The developer purchased 402 acres of land for the subdivision site at a price of $1302[10] per acre from one landowner, while the price of land in the eastern area of Charleswood varied from $1600 to $1800 in 1965.[11] At the same time, developers had to deal with several landowners for land assembly. On the other hand, existance of the treatment plant close to the site and easy access to other services such as telephone, hydro and water supply, contributed to the developer's choice. Under the circumstances of no public control and considering the opportunities of buying cheaper land and avoiding the problems of land assembly, the developer of Westdale leapfrogged and established the development at its present site.

In the following section, the cost of provision of various public infrastructure facilities generated as a result of Westdale development will be investigated.

TABLE 1

Pace of Development and Type of Housing in the Westdale Subdivision

Type of Housing	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	Total
Detached	33	21	58	97	142	104	58	113	98	75	2	2	2	805
Semi-Detached	--	--	--	12	102	104	102	121	116	8	20	20	20	625
Town-house	--	--	--	27	--	142	--	53	--	--	--	--	--	222
Multi-Family	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	33	21	58	136	244	350	160	287	214	83	22	22	22	1,652

Source: Department of Environmental Planning, Building Permition Division, Winnipeg, Manitoba, June 1977.

The Cost of Provision and/or Extension of Public Infrastructure Facilities to the Westdale Subdivision

In this section, the capital and operation costs of various public infrastructures facilities, as a function of the distance of the Westdale Subdivision from urbanized area will be investigated. The capital cost include the government's initial investment in cases where infrastructures were extended further to service the Westdale subdivision. The operation costs included the expenses generated by the distance, where government operated and maintained services.

Telephone Service

The Manitoba Telephone System advised that the cost of providing and maintaining telephone service is a function of the distance of the receiver from the distribution centre. The initial capital costs which are the costs of installation of conduits and cables are not the only costs to consider, but the ongoing expenses or annual charges are of major importance. According to the Manitoba Telephone System's fiscal procedure, the total cost of providing and operating this service in an area breaks down into the number of telephones over a specific period of time. In other words, the actual cost is the sum of initial costs and the annual maintenance cost of the service. The latter refers to the cost per subscribership and includes repayment of capital, interest on capital and maintenance of cables and conduits.

TABLE 2

Annual Operating Costs for Telephone Service in the Westdale Subdivision[1]
($ 1971)

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	Total
Number of Subscriberships	33	54	112	284	492	842	1,002	1,289	1,503	1,586	1,608	1,630	1,652	1,652
Annual Operation Cost per Phone	12.46	12.46	12.46	12.46	12.46	12.46	12.46	12.46	12.46	12.46	12.46	12.46	12.46	12.46
Cumulative Total Annual Costs ($)	411.18	672.84	1395.52	3090.00	6130.32	10491.32	12484.92	16060.94	18727.38	19761.56	20035.68	20309.80	20583.92	150155.38

1. For detail of the calculations, see Appendix C, Section I.

2. Number of subscriberships is assumed equal to the number of dwelling units. The commercial subscriberships are not included in the calculations.

Sources: Manitoba Telephone System;

Department of Environmental Planning, Winnipeg, Manitoba

An initial capital cost of $279,254.08 (1971), or $169,04 (1971) per subscribership, was paid out for the installation of 17,000 feet of cables and conduits from the distribution centre located at the intersection of Grant Avenue and Royal Road to the intersection of Dale Boulevard and Ronnock Avenue in the Westdale subdivision.[12] The cumulative total of annual expenditures to maintain the service in Westdale, as illustrated in Table 2, contributed to the initial capital cost.

The overall costs of extension of the service to the Westdale subdivision, considering the total cumulative annual cost resulting from Table 4 up to and including 1977, is $429,409.46 (1971).

Hydro

The electricity, after being generated at power stations, is usually carried through high-voltage transmission lines to different locations for consumption. Power for residential use is distributed to dwelling units after being transformed to a lower or secondary voltage. The cost of providing this service to residential areas is mainly the function of the length of distribution lines and transmission lines. According to Manitoba Hydro engineers, density and type of dwelling units have an effect on the amount of required material (such as wire) for a distribution system. Smaller lots and multi-family dwelling units reduce the overall cost of a distribution system. With regard to transmission lines, the cost differ by location of a residential area. A remote subdivision needs longer transmission lines and is more costly to service.

In the case of this study, transmission lines had been extended throughout the area for

regional purposes and the development of the Westdale subdivision has not had an incremental effect on the related costs. Because this transmission line passes along an equal distance from Westdale and the scenario site, and because the density and type of housing is assumed identical, the distribution costs would not differ in either of the two alternative sites, although in general this would not be the case.

Water Supply

Prior to 1965, the water distribution in the Charleswood area was provided by a feeder main extending from Wilkes Reservoir of the Metropolitan Corporation of Greater Winnipeg. Water was pumped to this area through a 30-in. feeder main from the reservoir, reducing the size to an 18-in. main at the intersection of Haney Street and Eldridge Avenue (Feeder Point B). This feeder main, then, extended along Haney Street toward the north, crossed the Assiniboine River and serviced St. James (Map 5). In 1965 another 30-in. feeder main was extended westward from Feeder Point B. At the intersection of Bestworth Street and Berkely Avenue (Feeder Point A) the feeder main extended north up to the Assiniboine River, for future extension. The second phase of this project was started in the St. James area in 1969.

To prorate the total capital costs of this project and to determine the share of Westdale from the total, the influencing factors leading to the installation of this feeder main should be discussed. Although it extended for 9460 feet through Charleswood between Feeder Points B and A, the area between Haney Street and Berkely Avenue was being served by a 12-in. main which branches from Feeder Point A at the intersection of Haney Street and Grant Avenue. The next take-off from the feeder watermain was at Feeder Point A for the Westdale subdivision. In other words, the only take-off from that section of the feeder watermain which lies west of Haney Street in Charleswood was for consumption of the Westdale subdivision residents.

The agreement which had been signed between the Rural Municipality of Charleswood and the developer of the subdivision also reinforced the fact that Westdale development had a significant influence on the extension of this feeder main through the area and in the specific direction. The agreement states:

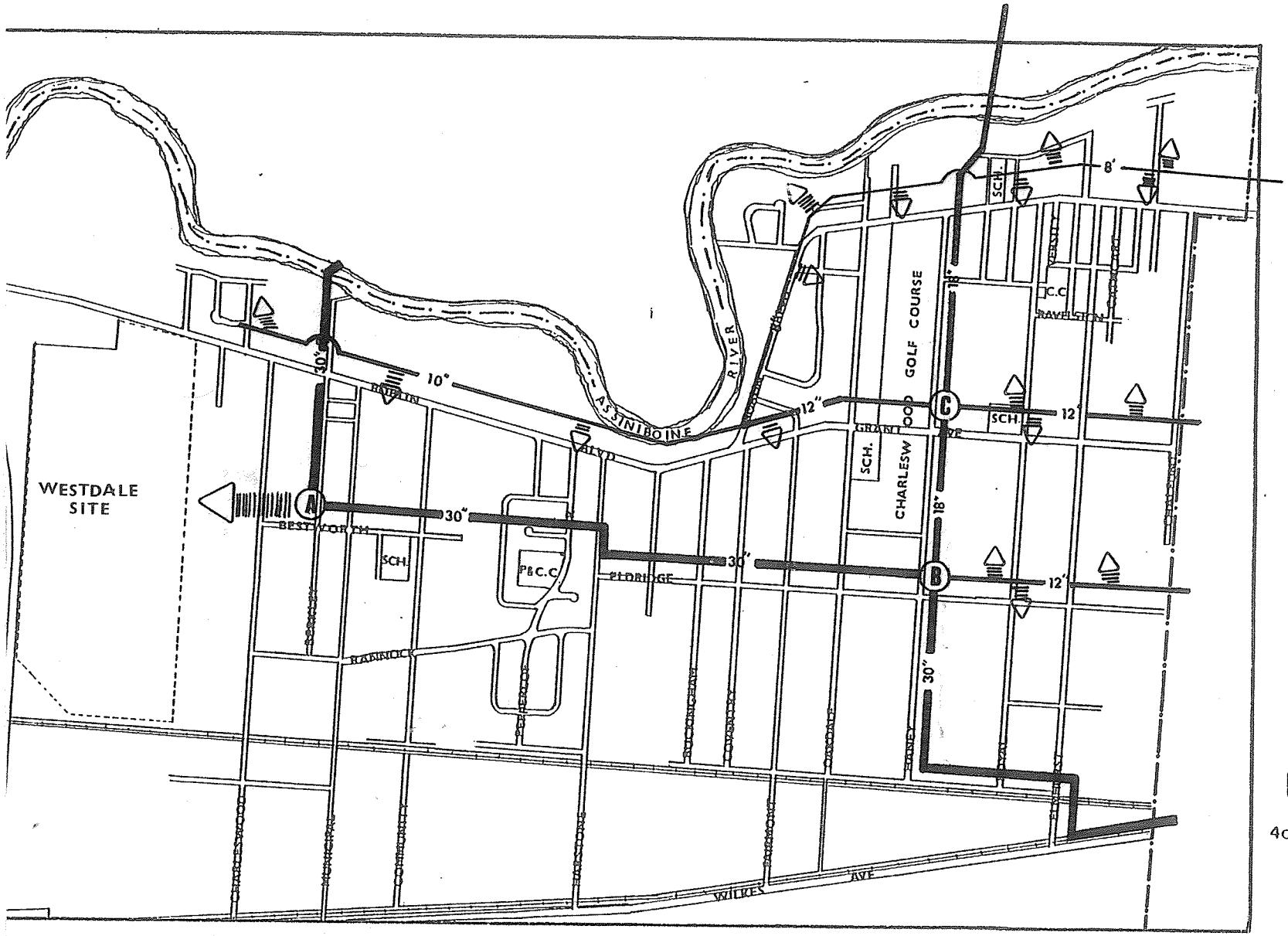
> . . . the municipality will commence to construct and install or cause to be commenced, constructed and installed the Feeder Water Main to the boundary of the "Planned Area" within 60 days after receiving a request from the Company to proceed with such construction and installation. . . [13]

The demand in the St. James area could not be considered as the most important reason for the installation of this service at the time: firstly, because the project stopped at the boundary of St. James and started again four year later; secondly, due to the fact that the existing feeder main which extends through Haney to St. James could have satisfied the demand of that area, at least until 1970; and thirdly, this feeder main could have been extended in several alternative directions to the area, if the only reason for its extension had been to serve St. James.

Based on the above evidence, the capital costs of the portion of the feeder main between Feeder Points B and A is assumed to be initiated because of the development of the Westdale subdivision. The Water Works, Waste and Disposal Division of the City of Winnipeg advise that the related capital costs were equal to $914,237.46 (1971).

Sanitary Sewer

Distance-related costs of providing sanitary sewer services are a function of the length of interceptors which carry the sewage from the point of disposal to the treatment plant. In the case of this study, the treatment plant was built adjacent to the west side of the Perimeter Highway, within the boundary of Charleswood. A main interceptor extends through Charleswood and carries



WATER SUPPLY

LEGEND

—10"— WATERMAIN

(C) FEEDER POINT

SERVICE AREA

MAP 5

CHARLESWOOD

400 0 800

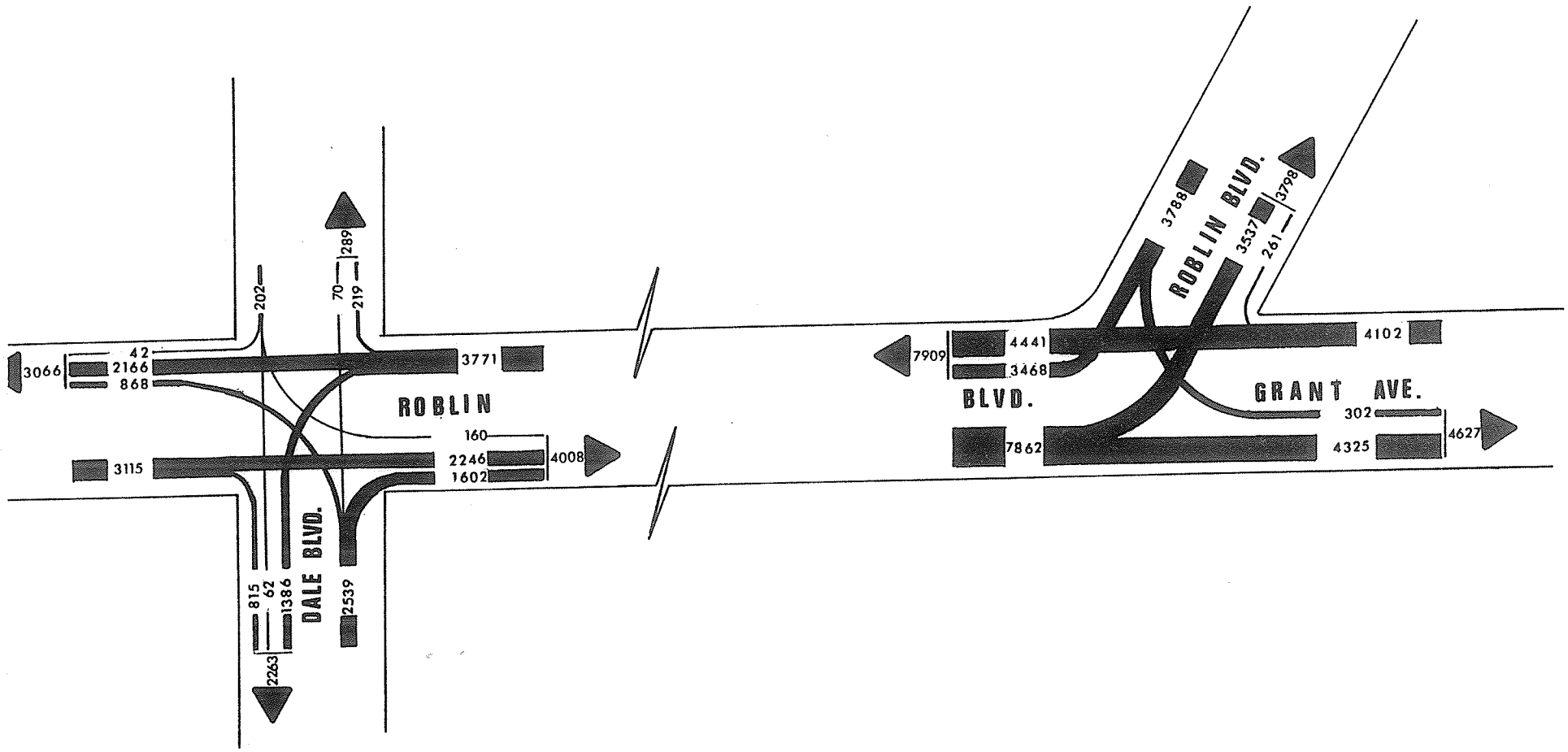
FEET

waste disposals of residents of Charleswood as well as the sewage generated in a wide area adjacent to Charleswood. Both the treatment plant and the interceptor were built prior to development of the Westdale subdivision. Due to the fact that the service has a regional catchment area, the costs of its provision did not directly relate to the development of Westdale and its location. However, the decision for the location of this subdivision might have been affected by the easy access to the service.

Street Network: Upgrading and Widening of Roblin Boulevard

Prior to 1967 Grant Avenue and Roblin Avenue were the two main arteries in Charleswood. They join just past Coventry Road and continue as a two-lane street westward, up to the Perimeter Highway. The upgrading and widening of this two-lane street to a four-lane divided boulevard was completed in a two-year project in 1968. According to the Street and Transportation Division of the City of Winnipeg, the entire capital costs of this project were $957,761.27 (1971). The annual costs of maintenance since 1968 include the maintenance costs of vegetation in the center strip and should also be added to the above figure.[14] The maintenance of grass for this section of the boulevard costs $4000 (1971) annually.[15] Based on this, the total maintenance of the previously mentioned portion of Roblin Boulevard amounts to $40,000 (1971) since 1948.

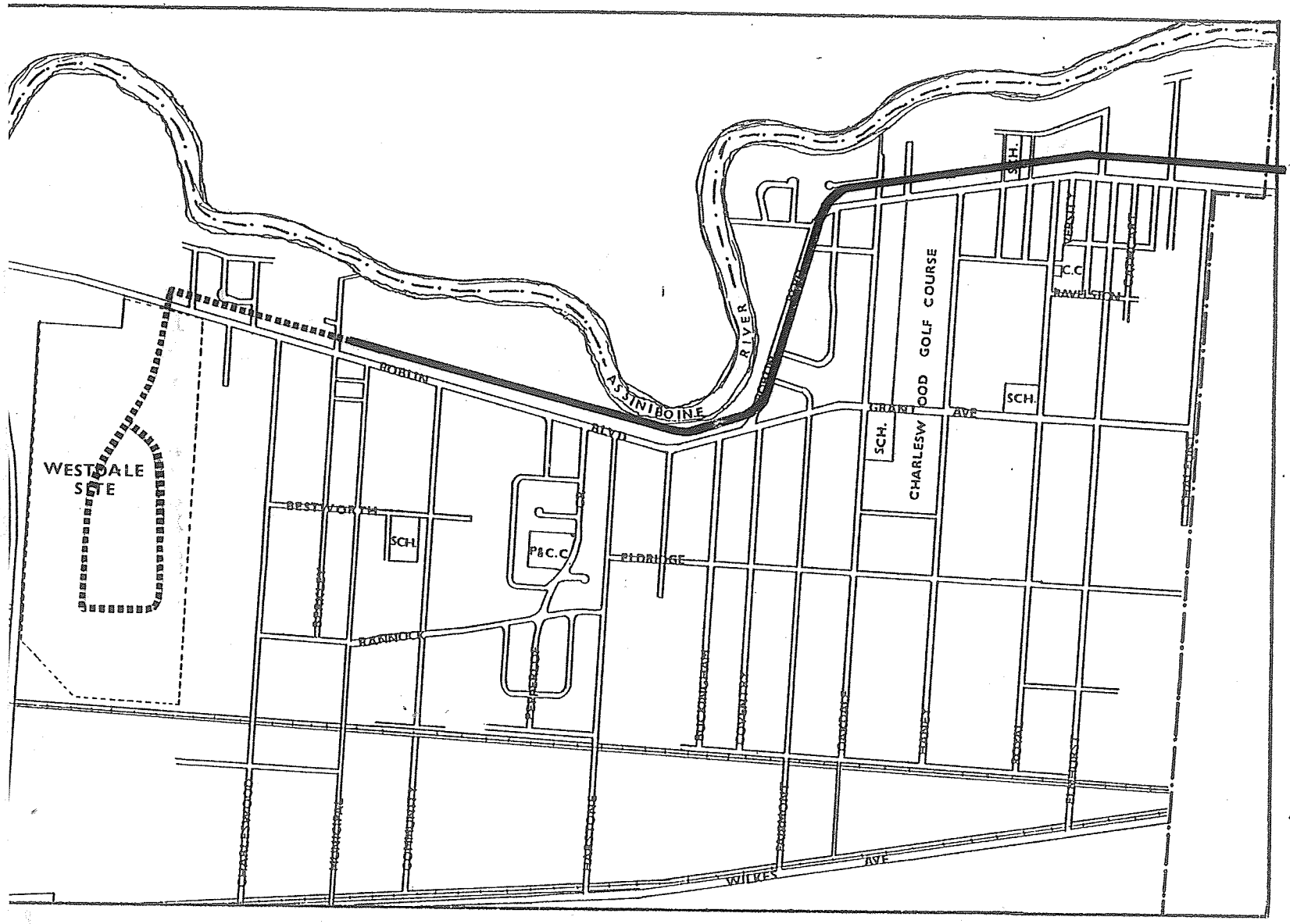
Westdale's share of the total cost is indicated based on user percentage. A vehicle intersection count study was conducted by the Traffic Department of the City of Winnipeg for that section of Roblin Boulevard between Grant Avenue and Dale Boulevard in 1975 (Map 6). This study indicates that 21.33% of the traffic in this section of Roblin Boulevard initiates from or ends at the Westdale subdivision. Based on these statistics, the amount of incremental capital and maintenance costs which the location of the Westdale subdivision imposed on the government totaled $212,822.47 (1971).[16]



VEHICLE-INTERSECTION COUNT STUDY, 1975

MAP 6

Source: Traffic Department, City of Winnipeg



PUBLIC TRANSIT SYSTEM

LEGEND

SERVICE OFFERED PRIOR TO 1967

EXTENSION OF THE SERVICE

MAP 7

CHARLESWOOD

400 0 800

FEET

Public Transit System

Prior to 1967, a bus transit route was serving the Charleswood area up to the intersection of Berkley Avenue and Roblin Boulevard. According to the City of Winnipeg's Transit Department, the development of the Westdale subdivision generated the demand for public bus service over a larger area. Based on this demand, a new schedule was established in the area by the fall of 1967 (Map 7). According to the new schedule, bus service covers the area beyond the intersection of Berkely Avenue and Roblin Boulevard and includes the Westdale subdivision. The extra time generated to service this subdivision is estimated by Winnipeg Transit System to be twenty minutes per trip for each bus. The deduction of this twenty minutes from each single trip which a bus has to perform daily in the area will result cumulative time savings from the total operation time of all buses in a day approximately equal to the daily operation time of one bus in the area which is twenty-one hours.[17] In other words, the costs of operation of one bus could have been saved.

The average cost of providing and operating a bus in any area of the city of Winnipeg is $12.20 (1971) per hour.[18] This amount includes capital costs, wages, depreciation and maintenance. Deducting $4.87 (1971), the average hourly revenue of the city out of each bus from the operational costs leads to a net average hourly operating cost of $7.33 (1971) for one bus.[19] Therefore, the total costs associated with operating one bus in the period from the fall of 1967 to 1977 is estimated to be $421,845.16 (1971).

Public School

In this section, the possibility of cost variations in providing public school service for the present development pattern in the study area and the suggested alternative scenario is being tested based upon expected enrollment and the capacity of each school. As Table 5 indicates, the

TABLE 3

Comparison of School Enrollment and Their Capacity Rate in Charleswood Area

School	Year of Operation	Rated Capacity in the Year of Operation	ENROLLMENT							
			1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77
Beaumont	*	504	693	447	625	558	553	556	554	444
Chapman	*	208	174	184	183	195	187	164	196	184
Dieppe	*	644	674	641	666	633	630	605	594	582
Royal	*	469	511	648	716	711	720	705	695	677
Charleswood Collegiate	*	433	598	655	718	594	548	515	520	511
SUBTOTAL I		2,258	2,650	2,575	2,908	2,691	2,638	2,555	2,559	2,398
Westgrove**	1970	532	--	490	575	552	509	525	538	536
Westdale Jr. High**	1972	600	--	--	--	592	555	550	567	542
Beaverlodge**	1973	560	--	--	--	--	466	555	594	498
SUBTOTAL II		1,692	--	490	575	1,197	1,530	1,630	1,699	1,576
Total Enrollment			2,650	3,065	3,483	3,835	4,168	4,185	4,258	3,974
Total Rated Capacity			2,558	3,093	3,093	3,693	4,253	4,253	4,253	4,253

*Operation of the school began prior to 1965.
**Schools which are located in the Westdale subdivision.

increase in the population of Charleswood regardless of its distribution would cause an increase in the number of students and the resultant extra demand for the public school service could only be satisfied by means of adding to the capacity of existing schools and/or building new ones. In 1970, the first new school began to operate in the Westdale subdivision. Prior to that time, the existing schools in Charleswood were accommodating the students from this subdivision. To serve the entire area, these five schools were operating in a capacity higher than their rated capacity. Three extra schools were gradually built in the Westdale subdivision since 1970. The construction of these new schools and the extension of the existing schools provide a better, more convenient service to the area.

Since the distance between the two alternative sites is not great enough to affect the costs of building erection, construction costs would not differ in the Westdale subdivision, nor in the chosen scenario. However, the transportation costs for the Westdale student who enrolled in schools two to three miles away, for the period between 1965 and 1970 is an additional cost factor.[20] Since the major focus of this study is on the incremental costs to the government, the issue is not discussed here.

Police Services

According to the Police Department of the City of Winnipeg, one police car patrols throughout Charleswood, under ordinary circumstances. Having the Westdale subdivision established away from the rest of the residential development of Charleswood causes a drop in the level of service. As the population is distributed over a large area, the possibility of the police's presence at or near the location of a crime or an emergency decreases. At the same time, the cost per trip for a patrol car is higher when the area of inspection is greater. The incremental costs are due to more consumption of fuel and the faster depreciation of the vehicles.

Due to the nature of the service and the irregualr basis for the number of trips and time per trip, an accurate estimation of the incremental costs imposed by the Westdale subdivision on the government in providing this service could not be formulated.

Fire Services

The Fire Department of the City of Winnipeg advised that this service is offered based on the co-ordination of activities of all stations in a city-wide dimension. In other words, in the event of fire in any location of the city, the needed vehicles and manpower will be mobilized from all fire stations depending on the dimension of the fire. Therefore, the location of the Westdale subdivision will not significantly increase the cost of provision of this service. However, the discussion of the drop in the level of service and extra costs of longer trips, as mentioned earlier in the case of police service,is valid for this service as well.

Summary

Among the nine infrastructure facilities which are under investigation in this study, the development of the Westdale subdivision has a more obvious cost differential effect on telephone, water supply, street networks and public transit systems. For the hydro, sanitary sewer, and police and fire protection services, although there is evidence of the effect of the Westdale subdivision location on performing the services with higher costs, the cost estimation for them is avoided because of the lack of sufficient data and the infeasibility of measuring the cost additive variables. Only in the case of public schools does the cost to government not seem to vary with distance. The costs of providing this service appears to be a direct function of population size.

Table 4 summarizes the cost of provision and/or extension of these services for the Westdale subdivision.

TABLE 4

The Total Distance-Related Cost of Providing Infrastructure Facilities for the Westdale Subdivision (1971 Dollars)

Telephone *	$429,409.46
Hydro	N/A
Water Supply **	914,237.46
Sanitary Sewer	N/A
Street Networks *	212,822.47
Public Transit System *	421,845.16
Public School	N/A
Police Protection	N/A
Fire Protection	N/A
TOTAL	$1,978,314.53

*Capital and operating costs.

**Only capital costs.

Footnotes

[1]Charleswood News Editorial [Winnipeg, Man.] February 1967.

[2]Ibid.

[3]The Metropolitan Corporation of Greater Winnipeg, Charleswood Detailed Area Plan, Planning Division, Winnipeg, 1970, p.5.

[4]For detailed land use statistics, see Appendix B.

[5]The density is calculated based on the population of Charleswood in 1971.

[6]Metropolitan Corporation of Greater Winnipeg, Charleswood Detailed Area Plan, Winnipeg, December 1970, p. 51.

[7]For more detailed information on the agreement and the agreement and the proposed level of services, see Appendix A.

[8]Department of Environmental Planning, Building Permit Division, Winnipeg, Manitoba.

[9]Statistics Canada, "Electoral Districts by Age Groups and Sex," 1971, pp. 2933-2934.

[10]Land Titles Office, Winnipeg, Transfer No. G49162, Certificate No. A-45187.

[11]The estimate of land value in the eastern part of Charleswood is based on the interview with local real estate agencies. It should be noted that some land owners were asking a considerably higher price, thus effectively precluding any profitable land use and why.

[12]Appendix C, Section I.

[13]Coded from the agreement between the Rural Municipality of Charleswood and Parkland Ltd. Company, Section 4.F.iii, 1964, p. 4.

[14]Department of Parks and Recreation, City of Winnipeg.

[15]The costs of maintenance and reparation of the concrete pavements and curbs is ignored due to the small amount.

[16]Although interviews with transportation planners of the city indicated that development of

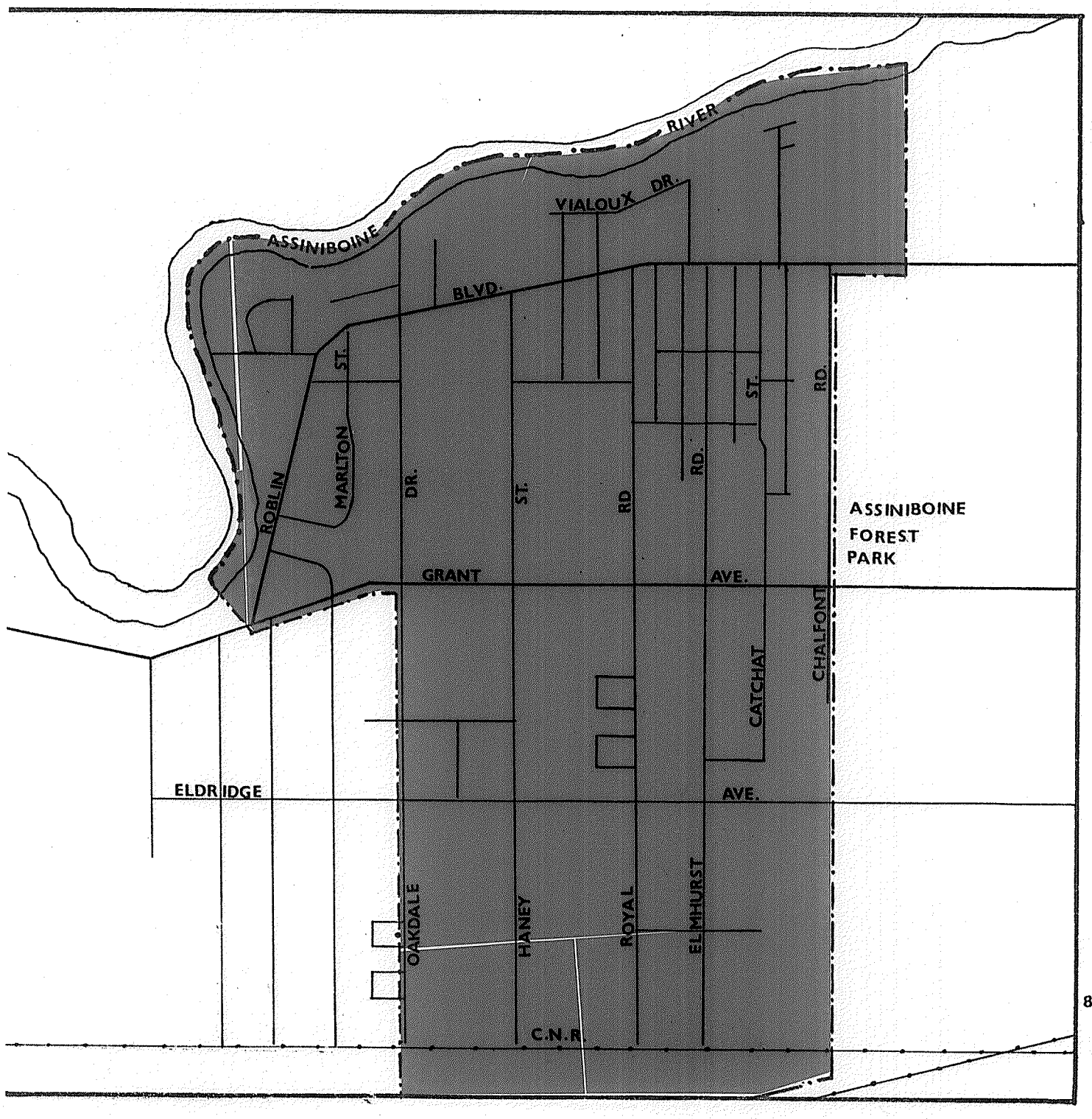
the Westdale subdivision was substantially responsible for widening of Roblin Boulevard, here, user percentage is taken as the criteria for prorating the total cost of the project.

[17]For detailed calculations, see Appendix C, Section II.

[18]The City of Winnipeg, Financial Results from Transit Operations, 1971, current estimate.

[19]The City of Winnipeg Transit Department, March 1977.

[20]According to the Assiniboine South School Division #3, the existing schools did not provide the transportation fund. These costs were imposed on students.



SCENARIO AREA

«CENSUS TRACT 522»

LEGEND

CENSUS TRACT 522

MAP 8

CHARLESWOOD

800 400 0 1600

FEET

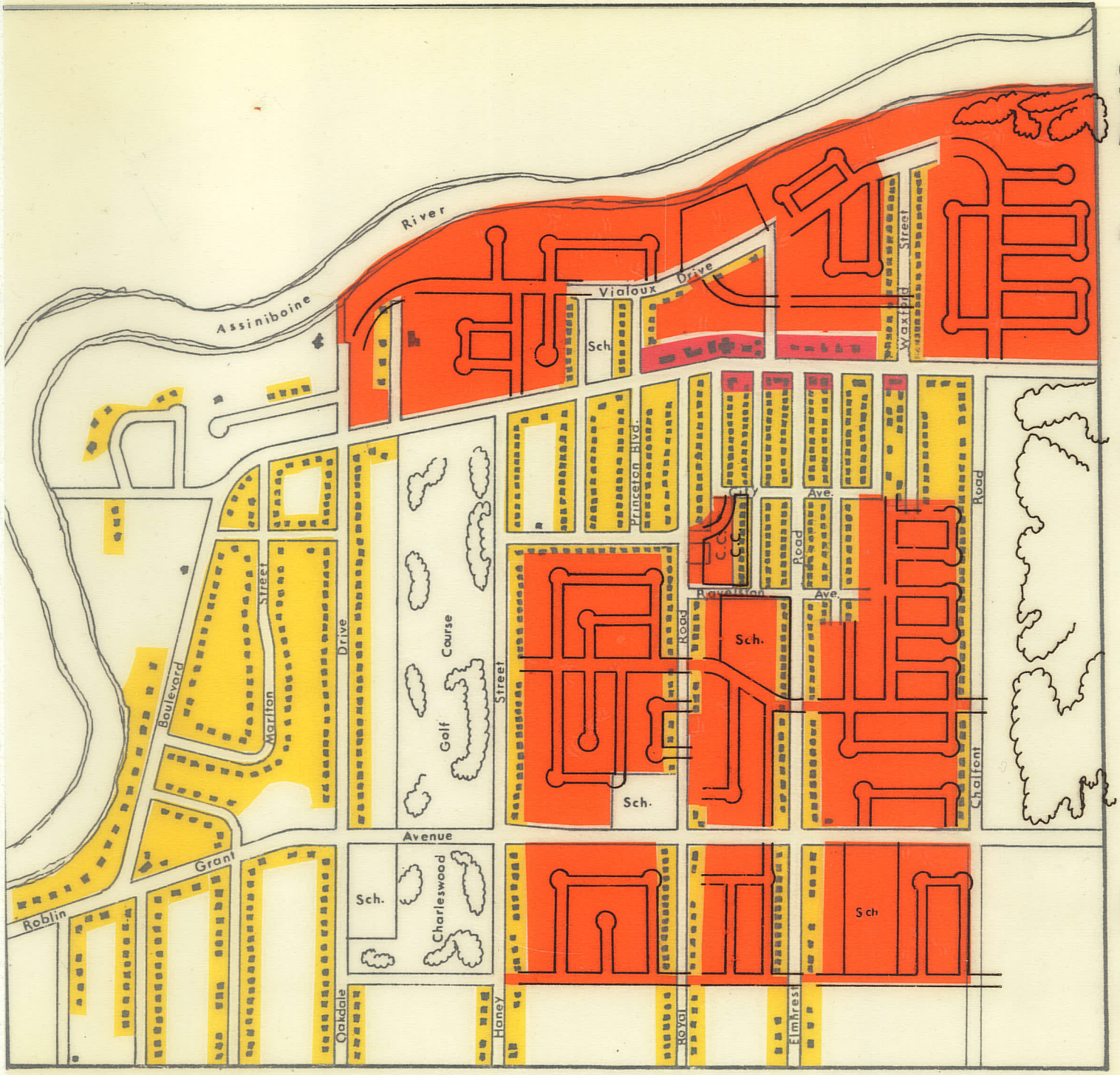
CHAPTER THREE

THE SCENARIO

Growth Pattern in the Scenario Area in 1965

The area of Charleswood indicated by Census Canada as Census Tract No. 522, which is referred here as the eastern part of Charleswood, is the original area of development in Charleswood (Map 8).[1] In 1965 this area was characterized by a small linear commercial core on Roblin Boulevard surrounded by older dwelling units. Residential development was confined to single family homes set on large lots in a semi-rural environment. Houses had been built along the street frontages throughout the area, leaving tracts of undeveloped land in the middle of the blocks. In addition to these narrow strips of vacant land between built-up frontages, a number of larger parcels of vacant land were in existance in the Charleswood East area (Map 9).

Residential development in the area between Roblin Boulevard and the Assiniboine River can be described as a strip of houses along Waxford Street frontages and a number of houses here and there along Vialoux Frive, McQuaker Drive and Ridgedale Crescent. South of Roblin Boulevard, a grading pattern had been developed in a small area bound by Varsity View Drive, Ravelston Avenue and Cathcart Street. For the rest, ribbons of houses were built along the existing streets. The strips of shops on the two sides of Roblin Boulevard were mainly concentrated between Waxford Street and Varsity View Drive. When the development of the Westdale subdivision began at its present site, a



SCENARIO AREA-1965 DESIGN

LEGEND

C.C. COMMUNITY CENTER

Sch. SCHOOL

RESIDENTIAL

COMMERCIAL

PROPOSED SITE

MAP 9AB

CHARLESWOOD

400 200 0 800

FEET

part of the existing 843.34 acres of vacant land south of Roblin Boulevard and the area between the Assiniboine River and Roblin Boulevard in the eastern part of Charleswood could accommodate the projected housing and facilities of the Westdale subdivision.

On the other hand, by means of an infilling process, the sprawled pattern of this area could be repaired to some extent; a more efficient utilization of land and services could be achieved, and as it will be shown later in this study, the government could be economically better off by saving on the cost of providing infrastructure facilities. The site for the scenario, therefore, is selected from the parcels of land available in 1965 in this area of Charleswood. On the average, the scenario site is about 2.5 miles away from the Westdale subdivision.

The Scenario Design

An area of 332.5 acres of land is selected for the scenario site. This is equivalent to the land which had been used for the development of the Westdale subdivision. Because of the nature of land use in the area, separated parcels of land adjacent to the existing built-up pattern had to be chosen for this purpose (Map 9A).

The concept of the design is mainly to achieve a degree of physical integration between the new elements of the development and existing pattern through infilling. In order to avoid the destruction of existing buildings, an attempt is made to extend the street layout in the directions which the open land allowed. From the aesthetic point of view, the design may not represent the optimum. This is partly due to the constraints which existing street patterns and scattered strips of buildings impose on the directions which new streets should follow, and partly because of the attempt to maximize the harmony of the new and old patterns of development (Map 9B). The extension of commercial facilities is proposed for the area adjacent to the existing shopping centre, between

Roblin Boulevard and Vialox Drive. Three schools are also assigned to serve the needs of the new population. The ultimate population for the scenario, the same as is the Westdale subdivision is assigned to be 4500 people. The residential development is considered to contain the same number of single-family dwellings and townhouses as in the case of Westdale.

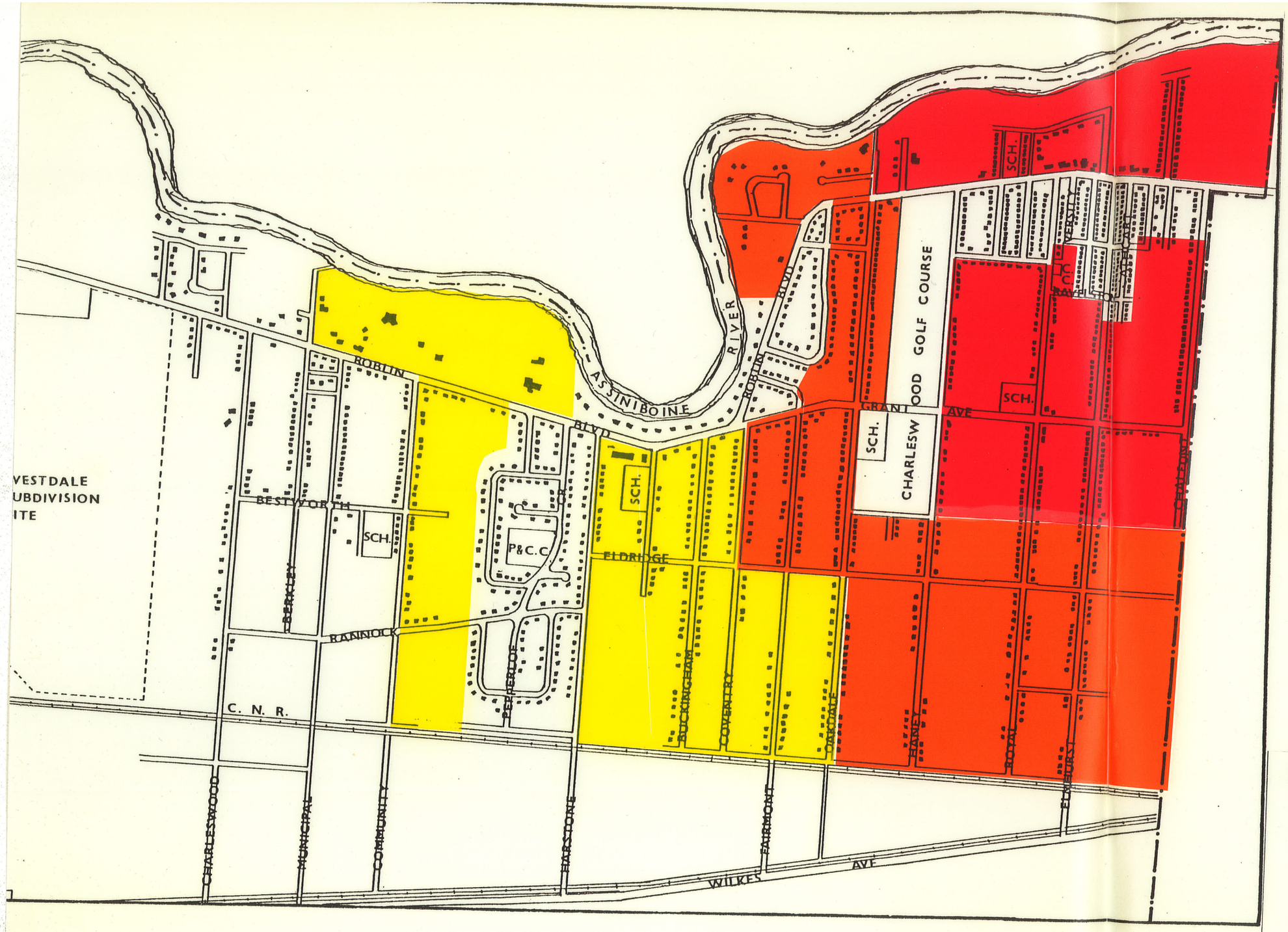
It is assumed that the construction schedule for the development of the Westdale subdivsion would be repeated identically in the scenario. While during the development of the Westdale subdivision, a number of residential constructions were occuring in the scenario in each year, the accumulation of all the completed dwelling units which had been constructed yearly in both sites would have pushed forward the date of completion of the infilling process in the scenario. Based on the figures in Table 5, the infilling process for the scenario would have been completed by 1973. In this case, phases of contiguous development could be followed to accommodate the preceding growth beyond 1973 (Map 10).

TABLE 5

Time Span for the Construction of Dwelling Units in the Westdale Subdivision and in the Scenario

Location	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Westdale	33	21	58	136	244	350	160	287	214	83	22	22	22
Scenario	6	10	21	39	34	52	30	29	72	102	12	9	9
Cumulative Total	39	70	149	324	602	1,004	1,194	1,510	1,792	1,981	2,015	2,046	2,077

Source: Department of Environmental Planning, Building Permission Division, Winnipeg, Manitoba, June 1977.



PROPOSED PHASES OF CONTIGUOUS DEVELOPMENT

LEGEND

- SCENARIO
- PHASE ONE
- PHASE TWO

MAP 10

CHARLESWOOD

400 0 800
FEET

The Test of the Scenario Design

The economic validity of the scenario design is tested by comparing the costs of providing the water distribution system in the scenario with similar costs in the Westdale subdivision. The Hardy Cross method is used for the design of water distribution in the scenario.[2]

Because the patterns of development of the scenario are located between the existing built-up areas, the new pipe network should be linked to the existing system. The size fo the pipes and the pressure in them is designed with the consideration of the water flow needed for consumption by the population of the scenario and the adjacent area. The system is designed, therefore, for a population of 8,034 people in 2,298 dwelling units (see Appendix D). A number of water mains were installed in some of the streets in the area prior to 1965. In the design of the system, these pipes, which are able to carry the new flow, are connected to the system and only in a few locations the existing four-inch pipes are reinforced with new pipes to satisfy the new demand.

The total capital cost for this water distribution network is estimated to be $1,007,097.53 (1971). This includes the cost of purchasing materials, installation and engineering fees. The costs of providing the same service for 1652 households of the Westdale subdivision are $1,003,340.52 (1971)[3], while the designed water distribution system for the scenario offers the adequate service to the population of the infilled area, and improves the level of service in the adjacent area. The close approxiamtion of its costs, in comparison to the costs of provision of the water distribution system in the Westdale subdivision, testifies to the validity of the scenario design. Although such a scenario should be evaluated for all attributes physical, econ-

omic, social and even psychological, it is beyond the scope of the present work to evaluate the scenario for all these variables.

The Costs of Provision and/or Extension of Public Infrastructure Facilities to the Scenario

Telephone Service

As it is indicated in Chapter 3, the costs of providing and operating the telephone service varies with the distance of the distribution centre from the receiver. According to the Manitoba Telephone System, had the population of the Westdale subdivision been accommodated in the scenario, the installation of 5,000 feet of cables and conduits would provide the same level of service. The initial costs of installation of the same number of telephones in the scenario, therefore, would be $82,137.44 (1971), or $49.72 (1971) per subscribership.[4]

The cumulative total of the annual operating costs of providing the telephone service in the scenario is tabulated as shown in Table 6.

Since the development of the scenario would have been completed in 1973, the annual operational costs beyond this date would be constant annually. The overall capital and operative costs of providing the telephone service for the scenario, therefore, were $130,273.76 (1971).

Water Supply

The amount of water needed for the scenario site residents' consumption could have been supplied from the existing feeder water mains in the area, from Feeder Points A and B, in 1965 (Figure 4). Therefore, the development of the alternative scenario would have required no additional

TABLE 6

Annual Operating Costs of Providing Telephone Service for the Scenario 1965-1977[1]

(1971 Dollars)

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	Total
Number of Dwelling Units[2]	39	70	149	324	602	1,004	1,194	1,510	1,652	1,652	1,652	1,652	1,652	1,652
Annual Cost per Telephone ($)	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	2.66	--
Cumulative Total Cost($)	142.74	256.20	545.34	1185.54	2203.32	3,674.64	4,370.04	5,526.60	6,046.32	6,046.32	6,046.32	6,046.32	6,046.32	48,136.32

1. For detail of calculations, see Appendix C, Section I

2. Number of subscriberships is assumed equal to the number of dwelling units. The commercial subscriberships are not included in the calculations

Sources: Department of Environmental Planning, Building Permission Division, Winnipeg, Manitoba, June 1977.

Manitoba Telephone System.

capital investment for this purpose. It would also have saved government the implicit costs of premature extension of the feeder water main through the sparsely populated areas of Charleswood.

Street Network

According to the Traffic Department of the City of Winnipeg, traffic generated due to the development of the scenario site could have been sufficiently carried by the two existing main arteries, Roblin Boulevard and Grant Avenue. Assuming the movement characteristics of the scenario residents to be the same as those of the Westdale residents, 96.46 percent of this population would have commuted eastward to the various activity centres of the city through these routes.[5] Interviews with transportation planners of the Department of Transportation Planning of the City of Winnipeg also indicated that the development of the scenario would have eliminated the immediate need for widening Roblin Boulevard and would have prevented the associated extra costs.

Public Transit System

Because of the scattered pattern of development in Charleswood, the existing buses always operate below their "efficient design load".[6] If the development of the Westdale subdivision had occurred in the scenario, the service would have been offered in a smaller and more densely populated area. Therefore, the same level of service could have been provided with a smaller number of buses, and this more efficient use of the bus system would have increased the revenue per trip for each bus. In other words, by having the population of Westdale accommodated in the scenario site, the government could have saved the costs of operating one bus, and at the same time, would have saved on the net operating loss for the remaining buses.

As already explained in Chapter 3, capital and operating costs of infrastructure facilities

such as hydro, sanitary sewer, police and fire protection differ with distance. Hence, the government's costs of providing these utilities would have been less in the scenario alternative. However, due to lack of sufficient information in these areas, the associated costs in both locations are not quantified.

Summary

The scenario site is located about 2.5 miles closer to the city's core. The infilling process of the scenario would have caused concentrations of additional construction activities in remaining parcels of vacant land in the eastern area of Charleswood, and would have given more discipline to the physical pattern of the area.

Considering the quality and quantity of the infrastructure facilities in the entire area of Charleswood in 1965, the accommodation of the population of the Westdale subdivision in the scenario development would not have imposed additional costs to the government in the provision of services such as water supply, sanitary sewer, hydro, public transit and street network. The capital and operating costs for telephone service in the scenario would have been $130,273.76 (1971); police and fire protection would have cost less; and, public school service would have had the same cost for the government in both locations.

Footnotes

[1]See also, Appendix B.

[2]The program for the Hardy Cross Method, which allows the use of computer in calculating pressures and flows in a pipe system, was developed by the Department of Civil Engineering at Queen's University in Kingston, Ontario.

[3]This figure is calculated by Templeton Engineering Company, the consultant to the Rural Municipality of Charleswood, who designed and supervised the project.

[4]For detailed calculations, see Appendix C, Section I.

[5]The City of Winnipeg Traffic Department, "Vehicle Intersection Count Study," 1975.

[6]According to the City of Winnipeg's Transportation Planning Department, 75 passengers per bus is considered as "efficient design load".

CHAPTER 4

COST EVALUATIONS

Introduction

The two preceding chapters have demonstrated the monetary costs of providing infrastructure facilities for the discontinuously developed subdivision of Westdale, as well as for the contiguous alternative--the scenario. In this chapter, the proposed hypothesis will be tested by means of comparing the costs. Whereby, the least cost alternative in terms of provision of public infrastructure facilities by government will be ascertained. The only variable factor for the two alternatives is their location, while the level of service, physical features and socio-economic characteristics of the scenario are assumed identical to those of the Westdale subdivision. Therefore, the cost differentials are directly related to the distance of each site from the existing utilities.

In economic terms, the proper alternative is the one with greater benefit/cost ratio. Since one aspect of the public sector is to provide a certain level of infrastructure services for the residents of urbanized areas, the benefits in this issue can be defined as the achieved level of service which is taken as constant. The cost, then, is the monetary value of the resources used to provide these services, and the best alternative is the one with least cost. In this study, the cost variations are discussed as direct costs in the form of capital and operating costs of providing infrastructure facilities and the opportunity cost of this money not being used in a better way.

Direct Costs

The capital and operating costs involved in the provision and/or extension of each service for the alternative sites will be compared in this section.

Telephone Service

The Westdale subdivision is approximately 2.4 miles away from the telephone distribution centre which provides the service for the area. This distance required the Manitoba Telephone System to install 12,000 feet more cables and conduits than would have been required if the service were offered in the scenario. The extra capital cost used for this purpose was $197,116.64 (1971). That is, each subscribership in the Westdale subdivision imposes $119.32 extra capital cost on the government.[1] The increase in operating costs due to this distance is $14.16 (1971) per year for each telephone. Table 9 summarizes the annual operating cost of telephone service for each site during the period 1965 - 1977. It is indicated here that as the number of subcribers increased, the difference between the annual costs of operating the telephone service in the two locations becomes greater.

Development of the Westdale subdivision at its present site caused an overall extra capital and operating cost of $301,164.18 (1971) for the government during the period between 1965 and 1977.

Water Supply and Sanitary Sewer

As indicated in Chapter Three, the scenario could have been serviced adequately by the available feeder water main system in the area. The development of the Westdale subdivision caused the installation of 9460 feet of feeder water mains with the total capital cost of $914,237.16 (1971)

TABLE 7

Comparison of Operating Costs of Telephone Service for the Westdale Subdivision and the Scenario
(1971 Dollars)

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	Total
Westdale Subdivision	411.18	672.84	1395.52	3090.00	6130.32	10491.32	12484.92	16060.92	18727.38	19761.56	20053.68	20309.80	20583.92	48136.32
Scenario	142.74	256.20	545.34	1185.84	2203.32	3674.64	4370.04	5526.60	6046.32	6042.32	6046.32	6046.32	6046.32	150155.38
Difference	268.44	416.64	850.18	1904.16	3927.00	6816.68	8114.88	10534.32	12681.06	13712.24	14007.36	14263.48	14537.60	102019.06

Sources: 1. Manitoba Telephone System.

2. Building Permits Division, Department of Environomental Planning, City of Winnipeg.

throughout the area.

For sanitary sewers, in the case of this study, because of the regional nature of the service and the location of the two alternative developments in relation to the treatment plant and interceptors, no cost differential was developed. But it should be noted here that the efficiency in the use of such services as water and sewer decreases when they are prematurely extended through a large area of low density. This is due to the following facts: firstly, when the density is low, a given population occupies a greater area, and to provide the service, more length of pipe should be installed throughout the area. Secondly, smaller numbers of people using a given quantity of the service in an area raise the per capita cost of provision of that service. These costs are not included in this study.

Street Network

The cost differential with regard to the street network for the two alternative developments is summarized in the related capital and operating costs of upgrading and widening Roblin Boulevard. As indicated in the preceding two chapter, the traffic movement generated by the residents of the scenario could have been carried through existing street systems of the area, while the development of the Westdale subdivision required extension of this service and had intensified the need for widening of the boulevard. The degree of influence of the Westdale development on implementation of this project is indicated by means of user percentage and the total costs are prorated with this assumption. The additional costs due to development of the Westdale subdivision therefore, is determined to be $212,822.47 (1971) or 21.33 percent of the total.

Public Transit System

Study of the public transit sytem indicates that having the population of the Westdale subdivision accommodated in the scenario site would have saved the government the capital and operating costs of one bus without any drop in the level of service. In other words, the leap-frogged subdivision of Westdale has been $421,845.16 (1971) more costly for the public sector since 1967.

Public Schools

The distance between the two alternative developments is not great enough to affect the construction costs. Therefore, the distance-related costs with regard to public schools are only the costs of transporting students from and to their homes. Since the transportation services for the commuting students of the Westdale subdivision were not provided by this public institution, in the particular case of this study, neither of the two alternatives impose additional costs on the government as far as distance parameter is concerned.

Fire and Police Services

Comparison of distance-related costs of providing polic services for the two alternative residential developments requires an estimate of both travel costs involved in trips between police station and each of the two sites, and the exact number of trips taken annually. Lack of data in this area prevents any significant comparison of the costs. However, casual observation reveals that having the Westdale subdivision developed in a remote location would enlarge the service area and increase the travel costs per trip. These incremental costs would be avoided if the enlargement of the service area were prevented by encouraging the infilling process of the scenario.

For fire services, as in the case of police services, estimates of distance-related costs require information concerning both cost per trip and number of trips between fire station and the two sites. Since this particular service involves the co-operation of all fire stations throughout the city, precise estimation of cost variations with regard to the distance between the Westdale subdivision and the scenario seems unfeasible. However, it can be argued that if the expansion of the city follows a contiguous pattern of development, the resultant compactness would decrease the distance and provide a better level of service for fire protection with less cost.

Summary of Direct Cost

TABLE 8

Comparison of the Distance-Related Costs of Providing Infrastructure Facilities for the Westdale Subdivision and the Scenario (1971 Dollars)

	Westdale Subdivision	Scenario	Additional Distance-Related Costs Due to the Location of Westdale
Telephone*	$ 429,409.46	$130,273.76	$ 301,164.18
Hydro	N/A	N/A	N/A
Street Networks*	212,822.47	--	212,822.47
Public School	--	--	--
Public Transit*	421,845.16	--	421,845.16
Water Supply**	914,237.46	--	914,237.46
Sanitary Sewer	N/A	N/A	N/A
Fire	N/A	N/A	N/A
Police	N/A	N/A	N/A
Total Cost	$1,978,314.53	$130,273.76	$1,848,040.79

*Capital and operating costs.

**Only capital costs.

As indicated in Table 8, total additional distance-related costs which contributed to the development of the Westdale subdivision was $1,848.040.79 (1971). This sum includes only the direct costs of four items: telephone service, water supply, street network, and public transit, for which available data permitted cost estimations. Although lack of presentable data in the case of some utilities and/or special situations of other utilities in relation to the study prevented development of cost comparisons with the exception of public school, the capital and operating costs for the rest of the infrastructure facilities which are under investigation in this study are recognized to increase with distance.

In terms of operating cost, telephone and public transit system appear to impose more additional costs on the government. Operating costs for fire services should be less than those for police services because fire vehicles respond only to alarms, while police vehicles also perform a patrolling function. Finally, provision of water supplies for the Westdale area had resulted in the greatest capital cost to the government.

Opportunity Costs

The preceding part of this chapter indicates the additional direct costs which the discontinuously developed subdivision of Westdale imposed on the government. By having the development of the Westdale subdivsion accommodated in the scenario site, the government's direct cost savings in the capital and operating costs of providing infrastructure facilities would amount to $1,848.040.79 (1971). This sum only resembles the explicit portion of the total cost savings which government could gain by not having allowed this residential development to occur discontinuously. Based on our definition, actual amount of cost savings is the accumulation of the additional direct costs involved in the provision of infrastructure facilities and the implicit opportunity costs of this capital.

The concept of opportunity cost emphasizes the problem of choice by measuring the cost of obtaining a quantity of one commodity in terms of quantity of some other commodity that could have been obtained instead. In their book, Economics, Lipsey and Steiner explained the principle of the opportunity cost as follows:

> The cost of using a factor in a particular venture is the benefit forgone (or opportunity lost) by not using it in its best alternative use.[2]

The investigation of the best possible alternative use of the capital saved from the costs of providing the infrastructure facilities is not the concern of this thesis. In the case of this study, the opportunity cost is being assumed as the return that government could have gained if it had not used this capital on the extension of utilities to the Westdale subdivision, but had invested it each year, at prime interest rate of the Bank of Canada in the period from 1965 to 1977.

The cost of capital in real terms (constant dollar term) is assumed to be constant in order to eliminate the effect of the inflation on this real money value. The opportunity costs, then, are calculated based on the compound interest gained from the total capital investiments in each year, for the period between that year to 1977.[3] As indicated in Table 9, the opportunity costs of the additional capital involved in the provision of the utilities for the Westdale subdivision amount to $2,968,285.00 (1971).

The Hypothesis

Based on the analysis and comparison of the distance-related costs of providing the necessary infrastructure facilities for the two alternative sites, the government, in order to service 4509 residents of a discontinuously developed subdivision has spent an additional cost of

TABLE 9

Distance-Related Incremental Direct and Opportunity Costs of Providing Infrastructure Facilities for the Westdale Subdivision 1965-1977

(1971 Dollars)

	DIRECT COSTS												Opportunity Costs[2]		Total
	Street Networks*			Telephone System*			Water Supply**			Public Transit System*					
Year	Westdale Subdivision (1)	Scenario Site (2)	Incremental Distance-Related Costs (1)-(2)=(3)	Westdale Subdivision (4)	Scenario Site (5)	Incremental Distance-Related Costs* (4)-(5)=(6)	Westdale Subdivisions (7)	Scenario Site (8)	Incremental Distance-Related Costs (7)-(8)=(9)	Westdale Subdivision (10)	Scenario Site (11)	Incremental Distance-Related Costs (10)-(11)=(12)	Total Incremental Distance-Related Costs 3+6+9+11=(13)	The Bank of Canada Prime Interest Rate in each year (14)		(13)+(14)=(15)
1965				$279,665.26	$ 82,280.18	$119,413.56	$914,237.46	--	$914,237.46				$1,111,622.54	(1,111,622.54)(1.046)[12]	= $1,906,942	$3,018,564.54
1966				672.84	258.20	416.64							416.64	(416.64) (1.052)[11]	= 727	1,143.64
1967	$155,817.18	--	$155,817.18	1,395.52	545.34	850.18				$ 20,087.86	--	$ 20,087.86	176,755.86	(176,755.22) (1.051)[10]	= 290,669	467,424.22
1968	49,236.49	--	49,326.49	3,090.00	1,185.84	1,904.16				40,175.73	--	40,175.73	91,406.38	(91,406.38) (1.067)[9]	= 163,853	255,259.38
1969	853.20	--	853.20	6,130.32	2,203.32	3,927.00				40,175.73	--	40,175.73	44,955.93	(44,955.93) (1.075)[8]	= 80,177	125,132.93
1970	853.20	--	853.20	10,491.32	3,674.64	6,816,68				40,175.73	--	40,175.73	47,845.61	(47,845.61) (1.067)[7]	= 75,334	123,172.61
1971	853.20	--	853.20	12,484.92	4,370.04	8,114.88				40,175.73	--	40,175.73	49,143.81	(49,143.81) (1.052)[6]	= 66,613	120,322.99
1972	853.20	--	853.20	16,060.94	5,526.60	10,534.34				40,175.73	--	40,175.73	51,563.27	(51,563.27) (1.047)[5]	= 64,874	116,437.27
1973	853.20	--	853.20	18,727.38	6,046.32	12,681.06				40,175.73	--	40,175.73	53,709.99	(53,709.99) (1.061)[4]	= 68,063	121,772.99
1974	853.20	--	853.20	19,761.56	6,046.32	13,715.24				40,175.73	--	40,175.73	54,744.17	(54,744.17) (1.087)[3]	= 70,311	125,055.17
1975	853.20	--	853.20	20,035.68	6,046.32	13,989.36				40,175.73	--	40,175.73	55,018.29	(55,018.29) (1.086)[2]	= 64,888	119,906.29
1976	853.20	--	853.20	20,309.80	6,046.32	14,263,48				40,175.73	--	40,175.73	55,292.41	(55,292.41) (1.09)[1]	= 60,268	115,560.41
1977	853.20	--	853.20	20,583.92	6,046.32	14,537.60				40,537.73	--	40,175.73	55,566.53	(55,566.53) (1.077)[0]	= 55,566	111,132.53
Total	$212,822.47		$212,822.47	$429,409.46	$130,273.76	$301,164.18	$914,237.46	--	$914,237.46	$421,845.16	--	$421,845.16	$1,848.040.79		$2,968,285	$4,816,325.79

*Capital and operating costs.
**Only Capital cost.

To calculate the opportunity costs from the period from 1965 to 1977, the Bank of Canada Interest Rate is used for each year.

$4,816,325.00 (1971) since 1965. The hypothesis is accepted: a contiguous development pattern in suburbia, as it is suggested in this study as the scenario, saves government the costs of infrastructure facilities. Of course, this fact alone is not surprising; however, the magnitude of the cost difference is significant. The fact that the sum of $4,816,325.00 (1971) is the incremental cost generated only by 1652 dwelling units declares the importance of the problem in a city-wide scale.

By the implementation of phases of continuous development in the Charleswood area, after 1973, the year of completion of the infilling process of the scenario, the government's cost savings would have increasingly continued (Map 10). Because the existing infrastructure facilities would have been utilized more efficiently, the premature extension of services which require government's early investment for the future would have been avoided. With the lack of controlling policies, the increasing number of developments in the fringe area will continue their undisciplined and scattered settlement over this area; the provision of services will become excessively expensive; and, the city's fiscal crises will become more and more inevitable.

As it has been described in the preceding chapters, the incremental cost to government is only one of the ways that sprawl in suburbia affects cities. Other direct and indirect effects of this phenomenon upon urban society in the form of social costs such as deterioration of the central city and the negative externalities to its residents, environmental hazards and economic losses of the occupants of sprawled areas are significant issues needing more investigation.

Footnotes

[1]See Appendix C, Section I.

[2]Richard G. Lipsey and Peter O. Steiner, Economics, Harper and Row Publications, New York, 1966, p. 199.

[3]Compound Interest: with simple interest, the amount of interest earned is based on the initial value of the loan and is due at the end of the loan period. With compound interest, the life of a loan is divided into a number of interest periods (e.g., one year). At the end of the first period, the earned interest is calculated and added to the initial value of the loan. The sum is then considered to be the value of the loan for the second period. In this way, the interest earned during each period, in turn, earns interest during the following periods. The following formula is used for calculation:

$$F = P(1 + i)^n$$

where F = a future sum of money, P = present amount or principal, i = interest rate per period, and n number of interest periods.

CHAPTER FIVE

SUMMARY, POLICY OPTIONS, CONCLUSIONS

SUMMARY

In this research the effect of urban spatial structure on utilization of urban resources was investigated. Specifically, the study dealt with the distance-related incremental costs which are imposed on the public in providing various infrastructure facilities for discontinuous residential development in suburban areas of Winnipeg. The leapfrog subdivision of Westdale was being compared with a hypothetical subdivision 2.5 miles closer to city core and adjacent to urbanized area. The services which were investigated in this study include: fire and police protection, school facilities, water supply and sanitary sewer services, telephone, hydro, and street networks. Cost estimates were possible only for telephone service, water supply, street networks, and the public transit system. While lack of data and/or the special nature of the service prevented quantification of the government incremental costs for other services, with the exception of school service, it was understood that for the reamining infrastructures, the capital and operating costs are similarly responsive to distance.

The study examining the residential development in suburban areas, demonstrates the following:

Firstly, that the private sector, in absence of effective and rational public policies is

given a great amount of freedom of choice in the location and timing of development. Naturally, this freedom exacerbates the undisciplined development pattern of suburbia. Meanwhile, the lack of coordination and communication among various government agencies leaves public policies ineffective. Subsequently the private sector, taking advantage of the resulting uncertain conditions implements its own decisions, which are usually not directed toward the common good, but personal gains.

Secondly, the study shows that the decisions of the private sector on the location of residential development affect public sector expenditures. When the developer leapfrogs in order to benefit from the advantages occurring from the development of remote land, the governmernt has to spend more to provide the infrastructures for that development. It has been shown that the public sector had spent $1,848,040.00 more in terms of direct cost servicing the Westdale subdivision in the last 13 years. In addition, the opportunity cost on this amount for the same length of time equals $2,968,285. In other words, the government would have been $4,816,325 better off had the development of the Westdale subdivision not been permitted to occur at its present site. This means an average annual cost saving of $224.00 per dwelling unit. Although the cost estimates cover only four utilities, and although at the time of cost extimation it was intended to minimize the costs by quantifying them critically, the government losses are very significant.[1]

Thirdly, new residential development takes place only where there is an adequate range of readily available public infrastructure facilities, i.e. trunk sewers, watermains, etc.

Fourthly, it was demonstrated that the additional costs of providing infrastructure facilities for outlaying areas are distributed over the entire city. These costs are subsidized using the general public revenue and subsequently the benefit is being transferred to remote dwellers,

rather than to inner city residents.[2] While the results of this research show significant incremental distance related costs to the government, other losses which are involved in this particular area should not be understimated. These losses, in terms of environmental, social and psychological costs, although not analyzed in this study, are substantial and give rise to a number of questions.

- How do costs vary with density?
- What are the social costs to the occupants of sprawled areas, and to the residents of central city?
- What are the criteria to measure these costs?
- To what extent and in what ways does sprawl in suburbs affect the deterioration of the central city?
- What are the future environmental losses and aesthetic problems?
- How do these elements affect the physcial and social integration of the city?
- Does the resultant undisciplined physical form cause personal and social behaviour malfunctions?

The issue is not new. Some of these questions have been partially explored and answered, but the problem still exists. A series of further studies should be undertaken in order to demonstrate the magnitude of the impact of this phenomenon on urban life, to aim at the roots of the problem by showing what insitutions are involved, and to investigate the possible solutions to the problem. The remaining part of this chapter will discuss public policies which may be used to constrain sprawl. This discussion is presented not as a firm policy recommendation, but as a framework for further research.

Policy Options

Since the private sector influence results in increasing expenses to the public sector, the government must assume a stronger position in the control and regulation of urban growth.

Initially, in the specific case of Winnipeg, the city must redefine and re-evaluate its philosophy toward the concept of "Freedom" and "Restriction of Freedom". Controlling regulations and restrictions, if rationalizing the growth, and if preserving public interest are justified within any doctorine. Benefits to society as a whole may be much more imporatnt than benefits for particular groups in the world of social justice.

Zoning, Development Plan, Taxation, and Infrastructure Planning are four obvious areas of policy through which the public sector can control suburban growth, and subsequently constrain sprawl. Here these policies will be explored briefly.

With regards to timing and location of residential development, land use control policies, through implementation of zoning regulations can effectively be utilized by planners. Theoretically, zoning is a tool in rationalizing the use of land in a community by zones or districts. Then, why has it never been used effectively to rationalize the pace and location of new developments? Is it that the nature of this device creates the problem? Is it the ways in which zoning is being implemented? Or is it both? Perhaps a better result would be achieved, if zoning was implemented in conjunction with other land use control policies such as the Development Plan.[3] The development plan poses an opportunity for more controlling power and the ability to formulate general policies for a greater area. Application of zoning devices following land use guidelines established by a development plan, may give more power to zoning by reserving the right of final approval of development and construction for the planning body. For example, undesirable areas for residential development can be zoned agricultural, while the rezoning right is saved for

proper time and proper use.

Moreover, the implementation of land use control policies in isolation may not be effective enough. Real estate tax policies must be coordinated with planning goals. For example, if the continuation of agricultural land use in an urban area is recognized of public interest, the tax deferral may be a preferable method to outright zoning.[4] We showed in this research that sprawl is partially caused by underassessment of land which allows speculators to withhold desirable land from the market, thus forcing premature subdivision further out. Tax policies should be oriented to operate against this phenomenon.

The fact that the value of unimproved suburban land increases from the monies which the public has invested into provision of infrastructures must be given high consideration in studies of tax policies. In this category of research some strategies must be developed to prevent the intensification of speculative activities in the areas beyond the boundaries of the influence of land use control policies.

Planned extension of infrastructures is another potentially significant means of guiding and controlling urban growth. If a logical extension of public services could be provided, much of the problem of urban sprawl could be solved. Utility extension is not simply an engineering matter, it is the responsibility of planners to plan for a rational extension of the infrastructures and to use this as a tool to encourage or discourage growth. The criteria for this set of policies may place emphasis on economical provision of infrastructures. That is, the service must be extended logically and the scattered subdivisions must be avoided in favor of contiguous developments. The extension of services must be incorporated with the land use of the area and with the pace of growth. Some schedules should be set up for extension of services to particular areas, and related agencies should refuse to extend services to other areas, until each area served has

been built up to an appropriate level.[5] Further research is required to investigate various alternative strategies for implementation of the policy, and to study its effects on land value structure and on speculative activities.

The fact that all these policies which were outlined above act within a political realm, should be given high consideration. For example, with regards to development plan, the assumed flexibility may be manipulated by politicians, developers or other interested groups and may leave the plan ineffective by resultant changes. Sometimes the implementation of these policies suffers from the absence of legal power to uphold the device. Studies with regard to these shortcomings will be of great benefit.

Conclusion

The further investigation in the nature, benefit, and shortcomings of what has been discussed above may lead to some probable solutions, or may declare the need for additional initiative and active participation of the public sector in various levels of urban development activities.

We have explored four policy options: zoning, development plan, taxation and infrastructure planning. Future research should show relative strengths and weaknesses of each policy, and should indicate which combination of policies will best control sprawl.

If the forthcoming studies reveal that developers and other private institutions involved in urban development are getting too strong to be controlled only by such policies which we had discussed, the public sector then may explore the possibility of implementing such additional control devices as large scale land assembly or direct participation in housing industry.

The major issue is to avoid accepting sprawl as a natural phenomenon of urban growth. Sprawl is not natural, it is the by-product of irrational activities of developers and land speculators, in absence of effective planning. The existance of this problem and the magnitude of the resultant losses shall be demonstrated repetetively in order to keep the presence of the problem in mind, and to show the urgent need for immediate response. The results of these studies should not be kept isolated in the academic world, but should be clearly explained to the public in order to obtain their support in implementation of control policies. Such an awareness will encourage public participation, and strenghten the position of the decision makers.

Footnotes

[1]It should be re-emphasized here that this study deals with one subdivision and with approximately 2.5 miles distance. Obviously the cost differentials for government will be of much greater magnitude if the investigator had included all current residential activities in the entire suburban areas of Winnipeg.

[2]For example, with regard to telephone service, 2.5 mile distance imposes a total of $133.48 (see Appendix C, Section I) incremental capital and operating costs per dwelling unit annually on government.

[3]The purpose of Development Plan is to present the policies, and proposals designed to achieve the State Planning aims for the area. The aims of the Plan should be designed to satisfy social and economic aspirations as far as possible, through the creation of an efficient physical structure, and a good environment.

[4]Tax deferral measures are mostly used to ease the burden upon farmers and also to recoup the taxes when the property is transferred to another use. The agricultural land is assessed at a higher non agricultural use rate, but the tax is not paid until the use changes to non-agricultural. This is a good solution for situations where a farmer in an urban area really wants to continue farming.

[5]Economic measures can be related as indicators of the "appropriate level".

APPENDIX A

Summary of Agreement between
Rural Municipality of Charleswood and
Parkland Company Limited

This agreement made in duplicate this 27th day of November A.D. 1964.

BETWEEN:

The Rural Municipality of Charleswood,
hereinafter called "the Municipality"

of the First Part

- and -

Parklands Ltd., hereinafter
called "the Company"

of the Second Part.

WHEREAS the Company desires to develop the land contained within the area outlined in red on the plan attached hereto as Schedule "A" for residential and/or commercial purposes, which land is described below, and is located within the boundary of the Municipality, and

WHEREAS certain municipal and public services must be constructed and installed in order to develop the said land, and

WHEREAS the Company requires the approval and co-operation of the Municipality in order to proceed with said development and with the installation of the services referred to above, and

WHEREAS the Municipality has approved to the development of the said land and had approved in principle of Schedule "A" attached hereto;

NOW THEREFORE THIS AGREEMENT WITNESSETH that in consideration of the premises and other good and valuable consideration, and of the covenants and agreements hereinafter set forth and contained, the parties hereto covenant and agree as follows:

1. Where used herein:

"Planned Area" shall mean the land contained within the lines coloured red on the plan attached hereto as Schedule "A" and more particularly described in Schedule "A1".

"Designeated Area" shall mean that portion of the land within the "Planned Area" or within any Plan of Subdivision thereof, in which improvements will be undertaken in any one year.

"Company-owned" lands shall mean lands owned by the Company, or in which the Company has a beneficial interest.

"Privately-owned" lands shall mean lands owned by others than the Municipality or the Company.

"Municipal" lands shall mean lands owned by the Municipality.

"Engineer" shall mean a firm of engineering consultants appointed by the Municipality, or the duly authorized representative of such firm, or anyone nominated and/or appointed by the Municipality, including the Municipal Engineer to act with or on behalf of the said Municipal Engineer;

2. The agreement between the parties hereto shall consist of the following:

a) This agreement.

b) The Plan attached herto as Schedule "A", and the legal description attached hereto as Schedule "A1".

c) The memorandum of engineering specifications attached hereto as Schedule "B".

d) All of the plans including plans of subdivision, specifications and drawings with all other documents or exhibits attached hereto or which may be attached hereto from time to time after having been initialled or otherwise identified by the parties hereto, each of which will be identified as a schedule commencing with Schedule "C".

e) Any variation in, additions to or deletions to or deletions from this agreement as the parties hereto may agree upon from time to time and which shall be confirmed by both parties in writing, all of which shall be binding upon the parties hereto as fully

and to the same extent as through set out and incorporated herein.

3. CONVENANTS BY THE COMPANY

A. The Company convenants and agrees to construct, install and complete in a good and workman-like manner, in accordance with the Plan or Plans approved by the Municipality, and in accordance with the detailed Specifications to be supplied by the Engineer, which specifications are generally described in Schedule "B" hereof, and at its own expense, the municipal services within the "Planned Area" required to service the "Planned Area" or any portion thereof, which services are generally described as follows: -

a) The sub-trunk and lateral storm sewer system, the sub-trunk and lateral sanitary sewer system, and the water system complete with all water mains and fire hydrants, and all the usual engineering appurtenances applicable to each of these services. The sanitary sewer system and the water system shall be connected with existing municipal services;

b) Concrete pavement, together with curbs;

c) Where shown in a plan of subdivision, concrete paved lanes with proper drainage;

d) Front driveways where lanes are not provided, constructed out of contrete pavement together with curbs, from the property line of each building site to connect with pavement on streets;

e) Concrete sidewalks as shown on a general layout plan or detailed construction plans;

f) Sewer and water house connections, which shall be taken and extended from the mains in the street up to the front lot line, which house connections shall be installed at the same time as the sewer and water mains are installed;

g) Ornamental street lights and permanent street signs;

h) The grading, seeding and/or sodding of all boulevards from the curb to the front

property line.

B. All municipal services referred to in this agreement, and which the Compnay is required to install shall become the property of the Municipality immediately on the installation thereof, and the ownership of and title to the said municipal services shall vest in the Municipality without any costs, except for such local improvement levies as are provided herein, and the Company shall have no claim or rights thereto other than those accuring to the Company as an owner of land fronting or abutting on streets in which services are installed.

4. CONVENANTS BY THE MUNICIPALITY

In order to enable the Company to proceed with the development of the land referred to herein and to carry out and perform the work referred to in Paragraph 3 above, the Municipality covenants and agrees:

a) To permit the Copmany to tie into, extend and use the existing and future municipal sanitary sewer system and the existing and future municipal water system;

b) To take all necessary measures, pursuant to and in accordance with The Municipal Act, being Chapter 173, RS.M. 1954, and amendments thereto, to create "Sewer District No. 6", and to enact the necessary by-laws to effect local improvement levies upon lands benefitting from services provided in such district as more specifically set out in Paragraphs 11 (c) and 12 (a) hereof;

c) To approve for registration in the Winnipeg Land Titles Office each Plan of subdivision as may be agreed upon between the parties hereto;

d) To enact such necessary by-laws, pursuant to the Municipal Act, as may be required to open, establish, alter, divert or close highways, streets, roads and lanes within the

"Planned Area";

e) To expropriate from private owners the lands which may be required for street openings or rights-of-way, so as to insure the registration of the approved Plans of Subdivision and as provided in Paragraph 8 hereof;

f) i) To commence to construct and install, or cause to be commenced, constructed and installed, the storm sewer trunk, from the Assiniboine River to the Northern limit of the "Planned Area", within 90 days after the execution of this agreement, and the Municipality may construct or cause to be constructed, the sanitary sewer trunk, as well as a lift station for the sanitary sewer system as specified by the Engineer, whenever the Council of the Municipality decides to proceed with such sanitary sewer system installation, both of which services are to service Sewer District No. 6;

ii) The Municipality will commence to construct and install or cause to be constructed and installed the storm sewer trunk and the sanitary sewer trunk to service any "Designated Area" within 90 days after receiving a request from the Company to proceed with such construction and installation;

iii) The Municipality will commence to construct and install or cause to be commences, constructed and installed the Feeder Water Main to the boundary of the "Planned Area" within 60 days after receiving a request from the Company to proceed with such construction and installation;

iv) It is agreed between the parties hereto that the Notice referred to in f) (iii) above, will not become effective until a Water Feeder Main shall have been constructed and installed by the Metropolitan

Corporation of Greater Winnipeg to the junction of Beaumont and Berkley;

(v) It is agreed between the parties hereto that the portions of the storm sewer trunk, and the sanitary sewer trunk to be constructed and installed within the "Planned Area" shall be constructed and installed progressively, as the Company designates the particular area to be developed from time to time, and that these services will be installed to service only the "Designated Area". . .

11. PAYMENT OF CERTAIN COSTS:

a) The Company shall pay all of the costs and expenses related to the preparation of the plans of subdivision, the costs and expenses of obtaining approval for registration of the Plans, including all Municipal Board and Land Titles Office fees and expenses, all survey costs, all advertising costs and expenses and all legal fees and expenses incidental to the development of the "Planned Area". The legal fees will be based on the tariff issued by the Law Society of Manitoba. The Company will pay, in addition, the legal fees incidental to the preparation of this agreement.

b) It is understood and agreed that the Company or its purchasers will pay all the regular and usual municipal fees charged for the issuing of Building Permits, plumbing, electrical and house connection inspections or any other regular municipal fees provided for in any municipal by-law, including $25.00 for each water meter installed in each building.

c) (i) In arriving at the amount to be paid for the installation of trunk storm and trunk sanitary sewers as well as a lift station within Sewer District No. 6, and any Feeder Water Mains necessary to service the "Planned Area" which are to be constructed outside of the "Planned Area", the Engineer shall apportion the total cost of each of the above services against all of the lands benefitting

from each service, and shall certify as to the amount payable by "Company-owned" lands, "Privately-owned" lands, and "Municipally-owned" lands, whether any of such lands are within or without the "Planned Area";

(ii) The amount to be paid by "Privately-owned" and "Municipally-owned" lands for their share of said sewer trunks may be paid for in cash or by the issue of Municipal Debentures approved by the Municipal Board and Issued pursuant to the Municipal Act, and the Company agrees to accept such Municipal Debentures covering the amounts owing by said "Privately-owned" or "Municipally-owned" lands at par, with interest at the rate of 6-3/4% per annum, amortized over a period of 20 years, if the Municipality cannot sell these debentures elsewhere at the same or a lower rate;

iii) If the Municipality issues debentures as set out above, the Municipality agrees to enact the necessary levying by-law to provide for a levy against the land outside the "Planned Area" benefitting from the sewer trunks or the Feeder Water Main, of an amount sufficient to meet the annual payment in respect of the debentures to be issued to the Company.

12. a) The Municipality agrees to effect alocal improvement levy as provided in the Municipal Act and amendments thereto, of the costs of the storm sewer trunk and the sanitary sewer trunk as well as the water feeder mains necessary to service the "Planned Area", against all of the lands within the "Planned Area", on an acreage basis, or on a lot basis, or on a frontage basis, but in no case shall the amount of the levy be greater than $5.00 per front foot, or its equivalent. The Engineering shall certify as to the amount of as

well as the most equitable method of applying the levy. This levy shall be amortized over a period of twenty (20) years with interest at the rate of 6-3/4% per annum, and the Municipality agrees to enact the necessary levying By-law against all of the "Company-owned" lands, which By-law shall provide for an annual levy against the land affected, in an amount sufficient to meet the amortized amount due in respect of each acre or lot within the "Planned Area", provided, however, that this levy shall not be applied to lands donated to the Municipality by the Company as set out in Paragraph 9 above;

b) From the levy referred to above, the Municipality may deduct the sum of $550.00 annually, to be retained by the Municipality in payment of added administration costs, the first of such deductions to be made at the time when the first levy is collected by the Municipality, and such deductions to be continued for a period of twenty (20) consecutive years, at the end of which 20-year period, this deduction of $550.00 will automatically cease.

c) The Municipality agrees to remit to the Company the amount collected annually by the levy referred to above, and such remittance shall be made during the month of November in each year. The first levy is to be made by the Municipality in the year following the installation of a storm sewer trunk, a sanitary sewer trunk and a water main;

d) It is clearly understood that the Municipality will not issue debentures for the levy referred to in Paragraph 12 (a) above.

13. a) If the ratepayers outside of the "Planned Area" reject the By-law to provide a Feeder Water Main between Berkley street and the eastern limit of the "Plannted Area", then the Municipality will construct and install the Fedder Water Main as and when requested by the Company, and the Company will pay for same in cash.

b) It is expressly agreed, however, that under these circumstances, the said Feeder Water Main shall be for the exclusive use of the lands within the "Planned Area" and that no one outside of the "Planned Area" will be permitted to tie into and use said Feeder Water Main.

c) It is further agreed, that if the Municipality wishes to permit the owners of land without the "Planned Area" to tie into and use the said Feeder Water Main, then upon payment to the Company, by the Municipality, of the amount owing for such Feeder Water Main by "Privately-owned" lands as certified by the Engineer, the said Feeder Water Main will be available for such use as the Municipality directs. The payment referred to may be in cash or by the issue of Municipal Debentures as set out above;

d) It is further agreed that all of the "Privately-owned" and "Municipally-owned" lands fronting the Feeder Water Main to be installed on Beaumont Avenue, from Berkley Street, shall pay $4.25 per front foot for the use of this main, and the Company agrees to pay the difference between the actual cost of said Feeder Water Main and the amount which would be raised by the imposition of said levy of $4.25 per front foot. . .

SCHEDULE "B"

R. M. OF CHARLESWOOD - PARKLANDS LTD. AGREEMENT

MEMORANDUM OF ENGINEERING SPECIFICATIONS

The purpose of this memorandum is to outline in general terms, the design criteris which will be required for each service. They shall not be interpreted as being specific specifications. Specifications will be supplied for each contract as it is designed. Changes to specific specifications will be made to meet unforeseen conditions that are encountered. These criteria are general indications only.

Sanitary Sewers

The minimum size of sanitary sewers shall be 8" with a minimum depth of 8½'. Sewer pipe may be extra strength concrete or asbestos cement - Class 2400 minimum. Pipe jounts shall have rubber gaskets. Junctions and sewer connections to the property line shall be installed when the sewers are laid. Minimum velocity shall be 2 feet per second with pipe flowing full of half full.

Storm Sewers

Minimum size shall be 12". Pipe materials shall be extra-strength concrete or reinforced concrete, depending on the size. Minimum depth of bury shall be 5'. Minimum velocity shall be 2 feet per second with pipe flowing full or half full.

Designs shall be based on a rainfall intensity of $i = \frac{100}{t + 18}$ ins./hr.

Inlet times shall be 15 minutes except for areas which are zoned such that large amounts of pavement or roof areas will justify the use of a lesser inlet time. Run-off coefficient shall be .35 for residential areas, .90 for commercial areas and .10 for park areas.

Sidewalks

Sidewalks shall be of air entrained concrete, 4" thick and 5' wide, except at driveways where thickness shall be 6 inches. Sidewalks will be required on both sides of the streets of all collector streets and major thoroughfares. In some instances where the planning justifies it, sidewalks will not be required on shart bays. Bays on which more than 40 houses are constructed or on streets where through traffic can result shall be installed with sidewalks at least on one side and, in most instance, on both sides.

Pavement

Collector streets shall be of 8" thick bar mat reinforced concrete pavement with a flexural strength of 550 psi at 14 days. Sub-grade shall be 3" of gravel. The curing shall be accomplished by a sprayed membrane in addition to white polythene. Slit pockets shall be dug out to a depth of 2½' below underside of pavement and replaced with approved material, properly compacted.

Residential streets shall be of 6" thick bar mat reinformed concrete pavement, cured as per the thoroughfare specification mentioned above. Strength requirements are the same as for collector street pavements. The above specification for residential street pavements is considered minimum and where conditions such as silt, or the running of construction equipment including that used by house builders over the concrete, make it necessary, additional requirements will be made by means of additional preparation of subgrade to strengthen the slabs.

Before concrete can be laid, it will be necessary to ensure that the service trenches are dense enough to prevent settlement of slab. If the sewers are tunnelled or put in the boulevard, paving may be proceeded with immediately providing the construction equipment can be kept off the pavement. If the service lines are installed by means of vertical trench, by August 15th of one year, paving may start by July of the following year, providing the sewers have been flooded and tamped with a 2000 lb. hammer dropped 10' along the lines of the trench and service connections. If the sewers are installed in a V trench, rebuilding of the trench with compact equipment will be required to give a density similar to that outside the trench. The above remarks apply to all trenches including service connections.

Pavement widths shall be 25' wide, back of curb to back of curb, for residential streets and 32' wide, back of curb to back of curb, for collector streets. Where a median strip is used, each roadway shall be a minimum of 25', back of curb to back of curb.

Curbs on collector street pavements shall be 6" x 6" reinforced concrete barrier type. Residential street pavements shall have 4" high by 6" wide concrete lip type curbs poured monolithically with the pavement.

Back lane pavements shall be 6" thick concrete, reinforced with perimeter steel. Concrete shall meet all the strength and curing requirements of residential street pavements. Where field conditions such as silt or the running of construction equipment including that used by house builders over the concrete makes it necessary, additional requirements will be made by means of additional preparation of subgrade or the use of bar mat reinforcement to strengthen the slabs.

Residential Driveways

Driveways shall be 6" thick non-reinforced concrete measuring 10 feet back to back of curbs. Driveways shall be installed between the street property line and the edge of the street concrete pavement on all streets where back lanes are not provided. Curb cuts for residential driveways shall be 16 feet long. Concrete for driveways shall meet all the curing and strength requirements of residential street concrete pavement.

Watermains

Waterlines to be installed in the area shall be of a size required to fit into the over-all municipal water development plan, with a minimum size of 6" and amaximum size of 12", except on Beaumont. Maximum spacing of hydrants to be 400 feet.

Boulevards

Upon completion of street paving or as otherwise directed, all boulevards between the curb and street property line shall be graded, seeded and/or sodded and continuously maintained until the grass is growing vigorously.

Permits

To protect the Municipality in the event that a hous builder's operation damages the public sidewalk fronting a building lot, the water services box to the future house, or some other adjacent Municipal service, the Municipality will require the house builder to obtain a permit which will cost $135.00 to cover the cost of any damage to a Municipal service in the vicinity of the house being constructed. When construction of the house is completed, the house builder may make application for a refund if no damage has occured to such Municipal services during the

period the house is under construction. A Municipal representative will then inspect the adjacent services to determine what amount, if any, will be refunded to the builder.

APPENDIX B

STATISTICAL CHARACTERISTICS OF CHARLESWOOD

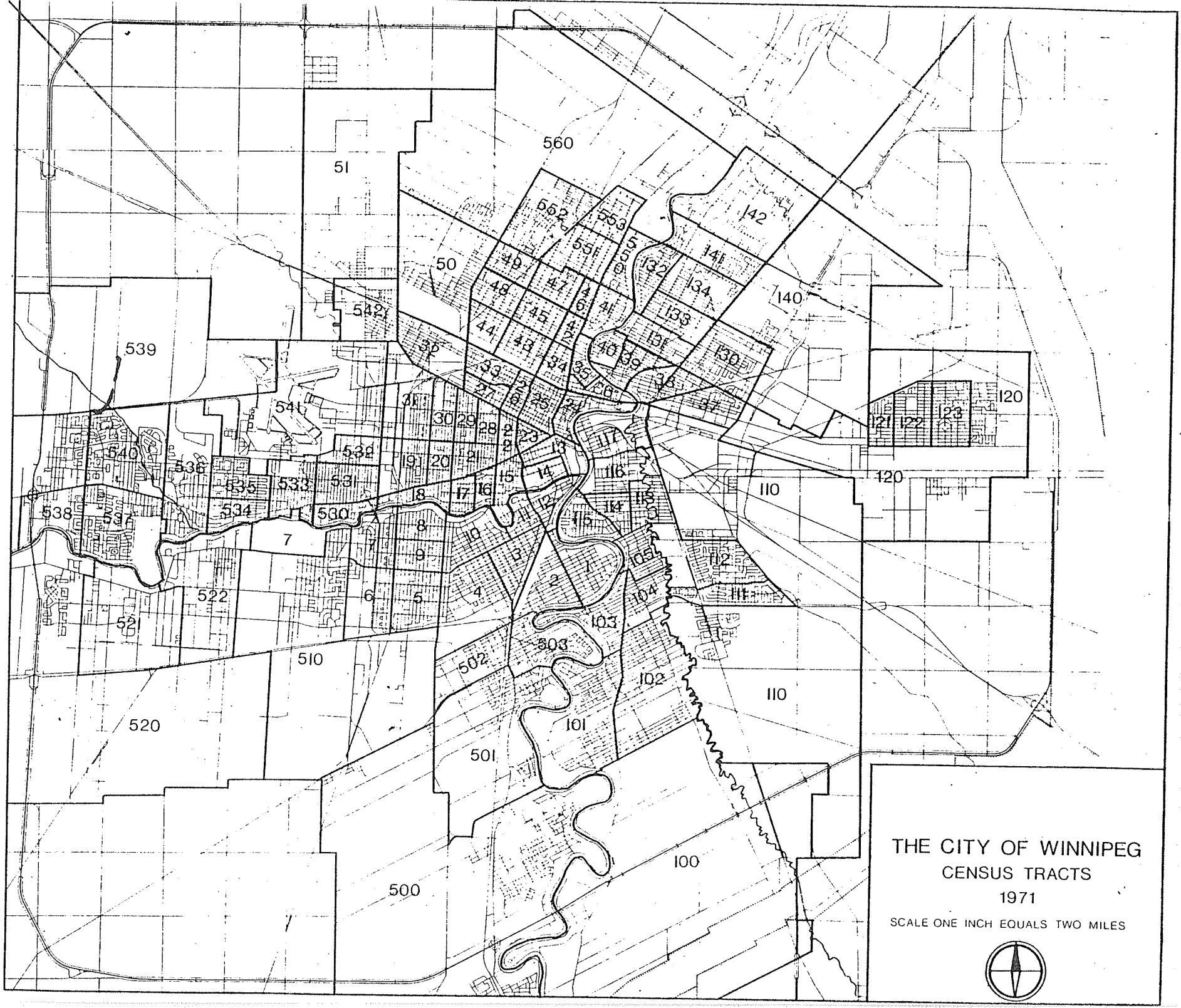

THE CITY OF WINNIPEG
CENSUS TRACTS
1971
SCALE ONE INCH EQUALS TWO MILES

TABLE 10

Land Use Characteristics - Charleswood, 1971

Census Tract	Total Acres	Industrial		Commercial		Residential		Parks, Schools, G.S., Cem., etc.		Pub. Bldgs. Hosp., Church Halls, etc.		Public Utilities		Undeveloped and Vacant Land	
		Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
520	21203.13	330.68	1.55	13.37	.06	222.34	1.04	192.24	0.90	.92	.004	169.28	.79	20274.30	95.61
521	1398.37	.94	.06	9.79	.70	413.04	29.53	24.02	1.71	4.43	0.31	28.65	2.04	917.50	65.61
522	1312.00	--	--	10.88	.82	310.15	23.63	112.28	8.5	12.97	.98	22.38	1.70	843.34	64.27
Charleswood	23913.00	331.62	1.38	34.04	0.14	945.53	3.95	-28.54	1.37	18.32	0.07	220.31	0.92	22035.41	92.14

Source: Department of Environmental Planning, City of Winnipeg

TABLE 11

Population Characteristics by Census Tract, 1971

No.	Characteristics	Charleswood, mun.			
		Total	521	522	Other parts – Autres parties
1	TOTAL POPULATION	12,185	4,405	4,270	3,505
	Birthplace and immigration:				
2	Born in Canada	10,465	3,865	3,515	3,085
3	Born outside Canada	1,720	545	755	420
4	Immigrated after 1945	1,215	360	540	310
	Ethnic group:				
5	Asian	105	10	15	80
6	British Isles	6,545	2,250	2,420	1,880
7	French	585	155	215	215
8	German	1,785	845	505	435
9	Hungarian	100	15	25	55
10	Italian	75	40	20	15
11	Netherlands	500	170	145	180
12	Polish	285	110	105	70
13	Russian	35	25	–	10
14	Scandinavian	700	325	235	145
15	Ukrainian	790	300	285	205
	Religion:				
16	Anglican	2,015	585	805	625
17	Baptist	270	135	60	75
18	Greek Orthodox	100	20	55	25
19	Jewish	35	–	5	25
20	Lutheran	970	430	340	195
21	Pentecostal	240	55	145	50
22	Presbyterian	390	95	165	135
23	Roman Catholic	2,105	745	730	630
24	Salvation Army	30	20	10	–
25	Ukrainian Catholic	280	80	105	90
26	United Church	3,915	1,520	1,230	1,165
27	No religion	770	310	305	160
	Language most often spoken at home:				
28	English	11,635	4,180	4,085	3,365
29	French	60	20	20	20
30	German	295	160	90	50
31	Italian	10	10	–	–
32	Netherlands	5	5	–	–
33	Polish	5	–	5	–
34	Ukrainian	65	20	25	15
	Official language:				
35	English only	11,530	4,185	4,005	3,335
36	French only	–	5	–	–
37	Both English and French	605	200	235	160
38	Neither English nor French	50	10	30	10
39	POPULATION 5 YEARS AND OVER	10,760	4,005	3,830	2,925
40	Attending school full-time	3,640	1,450	1,210	975
41	Not attending school full-time	7,125	2,555	2,615	1,955
	Highest level of schooling:				
42	Less than Grade 9	4,000	1,465	1,420	1,115
43	Grades 9-10 – No other training	1,780	720	670	385
44	With other training	410	150	150	105
45	Grade 11 – No other training	1,165	460	390	320
46	With other training	560	215	215	135
47	Grades 12-13 – No other training	950	350	345	255
48	With other training	635	225	230	185
49	Some university – No other training	500	175	135	190
50	With other training	265	75	105	80
51	University degree – No other training	415	140	135	140
52	With other training	85	35	20	25
	Migration:				
53	Non-migrants	7,485	3,155	2,725	1,605
54	Same dwelling	4,370	1,980	1,760	635
55	Different dwelling	3,115	1,175	965	975
56	Migrants	3,270	850	1,095	1,325
57	From an MA	1,620	365	505	745
58	Same MA	920	270	275	375
59	Different MA – Same province	–	–	–	–
60	Different province	695	90	230	370
61	From a non-MA	1,005	300	315	385
62	Same province	615	185	245	195
63	Different province	385	120	75	190
64	From outside Canada	535	125	250	160
65	Place of residence in 1966 not stated	115	60	20	30
66	WOMEN 15 YEARS AND OVER	3,910	1,440	1,455	1,015
67	Total women ever married	3,195	1,130	1,185	880
68	Children per 1,000 women	2,476	2,563	2,462	2,381
69	Women 15-44 years ever married	2,035	655	685	690
70	Children per 1,000 women	2,214	2,390	2,134	2,126
71	Women 45 years and over ever married	1,160	465	500	190
72	Children per 1,000 women	2,935	2,806	2,914	3,311

Note: Other training includes vocational training and postsecondaire non universitaire.

Source: Statistics Canada

TABLE 12

Income Distribution by Census Tract, 1971

No.	Characteristics	Charleswood, mun.			
		Total	521	522	Other parts — Autres parties
	INCOME				
	Total income:				
1	Males 15 years and over with income	3,685	1,350	1,335	995
2	Under $1,000	300	110	125	65
3	$ 1,000-$ 2,999	420	175	170	70
4	3,000- 4,999	285	85	95	100
5	5,000- 6,999	620	195	260	160
6	7,000- 9,999	1,050	385	380	285
7	10,000- 14,999	750	330	205	220
8	15,000 and over	260	70	90	95
9	Average income	7,935	7,647	7,451	8,975
10	Median income	7,624	7,867	7,079	8,043
11	Females 15 years and over with income	2,335	840	915	575
12	Under $1,000	715	260	245	205
13	$ 1,000-$1,999	470	180	205	85
14	2,000- 2,999	325	125	115	85
15	3,000- 4,999	475	170	195	115
16	5,000- 6,999	200	70	80	50
17	7,000- 9,999	100	25	50	30
18	10,000 and over	45	5	20	15
19	Average income	2,648	2,501	2,770	2,667
20	Median income	1,960	1,885	2,042	1,965
	Employment income:				
21	Males who worked in 1970	3,485	1,295	1,230	960
22	Under $1,000	295	115	110	75
23	$ 1,000-$ 2,999	350	150	135	70
24	3,000- 4,999	260	85	80	85
25	5,000- 6,999	690	245	290	155
26	7,000- 9,999	1,015	365	350	300
27	10,000- 14,999	650	280	180	190
28	15,000 and over	220	55	85	85
29	Average income	7,738	7,295	7,440	8,717
30	Median income	7,428	7,458	6,979	7,917
31	Females who worked in 1970	1,895	690	730	475
32	Under $1,000	450	180	145	125
33	$ 1,000-$1,999	315	115	120	80
34	2,000- 2,999	275	110	105	70
35	3,000- 4,999	450	170	185	100
36	5,000- 6,999	195	65	80	50
37	7,000- 9,999	100	20	40	35
38	10,000 and over	20	10	10	10
39	Average income	2,934	2,794	3,056	2,955
40	Median income	2,502	2,368	2,716	2,391
	Household income:				
41	Under $1,000	35	15	15	10
42	$ 1,000-$ 2,999	180	55	95	30
43	3,000- 4,999	145	50	55	45
44	5,000- 6,999	310	85	135	90
45	7,000- 9,999	815	270	300	245
46	10,000- 14,999	1,085	440	365	285
47	15,000- 19,999	365	140	110	110
48	20,000 and over	205	65	70	65
49	Average total income per household	11,200	11,316	10,534	11,924
50	Median total income per household	10,405	11,032	9,720	10,461
51	Average total income of household heads	8,932	8,812	8,291	9,925
52	Average employment income of household heads	8,807	8,577	8,297	9,731
	Family income:				
53	Under $2,000	75	20	35	20
54	$ 2,000-$ 2,999	70	20	40	10
55	3,000- 4,999	135	40	55	40
56	5,000- 6,999	325	100	135	90
57	7,000- 9,999	840	290	300	250
58	10,000- 14,999	1,035	410	345	280
59	15,000- 19,999	340	135	120	90
60	20,000 and over	170	50	60	60
61	Average total income per family	11,206	11,130	10,842	11,767
62	Median total income per family	10,236	10,758	9,780	10,177
63	Average total income of family heads	9,146	8,910	8,719	9,987
64	Average employment income of family heads	8,936	8,577	8,662	9,721
	Income of persons not in families:				
65	Under $1,000	170	35	100	35
66	$ 1,000-$1,999	120	55	50	15
67	2,000- 2,999	60	15	45	—
68	3,000- 3,999	40	10	20	15
69	4,000- 4,999	40	25	10	5
70	5,000- 6,999	50	20	20	10
71	7,000- 9,999	50	10	35	10
72	10,000 and over	45	20	15	10
73	Average income	3,053	3,793	2,300	4,020

Source: Statistics Canada, Catalogue No. 95-753, pp. 34-35.

TABLE 13

Housing and Labour Force Characteristics by Census Tracts, 1971

No.	Characteristics	Charleswood, mun.			
		Total	521	522	Other parts — Autres parties
1	OCCUPIED DWELLINGS	3,125	1,115	1,140	870
	Owner-occupied dwellings:				
2	Median value	22,182	22,259	20,966	23,696
3	Reporting a mortgage	1,950	775	690	490
	Tenant-occupied dwellings:				
4	Average cash rent	126	101	124	147
	Length of occupancy:				
5	Less than one year	740	200	250	290
6	1- 2 years	675	200	205	270
7	3- 5 "	510	200	170	140
8	6-10 "	420	180	180	65
9	More than 10 years	780	330	335	115
	Period of construction:				
10	Before 1946	410	95	210	100
11	After 1960	1,660	505	490	665
	Dwellings with:				
12	Automatic clothes dryer	2,150	830	705	620
13	Colour television	660	255	210	195
14	Vacation home (owned)	220	85	90	50
15	One automobile	1,785	600	670	525
16	2 or more automobiles	1,155	465	365	320
17	Oil as principal heating fuel	745	255	290	200
18	Gas as principal heating fuel	2,250	820	800	630
19	Electricity as principal heating fuel	125	40	45	35
	LABOUR FORCE				
20	Males 15 years and over	3,995	1,485	1,455	1,060
21	In the labour force	3,405	1,255	1,205	940
22	Participation rate	85.1	84.8	82.7	88.7
23	15-24 years	635	250	225	160
24	25-44 "	1,760	570	580	620
25	45-64 "	935	425	355	155
26	65 years and over	70	15	45	5
27	Employed	3,240	1,210	1,125	905
28	Unemployed	160	50	75	35
29	Females 15 years and over	3,910	1,440	1,455	1,015
30	In the labour force	1,595	560	635	405
31	Participation rate	40.8	38.8	43.5	39.6
32	15-24 years	445	155	155	135
33	25-44 "	720	245	265	205
34	45-64 "	410	160	200	55
35	65 years and over	25	5	15	5
36	Employed	1,445	510	575	360
37	Unemployed	150	50	55	45
	Occupation major group:				
38	Males	3,360	1,245	1,180	935
39	Group 11	240	65	85	85
40	" 27	95	40	20	30
41	" 31	60	15	20	20
42	Groups 21, 23, 25, 33	300	115	95	85
43	Group 41	325	155	115	55
44	" 51	575	200	175	190
45	" 61	285	100	110	70
46	Groups 71, 73, 75, 77	125	30	45	50
47	Group 81/82	45	15	25	10
48	Groups 83, 85	435	155	145	130
49	Group 87	395	160	145	90
50	" 91	135	55	45	35
51	Other	210	95	80	40
52	Females	1,540	540	610	390
53	Group 11	25	10	10	-
54	" 27	120	35	50	35
55	" 31	100	35	30	35
56	Groups 21, 23, 25, 33	55	10	25	15
57	Group 41	615	255	220	140
58	" 51	175	75	70	30
59	" 61	235	60	90	85
60	Groups 71, 73, 75, 77	10	-	-	5
61	Group 81/82	-	-	5	-
62	Groups 83, 85	30	10	10	10
63	Other	35	5	10	10
	Industry division:				
64	Both sexes	4,905	1,790	1,790	1,325
65	Divisions 1, 2, 3, 4	80	20	15	45
66	Division 5	605	205	220	175
67	" 6	410	145	150	115
68	" 7	565	230	210	120
69	" 8	1,055	410	360	290
70	" 9	320	130	120	75
71	" 10	1,185	400	445	345
72	" 11	440	170	140	120
	Class of worker:				
73	Males	3,365	1,245	1,180	930
74	Wage-earners	3,165	1,180	1,110	880
75	Self-employed	185	65	70	50
76	Females	1,545	540	610	390
77	Wage-earners	1,450	510	570	370
78	Self-employed	20	15	10	5

Source: Statistics Canada, Catalogue No. 95-753, pp. 22-23.

APPENDIX C

COST ESTIMATIONS

SECTION I

COST ESTIMATIONS FOR TELEPHONE SERVICE

A. Capital Costs

The construction costs to provide telephone service (excluding buildings):

Conduit - 6 duct @	$32.04 per foot
Cable - 1800 - 26 gauge @	13.00 per foot
Total cost of material and installation	$45.04 per foot

The working capacity of 1800 pairs of cable is 80% and only two ducts are required for 1652 dwelling units. Therefore, the actual initial cost of installation of conduits and cables is:

For conduits - 32.04 ÷ 3 = 10.28 x 1.20 =	$12.82
For 1800 paid cable - 13.00 x 1.20 =	15.60
Total	$28.42 per foot

Initial capital cost per subscriber = $28.42 ÷ 1800 = 0.16 per foot.

Distance of Westdale from Distribution Centre is equal to 17,000 feet. The same distance for scenario is equal to 5000 feet. So:

initial capital cost per subscriber for Westdale is:

17,000 x .016 = $272

and for scenario:

5,000 x .016 = $ 80

Using the dollar base of 1971, the capital costs per subscription are:

for the Westdale subdivision: $169.04
and for the scenario: $ 49.72

B. Annual Costs[1]

Based on $1.18 annual cost per 1000 feet per subscription (Table 14), the total annual cost for each site will be as follows:

Westdale 17 kft x 1.18 = $20.06
and
scenario 5 kft x 1.18 = $ 5.90

Using the dollar base of 1971, these costs will be:

For Westdale $\frac{100}{161.2} \times 20.06 = \$12.46$

For Scenario $\frac{100}{161.2} \times 5.90 = \$ 3.66$

TABLE 14

Feeder Cable Costs Per 100 Feet

Facility	Cable			Structure			Cost	Annual Charges			Total
Underground	Unit Cost	+10% Stubs Pole Ends	Splice Per 1000'	Loading	Single Duct	Manhole Per 1000' Ducts	Total Facility Per 1000' + 22% Permits	Mtce.	Rate	Total Rate Per 1000'	Cost Per Pair	Annual Charge Per Pair
Underground												
30-26 Ga NL	14630	1463	3800		3600	778 963	19893	.015	.1060	.1210	6.63	.80
							5341	.007	.1047	.1117	1.78	.20
							25234				8.41	1.00
18-26 Ga NL	9320	932	2354		3600	778 963	12606	.015	.1060	.1210	7.00	.85
							5341	.007	.1047	.1117	2.97	.33
							17947				9.97	1.18
18-26 Ga H88	9320	932	2364	1276	3600	778 963	12606	.015	.1060	.1210	7.00	.85
							1276	.015	.1091	.1241	.71	.09
							5341	.007	.1047	.1117	2.97	.33
							19223				10.68	1.27
18-24 Ga H88	13270	1327	2354	1276	3600	778 963	16951	.015	.1060	.1210	9.42	1.14
							1276	.015	.1091	.1241	.71	.09
							5341	.007	.1047	.1117	2.97	.33
							23568				13.10	1.56
15-24 Ga NL	11260	1126	1999		3000	778 963	14385	.015	.1060	.1210	9.59	1.16
							5341	.007	.1047	.1117	3.56	.40
							19726				13.15	1.56

Source: Manitoba Telephone System, 1976.

SECTION II

Cost Estimations For Public Transit System

TABLE 15

Daily Bus Transit Schedule, Operating Time, and Number of Trips in Charleswood Area, 1967 - 1977

Timing	Number of Buses in Each Time Interval	Operating Time per Bus (Minute)	Total Operating Time (Minute)	Time per Trip (Minute)	Number of Trips
5:30 a.m.-7 a.m.	2	90	180	53	3
7:00 a.m.-9 a.m.	4	120	480	53	9
9:00 a.m.-12 a.m.	2	180	360	53	7
12 a.m. -3:30 a.m.	3	210	630	53	11
3:30 p.m.-6 p.m.	5	150	750	53	14
6:00 p.m.-1:30 a.m.	2	450	900	53	17
					61

Source: Transit Department, The City of Winnipeg.

1) Total number of trips per day = 61
   Saving in travel time per trip, having the Westdale subdivision located at scenario = 20 minutes
   Saving in total daily operation time = (20 x 61)/60 = 20.33 hours
   Operation time per bus per 24 hours = 21 hours
   Therefore, development of scenario site could save the daily operation of one bus.

2) Average hourly capital and operation cost per bus in Winnipeg = $12.20 (1971)
   Average hourly revenue per bus in Winnipeg = $4.87 (1971)

Net average hourly cost per bus = $7.33 (1971)

Net yearly cost per bus (261 working days) = 7.33 x 21 x 261 = $40,175.73

Total capital and operation costs for the period from the fall of 1967 to the fall of 19-7 = $421,845.16 (1971)

APPENDIX D

WATER DISTRIBUTION SYSTEM IN THE SCENARIO:

DESIGN AND COST ESTIMATIONS

Scenario Water Distribution System

The scenario is assumed to be occupied by the population of the Westdale subdivision. The ultimate population of the Westdale subdivision, based on a family size of 2.73 (calculated from Census Canada's statistics for 1971), is projected to be 4,509 persons in 1977. However, to permit future shortages, considering the possibility of an increase in the size of young families having more children, an average of 3.5 persons per household is used for calculation. The water distribution system, in addition to 1,652 dwelling units of the scenario, should also serve 634 extra households located in the adjacent areas. Based on 3.5 family size, the system is designed for a population of 8000.

Domestic Consumption

According to the Water Works, Waste and Disposal Division of the City of Winnipeg, the average daily residential per capita water consumption for the area is 52.5 GPCD.[1]

To obtain the design consumption, the co-efficient of 3.5 is used as Residential Maximum Hour Factor.[2] The total domestic consumption is calculated as follows:

$$Q = \frac{2286 \times 52.5 \times 3.5 \times 3.5}{24 \times 60} = 1020 \text{ GPM}$$

Plans were prepared schematizing the water distribution network and consumption figures. The consumption as assigned to various blocks is based on the number of dwelling units in each block.

The Hazen-Williams Coefficient for pipe resistance was taken as 100 for cost-iron pipes, and 140 for asbestos-cement (transite) pipes.

Using the obtained information, water flow and pressure drops in the pipe network were calculated by means of Hardy-Cross technique. The IBM 370/168 computer at the University of Manitoba was used to process the data.

Fire Demand

If there were no fire hazard, the hydraulic capacity of the distribution system would have to equal the maximum demand for domestic uses. With the increase in the density of housing in the area due to infilling, to ensure absolute safety, the fire demand is added to the domestic demand.

The fire flow is established according to the Canadian Fire Underwriters requirements as follows:

$$Q = 850 \sqrt{P} (1 - 0.01 \sqrt{P})$$

or

$$Q = 850 \sqrt{8} (1 - .01 \sqrt{8}) = 2336 \text{ GPM}$$

The location of fire is taken at the two most critical points of the network. The design allows three fire engines to pump 1800 GPM in the case of two simultaneous conflagarations.

Cost Estimate

Prior to 1965, water supply service partially available for existing residential developments in an area adjacent to the scenario. The cost of the completed water distribution service is calculated based on average unit prices which is used in current estimations of consulting engineering companies in the city of Winnipeg.

TABLE 16

The Costs of Water Distribution System for Scenario (1971 Dollars)

Pipe Size	Length (ft.)	Unit Price*	Amount
6 inches	35,170	$12.43	$437,163.1
8 inches	13,690	21.75	297,757.5
10 inches	6,125	24.86	152,267.5
12 inches	1,320	31.07	41,012.4
Total			$928,200.5

* Unit price includes purchase of pipe, values tees, gauges, hydrants and installation.

Adding 8.5 percent engineering fees to the above total, the total costs of this project will be $1,007,097.53 (1971).

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