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A Catalogue of Benefits Associated with Greenspaces and An Analysis of the Effects of Greenspaces on Residential Property Values: -A Windsor Case Study-

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EXECUTIVE SUMMARY

Greenspaces make good economic sense: Living and working in or near a greenspace can enhance the economic prospects of existing businesses and increase the property values of homes adjacent to protected greenways. Perhaps more significant than these direct economic effects is the overall impact of greenspaces on a community's image. Greenspace projects have been used as a spur for urban redevelopment, prompting private investment in adjacent areas.

Greenspaces are able to take advantage of linear features that do not attract other economic activities; for example, floodplains, abandoned rail lines, and utility rights-of-ways. With vision and forethought, greenways can convert low-value, often derelict, remnants of the urban landscape into environmental and economic assets [Royal Commission on the Future of the Toronto Waterfront 1992].

This report considers various categories of values and benefits accruing through the existence and maintenance of greenbelts and greenways within urban areas, and specifically focuses on greenbelts within the City of Windsor. In Part A of this report, A Catalogue of Benefits, eight basic categories of benefits are discussed. The components of benefits consist of economic, social and personal. Examples are provided as to how greenbelts are an enhancement to local economies.

The Catalogue of Benefits contains eight sections, each focusing on a different set of economic rationales. The sections included in the catalogue are:

1) *Real property values:* presents evidence that greenbelts may increase nearby property values, and demonstrates how an increase in property values can increase local tax revenue and help offset greenbelt acquisition costs.

2) *Expenditures by residents* on greenbelt-related activities can help support recreation-oriented businesses and employment, as well as other businesses which are patronized by greenbelt users.

3) *Trends and expenditures* by activity provides information on trends associated with uses of greenbelts, and provides evidence where spending associated with greenbelt-related activities have been quantified.

4) *Commercial uses* explores the potential of greenbelts in the provision of business opportunities, locations, and resources for commercial activities. These activities may include on-site concessions, permittees, special events, and commercial filming activities.

5) *Agency expenditures* examines how the managing agency may support the local economy by providing jobs, and purchasing supplies and services to develop, operate, and maintain the greenbelt.

6) *Tourism* - a greenway or greenbelts which provide local opportunities and enhances tourist draw can be an important asset to a community. Outdoor recreation, natural and historical, and cultural resources are increasingly important attractions for travelers.

7) *Business promotion and retention* - many communities want to attract new, expanding, or relocating businesses to their areas in order to increase their employment and tax base. Retaining existing businesses within a community is also important for economic stability.

8) *Public cost reduction* - conservation of greenways, rivers, and trails may result in reduced costs to local government and other public agencies. Through the conservation of greenways and greenbelts rather than the destruction of natural areas resulting from urban sprawl, local governments may reduce costs associated with servicing these subdivisions, such as costs associated with sewers, roads, and schools.

The effects of greenspaces on residential property values in the City of Windsor

The effects of greenspaces on residential property values concentrates on the impact that a greenspace may have on property values, through its amenities, such as attractive views, open spaces preservation, and convenient recreational opportunities. This portion of the report is in two parts; the first outlines a description of the study, the methodology, a description of the study areas, and the empirical results of the sample regression runs. The second part includes a theoretical exercise of calculating the aggregate value of the greenbelt, based on the quasi-public good effect of the amenity on the property values. These amenities are valued by isolating the appreciation in market value, attributable to the greenbelt amenity, for those properties neighbouring the greenbelt.

Household characteristics in addition to property values were collected for single-family homes in the greenbelts of Askin, Ganatchio Trail and the Springgarden ANSI. The data collected included: the year of the transaction, age of the property, the number of bathrooms, the number of bedrooms, the lot size, the square foot of living space, the number of stories, heating type, number of fireplaces, air-conditioning, garage type and garage spaces, finished basement, and the selling price. The sales were screened for those that might not be representative; for example where the last names of the seller and buyer were the same or if the sale was listed as an estate sale. The total number of real estate transactions in Neighbourhoods 1, 2 and 3, in 1991, were 32, 48 and 34, respectively.

The Pooled Sample encompassed all three neighbourhoods, for a total of 114 properties. According to the results, vicinity to the greenbelt has a statistically significant positive impact on the price of residential property. Other things being equal, there is $6.92 increase in price of a residential property for every walking foot one moves in the direction of the greenbelts. This suggests that a home located 30 feet from the greenbelt would have an excess value of approximately $3,252 over that of a property located 500 feet from the greenbelt. Individuals with a high demand for proximity bid up prices for residential space, the consumption of which is rival. As one moves further away from the greenbelt, there is less effect from the greenbelt as a neighbourhood quasi-pubic good; however, all properties and citizens are still positively affected by the availability and existence of the public good.

In the pooled sample, other variables are also significant; for example, square footage and the number of bathrooms and bedrooms have a strong positive effect on price. More specifically, each additional square foot raises the price of the property by $21.34 and each additional bathroom and bedroom raise the price by $17,858 and $4,846 respectively, *ceteris paribus*. In the pooled sample, age has a significantly negative impact on property value, this is consistent with expectations, since as a home ages it requires additional effort and resources in terms of maintenance.

As a framework for considering possible policy issues the quasi-public good effect of the greenbelt on property values in sample 1 (Askin) was estimated. The effect of the greenbelt on the aggregate property value for neighbourhood 1 was approximately $24 million greater than it would have been in the absence of the greenbelt. This increment resulted in an addition of approximately $482,450 to the potential neighbourhood property tax revenue. Using assessment records for neighbourhood 1, the average property tax value in the neighbourhood is approximately $2,642. Based on this value, the total property tax value for neighbourhood 1 is approximately $6.27 million. The potential increase in property tax revenue for neighbourhood 1, due to the effect of the greenbelt, amounts to an increase in property tax revenue of approximately eight percent. The quasi-public good benefit to the properties in neighbourhood 1, of $24 million, amounts to approximately seven per cent of the value of the properties in the neighbourhood.

The results of these exercises suggest that the existence of greenbelts may have a significant impact on neighbourhood property values. Having calculated the approximate purchase price of the greenbelt in neighbourhood 1 to be $3.2 million, comparisons are made between this cost and the Present Discounted Value (PDV) of the property tax revenue at discount rates of zero, three and five percent. At a discount rate of zero percent, the PDV of gains to the municipality through property taxation is approximately $7.1 million, which is more than twice the cost of the greenbelt.

As the public good of open space becomes more common in the city, it is expected that the property value effects of adjacent property may begin to diminish, but the collective value of greenbelts as an important part of maintaining quality of life will continue.

PART A

1.0 INTRODUCTION

This report consists of two main parts: first, a catalogue of examples and case studies relating to greenways and greenbelts; and second, an examination of the effect of greenbelts/greenways on the value of adjacent properties, within the City of Windsor.

The examples case studies relating to greenways and greenbelts (Part A) have been chosen for their similarities to circumstances in the Windsor/Detroit RAP area of concern. The categories included in Part A of the report include personal, social, economic and environmental values and benefits. Greenway corridors provide a variety of amenities such as attractive views, open space preservation, and convenient recreational opportunities. Part B of this report examines how these amenities are valued and how this value is communicated through increased property values and increased marketability for those areas surrounding the greenway.

The purpose of the examples in Part A is to stimulate thinking regarding the benefits[1] associated with greenbelts/greenways, and natural areas in general. It is hoped that an overview of the benefits associated with greenways and greenbelts will make decision-makers aware of the need to cooperate with developers, municipal staff, citizens and special interest groups to ensure that sustainable natural areas and greenbelts in the area of concern are maintained.

1.1 Background: The Ecosystem Approach

The Detroit River is the lowest link of the upper Great Lakes connecting channels, conveying water from Lakes Michigan, Superior, and Huron to Lake Erie. It has a natural drainage basin of 1800 square kilometers and receives the additional discharge from the sewage collection system for an additional 297 square kilometers. In 1991 the population of the drainage basin was approximately four million [MDNR and MOEE 1991]. The Detroit River has been listed as one of 42 Great Lakes Areas of Concern (AOCs) by the International Joint Commission (IJC) because degraded water quality conditions impair certain beneficial uses as defined by the Great Lakes Water Quality Agreement of 1978 (as amended) [MDNR and MOEE 1995]

Land use in the Detroit River Area of Concern (AOC) differs significantly in Michigan and Ontario. Nearly ten percent of Michigan's land use is commercial or industrial, compared to two percent in Ontario. Thirty percent of the Michigan OAC is undeveloped or used for agricultural purposes, compared to 90 percent in Ontario. Similarly, shoreline use in Michigan is 61 percent industrial or commercial, versus 33 percent of the Ontario

[1] Part A of this report is not an exercise of benefit assessment nor it is a literature review of assessment methods and terminology.

shoreline. Thirty-one percent of the Ontario shoreline is residential and 22 percent recreational, compared to 16 and 6 percent respectively, in Michigan [MDNR and MOEE 1991].

Despite their vital importance and unique character, few of Essex Region's natural areas remain; for example only 3.7 percent of the region is forested, and less than 10 percent of the area's original wetlands remain. Very little of the area's extensive shoreline is undeveloped. In the entire Essex Region, publicly owned natural areas comprise less than two percent of the landscape [Essex County Conservation Authority, 1995].

Recreational use of the Detroit River includes boating, fishing, and hunting. Swimming occurs at the three beaches along the river, and at marinas and shoreline parks to a limited extent, being prohibited in some areas by strong currents, and in others by the degraded bacteriological quality of the water. The river is a major recreational boating area supporting approximately 75 marinas with over 5500 boat slips. Although there is currently no commercial fishery on the Detroit River, the sport fishery is a very important and thriving resource. The value of the sport fishery for the Detroit-St. Clair River system was estimated at ten million dollars annually (1975-1977) [MDNR and MOEE 1991].

2.0 GREENWAYS

In the past 20 years the greenspace concept has acquired new importance, particularly at the suburban level, with communities becoming acutely aware of the relationship between sprawl and a decimated stock of open space. In 1987 The World Commission on Environment and Development recognized the need for a shift in development away from that of urban sprawl towards that of a more sustainable form.

Rivers, trails, and greenway corridors are traditionally recognized for their environmental protection, recreational values, and aesthetic appearance. These corridors also have the potential to create jobs, enhance property values, expand local businesses, attract new or relocating businesses, increase local tax revenues, decrease local government expenditures, and promote the local community [National Parks Service, 1995].

The literature reviewed for this exercise recognizes the importance of the intrinsic environmental and recreational benefits of all natural areas. Consequently, the non-monetary value of open space should continue to be the primary emphasis in conservation efforts. In some instances it may be more appropriate to stress intrinsic environmental benefits. In other instances, the clear communication of intrinsic values and potential economic impacts will help decision makers recognize natural areas as vital to the well-being of a community.

Greenways are corridors that connect communities' natural and cultural resources. Greenways may follow natural features, such as waterways and ridges, or built features, such as abandoned railroads, utility lines, and scenic roads. They can link homes to workplaces, schools, shops, and recreation areas. They conserve green space, protect water resources, shelter plants and wildlife, provide recreational opportunities for people of all ages and mobility levels, allow healthy and efficient non-motorized transportation, preserve historic features, and act as outdoor classrooms for environmental education [Southeast Michigan Greenways, 1994].

In the Environmental Policy Study entitled "The River and the Land Sustain Us", the City of Windsor recognizes the importance of natural areas and the need for policies to protect them, in the City of Windsor and the County of Essex. As a result, the following vision statement has been developed to serve as the basis for achieving a sustainable community:

As a community, we value a healthy environment in which we, along with aquatic and terrestrial communities, can flourish. This well-being is achieved and maintained through actions that establish greater harmony between human activities and natural systems [City of Windsor Department of Planning 1994].

The City of Windsor has outlined eight categories through which lands identified as part of a Greenway system may be acquired:

1. purchase of all or part of the identified area;
2. cooperation with the Essex Region Conservation Authority (E.R.C.A.) or other public bodies to acquire the identified area;
3. negotiation with property owners for the conservation of all or part of the identified area as a condition of the Site Plan Control or Subdivision/Condominium Approval, or as a condition of approval by the City, of an Official Plan or Zoning By-law amendment;
4. the arrangement of leases with private property owners to provide for the protection and appropriate management of all or part of the identified area;
5. an exchange for the transfer of development density to another location satisfactory to the City;
6. an exchange of lands;
7. an approval expenditure of the Development Charges Act; and
8. donations, gifts, or bequests from individuals or corporations [City of Windsor Department of Planning 1994].

Linkages that form a part of the Greenway System may include: bikeways, recreation ways, trails, utility corridors, abandoned railway corridors, schools and other open spaces as deemed appropriate.

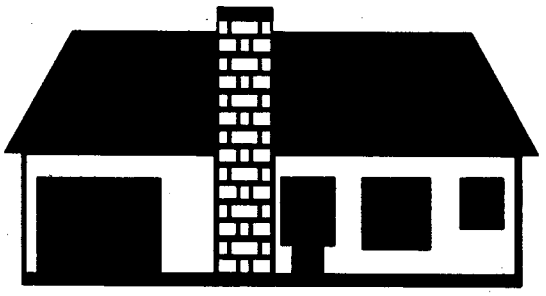
3.0 REAL PROPERTY VALUES

Greenway corridors provide a variety of amenities, such as attractive views, open space preservation, and convenient recreational opportunities. These amenities are valued and this value is communicated through increased property values and increased marketability for those areas surrounding the greenway.

3.1 Increased Property Values Quantified

The effect on property values of a location near a park or open space has been the subject of several statistical analyses. Through attempting to control other variables, such as age, square footage and conditions of homes, these studies attempted to isolate the effect of open spaces. In 1967 the citizens of Boulder Colorado approved the establishment of a fund to be used for purchasing and managing greenbelts, financed by a 0.4 percent city sales tax, which generated over one million dollars per year in revenue.

Debates on the merit of such programs have stressed the local public good benefits of preserving open space. For the most part this emphasis has overlooked the quasi-public good benefit which is associated with the increased property values adjacent to greenbelts and which could provide additional tax revenue to support such purchases [Correll et al 1978]. Correll et al, discovered that greenbelts in their study area had a statistically significant impact on the price of residential property. That is, the homes located closer to the greenway have a higher value. This study suggests, ceretis peribus, there is a $4.20 increase in the price of a residential property for every foot one moves towards the greenbelt, within a 3,200 foot perimeter. For example, a single-family dwelling located 30 feet from the greenway is valued at $54,379, while a single-family dwelling located 3,200 feet from the greenway is valued at $41,206. Consequently, Correll et al suggest that if other variables are held constant, the average value of properties adjacent to the greenbelt would be 32 percent higher than those 3,200 walking feet away.



An analysis of property surrounding four parks in Worcester, Massachusetts, showed that a house located 20 feet from a park sold for $2,675 (1982 dollars) more than a similar house located 2,000 feet away [National Parks Service 1995]. Similarly, in the neighbourhood of Cox Arboretum in Dayton, Ohio, the proximity of the park and arboretum accounted for an estimated five percent of the average residential selling price.

In the Whetstone Park area of Columbus, Ohio, the nearby park and river were estimated to account for 7.35 percent of selling prices [National Parks Service 1995].

The effects of proximity to the open space may not be as easily quantified as in the above examples for a variety of reasons. Rather, values of properties within a vicinity to an open space may depend upon a variety of characteristics such as:

- open space rather than highly developed facilities;
- limited vehicular access, but some recreational access; and
- effective maintenance and security.

It has been shown, in the case of traditional parks, that high use areas can have a potentially negative influence on adjacent properties, however, they may also contribute to an increase in value for nearby properties [Lyon 1972].

3.2 Increased Property Tax Revenues

An increase in property values has the potential to increase local tax revenues collected by municipalities where tax structures are capable of capturing changes in tax. As a result, land acquisitions (if necessary), could in fact pay for themselves over a relatively short period of time. A point to remember, however, is that many jurisdiction's assessments of property values often lag behind market value.

3.3 Construction/Development Perspectives

Proximity to greenways, rivers, and trails can increase property sales price, increase the marketability of adjacent properties, and promote faster sales. Clustering of residential development to allow for establishment of a greenway, or intensification of residential development surrounding a greenway, may decrease overall development costs. Under the category of avoided costs, residential intensification can allow more efficient use of new and existing infrastructure, yielding savings in the provision of services such as community and recreational centres, fire and police, postal services, schools and so on. Where residential intensification occurs near work sites or public transit routes, it can also help to reduce private commuting and public transit costs [Environment Canada 1993].

A study commissioned by Environment Canada examined the development potential and other benefits from restoration, enhancement, and protection of Great Lakes basin watersheds. This study, in the category of avoided costs, suggests that in coordination with the clean-up of Hamilton Harbour, follow-on investments should focus on residential intensification in Hamilton Centre. The study calls for business promotion and retention in the downtown Hamilton core and the waterfront, as well as, the redevelopment of lands currently used for industrial and residential uses. The study concluded that with the corresponding increases in availability of and access to recreational facilities, savings in municipal expenditures for expanded infrastructure

development in new suburban areas will occur, resulting in $84 million in capital savings (1993 dollars) [Environment Canada 1993].

4.0 EXPENDITURES BY RESIDENTS

This section examines the expenditures related to the use of greenways and greenspaces by local residents (day users). It should be noted that these expenditures are referred to as transfers rather than as benefits. In addition, this section will examine overall expenditures on outdoor recreation, and the impact such expenditures have on the local and provincial economy.

4.1 Outdoor Recreation, a Spending Priority

The increased interest in fitness and demand for outdoor recreation and leisure opportunities has resulted in higher values being placed on accessibility to greenspaces and greenways. Leisure is often considered to be discretionary, or free time away from work and other responsibilities, where participants choose and control their activities. Outdoor recreation and leisure expenditures can account for a substantial part of an individual's discretionary spending [National Park Service 1995].

A recent report prepared for the British Columbia Ministry of Environment, Lands and Parks undertook a study of the benefits of the provincial park system to the province. The study concluded that expenditures on parks totaled $430 million in 1993, 90 percent of which was generated by the spending of park visitors. A significant portion (approximately one third) of this expenditure was made by out-of-province residents. Overall, the park system contributed over $400 million to provincial GDP (the value added by British Columbia workers and businesses), and sustained 9,300 jobs in the province. As well, it accounted for approximately $40 million in provincial tax revenue for British Columbia and about $120 million in federal tax revenues [Ministry of Environment, Lands and Parks 1995].

The total value of personal expenditures in Canada on goods and services related to physical activity was estimated at $6.3 billion in 1986 [Conference Board of Canada 1991]. At the same time a total of 184,000 jobs were generated in Canada by industries associated with goods and services related to physical activity [Conference Board of Canada 1991].

Many outdoor recreational activities take place along greenways. Currently only 42 percent of Windsor - Essex County residents are active on a regular basis [Windsor - Essex County Active Living Coalition]. Patterns vary significantly due to factors such as proximity to recreational facilities weather, recreational opportunities, income, and educational levels [National Park Service 1995].

In the Windsor area the older age cohorts in the population are increasing rapidly, as is the case in the rest of Canada. Canada experienced a phenomenon after World War II that few other countries experienced - a massive population explosion called the Baby-Boom. People 65 years of age and older will account for approximately 22 percent of the total Canadian population by the year 2031. In 1986, only 11 per cent of Canadians were in this age bracket [Gravelle et al 1993]. In the case of Windsor in 1991, 13 per cent of the population fell in the 65+ age bracket (see Table 1). In comparison, by 2031, 38 per cent of the population will fall within this age group. These numbers suggest that Canada, as well as Windsor, is an aging population; this is largely attributed to the fact that Baby-Boomers are entering their senior years. The question then is how does this demographic trend affect the recreation and leisure decisions of tomorrow.

TABLE 1

City of Windsor					
1991 Demographic Statistics					
Male (by age)		Female (by age)		Combined (by age)	
0-4	9,120	0-4	8,535	0-4	17,655
5-9	8,955	5-9	8,710	5-9	17,665
10-14	9,150	10-14	8,570	10-14	17,720
15-19	9,680	15-19	9,435	15-19	19,115
20-24	10,095	20-24	10,100	20-24	20,195
25-29	10,955	25-29	11,130	25-29	22,085
30-34	10,895	30-34	11,075	30-34	21,970
35-39	9,860	35-39	10,370	35-39	20,230
40-44	9,515	40-44	9,825	40-44	19,340
45-49	7,750	45-49	7,635	45-49	15,385
50-54	6,345	50-54	6,550	50-54	12,895
55-59	5,975	55-59	6,080	55-59	12,055
60-64	5,985	60-64	6,350	60-64	12,335
65-74	8,630	65-74	11,460	65-74	20,090
75+	4,720	75+	8,615	75+	13,335
Total	127,640	Total	134,435	Total	262,075
Source: Statistics Canada Catalogue No. 93-346					

Today, many Baby-Boomers are approaching retirement age, and will be searching for leisure opportunities to take part in while enjoying their remaining years. According to demographer David Foot, gardening and bird-watching are among the fastest growing pursuits in Canada, and will continue to grow in the 1990s. Foot's research shows that age is the most important factor in choosing a leisure activity: the older a person, the more likely he/she is to enjoy slow-paced activities [Foot, 1990]. According to Foot's research on leisure growth in Ontario from 1990 to 2015, gardening and yard-work are the most popular leisure activities when it comes to participation and are expected to keep growing in popularity. In fact, by 2015 they are expected to increase in popularity by 52 percent. Not far behind are the activities of walking/hiking (33 per cent) and bird-watching (29 per cent). Foot suggests that society needs to focus on the expansion and maintenance of parks, forests and trails and should offer more interpretive and outdoor skills programs to respond to the demands of an aging population [Foot, 1990]. Jack Wright, a professor of leisure studies at the University of Ottawa, says the values of Baby-Boomers will contribute to an increase in nature activities and give way to a new 'age of biology.' [Wright, 1993].

4.2 Spending by Local Residents

Local greenways encourage expenditures related directly to the activities undertaken on them, and generate economic activity for local businesses, (for example, recreation related equipment and services). These spin-offs result in the generation of employment and income at the local level. The level of these spin-offs is a function of the boundary and the character of the local economy and the level of spending by local residents. Similarly if greenways attract visitors from outside the local area, this results in outside dollars which may stimulate the local economy and create new jobs and income. These non-resident expenditures are discussed in further detail in later chapters.

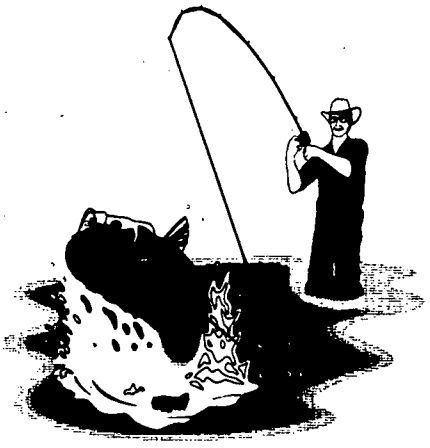
5.0 TRENDS AND EXPENDITURES BY ACTIVITY

The following discussion provides information on trends associated with uses of greenways, and provides evidence where spending associated with greenway-related activities has been quantified.

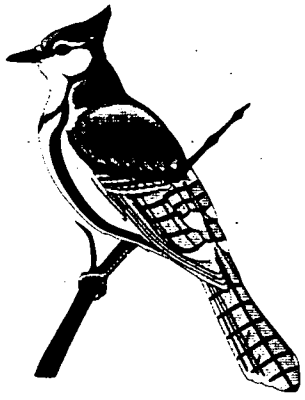
Fish and wildlife-related recreation

- Fishing
- Hunting
- Bird-watching
- Wildlife photography
- Photography
- Camping
- Attending Special Events
- Hiking
- Bicycling
- Cross-county skiing
- Traditional park pursuits
- Concerts/Festivals
- Trail-related recreation
- Walking

5.1 Fish and Wildlife-Related Recreation



Activities associated with fish and wildlife-related recreation include fishing, hunting, bird-watching, and wildlife photography. In 1991, 18.9 million Canadians (90.2 percent of the population) took part in one or more wildlife-related activities, devoting a total of 1.3 billion days and $5.6 billion to these activities [Environment Canada, Canadian Wildlife Service 1993]. Primary non-consumptive trips and other wildlife related activities accounted for $4.4 billion, recreational hunting accounted for $1.2 billion, and recreational fishing accounted for $2.8 billion. Canadians spent $1.6 billion on wildlife-related equipment and $1.2 billion on maintaining, improving or purchasing natural areas.



Essex County has long been recognized as one of the most popular bird siting areas. At Point Pelee, Ontario, the net economic value of birding amounted to more than six million dollars in 1987 (Hvenegaard et al 1989). A survey related to the economics of birding, conducted by the International Council for Bird Preservation, suggests the average yearly amount spent per birder to be $1,852 U.S. dollars (1990 dollars)(American Birds, 1990). These funds are spent on bird-related activities and paraphernalia, such as, optical equipment, books and magazines.

5.2 Trail -Related Recreation

Trail-related recreational activities include: walking for pleasure and health, jogging, hiking, bicycling, in-line skating and cross-country skiing. The growth of passive recreation has had a direct impact on the demand for trails and greenways; this demand is expected to grow. Bicycling attracts people of all ages; interest in this activity is retained from childhood into later years. With the aging population, bicycling will likely retain its popularity as a "lifetime" activity.

Lawton (1986), investigating the annual economic impact of the 23.5 mile Sugar River Trail (bicycle trail) near Glarus, Wisconsin, found that trail users spent nearly $430,000 (U.S. dollars) in 1985 or $9.04 per person. Similarly, the State of Minnesota reported the

average amount rail-trail users expected to spend on the day they were interviewed varied from $1.90 to $8.38 [Siderelis and Moore 1995].

A computer model (Conference Board of Canada 1991) predicted that an increase in consumer expenditures on goods and services related to physical activity generated more jobs and higher overall labour income than an equivalent increase in expenditures on general goods and services [The Parks and Recreation Federation of Ontario 1992].

6.0 COMMERCIAL USES

Greenways can provide business opportunities, locations, and resources for commercial activities. These activities may include on-site concessions, permittees, special events, and commercial filming activities.

6.1 Special Events

Special events not only generate revenues for sponsors and the community, but promote the greenway itself to residents and visitors.

The 12th annual "Great Race" in Pittsburgh, in 1987, attracted 12,807 runners to the city. Those runners living outside Pittsburgh, but within Allegheny County, spent an average of $14.40 on race-related items. Overall, the Great Race generated an estimated direct economic impact of $220,000 within Allegheny County. Adding registration fees paid by race participants, this total exceeds $330,000 [National Park Service 1995].

Special events can also be used to raise money and promote the greenway or trail itself. In addition, unique and scenic areas are desirable as location backdrops for movies, television, and photo sessions for magazine and newspaper advertising. Fees paid to use these areas, in addition to the money spent locally by film production crews during filming sessions, are beneficial to the local economy.

7.0 AGENCY EXPENDITURES

7.1 Greenway Related Expenditures

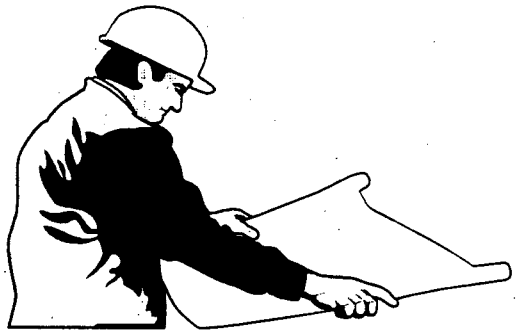
The managing agency supports the local economy by providing jobs, and purchasing supplies and services to develop, operate, and maintain the greenway. Benefits to the local community are greater if supplies and services are purchased from local business [National Park Service, 1995]. Initial greenway investments are being undertaken to provide increased access to natural areas, thereby enhancing greenway social, recreational and economic benefits. Recreational uses require increased access to greenways and parks, increased utilization of existing recreational areas and the development of abandoned or underutilized areas.

Employment generated through the creation of greenways can be targeted to benefit particular needs of the community. For example, programs may be implemented to employ population segments experiencing high unemployment.

During 1995 the City of Windsor invested approximately $900,000 in trail development. This included monies from the National Infrastructure Program, Ministry of Transportation and the City of Windsor. Some of the projects undertaken in 1991 included the Ganatchio trail re-development, Devonwood/Homesite trail, Maryvale trail, College Avenue trail, Centennial Park, and Roseville and Malden Road trail [personal communication Dan Jaworski, Parks & Recreation Department Windsor, Jan. 26 1996].

7.2 Local Business Support

Expenditures by local governments may in fact be more important for some local businesses than others. Some local businesses and contractors may be more dependent upon local recreation programs for a significant portion of their revenue.



The experience in the City of Windsor has been to hire contractors from within the region, hence providing financial benefits for local businesses. The costs of constructing a greenway in the City of Windsor for a three meter wide by one kilometer long stone or asphalt trail has been $40,000 and $65,000, respectively [personal communication Dan Jaworski, Parks & Recreation Department Windsor, Jan. 26 1996].

Numerous towns and cities in Ontario have applied the Economic Impact Model for Municipal Recreation developed by the Ontario Ministry of Tourism and Recreation. Places like Peterborough, Red Lake, Woolich Township, Uxbridge, Midland and Burlington have analyzed how municipal expenditures in recreation have affected expenditure patterns in the private and public sectors of their communities. Each have determined what the economic multiplier is for their community and range from approximately 1.02 to 1.42 [Ontario Ministry of Tourism and Recreation , 1992].

8.0 TOURISM

Tourism is a major industry within the Ontario economy. Tourism activities are one of the primary activities in many centres, and Ontario's tourism industry is the province's fourth largest export. Tourism is a traded industry attracting vital export earnings through the visits of tourists from the United States and overseas. [Ministry of Culture, Tourism and Recreation 1994].

8.1 The Travel Industry

By the year 2000, the tourism industry in Ontario is projected to achieve leading levels of growth, more specifically it is projected to:

- attract 15 million more visitors - an increase in the number of visitors to Ontario from 159 million to 174 million;
- generate approximately $6 billion more from visitor spending to a new revenue level of $123 billion (1991 dollars);
- achieve clear recognition as one of the top industries in Ontario's economy [Ministry of Culture, Tourism and Recreation 1994].

Travel and tourism is a major industry within the Ontario economy and the economic health and prosperity of the region is critically linked to developments in this sector. Expenditures for travel and tourism impact transportation, lodging, eating establishments, retail, and service businesses. These expenditures support jobs, personal income, and government tax revenues.

For purposes of this section, "travel and tourism-related expenditures" refer to those visits that originate from beyond the boundaries of the local economy. Expenditure patterns for visitors are usually higher than for local users [National Park Service 1995].

Tourism expenditures in Windsor/Essex are estimated to have exceeded $316 million in 1992. More than 9,734 person years of employment in the province were associated with these expenditures, of which 7,455 were directly generated. Of the total jobs, 7035 were sustained in the Windsor region with the remaining jobs distributed throughout Ontario [The Convention and Visitors Bureau of Windsor/Essex County and Pelee Island, March 1993].

A casino was built in the city of Windsor in 1992. This interim casino, which is open 24 hours a day, seven days a week, employs 2,100 people and attracts 15,000 to 20,000 visitors a day [The Windsor and District Chamber of Commerce 1995].

Other initiatives to be pursued with respect to the development of Windsor's tourism industry include the implementation of the City Centre Revitalization Study and the development of a transient marina with over 400 berths on the city's waterfront. This marina will be located across the street from the casino. [The Windsor and District Chamber of Commerce 1995]. With the casino as the primary catalyst and with the further development of additional tourism products including historical, agricultural and viticultural tours, it is anticipated that the tourism industry will experience continued growth in 1996 [The Windsor and District Chamber of Commerce 1995].

A greenway, which provides local opportunities and enhances tourist draw, can be an important asset to a community. Recent trend analyses show that weekend trips to nearby areas are on the increase, while the traditional two-week summer vacation is on the decline for today's travelers. According to the Windsor and Essex County Tourism Economic Impact Study (WECTEIS), with regard to length of visit to the Windsor Essex area, 56.7 percent of survey respondents stayed more than one day, and the remaining 43.3 percent were designated as day-trippers, spending less than a day in the region.

8.2 Natural/Cultural Areas Attract Travelers

Tourists' interests are shifting from escapism to enrichment. Demographic, socio-economic, lifestyle, travel and institutional trends have had a major impact on what is important in making travel plans. There is a clear trend to neo-traditional values as people seek to balance family, work and leisure pursuits. Substance and reliability are strong consumer values (see Figure 4) [Ministry of Culture, Tourism and Recreation, 1994].

Outdoor recreation, natural, historical, and cultural resources are increasingly important attractions for travelers. Eco-tourism is an environmentally responsible form of travel in which the focus is to experience the natural areas and culture of a region while promoting conservation and contributing economically to local communities [Adventure Travel Society 1994].

8.3 Attributing Expenditures to Rivers, Trail and Greenways

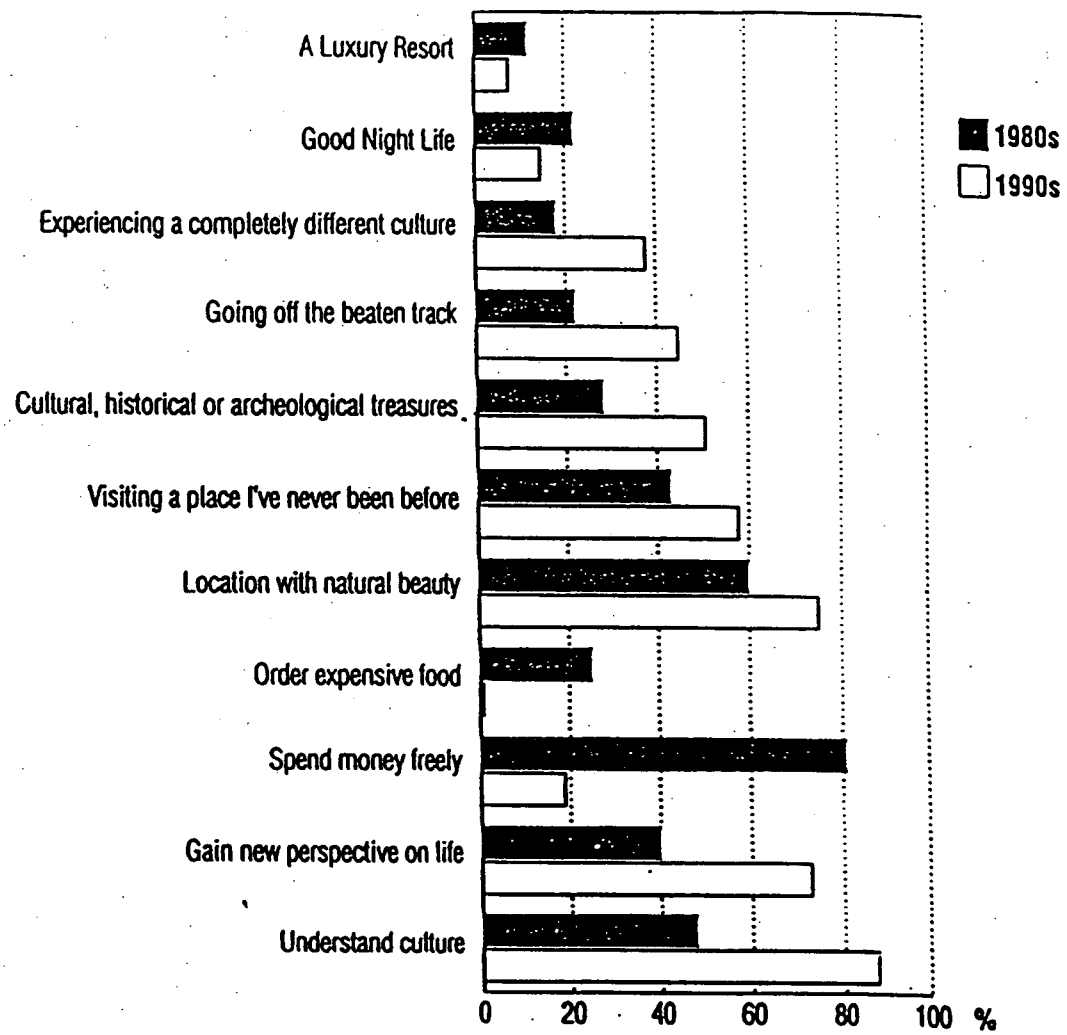
Greenways, rivers, and trails can have varied levels of tourist draw. They can be travel destinations in themselves, encourage area visitors to extend their stay, or enhance business and pleasure visits.

Tour operators, outfitters, and guides are also important to local economies due to the expenditures their businesses generate, the fees they pay to operate, and their advertising and promotion of local resources [National Parks Service 1995].

8.4 Marketing Potential

Rivers, trails, and greenways provide unique resources which nearby travel and tourist-serving establishments, chamber of commerce, and local visitors bureaus can capitalize on and feature in advertisements.

An example of changing trends. What is very important when planning trips?



Source: Lou Harris Poll for Travel & Leisure Magazine 1992.

9.0 BUSINESS PROMOTION AND RETENTION

Many communities want to attract new, expanding, or relocating businesses to their areas in order to increase their employment and tax base. Retaining existing businesses within a community is even more important for economic stability [National Park Service 1995].

9.1 Quality of Life Attracts Businesses

The importance of quality of life in an area is increasingly cited as a major factor in corporate and business location decisions. One aspect of quality of life is a location with convenient access to natural settings, recreational and cultural opportunities, and open space.

9.2 Greenways Contribute to Quality of Life

Greenways, rivers, and trails can play an important role in increasing a community's quality of life, and are attractive to businesses and corporations. Office site locations adjacent to rivers, trails and greenways are also likely to be more attractive to prospective tenants than sites lacking such amenities. Developers and property managers recognize these amenities.

9.3 Greenways Promote Employee Fitness

Businesses are realizing the benefits of healthy employees, both in increased efficiency and decreased health insurance claims. Greenways help promote fitness by providing convenient opportunities for exercise, such as walking, jogging, or exercise courses.
The results of several studies in support the connection between recreation activities, physical fitness, work performance and improved health or reduced illness. One study involved employees at the Canada Life Insurance Company as the experimental group and at the North American Life Assurance Company as the control group. Various fitness programs were instituted at Canada Life and nearly to 50 percent of all company employees participated in one or more of these programs. At the end of the six-month fitness program, the experimental group demonstrated significant positive results in several measures of physical fitness, including cardiorespiratory fitness, reduction in percent of body fat and an increase in flexibility. Furthermore, within the experimental group

the "high adherence" group showed a net decline in absenteeism of 22 percent over the study period, taking into account seasonal variations [Ministry of Tourism and Recreation, 1983].

Greenways and trails also help reduce firms' employees' commuting costs because they provide opportunities to commute by foot or bicycle.

10.0 PUBLIC COST REDUCTION

Conservation of greenways, rivers, and trails may result in reduced costs to local government and other public agencies. Through the conservation of greenways rather than the destruction of natural areas as a result of urban sprawl, local governments may reduce costs associated with servicing these subdivisions, such as costs associated with sewers, roads, and schools. Increasing taxation rates is directly related to the expanding budgets needed to pay for urban sprawl, because all governments rely primarily on taxes as revenue [Troyak and Muir 1993]. In addition, establishing a greenway in an area prone to hazards, such as flooding, may decrease costs for potential damages.

10.1 Public Service Requirements

One must consider the benefits and costs related to urban sprawl. Perceived expansion of the tax base associated with urban sprawl may, in fact, not occur. Expansion almost always results in increased public service requirements. In fact, the costs related to expansion may be greater than the revenues to local governments resulting from the expanded tax base.

10.2 Hazard Mitigation

Use of geographically or environmentally sensitive areas for open space or recreational purposes can reduce potential property damage costs and loss of life. For instance, hazards such as flooding can be mitigated through conservation of open space.

With regard to the redevelopment of the Ganatchio Trail, a portion of the work involved raising the grade of sections of the trail and surrounding greenbelt to provide a barrier landform (sufficient size and elevation to prevent flooding of adjacent undeveloped lands). The costs involved with this work will be charged to the developers of these adjacent lands since the lands cannot be developed without these flood control measures.

10.3 Pollution Control

Researchers have found that natural properties of plants and trees help mitigate water, air, and noise pollution. Greenways which help conserve such plants and trees provide a valuable contribution toward pollution control. Pollution can also be decreased by

establishing trail greenways which encourage people to walk or bicycle rather than drive automobiles.

The establishment of a greenway along a river or stream helps maintain water quality because riparian vegetation helps filter out pollutants. Riparian vegetation serves as an effective buffer between a stream and adjacent agricultural area. The retention capabilities of this vegetation prevents many agricultural chemicals from polluting the stream [National Park Service 1995].

Greenways can also help reduce other adverse impacts of urbanization. Drastic alterations of a ground surface, such as compaction or paving can reduce the infiltration capacity of a surface, which can cause a serious reduction in groundwater recharge and an increase in runoff.

Greenways also help control air pollution because plants are natural air cleaners. Plants cleanse the air through the process of photosynthesis, which removes carbon dioxide from the air and returns oxygen. In 1991, trees in the City of Chicago, Illinois (which is characterized by 11 percent tree cover) removed an estimated 17 tons of carbon monoxide, 93 tons of sulfur dioxide, 98 tons of nitrogen dioxide and 210 tons of ozone. The value of this pollution removal was estimated at one million dollars annually [National Parks Service 1995].

PART B

INTRODUCTION

In the past 20 years the greenbelt concept has acquired new importance, particularly at the suburban level, where communities have become acutely aware of the relationship between sprawl and a reduced stock of open space. In 1987 The World Commission on Environment and Development recognized the need for a shift in development away from urban sprawl towards a more sustainable urban form.

The subject of this study, Windsor Ontario, in 1994 recognized the importance of natural areas and the need for policies to protect the natural areas within the city limits and within the limits of the County of Essex. As a result, the following vision statement has been developed by the City of Windsor to serve as the basis for achieving a sustainable community:

As a community, we value a healthy environment in which we, along with aquatic and terrestrial communities, can flourish. This well-being is achieved and maintained through actions that establish greater harmony between human activities and natural systems [City of Windsor Department of Planning 1994].

Consequently, the City of Windsor has published The 1994 City of Windsor Environmental Policy Study entitled "The River and Land Sustain Us". It is this publication which outlines eight alternatives for Greenway system acquisition:

1. purchase of all or part of the identified area;
2. cooperation with the Essex Region Conservation Authority (E.R.C.A.) or other public bodies to acquire the identified area;
3. negotiation with property owners for the conservation of all or part of the identified area as a condition of the Site Plan Control or Subdivision/Condominium Approval, or as a condition of approval by the City, of an Official Plan or Zoning By-law amendment;
4. the arrangement of leases with private property owners to provide for the protection and appropriate management of all or part of the identified area;
5. an exchange for the transfer of development density to another location satisfactory to the City;
6. an exchange of lands;
7. an approval expenditure of the Development Charges Act; and
8. donations, gifts, or bequest from individuals or corporations

[City of Windsor Department of Planning 1994].

This portion of the report, The Effects of Greenspaces on Residential Property Values, concentrates on the impact that a greenspace may have on property values, through its amenities, such as attractive views, open space preservation, and convenient recreational opportunities. It is broken down into two parts; the first outlining a description of the study, the method, a description of the study areas, and lastly the empirical results of the

sample regression runs. The second part, involves a theoretical exercise of calculating the aggregate value of the greenbelt, based on the quasi-public good effect of the amenity on property values. These amenities are valued by isolating the appreciation in market value, attributable to the greenbelt amenity, for those properties neighbouring the greenbelt. This is followed by some discussion relating to policy implication as a result of the potential increase in the municipal tax base.

DECRIPTION OF THE STUDY

Policy debates in Windsor have stressed the public good benefits of preserving open space. However, in having recognized the public good benefits of open space, the City of Windsor has over looked the quasi-public good benefits associated with the amenity. This report draws from the work of Correll, Lillydahl and Singell (1978), whose work involved the examination of the quasi-public good effect of greenbelts on residential property values in Boulder, Colorado. The study, recognized that goods which have attributes of "publicness" may also confer private benefits. For instance, properties bordering a greenbelt may yield a higher value due to their vicinity to the greenbelt, thereby benefiting the property owners.

Most programs of public expenditures fall into a mixed category rather than a pure case of market imperfection. Most city owned and operated parks and greenbelts are available to the general public at no cost, constituting what is referred to as a perfectly public good[2]. It is possible in this case that an "excess demand" results for the private assets[3] within close vicinity to the green space. Therefore assuming greenbelts are a quasi-public good comprising benefits, the value of surrounding lands would demand a higher rent, the consumption of which is rival, reflecting the value of the externality.

Since the 1970's, many urban experts have examined ways in which amenities and disamenities affect urban residential property values. In this context the effect upon property values of neighbourhood parks, radioactive waste, canals, aircraft noise and location have been examined [Button and Pearce 1989; Payne, Olshansky and Segel 1987; Schall 1971]. In these models the neighbourhood housing is taken to represent the services offered by the land and structure. These models also assume that competitive markets exist, which allows for theoretical interpretation of price differentials that exist and can be attributed to the amenity.

This analysis hopes to provide some further clarification of the effect of an amenity on neighbourhood housing. Specifically there are two public goods, the first, Windsor's open space is a public good which benefits everyone in the Windsor area. Second,

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[2] A pure public good has the two following properties:
Non-excludability: if the public good is supplied, no household can be excluded from consuming it;
Non-rivalry: consumption of the public good by one household does not reduce the quantity available for consumption by any other.

[3] Private assets are single home dwellings surrounding the greenbelt.

specific parcels of greenbelts benefit those living nearby, consequently the amenity represents a quasi-public good. The first of these two public goods is assumed, it is the second public good, i.e. the quasi-public good, which will be further examined.

METHOD

The variables of interest and the residential property values are measured in terms of real estate transactions on single-family homes. In this respect, records of real estate transactions occurring in three specific parcels of greenbelts, during the calendar year 1991, within the City of Windsor were investigated. These include; Askin (Sample 1) (Figure 1), the Ganatchio Trail (Sample 2) (Figure 2) and the Springgarden ANSI[4] (Sample 3) (Figure 3) (see Appendices C-E), were drawn from the City of Windsor Assessment Records. These three greenbelts were chosen with the assistance of the City of Windsor Planning Department. They met the criteria of, (a) being within close vicinity of single-family dwellings, and (b) supported a mix of activities by users. Data was made available through assessment records, which included all real estate transactions, transfers and alterations within the City of Windsor. With the assistance of the City of Windsor Planning Department, data was collected on real estate transactions for single-family residences up to a 3,000 walking foot radius from the perimeter of these three greenbelts.

In this study the following data was collected: the year of the transaction, age of the property, the number of bathrooms, the number of bedrooms, the lot size, the square foot of living space, the number of stories, heating type, number of fireplaces, air-conditioning, garage type and garage spaces, finished basement, and the selling price. The sales were screened for those that might not be representative because the last names of the seller and buyer were the same or if the sale was listed as an estate sale[5]. The total number of real estate transactions in Neighbourhoods 1, 2 and 3, in 1991, were 32, 48 and 34, respectively. Of the variables listed above, a limited number were employed in the model, the year of the transaction, age of the property, the number of bathrooms, the number of bedrooms, the lot size, the square foot of living space, and the sales prices. Additional housing characteristics variables were considered e.g. basement and garage, however, this data was not always complete and further literature review suggested these variables would not add to the explanatory power of the model and would lead to problems of multicollinearity. A zoning variable might have been a good proxy for some neighbourhood effects, but zoning did not vary significantly among the three neighbourhoods sampled.

[4] ANSIs are areas of land and water containing natural landscapes or features which have been identified by the Ministry of Natural Resources (MNR) as having values related to protection, natural heritage appreciation, scientific study or education. The ANSI program set up by the MNR is concerned with protection of areas of natural and scientific interest which are protected in Provincial Parks.

[5] Estate sales were thrown out since it is not uncommon for the selling price under these conditions to be less than under normal conditions.

Drawing on the literature [Correll, Lillydahl and Singell 1978] a model was constructed relating price to property characteristics. The variable definitions and sources are as follows:

P	=	Sale price of single-family residential property in 1991, from the City of Windsor Planning Department.
AGE	=	Age of house in 1991, from assessment data.
SQF	=	Finished square footage of house, from assessment data.
BTRMS	=	Number of bathrooms, from assessment data.
BDRMS	=	Number of bedrooms, from assessment data.
DGB	=	Walking distance in feet, usually most direct public access to greenbelt, estimated from the City of Windsor Planning Department maps.
LTA	=	Lot area, from assessment data.

Neighbourhood characteristics, such as deterioration, race, education, income and housing density were not readily available consequently were not used. It has been assumed that age and lot size variables would capture deterioration and density.

STUDY SITES

The study sites were selected with the assistance of the City of Windsor Planning Department. It was thought to be essential to select open spaces which were bordered with a neighbourhood of single-family dwellings, which ensured an ample sample size based on 1991 sales, and which supported a mix of activities by area users. Some characteristics of the samples are provided in Table 1.

TABLE 1
CHARACTERISTICS OF PROPERTY SAMPLES IN THREE NEIGHBOURHOODS

Neighbourhood Sampled	Number of Properties	Average property Value (dollars)	Average Age of House (in 1991)	Average Number of Bathrooms	Average Number of Bedrooms	Average Lot Size	Average Distance to Greenbelt
Sample One	32	138,124	26	1.7	3.1	7,085	688
Sample Two	48	108,154	40	1.33	2.9	6,536	1,403
Sample Three	34	123,309	19	1.44	2.9	6,285	1,269

The greenbelt in Sample 1 is bordered by residential properties, as well as 3 perimeter roads. The age of the properties within Sample 1 range from 0, (i.e. built in 1991), to 36 years of age , (i.e. built in 1954). The average distance to the greenbelt in Sample 1 is

680 feet. The properties in Sample 1 contain on average: 3.1 bedrooms; 1.7 bathrooms; and sit on an average lot size of 7,085 square feet (see Table 1 and Appendix C). The average sales prices in Sample 1 was the highest of the three samples. The average distance of the properties which sold in Sample 1 is less than that of Samples 2 and 3.

The greenbelt in Sample 2, unlike Samples 1 and 3, consists of an asphalt pathway, landscaped greenbelt and exercise stations. The Ganatchio Trail (Sample 2) is eight kilometers of scenic trails stretching from the City of Windsor to the Town of Tecumseh. Sample 2 consists of only a portion of this trailway. The Ganatchio trail system is in close vicinity to an additional amenity, the Detroit River. The impact which the Detroit River has on the results in Sample 2 will be discussed in later sections.

The average age of the properties in Sample 2 is 40 years of age, (i.e. built in 1951). The average distance to the greenbelt in Sample 2 is 1,400 feet. The properties contain, on average, 2.9 bedrooms, 1.33 bathrooms and sit on an average lot size of 6,536 square feet (see Table 1 and Appendix D). The average sales prices of Sample 2 was the least of the three sample.

The greenbelt within Sample 3 is that of an Area of Natural and Scientific Interest (ANSI). This particular greenbelt is adjacent to residential development, much of which has occurred in recent years. This is reflected in a relatively low average age of properties within the sample. Properties range in age from 0 to 65 years, and of the 34 properties within Sample 3, nine were built in 1991. The average distance to the greenbelt in Sample 3 is 1,269 feet. The properties in Sample 3 contain on average 2.9 bedrooms, 1.44 bathrooms and sit on a lot size on average of 6,285 feet (see Table 1 and Appendix E).

EMPIRICAL RESULTS

The exercise began using ordinary least squares procedures to estimate the relationship between the age of the property, the number of bathrooms and bedrooms, the lot size, the finished square footage and greenbelt proximity on a pooled sample of neighbourhoods 1-3. Second, the same exercise as above is carried out on a aggregate sample of neighbourhoods 1 and 3. Finally, the relationship within each neighbourhood was estimated independently, and neighbourhood 1 was chosen to further explore the potential implications of neighbourhood open space.

TABLE 2

Regression results for all three neighbourhoods with adjacent Greenbelts			
Neighbourhood			
	Sample 1	Sample 2	Sample 3
Constant			
AGE	-814.27	27.452	-957.05
SQF	20.718	36.605	14.639
BTRMS	18777	9400.7	3342.6
BDRMS	TO	3068.9	19907
DGB	-8.1227	0.3287	-7.7219
LTA	TO	-1.898	3.0688
n	32	48	34
Adjusted R2	0.6937	0.5023	.8030
Sample 1 results presented are based on a run having thrown out the two variable noted above by TO.			

POOLED SAMPLE

The results of the pooled sample are as follows (standard error terms are in (parenthesis) and student - T values are in [parenthesis]):

$$P = 69874 - 6.92DGB - 448.05AGE + 21.34QF + 17858BTRMS + 4846.40BDRMS - 0.46LTA$$

(2.47)	(117.1)	(5.32)	(3341)	(3107)	(0.74)
[-2.80]	[-3.85]	[4.010]	[5.264]	[1.560]	[-0.618]

n=114; Adjusted R^2 = .669
significant at the .10 level

The Pooled Sample encompassed all three neighbourhoods, for a total of 114 properties. Each of the coefficients of the explanatory variables has the expected sign except for lot area, all are statistically significant at conventionally acceptable test levels, with the exception of lot size. According to the results above, vicinity to the greenbelt has a statistically significant positive[6] impact on the price of residential property. Other things being equal, there is $6.92 increase in price of a residential property for every walking foot one moves in the direction of the greenbelts. This suggests that a home located 30 feet from the greenbelt would have an excess value of approximately $3,252 over that of a property located 500 feet from the greenbelt. Recall, that near the greenbelt, individuals with a high demand for proximity bid up prices for residential space, the consumption of

[6] The DGB coefficient reads negative, recall that the hypothesis is that as one moves away from the greenbelt property values decrease.

which is rival[7]. As one moves further away from the greenbelt, there is less effect from the greenbelt as a neighbourhood quasi-pubic good,[8] however, all properties and citizens are still positively affected by the availability and existence of the public good.[9]

While the pooled sample results are generally consistent with expectations, it was realized that the coefficient on DGB was weakened, a result of the fact that in Sample 2 the coefficient on DGB is not well behaved. (see Table 2). It is believed that the explanation of this lies in the proximity of the greenbelt to the Detroit River.

In the pooled sample, other variables are also significant, square footage and the number of bathrooms and bedrooms have a strong positive effect on price. More specifically, each additional square foot raises the price of the property by $21.34 and each additional bathroom and bedroom raise the price by $17,858 and $4,846 respectively, *ceteris paribus*. In the pooled sample, age has a significantly negative impact on property value, this is consistent with expectations, as a home ages it requires additional effort and resources in terms of maintenance.

AGGREGATE SAMPLE

The results for the aggregate sample are as follows (standard error terms are in (parenthesis) and student - T values are in [parenthesis]):

P = 80437 -7.98DGB - 880.21AGE + 17.75SQF + 16009BTRMS + 5189.50BDRMS+0.17LTA

(3.259)	(142.8)	(6.050)	(3875)	(4129)	(0.78)
[-2.45]	[-6.164]	[2.934]	[4.131]	[1.257]	[0.224]

n=66; Adjusted R^2 = .7832
significant at the .10 level

The aggregate sample encompassed samples 1 and 3, for a total of 66 properties. Each of the coefficients of the explanatory variables has the expected sign. No serious multicollinearity persisted in this model or other runs. According to the results noted above, proximity to the greenbelt has a positive impact on residential property price. The model suggests that for every linear foot in the direction of the greenbelt there is an

[7] The supply of homes in the neighbourhood of green space is a function of the size of the perimeter of the greenspace. Consequently, potential buyers may bid up the selling price, a result of a limited supply of greenspace properties.

[8] In this study it was assumed that beyond the 3000 feet mark the quasi-public good effect is zero. It is, however, more likely that beyond the 3000 feet mark there may exist a slight benefit. For simplicity in terms of calculations, it is assumed that quasi-public good benefits accrue only to those household neighbouring the greenbelt within 3000 walking feet.

[9] For all equations estimated for the samples a linear form provided a better fit than a log, semi-log, or quadratic forms. Having chosen the linear form, 3000 feet was chosen as a boundary. Darling [1973] and Correll et al. [1978] also chose linear forms. In addition, Correll et al. [1978], chose a boundary of 3,200 feet.

increase in the value of the property. *Ceteris paribus*, there is a $7.98 increase in price of a residential property for every foot one moves in the direction of the greenbelt. This suggests that a home located 30 feet from the greenbelt would have an excess value of approximately $3,750 over that of a property located 500 feet from the greenbelt.

The exclusion of Sample 2 from the Aggregate sample resulted in an increase in the DGB coefficient in the Aggregate Sample versus the Pooled Sample. Recall that in Sample 2 the DGB coefficient was not well behaved and that the direction of the effect of the greenbelt on property values was reversed.

In the aggregate sample, other variables are also significant, square footage and the number of bathrooms and bedrooms have a strong positive effect on price. More specifically, each additional square foot raises the price of the property by $17.75, and each additional bathroom and bedroom raise the price by $16,009 and $5,190 respectively, *ceteris paribus*. As in the pooled sample age has a significantly negative impact on the property values, in the Aggregate sample. According to the results of the model, the value of properties in Sample 2 is expected to increase by $0.17 with each additional square foot in lot area.

SINGLE SAMPLES

TABLE 3
VALUE OF THE AVERAGE HOUSE AND GREENBELT PROXIMITY
SAMPLE 1

VALUE OF THE AVERAGE HOUSE AND GREENBELT PROXIMITY	
Walking Distance from Greenbelt	Average Value of House
30 feet	$149,302
250	147,302
750	143,456
1,250	139,396
1,403	138,124
1,750	135,336
2,250	131,276
2,750	127,216
3,000	125,816
These results are calculated using the partial regression coefficient on DGB, for Sample 1, and by assuming that the Sample's average property value and average distance of $138,124 and 1,403 feet respectively, is the average for the neighbourhood population.	

In addition to the aggregate sample, individual equations were estimated for each of the three greenbelt neighbourhoods. This was considered advantageous due to differences among the three neighbourhoods. The results are summarized below.

In Sample 1, proximity to the greenbelt has a strong positive impact on the price of residential properties. The price increases by $8.10 for every foot one moves in the direction of the greenbelt. Table 3 provides some feeling for the impact of proximity to the greenbelt, in Sample 1, based on the partial regression coefficient on DGB and holding other variables constant. Table 3 suggests that a residential property within 30 feet of the greenbelt, would be approximately $23,000 or 19% greater in value than one 3,000 walking feet away.

Other variables in Sample 1, are also significant, for example, the living space adds $20.72 per square foot to the price of the property. Surprisingly, in this case the number of bathrooms adds significantly to the price of the property, for example, increasing price by $18,777, *ceteris paribus* (see Table 2). As expected, age has a significantly negative impact on the property value, in the order of $814. In Sample 1 two variables, number of bedrooms and lot area, did not add to the explanatory power and were consequently thrown out of the equation.

In Sample 2, distance from the greenbelt has a marginally positive impact, of $0.33 on the price of residential properties. In Sample 2, DGB is significant at the 40% level, which is an unacceptable probability of a type I error[10]. In the individual equation for Sample 2, three of the variables have unexpected signs. Hence, in this case it is not surprising that the direction of this effect is reversed. Unlike Samples 1 and 3, Sample 2 has a second amenity, the Detroit River which impacts the result of the DGB coefficient. To remedy this it would require that the distance of each property in Sample 2 to the Detroit River be calculated and entered into the algorithm as an additional variable. However, since this would require significantly more time and effort the focus of this exercise is on the impacts of greenbelts on neighbouring properties in Samples 1 & 3.

In Sample 3, distance from the greenbelt has a positive impact. Sample 3 contains a sizable amount of undeveloped lands. When future development occurs in this area, there should be greater capitalization of the amenity, that is, the open space. In addition, with respect to Sample 3, there needs to be integration between neighbourhood development and access to open space. From a policy point of view, neighbourhood value of open space, as reflected by an increased value of adjacent properties, depends on developers and planners working together in trying to integrate these two bodies (see Table 2).

[10] The hypothesis test has resulted in the rejection of the hypothesis, based on evidence taken from a sample of 48 properties. This is referred to as a type 1 error. A type 1 error is the rejection of the hypothesis as false, based on a sample when the hypothesis is in fact true.

In Samples 1 and 3 the age of the house has a significantly negative impact on the property value. This is expected since in most cases, older homes require attention, which is reflected in the price of the property. However, it is possible, as in the case of Sample 2, for age to have a positive impact on price. This may be a result of additions and housing improvements to certain properties. However, in the aggregate equation, age remains a significantly negative variable.

The above analysis suggests that the existence of greenbelts may have a significant impact on neighborhood property values. If it were possible to capture this effect on tax revenues[11] the potential increase in tax revenue would allow the City to follow through on the acquisition of greenbelt via the eight categories outlined in the 1994 City of Windsor Environmental Policy Study.

AGGREGATE VALUE OF GREENBELT

As a framework for considering possible policy issues the quasi-public good effect of the greenbelt on property values in neighbourhood 1 has been estimated. While the value of the purely pubic good may be difficult to estimate, the quasi-collective value can be theoretically defined and empirically evaluated in approximate terms.

Due to the effect of the greenbelt on property values, the aggregate property value for neighbourhood 1 was approximately $24 million greater than it would have been in the absence of the greenbelt. This increment resulted in an addition of approximately $482,450 to the potential neighbourhood property tax revenue.[12] Using assessment records for neighbourhood 1, the average property tax value in the neighbourhood is approximately $2,642[13]. Based on this value, the total property tax value for neighbourhood 1 is approximately $6.27 million. The potential increase in property tax revenue for neighbourhood 1, due to the effect of the greenbelt, amounts to an increase in property tax revenue of approximately eight percent. The quasi-public good benefit to the properties in neighbourhood 1, of $24 million, amounts to approximately seven per cent of the value of the properties in the neighbourhood

The quasi-public good benefit to the properties in neighbourhood 1 was obtained in the following manner: Six concentric bands were drawn around the greenbelt, covering the area to roughly 3,000 feet from the greenbelt edge. The neighbourhood effect was considered negligible beyond the 3,000 feet mark, consequently, the 3000 feet mark was considered the reference point. The properties in each band were counted and assigned

[11] A move to market value assessment would be one possible instrument available to capture such benefits.
[12] The value of the properties in neighbourhood 1 amounted to $328 million and was calculated by multiplying the average property value in the sample ($138,124) by the number of properties in the neighbourhood (2,372).
[13] This value was calculated using the assessment values in Sample 1 and the mill rate of 204.07.

he average property[14] distance from the greenbelt for each band. The total number of single-family dwellings, within the six concentric bands in neighbourhood 1, amounted to 2,372. The increase in neighbourhood property value was calculated by multiplying the partial regression coefficient on DGB by the distance of the median property for each band. The total impact on each band was summed by taking the value for the median property in each band and multiplying it by the number of properties in each band. The total impact on the neighbourhood was then summed by adding up the sums of each band. The potential property tax revenue is based on an average assessment rate[15] for the neighbourhood of 0.09798 and a property tax rate of 204.07 mills

Investment decisions by governments are often based or influenced by the present discounted value of a project. Therefore it was considered beneficial for this exercise to measure the present discounted value of the future potential property tax revenue in neighbourhood 1, utilizing a range of discount rates. Table 4 presents estimates of the present discounted value of the increase in property tax revenue at discount rates of 0, 3 and 5 percent.

One of the main problems arising from the use of discounting in the evaluation of environmental measures is the resulting devaluation of the costs and benefits. The effect of discounting is that, as time or the discount rate increases, the present value of a given cash flow is smaller than the undiscounted cash flow. Table 4 exhibits the impact of discounting given various combinations of time and rate, it's clear that discounting at any rate greater than zero reduces the impact of long-term benefits and costs.

To minimize the bias of high discount rates a discount rate of zero was offered as one of three measures. Price (1993) argues that because many aesthetic resources are in constant or diminishing supply over time, their value is maintained or even increasing as time passes. Technology may make it easier to travel to experience these resources, thereby increasing the supply available. However, it is impossible to substitute environmental landscape or aesthetic resource for another, because each has unique attributes to their value. Under these circumstances, Price concludes that discounting these values is inappropriate [Price, 1993].

The above analysis suggests that the existence of greenbelts may have a significant impact on adjacent property values. A number questions arise with respect to the potential increase in the tax base, associated with the quasi-collective value outlined above. For instance could the quasi-collective value be captured by the tax structure? Should some alteration in tax policy be made because of this benefit? What is the appropriate unit of local government to internalize the quasi-public good? The City of

[14] The average property in this case is based on the midpoint distance in each band, e.g. midpoint property in 0-500 feet band would be 250.

[15] The average assessment rate is based on the properties within Sample 1.

Windsor has outlined eight alternatives for greenway system acquisition, one of these being the purchase of all or part of the identified area.

The approximate purchase price of the greenbelt in neighbourhood 1 is $3.2 million[16]; thus, the potential property tax revenue alone would require a recovery period of approximately seven years. Table 4 presents estimates of the Present Discounted Value (PDV) of this tax revenue at discount rates of zero, three and five percent. Therefore, for municipal government and school boards, the potential property tax revenue exceeds the approximate cost of the greenbelt at all rates. For instance, at a discount rate of zero percent, the PDV of gains to the municipality through property taxation amounts to approximately $7.1 million, which is more than twice the cost of the greenbelt. Alternatively, by introducing a discount rate of five percent, consequently devaluing the benefits of the greenspace, the PDV of gains to the municipality through property tax revenue amounts to approximately $3.6 million.

It is safe to assume that the tax revenue benefits accruing to the school boards will benefit the boards as well as the residents to some extent. The issue is that the burden of purchasing greenbelts falls upon the municipality and the benefits accrue to a broader segment. Consequently there needs to be some consideration of the dispersal of tax benefits to allow for a optimal provision of greenbelts.

TABLE 4
PRESENT DISCOUNTED VALUE OF GAINS IN PROPERTY TAX REVENUE
(30 YEAR TIME HORIZON)

	Discount Rate		
Unit of Government	0%	3%	5%
Municipal Government	$7,114,717	$4,649,107	$3,646,253
School Boards	$7,356,540	$4,807,126	$3,770,186
Total	$14,471,257	$9,456,233	$7,416,439

The above exercise is a theoretical one, since the City of Windsor does not have a tax structure in place which could capture the potential property tax revenue adjustments outlined above. Consequently, the City of Windsor is currently acquiring parcels of the Askin greenbelt though land swaps and land purchases.

Currently the residents in the neighbourhoods containing greenbelts, in the City of Windsor, are benefiting from the proximity of their properties to the open space. However, with the potential of purchases of greenbelts by residents in suburban

[16] Since March of 1996, the City of Windsor has been acquiring parcels of the Askin greenbelt through land swaps and land purchases. The purchase price of parcels in the Askin greenbelt range from $150-$300 a frontage foot. The greenbelt consists of approximately 225 parcels [personal communication: City of Windsor Property and Housing Department, October 31, 1996].

communities for instance, an attempt may be made to limit growth and preserve open space. In the future more city-wide and region-wide planning may be required to provide the optimal amount of greenspace.

As the public good of open space becomes more common in the city, it is expected that the property value effects of adjacent property may begin to diminish, but the collective value of greenbelts as an important part of maintaining the quality of urban life will continue.

APPENDICES

Pooled Sample						
Price	Age (as of 1991)	Square Footage	Number of Bathrooms	Number of Bedrooms	Distance to Greenbelt	Lot Area (square footage)
$175,000	8	2,415	2	3	75	8,315
$85,000	36	978	1	2	75	8,125
$148,000	11	1,900	2	4	75	5,500
$156,000	11	1,600	2	4	75	5,400
$140,000	0	1,200	2	3	75	3,500
$145,000	0	1,100	1	3	75	6,930
$148,000	0	1,500	2	3	75	9,375
$169,888	0	1,500	2	3	75	5,000
$170,000	19	1,800	1	3	150	7,000
$128,000	10	1,760	1	3	150	5,600
$81,000	49	1,014	1	2	225	6,010
$145,000	19	2,283	2	3	300	9,375
$122,000	4	1,119	1	3	337.5	2,900
$121,028	0	1,617	2	3	375	4,000
$84,000	45	1,321	1	3	525	4,100
$160,000	19	2,400	2	3	525	8,800
$143,000	19	1,800	2	3	525	7,200
$117,000	4	1,545	1	3	562.5	4,800
$103,000	41	968	1	3	750	8,710
$85,000	28	1,876	1	2	825	9,240
$116,500	36	1,086	1	3	900	7,500
$60,000	51	816	1	2	975	8,223
$84,000	41	747	1	2	1050	6,500
$80,000	49	1,193	1	3	1050	3,410
$60,000	65	1,231	1	3	1050	3,000
$142,000	4	1,760	2	3	1050	4,480
$101,000	39	1,450	1	3	1125	6,400
$148,000	1	1,173	2	3	1200	8,925
$127,000	0	1,335	1	3	1200	5,950
$100,000	33	1,195	1	3	1500	8,900
$133,996	0	1,746	2	3	1500	5,950
$158,882	0	1,648	2	3	1575	5,850
$128,000	11	1,391	2	3	1650	4,440
$127,201	0	1,330	1	3	1725	4,281
$152,000	32	1,633	1	3	30	6,480
$130,000	31	1,241	2	3	30	6,955
$120,000	36	1,993	2	2	350	8,064
$163,000	13	1,726	2	3	390	6,679
$115,000	33	1,047	1	3	840	6,456
$115,500	23	1,969	1	3	840	6,180
$140,000	29	1,300	1	3	960	6,360
$127,000	31	1,270	2	3	960	6,360
$152,000	27	1,827	3	5	1080	6,420
$190,000	10	2,295	3	3	1140	5,718
$148,000	1	1,773	2	3	1200	8,937
$148,000	33	2,026	2	4	1350	8,640

Pooled Sample (Appendix A)

$130,000	33	1,849	2	4	1380	6,835
$100,000	33	1,195	1	2	1425	23,400
$121,000	32	1,520	1	3	1440	7,062
$170,000	29	2,067	2	3	1440	7,490
$185,500	30	2,138	4	4	1440	7,490
$215,000	7	2,151	3	3	1470	2,228
$145,000	30	2,204	2	5	1560	6,420
$127,000	27	2,202	2	3	1560	6,420
$204,450	6	1,850	3	3	1590	6,632
$118,000	33	1,837	1	3	1620	6,000
$101,000	33	1,503	1	3	1620	6,060
$113,000	33	1,944	1	3	1680	6,000
$123,500	33	1,329	2	3	1680	6,060
$133,500	28	1,488	2	3	1800	6,420
$125,000	33	1,655	1	3	1860	6,400
$115,000	33	1,456	1	3	1860	6,000
$126,500	33	1,531	1	3	2100	6,120
$121,028	0	1,617	2	3	2405	4,000
$80,000	36	978	1	2	2860	8,125
$165,000	8	2,415	2	3	2925	8,315
$123,000	30	1,896	2	3	50	8,150
$70,000	41	1,171	1	2	150	7,519
$121,200	24	1,445	1	3	150	5,835
$96,000	41	1,387	2	4	260	5,726
$100,000	41	1,251	1	3	300	5,726
$128,000	23	1,551	2	3	450	5,500
$125,000	28	1,581	1	3	475	8,300
$80,000	66	922	1	2	525	4,765
$119,000	23	1,214	1	3	550	6,279
$103,000	71	925	1	2	575	6,335
$130,000	24	1,255	2	3	600	5,500
$147,000	40	2,017	2	3	675	5,001
$71,000	26	1,000	1	4	675	7,290
$116,000	71	1,122	1	2	700	4,510
$102,000	33	1,206	1	2	725	9,453
$126,000	33	1,454	1	3	750	5,699
$69,900	66	1,222	1	2	775	8,379
$82,000	44	1,448	1	3	775	8,320
$65,000	67	851	1	2	800	3,745
$116,000	39	1,832	2	2	850	6,010
$141,000	26	1,828	2	3	900	8,923
$89,500	34	1,065	1	3	1075	6,629
$110,000	39	1,406	1	3	1225	6,042
$117,000	61	979	1	3	1250	6,005
$114,900	39	1,730	1	3	1275	5,717
$136,900	61	1,542	2	3	1300	5,463
$105,000	2	1,611	2	3	1400	9,833
$91,000	51	949	1	3	1425	6,688
$119,900	31	2,170	1	4	1525	5,661
$55,000	31	646	1	2	1600	9,200
$112,000	35	1,368	2	3	1725	7,209
$90,101	43	838	1	2	1750	6,840

Pooled Sample (Appendix A)

$88,900	41	970	1	3	1750	5,310
$90,000	35	1,310	1	2	1750	6,500
$115,000	37	1,625	1	4	1800	5,000
$117,750	35	1,556	1	3	1850	5,463
$98,000	34	1,769	1	3	1900	4,860
$149,000	27	1,880	2	4	1925	6,200
$110,750	39	1,384	2	4	2000	5,717
$109,000	44	1,630	2	2	2000	8,864
$120,000	39	1,711	1	3	2075	6,060
$124,100	33	1,492	2	3	2200	5,500
$135,000	66	1,791	1	4	2300	9,834
$112,000	46	1,364	1	3	2350	8,640
$105,500	33	1,393	1	3	2400	5,500
$109,500	61	1,602	2	4	2425	6,240
$107,000	37	1,191	1	3	2450	5,883
$127,500	41	1,600	2	3	2500	5,900

```
UNIT  6 IS NOW ASSIGNED TO: d:\greenwy\pooled2.out)
|_sample 1 114
|_read (a:pooled2.dif) price age sqf btrms bdrms dgw lta dv2 dv3 / dif
UNIT 88 IS NOW ASSIGNED TO: a:pooled2.dif
..NOTE..DIF FILE HAS     9 COLUMNS AND     114 ROWS
   9 VARIABLES AND       114 OBSERVATIONS STARTING AT OBS        1


|_ols price age sqf btrms bdrms dgw lta dv2 dv3

REQUIRED MEMORY IS PAR=   19 CURRENT PAR=  500
 OLS ESTIMATION
     114 OBSERVATIONS      DEPENDENT VARIABLE = PRICE
...NOTE..SAMPLE RANGE SET TO:     1,  114

 R-SQUARE =    0.6924      R-SQUARE ADJUSTED =    0.6690
VARIANCE OF THE ESTIMATE-SIGMA**2 =  0.29216E+09
STANDARD ERROR OF THE ESTIMATE-SIGMA =   17093.
SUM OF SQUARED ERRORS-SSE=  0.30677E+11
MEAN OF DEPENDENT VARIABLE =  0.12261E+06
LOG OF THE LIKELIHOOD FUNCTION = -1268.16

MODEL SELECTION TESTS - SEE JUDGE ET.AL.(1985, P.242)
 AKAIKE (1969) FINAL PREDICTION ERROR- FPE =   0.31522E+09
   (FPE ALSO KNOWN AS AMEMIYA PREDICTION CRITERION -PC)
 AKAIKE (1973) INFORMATION CRITERION- LOG AIC =   19.568
 SCHWARZ(1978) CRITERION-LOG SC =   19.784
MODEL SELECTION TESTS - SEE RAMANATHAN(1992,P.167)
 CRAVEN-WAHBA(1979) GENERALIZED CROSS VALIDATION(1979) -GCV=  0.31720E+09
 HANNAN AND QUINN(1979) CRITERION -HQ=  0.34399E+09
 RICE (1984) CRITERION-RICE=  0.31955E+09
 SHIBATA (1981) CRITERION-SHIBATA=  0.31158E+09
 SCHWARTZ (1978) CRITERION-SC=  0.39110E+09
 AKAIKE (1974)INFORMATION CRITERION-AIC=  0.31512E+09

                    ANALYSIS OF VARIANCE - FROM MEAN
                      SS          DF          MS              F
REGRESSION      0.69066E+11       8.     0.86332E+10        29.550
ERROR           0.30677E+11     105.     0.29216E+09
TOTAL           0.99742E+11     113.     0.88267E+09

                    ANALYSIS OF VARIANCE - FROM ZERO
                      SS          DF          MS              F
REGRESSION      0.17829E+13       9.     0.19810E+12       678.071
ERROR           0.30677E+11     105.     0.29216E+09
TOTAL           0.18136E+13     114.     0.15909E+11

VARIABLE   ESTIMATED  STANDARD    T-RATIO      PARTIAL STANDARDIZED ELASTICITY
  NAME    COEFFICIENT   ERROR      105 DF   P-VALUE CORR. COEFFICIENT  AT MEANS
AGE         -448.05      117.1     -3.825    0.000-0.350    -0.2685    -0.1094
SQF          21.343      5.322      4.010    0.000 0.364     0.2847     0.2626
BTRMS        17585.      3341.      5.264    0.000 0.457     0.3630     0.2139
BDRMS        4846.4      3107.      1.560    0.122 0.151     0.0982     0.1175
DGW         -6.9235      2.470     -2.803    0.006-0.264    -0.1677    -0.0640
LTA        -0.45831     0.7412     -0.6184   0.538-0.060    -0.0347    -0.0247
DV2          10425.      4934.      2.113    0.037 0.202     0.1584     0.0239
DV3          3033.2      4693.     0.6463    0.519 0.063     0.0506     0.0104
CONSTANT     69874.    0.1226E+05   5.700    0.000 0.486     0.0000     0.5699
|_stop
```

Pooled Sample (Appendix A)

Aggregate Sample (Askin and Springgarden)						
Price	Age (as of 1991)	Square Footage	Number of Bathrooms	Number of Bedrooms	Distance to Greenbelt	Lot Area (square footage)
$175,000	8	2,415	2	3	75	8,315
$85,000	36	978	1	2	75	8,125
$148,000	11	1,900	2	4	75	5,500
$156,000	11	1,600	2	4	75	5,400
$140,000	0	1,200	2	3	75	3,500
$145,000	0	1,100	1	3	75	6,930
$148,000	0	1,500	2	3	75	9,375
$169,888	0	1,500	2	3	75	5,000
$170,000	19	1,800	1	3	150	7,000
$128,000	10	1,760	1	3	150	5,600
$81,000	49	1,014	1	2	225	6,010
$145,000	19	2,283	2	3	300	9,375
$122,000	4	1,119	1	3	337.5	2,900
$121,028	0	1,617	2	3	375	4,000
$84,000	45	1,321	1	3	525	4,100
$160,000	19	2,400	2	3	525	8,800
$143,000	19	1,800	2	3	525	7,200
$117,000	4	1,545	1	3	562.5	4,800
$103,000	41	968	1	3	750	8,710
$85,000	28	1,876	1	2	825	9,240
$116,500	36	1,086	1	3	900	7,500
$60,000	51	816	1	2	975	8,223
$84,000	41	747	1	2	1050	6,500
$80,000	49	1,193	1	3	1050	3,410
$60,000	65	1,231	1	3	1050	3,000
$142,000	4	1,760	2	3	1050	4,480
$101,000	39	1,450	1	3	1125	6,400
$148,000	1	1,173	2	3	1200	8,925
$127,000	0	1,335	1	3	1200	5,950
$100,000	33	1,195	1	3	1500	8,900
$133,996	0	1,746	2	3	1500	5,950
$158,882	0	1,648	2	3	1575	5,850
$128,000	11	1,391	2	3	1650	4,440
$127,201	0	1,330	1	3	1725	4,281
$152,000	32	1,633	1	3	30	6,480
$130,000	31	1,241	2	3	30	6,955
$120,000	36	1,993	2	2	350	8,064
$163,000	13	1,726	2	3	390	6,679
$115,000	33	1,047	1	3	840	6,456
$115,500	23	1,969	1	3	840	6,180
$140,000	29	1,300	1	3	960	6,360
$127,000	31	1,270	2	3	960	6,360
$152,000	27	1,827	3	5	1080	6,420
$190,000	10	2,295	3	3	1140	5,718
$148,000	1	1,773	2	3	1200	8,937
$148,000	33	2,026	2	4	1350	8,640

Aggregate Sample (Appendix B)

$130,000	33	1,849	2	4	1380	6,835
$100,000	33	1,195	1	2	1425	23,400
$121,000	32	1,520	1	3	1440	7,062
$170,000	29	2,067	2	3	1440	7,490
$185,500	30	2,138	4	4	1440	7,490
$215,000	7	2,151	3	3	1470	2,228
$145,000	30	2,204	2	5	1560	6,420
$127,000	27	2,202	2	3	1560	6,420
$204,450	6	1,850	3	3	1590	6,632
$118,000	33	1,837	1	3	1620	6,000
$101,000	33	1,503	1	3	1620	6,060
$113,000	33	1,944	1	3	1680	6,000
$123,500	33	1,329	2	3	1680	6,060
$133,500	28	1,488	2	3	1800	6,420
$125,000	33	1,655	1	3	1860	6,400
$115,000	33	1,456	1	3	1860	6,000
$126,500	33	1,531	1	3	2100	6,120
$121,028	0	1,617	2	3	2405	4,000
$80,000	36	978	1	2	2860	8,125
$165,000	8	2,415	2	3	2925	8,315

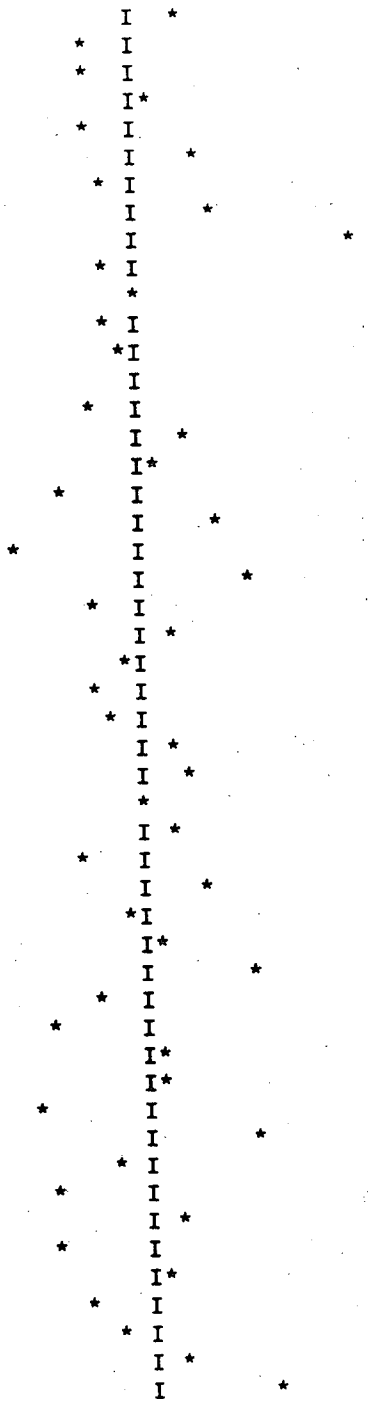
Aggregate Sample (Appendix B)

```
UNIT  6 IS NOW ASSIGNED TO: d:\windsor\windsor.out)
|_sample 1 66
|_read (d:\windsor\pooled.dif) price age sqf btrms bdrms dgw lta dv / dif
UNIT 88 IS NOW ASSIGNED TO: d:\windsor\pooled.dif
..NOTE..DIF FILE HAS     8 COLUMNS AND      66 ROWS
   8 VARIABLES AND       66 OBSERVATIONS STARTING AT OBS        1

|_stat price age sqf btrms bdrms dgw lta dv
NAME         N    MEAN          ST. DEV       VARIANCE      MINIMUM       MAXIMUM
PRICE        66   0.13049E+06    31972.        0.10222E+10   60000.        0.21500E+06
AGE          66    22.455         16.151        260.87       0.00000       65.000
SQF          66    1588.3         416.75        0.17368E+06  747.00        2415.0
BTRMS        66    1.6061        0.67662        0.45781       1.0000        4.0000
BDRMS        66    3.0152        0.56819        0.32284       2.0000        5.0000
DGW          66    1034.6         703.52        0.49494E+06  30.000        2925.0
LTA          66    6673.0         2680.1        0.71829E+07  2228.0        23400.
DV           66   0.48485        0.50360        0.25361      0.00000       1.0000

|_ols price age sqf btrms bdrms dgw lta dv / list

REQUIRED MEMORY IS PAR=   11 CURRENT PAR=  500
 OLS ESTIMATION
      66 OBSERVATIONS      DEPENDENT VARIABLE = PRICE
...NOTE..SAMPLE RANGE SET TO:     1,    66

 R-SQUARE =    0.7832      R-SQUARE ADJUSTED =    0.7570
VARIANCE OF THE ESTIMATE-SIGMA**2 =  0.24840E+09
STANDARD ERROR OF THE ESTIMATE-SIGMA =    15761.
SUM OF SQUARED ERRORS-SSE=  0.14407E+11
MEAN OF DEPENDENT VARIABLE =  0.13049E+06
LOG OF THE LIKELIHOOD FUNCTION = -727.295

MODEL SELECTION TESTS - SEE JUDGE ET.AL.(1985, P.242)
 AKAIKE (1969) FINAL PREDICTION ERROR- FPE =   0.27851E+09
   (FPE ALSO KNOWN AS AMEMIYA PREDICTION CRITERION -PC)
 AKAIKE (1973) INFORMATION CRITERION- LOG AIC =   19.444
 SCHWARZ(1978) CRITERION-LOG SC =   19.709
MODEL SELECTION TESTS - SEE RAMANATHAN(1992,P.167)
 CRAVEN-WAHBA(1979) GENERALIZED CROSS VALIDATION(1979) -GCV=  0.28267E+09
 HANNAN AND QUINN(1979) CRITERION -HQ=  0.30894E+09
 RICE (1984) CRITERION-RICE=  0.28815E+09
 SHIBATA (1981) CRITERION-SHIBATA=  0.27121E+09
 SCHWARTZ (1978) CRITERION-SC=  0.36274E+09
 AKAIKE (1974)INFORMATION CRITERION-AIC=  0.27818E+09

                    ANALYSIS OF VARIANCE - FROM MEAN
                      SS          DF          MS              F
REGRESSION       0.52036E+11      7.      0.74337E+10        29.926
ERROR            0.14407E+11     58.      0.24840E+09
TOTAL            0.66443E+11     65.      0.10222E+10

                    ANALYSIS OF VARIANCE - FROM ZERO
                      SS          DF          MS              F
REGRESSION       0.11759E+13      8.      0.14699E+12       591.724
ERROR            0.14407E+11     58.      0.24840E+09
TOTAL            0.11903E+13     66.      0.18035E+11


 VARIABLE   ESTIMATED  STANDARD   T-RATIO      PARTIAL STANDARDIZED ELASTICITY
   NAME    COEFFICIENT   ERROR     58 DF   P-VALUE CORR. COEFFICIENT  AT MEANS
```

Aggregate Sample (Appendix B)

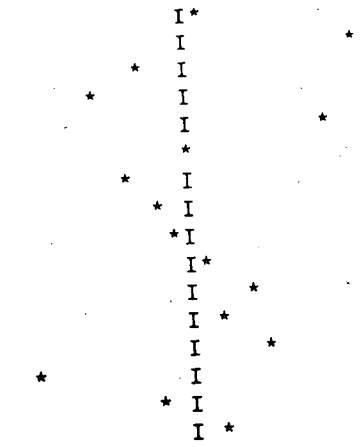
AGE	-880.21	142.8	-6.164	0.000	-0.4447	-0.1515
SQF	17.748	6.050	2.934	0.005	0.2313	0.2160
BTRMS	16009.	3875.	4.131	0.000	0.3388	0.1970
BDRMS	5189.5	4129.	1.257	0.214	0.0922	0.1199
DGW	-7.9838	3.259	-2.450	0.017	-0.1757	-0.0633
LTA	0.17429	0.7766	0.2244	0.823	0.0146	0.0089
DV	15201.	5153.	2.950	0.005	0.2394	0.0565
CONSTANT	80437.	0.1513E+05	5.315	0.000	0.0000	0.6164

OBS. NO.	OBSERVED VALUE	PREDICTED VALUE	CALCULATED RESIDUAL
1	0.17500E+06	0.16469E+06	10307.
2	85000.	93312.	-8312.2
3	0.14800E+06	0.15761E+06	-9611.4
4	0.15600E+06	0.15227E+06	3730.3
5	0.14000E+06	0.14933E+06	-9332.3
6	0.14500E+06	0.13215E+06	12854.
7	0.14800E+06	0.15568E+06	-7680.5
8	0.16989E+06	0.15492E+06	14970.
9	0.17000E+06	0.12726E+06	42741.
10	0.12800E+06	0.13423E+06	-6227.0
11	81000.	80942.	57.821
12	0.14500E+06	0.15106E+06	-6056.5
13	0.12200E+06	0.12616E+06	-4164.5
14	0.12103E+06	0.15443E+06	-33397.
15	84000.	92373.	-8373.0
16	0.16000E+06	0.15124E+06	8763.6
17	0.14300E+06	0.14031E+06	2691.0
18	0.11700E+06	0.13226E+06	-15260.
19	0.10300E+06	88636.	14364.
20	85000.	0.11050E+06	-25498.
21	0.11650E+06	93723.	22777.
22	60000.	70066.	-10066.
23	84000.	76744.	7256.0
24	80000.	82269.	-2268.7
25	60000.	68788.	-8788.3
26	0.14200E+06	0.14814E+06	-6136.7
27	0.10100E+06	95554.	5445.7
28	0.14800E+06	0.13994E+06	8063.4
29	0.12700E+06	0.12716E+06	-164.37
30	0.10000E+06	93752.	6248.2
31	0.13400E+06	0.14807E+06	-14077.
32	0.15888E+06	0.14572E+06	13165.
33	0.12800E+06	0.13063E+06	-2629.1
34	0.12720E+06	0.12259E+06	4607.7
35	0.15200E+06	0.12892E+06	23080.
36	0.13000E+06	0.13894E+06	-8935.3
37	0.12000E+06	0.14033E+06	-20329.
38	0.16300E+06	0.16046E+06	2535.5
39	0.11500E+06	0.11117E+06	3831.0
40	0.11550E+06	0.13629E+06	-20786.
41	0.14000E+06	0.11821E+06	21795.
42	0.12700E+06	0.13192E+06	-4921.4
43	0.15200E+06	0.17077E+06	-18768.
44	0.19000E+06	0.18306E+06	6942.8
45	0.14800E+06	0.16579E+06	-17788.
46	0.14800E+06	0.14605E+06	1948.6
47	0.13000E+06	0.14236E+06	-12356.
48	0.10000E+06	0.10689E+06	-6888.8
49	0.12100E+06	0.11576E+06	5240.8
50	0.17000E+06	0.14419E+06	25809.



Aggregate Sample (Appendix B)

51	0.18550E+06	0.18178E+06	3721.1
52	0.21500E+06	0.17990E+06	35101.
53	0.14500E+06	0.15498E+06	-9977.1
54	0.12700E+06	0.14720E+06	-20203.
55	0.20445E+06	0.17525E+06	29203.
56	0.11800E+06	0.11888E+06	-882.76
57	0.10100E+06	0.11297E+06	-11966.
58	0.11300E+06	0.12030E+06	-7302.7
59	0.12350E+06	0.12541E+06	-1907.4
60	0.13350E+06	0.13174E+06	1764.9
61	0.12500E+06	0.11381E+06	11194.
62	0.11500E+06	0.11020E+06	4795.2
63	0.12650E+06	0.10964E+06	16859.
64	0.12103E+06	0.15342E+06	-32390.
65	80000.	86278.	-6277.8
66	0.16500E+06	0.15714E+06	7860.1

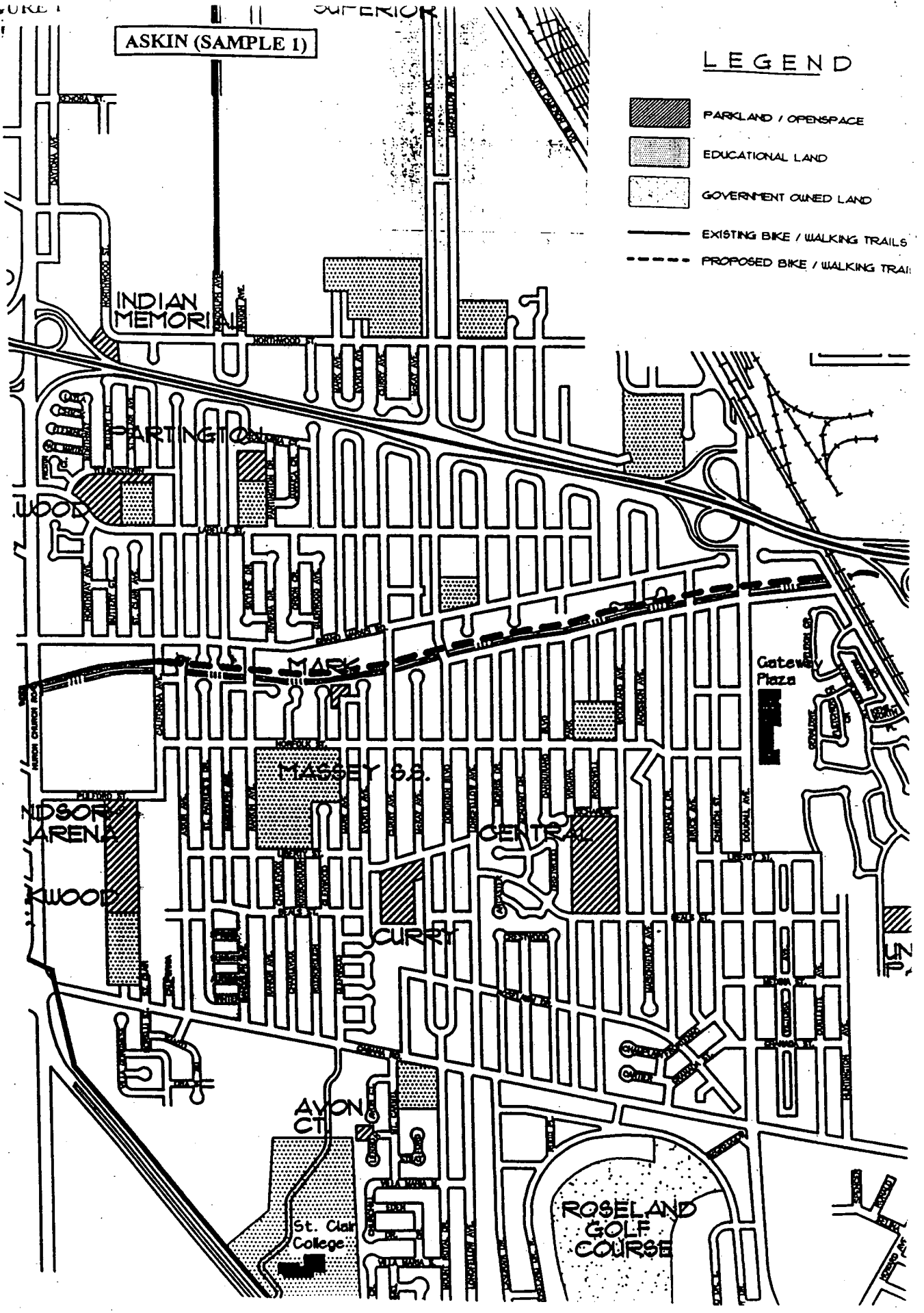


DURBIN-WATSON = 2.3645 VON NEUMANN RATIO = 2.4009 RHO = -0.18890
RESIDUAL SUM = 0.17799E-08 RESIDUAL VARIANCE = 0.24840E+09
SUM OF ABSOLUTE ERRORS= 0.75944E+06
R-SQUARE BETWEEN OBSERVED AND PREDICTED = 0.7832
RUNS TEST: 41 RUNS, 32 POSITIVE, 34 NEGATIVE, NORMAL STATISTIC = 1.7458
COEFFICIENT OF SKEWNESS = 0.3608 WITH STANDARD DEVIATION OF 0.2950
COEFFICIENT OF EXCESS KURTOSIS = 0.5699 WITH STANDARD DEVIATION OF 0.5821

GOODNESS OF FIT TEST FOR NORMALITY OF RESIDUALS - 12 GROUPS

OBSERVED	0.0	2.0	1.0	5.0	12.0	14.0	16.0	8.0	4.0	2.0	1.0	1.0
EXPECTED	0.4	1.1	2.9	6.1	9.9	12.6	12.6	9.9	6.1	2.9	1.1	0.4

CHI-SQUARE = 6.2894 WITH 2 DEGREES OF FREEDOM
|_stop



Askin (Sample 1) (Appendix C)

Askin Sample						
Price	Age (as of 1991)	Square Footage	Number of Bathrooms	Number of Bedrooms	Distance to Greenbelt	Lot Area (square footage)
$152,000	32	1,633	1	3	30	6,480
$130,000	31	1,241	2	3	30	6,955
$120,000	36	1,993	2	2	350	8,064
$163,000	13	1,726	2	3	390	6,679
$115,000	33	1,047	1	3	840	6,456
$115,500	23	1,969	1	3	840	6,180
$140,000	29	1,300	1	3	960	6,360
$127,000	31	1,270	2	3	960	6,360
$152,000	27	1,827	3	5	1080	6,420
$190,000	10	2,295	3	3	1140	5,718
$148,000	1	1,773	2	3	1200	8,937
$148,000	33	2,026	2	4	1350	8,640
$130,000	33	1,849	2	4	1380	6,835
$100,000	33	1,195	1	2	1425	23,400
$121,000	32	1,520	1	3	1440	7,062
$170,000	29	2,067	2	3	1440	7,490
$185,500	30	2,138	4	4	1440	7,490
$215,000	7	2,151	3	3	1470	2,228
$145,000	30	2,204	2	5	1560	6,420
$127,000	27	2,202	2	3	1560	6,420
$204,450	6	1,850	3	3	1590	6,632
$118,000	33	1,837	1	3	1620	6,000
$101,000	33	1,503	1	3	1620	6,060
$113,000	33	1,944	1	3	1680	6,000
$123,500	33	1,329	2	3	1680	6,060
$133,500	28	1,488	2	3	1800	6,420
$125,000	33	1,655	1	3	1860	6,400
$115,000	33	1,456	1	3	1860	6,000
$126,500	33	1,531	1	3	2100	6,120
$121,028	0	1,617	2	3	2405	4,000
$80,000	36	978	1	2	2860	8,125
$165,000	8	2,415	2	3	2925	8,315

Askin (Sample 1) (Appendix C)

```
UNIT  6 IS NOW ASSIGNED TO: d:\askin\run7.out)
|_sample 1 32
|_read (d:\askin\askin8.dif) price age sqf btrms dgw  / dif
UNIT 88 IS NOW ASSIGNED TO: d:\askin\askin8.dif
..NOTE..DIF FILE HAS     5 COLUMNS AND      32 ROWS
   5 VARIABLES AND        32 OBSERVATIONS STARTING AT OBS       1


|_ols price age sqf btrms dgw / list

REQUIRED MEMORY IS PAR=     4 CURRENT PAR=  500
 OLS ESTIMATION
      32 OBSERVATIONS      DEPENDENT VARIABLE = PRICE
...NOTE..SAMPLE RANGE SET TO:     1,    32

 R-SQUARE =    0.7332      R-SQUARE ADJUSTED =    0.6937
VARIANCE OF THE ESTIMATE-SIGMA**2 =  0.28549E+09
STANDARD ERROR OF THE ESTIMATE-SIGMA =    16896.
SUM OF SQUARED ERRORS-SSE=  0.77082E+10
MEAN OF DEPENDENT VARIABLE =  0.13812E+06
LOG OF THE LIKELIHOOD FUNCTION = -354.203

MODEL SELECTION TESTS - SEE JUDGE ET.AL.(1985, P.242)
 AKAIKE (1969) FINAL PREDICTION ERROR- FPE =   0.33010E+09
   (FPE ALSO KNOWN AS AMEMIYA PREDICTION CRITERION -PC)
 AKAIKE (1973) INFORMATION CRITERION- LOG AIC =   19.612
 SCHWARZ(1978) CRITERION-LOG SC =   19.841
MODEL SELECTION TESTS - SEE RAMANATHAN(1992,P.167)
 CRAVEN-WAHBA(1979) GENERALIZED CROSS VALIDATION(1979) -GCV=  0.33836E+09
 HANNAN AND QUINN(1979) CRITERION -HQ=  0.35521E+09
 RICE (1984) CRITERION-RICE=  0.35037E+09
 SHIBATA (1981) CRITERION-SHIBATA=  0.31616E+09
 SCHWARTZ (1978) CRITERION-SC=  0.41398E+09
 AKAIKE (1974)INFORMATION CRITERION-AIC=  0.32925E+09

                    ANALYSIS OF VARIANCE - FROM MEAN
                      SS          DF            MS              F
REGRESSION       0.21188E+11      4.      0.52971E+10          18.554
ERROR            0.77082E+10     27.      0.28549E+09
TOTAL            0.28896E+11     31.      0.93214E+09

                    ANALYSIS OF VARIANCE - FROM ZERO
                      SS          DF            MS              F
REGRESSION       0.63169E+12      5.      0.12634E+12         442.535
ERROR            0.77082E+10     27.      0.28549E+09
TOTAL            0.63940E+12     32.      0.19981E+11


VARIABLE   ESTIMATED  STANDARD   T-RATIO      PARTIAL STANDARDIZED ELASTICITY
  NAME    COEFFICIENT   ERROR     27 DF   P-VALUE CORR. COEFFICIENT  AT MEANS
AGE          814.27      323.4     2.518     0.018 0.436     0.2928    11.5846
SQF          20.718      9.681     2.140     0.042 0.381     0.2560     0.2579
BTRMS        18777.      4840.     3.879     0.001 0.598     0.4874     0.2421
DGW         -8.1227      4.640    -1.751     0.091-0.319    -0.1788    -0.0825
CONSTANT -0.15197E+07 0.6285E+06 -2.418     0.023-0.422     0.0000   -11.0022
    OBS.   OBSERVED     PREDICTED   CALCULATED
     NO.    VALUE         VALUE      RESIDUAL
      1   0.15200E+06  0.12785E+06   24153.                      I      *
      2   0.13000E+06  0.13932E+06  -9317.1                  *   I
      3   0.12000E+06  0.14823E+06  -28226.              *       I
```

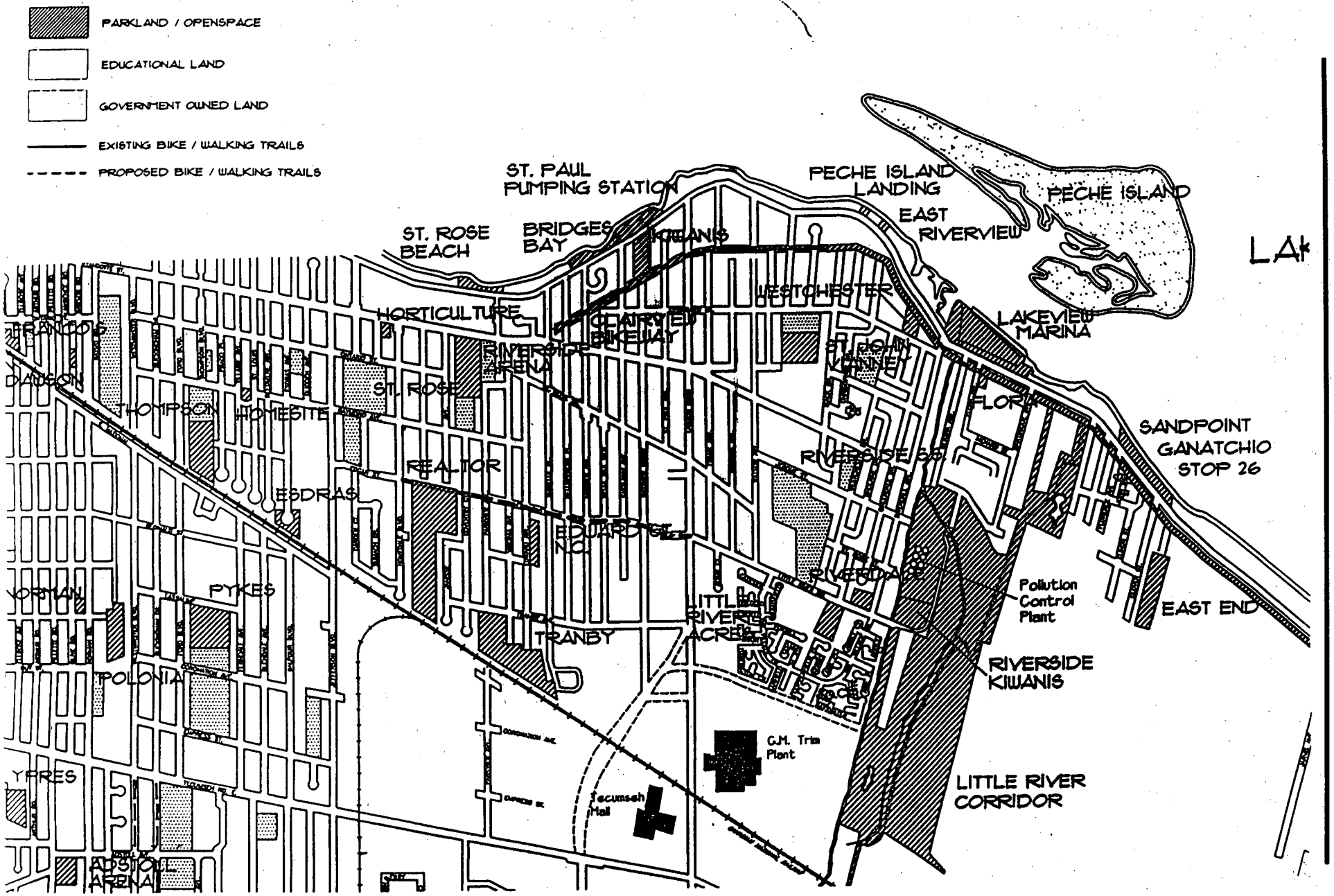
4	0.16300E+06	0.16110E+06	1902.2	I*
5	0.11500E+06	0.10831E+06	6686.7	I *
6	0.11550E+06	0.13556E+06	-20058.	* I
7	0.14000E+06	0.11584E+06	24163.	I *
8	0.12700E+06	0.13236E+06	-5363.8	* I
9	0.15200E+06	0.16496E+06	-12962.	* I
10	0.19000E+06	0.18801E+06	1986.4	I*
11	0.14800E+06	0.16526E+06	-17263.	* I
12	0.14800E+06	0.14323E+06	4770.1	I*
13	0.13000E+06	0.13932E+06	-9319.2	* I
14	0.10000E+06	0.10663E+06	-6627.7	* I
15	0.12100E+06	0.11405E+06	6946.6	I *
16	0.17000E+06	0.14661E+06	23395.	I *
17	0.18550E+06	0.18482E+06	684.72	*
18	0.21500E+06	0.18479E+06	30207.	I *
19	0.14500E+06	0.14765E+06	-2654.7	*I
20	0.12700E+06	0.15006E+06	-23056.	* I
21	0.20445E+06	0.17840E+06	26054.	I *
22	0.11800E+06	0.11834E+06	-344.50	*
23	0.10100E+06	0.11142E+06	-10425.	* I
24	0.11300E+06	0.12007E+06	-7073.9	* I
25	0.12350E+06	0.12611E+06	-2609.2	*I
26	0.13350E+06	0.13250E+06	1000.0	*
27	0.12500E+06	0.11262E+06	12376.	I *
28	0.11500E+06	0.10850E+06	6498.4	I *
29	0.12650E+06	0.10811E+06	18394.	I *
30	0.12103E+06	0.15306E+06	-32030.	* I
31	80000.	88033.	-8033.1	* I
32	0.16500E+06	0.15885E+06	6147.4	I *

DURBIN-WATSON = 2.2718 VON NEUMANN RATIO = 2.3451 RHO = -0.17706
RESIDUAL SUM = -0.44856E-08 RESIDUAL VARIANCE = 0.28549E+09
SUM OF ABSOLUTE ERRORS= 0.39073E+06
R-SQUARE BETWEEN OBSERVED AND PREDICTED = 0.7332
RUNS TEST: 17 RUNS, 16 POSITIVE, 16 NEGATIVE, NORMAL STATISTIC = 0.0000
COEFFICIENT OF SKEWNESS = 0.0749 WITH STANDARD DEVIATION OF 0.4145
COEFFICIENT OF EXCESS KURTOSIS = -0.3340 WITH STANDARD DEVIATION OF 0.8094

GOODNESS OF FIT TEST FOR NORMALITY OF RESIDUALS - 10 GROUPS

OBSERVED	0.0	1.0	2.0	4.0	9.0	9.0	2.0	5.0	0.0	0.0
EXPECTED	0.3	0.9	2.5	5.1	7.2	7.2	5.1	2.5	0.9	0.3

CHI-SQUARE = 6.9268 WITH 3 DEGREES OF FREEDOM
|_stop



Ganatchio (Sample 2) (Appendix D)

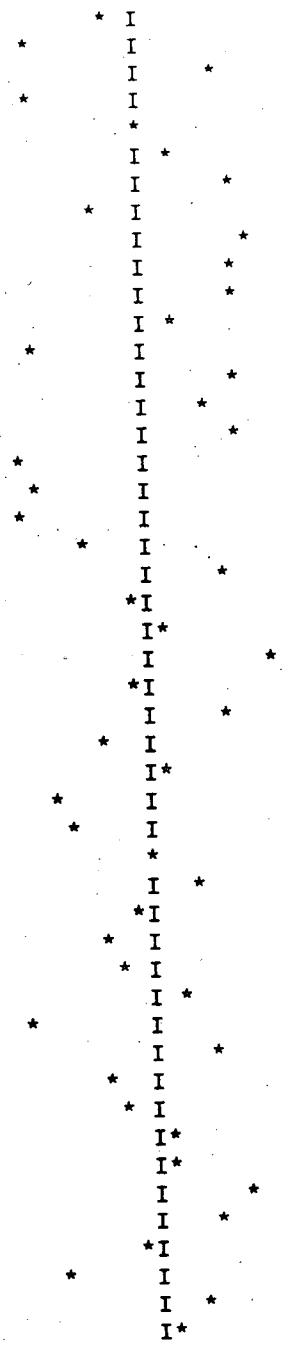
Ganatchio Sample						
Price	Age (as of 1991)	Square Footage	Number of Bathrooms	Number of Bedrooms	Distance to Greenbelt	Lot Area (square footage)
$123,000	30	1,896	2	3	50	8,150
$70,000	41	1,171	1	2	150	7,519
$121,200	24	1,445	1	3	150	5,835
$96,000	41	1,387	2	4	260	5,726
$100,000	41	1,251	1	3	300	5,726
$128,000	23	1,551	2	3	450	5,500
$125,000	28	1,581	1	3	475	8,300
$80,000	66	922	1	2	525	4,765
$119,000	23	1,214	1	3	550	6,279
$103,000	71	925	1	2	575	6,335
$130,000	24	1,255	2	3	600	5,500
$147,000	40	2,017	2	3	675	5,001
$71,000	26	1,000	1	4	675	7,290
$116,000	71	1,122	1	2	700	4,510
$102,000	33	1,206	1	2	725	9,453
$126,000	33	1,454	1	3	750	5,699
$69,900	66	1,222	1	2	775	8,379
$82,000	44	1,448	1	3	775	8,320
$65,000	67	851	1	2	800	3,745
$116,000	39	1,832	2	2	850	6,010
$141,000	26	1,828	2	3	900	8,923
$89,500	34	1,065	1	3	1075	6,629
$110,000	39	1,406	1	3	1225	6,042
$117,000	61	979	1	3	1250	6,005
$114,900	39	1,730	1	3	1275	5,717
$136,900	61	1,542	2	3	1300	5,463
$105,000	2	1,611	2	3	1400	9,833
$91,000	51	949	1	3	1425	6,688
$119,900	31	2,170	1	4	1525	5,661
$55,000	31	646	1	2	1600	9,200
$112,000	35	1,368	2	3	1725	7,209
$90,101	43	838	1	2	1750	6,840
$88,900	41	970	1	3	1750	5,310
$90,000	35	1,310	1	2	1750	6,500
$115,000	37	1,625	1	4	1800	5,000
$117,750	35	1,556	1	3	1850	5,463
$98,000	34	1,769	1	3	1900	4,860
$149,000	27	1,880	2	4	1925	6,200
$110,750	39	1,384	2	4	2000	5,717
$109,000	44	1,630	2	2	2000	8,864
$120,000	39	1,711	1	3	2075	6,060
$124,100	33	1,492	2	3	2200	5,500
$135,000	66	1,791	1	4	2300	9,834
$112,000	46	1,364	1	3	2350	8,640
$105,500	33	1,393	1	3	2400	5,500
$109,500	61	1,602	2	4	2425	6,240

Ganatchio (Sample 2) (Appendix D)

$107,000	37	1,191	1	3	2450	5,883
$127,500	41	1,600	2	3	2500	5,900

```
UNIT  6 IS NOW ASSIGNED TO: d:\ginatch\run2.out
|_sample 1 48
|_read (a:\gin2.dif) price age sqf btrms bdrms dgw lta / dif
UNIT 88 IS NOW ASSIGNED TO: a:\gin2.dif
..NOTE..DIF FILE HAS     7 COLUMNS AND      48 ROWS
   7 VARIABLES AND        48 OBSERVATIONS STARTING AT OBS        1

|_stat price age sqf bthrms bdrms dgw lta
...ERROR..VARIABLE bthrms    DOES NOT EXIST

|_ols price age sqf btrms bdrms dgw lta / list

REQUIRED MEMORY IS PAR=    7 CURRENT PAR=  500
 OLS ESTIMATION
      48 OBSERVATIONS      DEPENDENT VARIABLE = PRICE
...NOTE..SAMPLE RANGE SET TO:     1,    48

 R-SQUARE =    0.5658      R-SQUARE ADJUSTED =    0.5023
VARIANCE OF THE ESTIMATE-SIGMA**2 =  0.22930E+09
STANDARD ERROR OF THE ESTIMATE-SIGMA =    15143.
SUM OF SQUARED ERRORS-SSE=  0.94013E+10
MEAN OF DEPENDENT VARIABLE =  0.10815E+06
LOG OF THE LIKELIHOOD FUNCTION = -526.339

MODEL SELECTION TESTS - SEE JUDGE ET.AL.(1985, P.242)
 AKAIKE (1969) FINAL PREDICTION ERROR- FPE =   0.26274E+09
   (FPE ALSO KNOWN AS AMEMIYA PREDICTION CRITERION -PC)
 AKAIKE (1973) INFORMATION CRITERION- LOG AIC =   19.385
 SCHWARZ(1978) CRITERION-LOG SC =   19.657
MODEL SELECTION TESTS - SEE RAMANATHAN(1992,P.167)
 CRAVEN-WAHBA(1979) GENERALIZED CROSS VALIDATION(1979) -GCV=  0.26845E+09
 HANNAN AND QUINN(1979) CRITERION -HQ=  0.29067E+09
 RICE (1984) CRITERION-RICE=  0.27651E+09
 SHIBATA (1981) CRITERION-SHIBATA=  0.25299E+09
 SCHWARTZ (1978) CRITERION-SC=  0.34445E+09
 AKAIKE (1974)INFORMATION CRITERION-AIC=  0.26219E+09

                    ANALYSIS OF VARIANCE - FROM MEAN
                      SS          DF          MS              F
REGRESSION      0.12251E+11       6.      0.20418E+10        8.904
ERROR           0.94013E+10      41.      0.22930E+09
TOTAL           0.21652E+11      47.      0.46068E+09

                    ANALYSIS OF VARIANCE - FROM ZERO
                      SS          DF          MS              F
REGRESSION      0.57372E+12       7.      0.81960E+11      357.436
ERROR           0.94013E+10      41.      0.22930E+09
TOTAL           0.58312E+12      48.      0.12148E+11


 VARIABLE   ESTIMATED  STANDARD   T-RATIO      PARTIAL STANDARDIZED ELASTICITY
   NAME    COEFFICIENT   ERROR     41 DF   P-VALUE CORR. COEFFICIENT  AT MEANS
 AGE          27.452     167.9     0.1635    0.871 0.026     0.0187     0.0102
 SQF          36.605     8.113      4.512    0.000 0.576     0.5817     0.4735
 BTRMS        9400.7     5246.      1.792    0.081 0.269     0.2087     0.1159
 BDRMS        3068.9     4061.     0.7557    0.454 0.117     0.0925     0.0828
 DGW         0.32874     3.193     0.1030    0.919 0.016     0.0111     0.0039
 LTA         -1.8980     1.539     -1.233   0.224-0.189     -0.1320    -0.1147
 CONSTANT     46343.   0.2049E+05   2.262    0.029 0.333     0.0000     0.4285
     OBS.   OBSERVED     PREDICTED   CALCULATED
```

NO.	VALUE	VALUE	RESIDUAL
1	0.12300E+06	0.12913E+06	-6125.6
2	70000.	91650.	-21650.
3	0.12120E+06	0.10748E+06	13722.
4	96000.	0.11853E+06	-22534.
5	0.10000E+06	0.10110E+06	-1099.3
6	0.12800E+06	0.12147E+06	6534.2
7	0.12500E+06	0.10799E+06	17006.
8	80000.	88572.	-8571.6
9	0.11900E+06	98283.	20717.
10	0.10300E+06	85855.	17145.
11	0.13000E+06	0.11071E+06	19293.
12	0.14700E+06	0.14001E+06	6988.4
13	71000.	91723.	-20723.
14	0.11600E+06	96571.	19429.
15	0.10200E+06	89230.	12770.
16	0.12600E+06	0.10851E+06	17490.
17	69900.	92776.	-22876.
18	82000.	0.10363E+06	-21626.
19	65000.	88026.	-23026.
20	0.11600E+06	0.12829E+06	-12286.
21	0.14100E+06	0.12534E+06	15661.
22	89500.	92639.	-3139.5
23	0.11000E+06	0.10642E+06	3577.4
24	0.11700E+06	91475.	25525.
25	0.11490E+06	0.11892E+06	-4016.0
26	0.13690E+06	0.12253E+06	14371.
27	0.10500E+06	0.11517E+06	-10174.
28	91000.	88863.	2137.0
29	0.11990E+06	0.13806E+06	-18160.
30	55000.	69444.	-14444.
31	0.11200E+06	0.11227E+06	-271.92
32	90101.	81330.	8771.3
33	88900.	92079.	-3179.5
34	90000.	99033.	-9033.1
35	0.11500E+06	0.11962E+06	-4619.8
36	0.11775E+06	0.11311E+06	4642.0
37	98000.	0.12204E+06	-24038.
38	0.14900E+06	0.13584E+06	13156.
39	0.11075E+06	0.11896E+06	-8208.5
40	0.10900E+06	0.11599E+06	-6990.0
41	0.12000E+06	0.11783E+06	2167.5
42	0.12410E+06	0.12016E+06	3944.1
43	0.13500E+06	0.11748E+06	17518.
44	0.11200E+06	0.10052E+06	11484.
45	0.10550E+06	0.10720E+06	-1697.0
46	0.10950E+06	0.12669E+06	-17189.
47	0.10700E+06	99202.	7798.0
48	0.12750E+06	0.12367E+06	3831.7



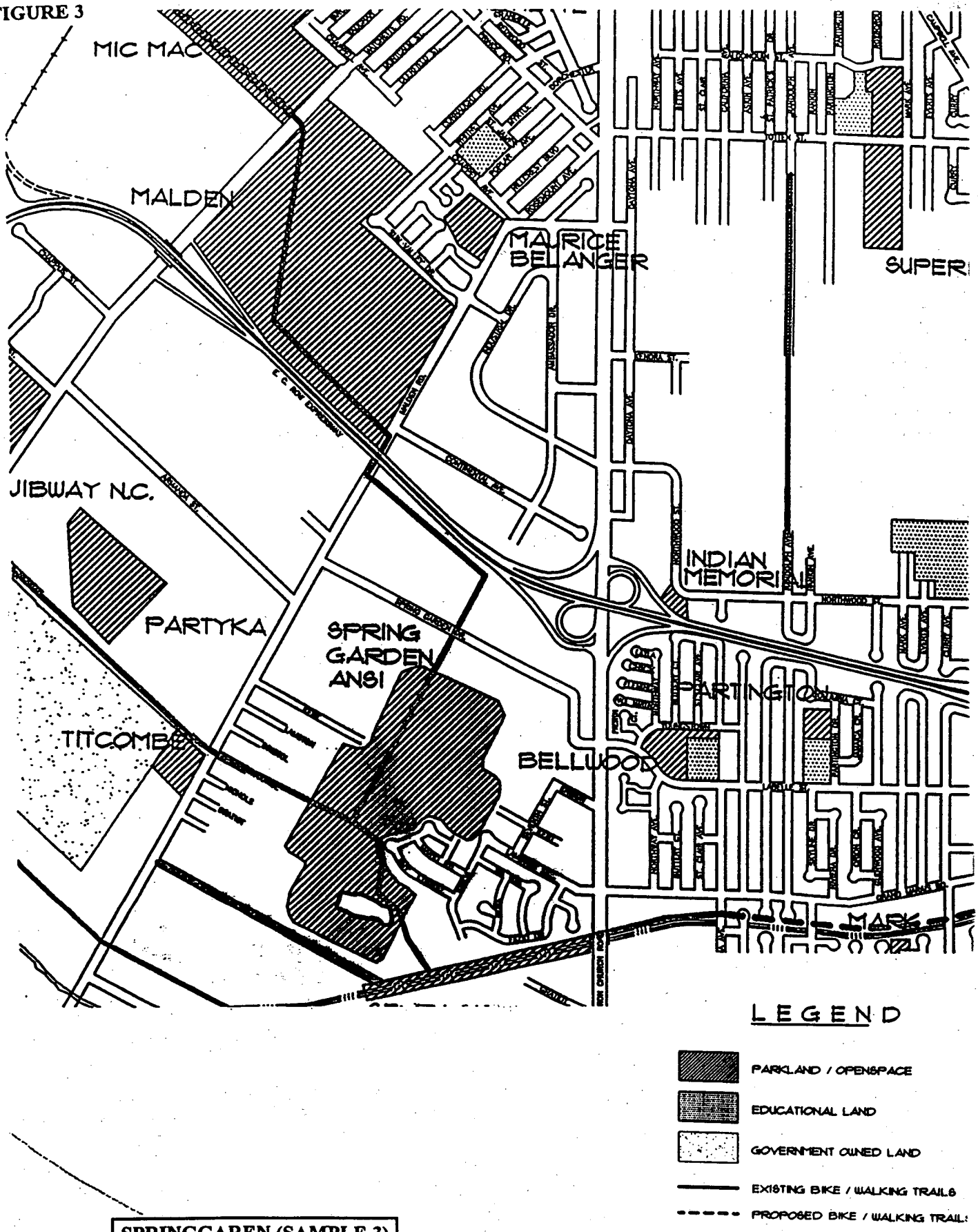
DURBIN-WATSON = 1.9095 VON NEUMANN RATIO = 1.9502 RHO = 0.04252
RESIDUAL SUM = -0.43110E-09 RESIDUAL VARIANCE = 0.22930E+09
SUM OF ABSOLUTE ERRORS= 0.57136E+06
R-SQUARE BETWEEN OBSERVED AND PREDICTED = 0.5658
RUNS TEST: 26 RUNS, 24 POSITIVE, 24 NEGATIVE, NORMAL STATISTIC = 0.2918
COEFFICIENT OF SKEWNESS = -0.1597 WITH STANDARD DEVIATION OF 0.3431
COEFFICIENT OF EXCESS KURTOSIS = -1.0634 WITH STANDARD DEVIATION OF 0.6744

GOODNESS OF FIT TEST FOR NORMALITY OF RESIDUALS - 10 GROUPS
OBSERVED 0.0 0.0 7.0 5.0 12.0 10.0 10.0 4.0 0.0 0.0

Ganatchio (Sample 2) (Appendix D)

```
EXPECTED  0.4   1.3   3.8   7.6 10.8 10.8   7.6   3.8   1.3   0.4
CHI-SQUARE =     7.9784 WITH   1 DEGREES OF FREEDOM
|_stop
```

FIGURE 3



SPRINGGAREN (SAMPLE 3)

Springgarden (Sample 3) (Appendix E)

Spinggarden Sample						
Price	Age (as of 1991)	Square Footage	Number of Bathrooms	Number of Bedrooms	Distance to Greenbelt	Lot Area (square footage)
$175,000	8	2,415	2	3	75	8,315
$85,000	36	978	1	2	75	8,125
$148,000	11	1,900	2	4	75	5,500
$156,000	11	1,600	2	4	75	5,400
$140,000	0	1,200	2	3	75	3,500
$145,000	0	1,100	1	3	75	6,930
$148,000	0	1,500	2	3	75	9,375
$169,888	0	1,500	2	3	75	5,000
$170,000	19	1,800	1	3	150	7,000
$128,000	10	1,760	1	3	150	5,600
$81,000	49	1,014	1	2	225	6,010
$145,000	19	2,283	2	3	300	9,375
$122,000	4	1,119	1	3	337.5	2,900
$121,028	0	1,617	2	3	375	4,000
$84,000	45	1,321	1	3	525	4,100
$160,000	19	2,400	2	3	525	8,800
$143,000	19	1,800	2	3	525	7,200
$117,000	4	1,545	1	3	562.5	4,800
$103,000	41	968	1	3	750	8,710
$85,000	28	1,876	1	2	825	9,240
$116,500	36	1,086	1	3	900	7,500
$60,000	51	816	1	2	975	8,223
$84,000	41	747	1	2	1050	6,500
$80,000	49	1,193	1	3	1050	3,410
$60,000	65	1,231	1	3	1050	3,000
$142,000	4	1,760	2	3	1050	4,480
$101,000	39	1,450	1	3	1125	6,400
$148,000	1	1,173	2	3	1200	8,925
$127,000	0	1,335	1	3	1200	5,950
$100,000	33	1,195	1	3	1500	8,900
$133,996	0	1,746	2	3	1500	5,950
$158,882	0	1,648	2	3	1575	5,850
$128,000	11	1,391	2	3	1650	4,440
$127,201	0	1,330	1	3	1725	4,281

Springgarden (Sample 3) (Appendix E)

```
UNIT  6 IS NOW ASSIGNED TO: d:\spring\test5.out)
|_sample 1 34
|_read (d:\spring\test4.dif) price age sqf btrms bdrms dgw lta / dif
UNIT 88 IS NOW ASSIGNED TO: d:\spring\test4.dif
..NOTE..DIF FILE HAS     7 COLUMNS AND      34 ROWS
   7 VARIABLES AND        34 OBSERVATIONS STARTING AT OBS        1


|_ols price age sqf btrms bdrms dgw lta

REQUIRED MEMORY IS PAR=     5 CURRENT PAR=  500
 OLS ESTIMATION
      34 OBSERVATIONS      DEPENDENT VARIABLE = PRICE
...NOTE..SAMPLE RANGE SET TO:     1,    34

 R-SQUARE =    0.8388      R-SQUARE ADJUSTED =    0.8030
VARIANCE OF THE ESTIMATE-SIGMA**2 =  0.20258E+09
STANDARD ERROR OF THE ESTIMATE-SIGMA =    14233.
SUM OF SQUARED ERRORS-SSE=  0.54697E+10
MEAN OF DEPENDENT VARIABLE =  0.12331E+06
LOG OF THE LIKELIHOOD FUNCTION = -369.478

MODEL SELECTION TESTS - SEE JUDGE ET.AL.(1985, P.242)
 AKAIKE (1969) FINAL PREDICTION ERROR- FPE =   0.24429E+09
   (FPE ALSO KNOWN AS AMEMIYA PREDICTION CRITERION -PC)
 AKAIKE (1973) INFORMATION CRITERION- LOG AIC =   19.308
 SCHWARZ(1978) CRITERION-LOG SC =   19.622
MODEL SELECTION TESTS - SEE RAMANATHAN(1992,P.167)
 CRAVEN-WAHBA(1979) GENERALIZED CROSS VALIDATION(1979) -GCV=  0.25510E+09
 HANNAN AND QUINN(1979) CRITERION -HQ=  0.27031E+09
 RICE (1984) CRITERION-RICE=  0.27348E+09
 SHIBATA (1981) CRITERION-SHIBATA=  0.22712E+09
 SCHWARTZ (1978) CRITERION-SC=  0.33250E+09
 AKAIKE (1974)INFORMATION CRITERION-AIC=  0.24284E+09

                    ANALYSIS OF VARIANCE - FROM MEAN
                      SS          DF          MS              F
REGRESSION      0.28459E+11       6.     0.47431E+10        23.413
ERROR           0.54697E+10      27.     0.20258E+09
TOTAL           0.33928E+11      33.     0.10281E+10

                    ANALYSIS OF VARIANCE - FROM ZERO
                      SS          DF          MS              F
REGRESSION      0.54543E+12       7.     0.77919E+11       384.628
ERROR           0.54697E+10      27.     0.20258E+09
TOTAL           0.55090E+12      34.     0.16203E+11

 VARIABLE   ESTIMATED   STANDARD    T-RATIO      PARTIAL STANDARDIZED ELASTICITY
   NAME    COEFFICIENT    ERROR      27 DF   P-VALUE CORR. COEFFICIENT  AT MEANS
 AGE          957.05      158.2      6.048    0.000 0.758     0.5804     15.3040
 SQF          14.639      7.961      1.839    0.077 0.334     0.1915      0.1739
 BTRMS        3342.6       6630.     0.5042   0.618 0.097     0.0514      0.0375
 BDRMS        19907.      6776.      2.938    0.007 0.492     0.2805      0.4701
 DGW         -7.7219      4.772     -1.618    0.117-0.297    -0.1310     -0.0431
 LTA          3.0688      1.378      2.227    0.034 0.394     0.1925      0.1564
 CONSTANT -0.18618E+07 0.3046E+06  -6.112     0.000-0.762     0.0000    -15.0987
 |_stop
```

Springgarden (Sample 3) (Appendix E)

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