Sustainable Subdivision Planning and Design: Analysis, Literature Review and Annotated Bibliography

Issues in Urban Sustainability No. 7

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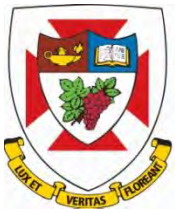
by David R. Van Vliet
1994

The Institute of Urban Studies



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SUSTAINABLE SUBDIVISION PLANNING AND DESIGN: ANALYSIS, LITERATURE REVIEW AND ANNOTATED BIBLIOGRAPHY

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PREFACE

Due to time and budgetary constraints, this literature review was restricted to documents held at the University of Calgary, and the Faculty of Environmental Design. A broad range of sources was nonetheless investigated: planning, urban design, architecture, landscape architecture, environmental planning journals; building industry publications; engineering research; and government-funded project documents. A number of works on ecological and environmental planning deal with land development as a sub-activity within overall environmental and land resource management.

With a few exceptions the bibliography cites publications since 1985 and focuses on Canada and the U.S. Foreign language material and foreign book reviews in the library holdings are few.

In addition the following indexes were consulted:

Journal of Planning Literature
Planning Librarians Bibliography
Council of Planning Librarians (CPL)
Urban Affairs Quarterly
International Journal of Urban and Regional Research
Journal of the American Planning Association
CD-ROM, database of citations available on the subject
Social Sciences Indexes
Urban Affairs Abstracts
Geographical Abstracts

I would like to thank Professor William T. Perks, Planning Programme Directory, Faculty of Environmental Design, University of Calgary, for permission to draw freely upon text from co-authored reports prepared as part of the Affordable Sustainable Community Research and Design Project, edited for the purposes of this review (see Perks and Van Vliet, 1993).

In its general objective, I hope this will contribute to the dialogue and to movement among the key actors in the system toward a more integrative management process, and some experimental movement in the direction of sustainability goals.

> Sustainability is an ideal, not attainable within our implicit assumptions about how we live our lives. Ecological design proceeds from the premise that there is more than one right answer, but that which ignores ecological reality in both its social and physical dimensions is dumb design (S. Van der Ryn, in Walker *et al.*, 1992).

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1.0 INTRODUCTION

This report presents an overview of some of the issues and commentary on the research and practice towards more sustainable subdivision planning and design. It presents critical planning concerns and presents some alternatives in the form of directive principles and propositions. A select bibliography and a list of projects proposed, in progress and built, is included for further reference. It is important to note that sustainable urban development theory at this point is formative, not conclusive or empirically tested, and not widely in practice. The potential for change is in the increasing number of individuals and the various sectors recognizing the problem so that actions can be taken at the neighbourhood community, town, city, regional and provincial levels to prepare more integrated plans and policies supportive of more sustainable subdivision design and landscape functioning. For improved plans and policies to become effective, a broader, well conceived ecosystems approach and experimental institutional framework are required. Planning of more sustainable residential community environments will require significant additional research and experimental practice to determine the conditions required to maintain the integrity of the environment.

The preliminary search of studies and research reports indicated that in both theory and practice, an international trend is emerging toward community proposals fundamentally different from current suburban development patterns. The report is focused on the Canadian context. Literature and examples from the U.S., Australia and Europe are included. Questions of site development, servicing standards, land use, codes, *etc.*, addressed in this report are shared by all municipal jurisdictions. I refer to the Calgary delivery system when specific comments are made; however, these may not be applicable elsewhere.[1]

The very topic presented to this reviewer, implies that "sustainable subdivision" is in fact an existing type, and a description of a body of work that can readily be classified as to incorporating characteristics of sustainability. As this is an emergent and dynamic field, this literature review and select bibliography is an attempt to document efforts to date and provide the basis for additions to be made resulting from research, new built projects and proposals and conclusions regarding their performance. Due to the limited time and resources available to the author this is a *scan* of the literature and issues.

Site planning and subdivision design are not the prerogative of a particular profession or discipline. It is a multi-disciplinary activity, involving the expertise of many people. Urban planners in practice have paid little attention to ecological aspects of the environment (this is now changing to some degree). This is accountable in part to planners having very little knowledge about ecosystem functioning or impacts, and lacking the critical tools and resources to help present more ecologically

sound planning options. Engineers have taken a narrow mechanistic approach to transportation design and infrastructure servicing. Landscape architects have narrowly defined their role as "bringing nature into the city," while being seduced by a romantic notion of nature. Architects have narrowly focused on the building to the neglect of the site and context. Ecologists and environmental scientists have focused on the "natural" environment, neglecting the urban context. Professions are broadening their scope to include each others' work in a search for workable alternatives, supported by reviews of site development and infrastructure standards in various communities. In fact, all involved need to comprehend and synthesize such issues as urban design, ecosystems, economics and politics into a more complex whole to build healthy communities:

> To coherently attack the issues of ecological design or the restructuring of urban form, one must apply ecological principles and processes to the interrelationships among natural, social and built environments and to view this simultaneous interaction as the domain of the urban ecosystem. It is no longer possible within this conceptual framework to look at the natural, the social and the built environment as discrete entities. Instead, they emerge as a complex interrelated whole in which the desirable functioning of one subsystem must be conducive to the desirable functioning of the other two (Tyler, 1993).

Although the call and challenge have been before us for some time, few believe the very substantial change suggested by many authors is possible in the near term, although nearly everyone now agrees something drastic is called for. Some readers will consider this review of literature as still, to some degree, an intellectual voyage into the future, but most will acknowledge that we cannot work for a future that we cannot imagine.

1.1 BACKGROUND AND THE ISSUES, CONCERNS

Canadian publics and their governments are increasingly recognizing there are health and economic benefits, social development assets and other amenity satisfactions to be secured by incorporating environmentally friendly practices in all aspects of living. Local urban communities and households alike have begun to demonstrate their concerns about conserving resources, about better waste management and recycling, and about reducing negative impacts attendant upon land development. During the past decade, in local communities across the country, we have witnessed a gradual capacity-building for collective initiative and concrete action, and increasing subscription to the idea of environmental stewardship. Senior governments have appealed for sustainable development in all sectors of economic activity and community life. "Round tables" are at work. Green Plan funding and other supportive measures in regulation, public administration and public policy

have begun to flow from the principles and precepts of Sustainable Development and "thinking globally" enunciated by the World Commission on Environment and Development in 1987.

Encouraging though these initiatives and directional shifts have been, they should not obscure the slow pace of change or experimentation that characterizes the Canadian urban development situation. Both municipal authorities and industry are still uncertain about their roles and their capacities to advance the notion of sustainability within a context of residential development, housing design, and urban form-making in general, including practices to conserve landscape functions and natural processes. Three positions—or "realities"—of the Canadian delivery system would seem to explain this uncertainty.

First, the operational meanings and the planning-design criteria—the "sustainability performance criteria"—in residential development settings are not as yet well defined and not empirically demonstrated (Proceedings, Human Settlements and Sustainable Development Conference, Toronto, June 1990; Canadian Institute of Planners Workshop on Sustainable Development, September 1990; Nozick, 1992; Richardson, 1990; Rees and Roseland, 1991; Perks and Tyler, 1991; D'Amour, 1991; Maclaren, 1992). In other words, there are no "on-the-ground" models in Canada of what, in a holistic or full sense of the concept, would constitute a residential community planned and built for sustainability performance.

Second, the property development industry has argued that inflexible municipal procedures, codes, engineering requirements and site-development standards variously deny the possibilities of making innovations. At very least, they have frustrated industry's attempts to innovate. Inter-sectoral differences of views, standards, *etc.* (*viz.* engineering *vs.* planning, transportation, *etc.*) are also noted. In response, municipal officials and politicians tend to argue that these regulatory and procedural conditions serve a confirmed public interest, i.e., orderly development; co-ordinated delivery of an equitable level of services and infrastructure across all development projects; a satisfying provision of amenities; durable, risk-free engineering designs and maintenance procedures; cost efficiencies relative to operating and maintaining public services and infrastructure; and security of reliable and balanced service within the infrastructure regime (e.g., transportation, fire protection, *etc.*) (Robinson, 1987; the A.C.T. Program; Goldberg, 1990).

A third "reality" to be confronted relates to certain suppositions about the market acceptability of the present form and character of residential community development in Canadian cities. The argument is commonly advanced by industry, municipal administrators and politicians alike (though not with unanimity or always with absolute confidence) that the consumer—the urban inhabitant —demands the type and form of community that is currently delivered. Further, it is argued, the

consumer would not accept (purchase) housing and residential communities that would be different in character from the customary forms of development—and most particularly if these were to reflect a significant re-direction towards sustainability performance goals (implying changed behaviours).

The argument of "consumer choice" holds certain truths but in many respects is circular. Choice for the consumer still remains only a narrow one, whether gauged by affordable price/rent, or by the character, form and ecosystem functioning of the housing and community. This condition of ineffectual choice rejoins the first statement about the absence in Canada of built models of a genuinely sustainable community form. Until such demonstrations appear, until choice is made meaningful and palpable, the proposition that the consumer "does not want it" remains untested.

More importantly, perhaps, the changes in individual and householder behaviours that are signalled by any policy of sustainable development, however partial or comprehensive in scope, cannot be willed independently of the interactive influences that our living environments produce in the individual and the household. We cannot expect that individuals will become lesser consumers of energy or better managers of waste, or active agents in recycling and environment restorations, if the form and character of the community and its social program are not conducive to those behaviours.

2.0 SUBDIVISION

Subdivision has a variety of meanings between jurisdictions, in degree of detail, in stipulations required, in anticipated/legislated timing of development, *etc.* A subdivision is a small planning scheme. In scale and detail of provisions, subdivisions vary from what would appear more like an outline or area structure plan by some jurisdictions to a very detailed site plan in others. As there are few examples of projects that can conclusively be deemed to represent the category of "sustainable subdivision," particularly in Canada, at this point in time, I will consider a broad interpretation of subdivision. Such a specialization as "sustainable subdivision" will be more appropriate as the field develops. At this time, it would limit the learning that this report is attempting to support. Research, theory and practices in the area of restructuring, urban renewal, *etc.*, also have legitimate application in site planning analysis, design and development. Considered relevant, therefore, are urban intensification or change-in-use projects beyond, say, an urban block in scale in addition to projects for green field sites. This report concentrates on the residential subdivision, which represents the bulk of development activities in most communities. I do not focus on the individual structure and lot. There are many initiatives in more sustainable housing, green architecture and green housing estates, but this does not mean that these are a dominant part of a green subdivision. The scale normally referred to will be between a few blocks in size (over 3 ha) to large tracts.

When tracts of land are subdivided for urban functions, it is usually for the purpose of creating new parcels of land. This generates many new land owners, whose compliance with development standards needs to be sought. The process of dividing up the land may precede the actual urban development process. The perspective of the community must be anticipatory in knowing the obligations it might face to service the new parcels of land, as well as the consistency of the new layout with adjacent tracts and the time at which development is to occur. The main concerns today are still with street layouts, open space provisions, drainage, the size and shape of building lots, and ease of providing water and sewer lines, all in which the community has a legitimate interest. On approval, the new pieces of property acquire independent status, and the community is obliged to honour its obligations whenever it should be built upon. This can be a constraint to a community's development pattern and quality, since the timing and character of what gets built is usually not yet specified. The process of subdividing land in a speculative way has involved a relatively new but very significant actor, the land developer, in the planning and development of communities.

2.1 THE DELIVERY SYSTEM FOR RESIDENTIAL COMMUNITY-WORKINGS, ISSUES OF EFFICIENCY, DESIGN

Housing production in most Canadian jurisdictions over the past two decades has shifted almost exclusively to the private sector. Senior government supports for assisted co-operative and other forms of social housing have been cut back dramatically. In 1986, the national production of assisted housing was 25,000 units; currently, it is of the order of 15,000. Financial resources for research and demonstration have similarly been withdrawn. (For example, Alberta Municipal Affairs recently ended its extolled Innovative Housing Grants Program). This is explained in large part by contracting government revenues, expanded debt and the preoccupation with the national deficit.

In most Canadian municipalities, the development industry, not the municipality, is the paramount planner of community and the designer of housing. For example, the City of Calgary administration does not play a highly directive role in the execution of either site plans or urban designs, or in specifying what types or numbers of households shall be accommodated in any given residential development project. And the City has not played a role to date in inducing planning and housing design or environmental impact assessment that would advance performance goals across a full front of sustainability measures. As a result, there are no competing or alternative models of housing and community by which the private sector could better gauge the range of wants and desires in the marketplace, or the propensity for innovative, sustainable community-type projects.

With a few exceptions, in recent decades the subdivision approach to housing had the following general characteristics:

- non-linear patterns—winding streets with groupings of trees and landscaping treatments. Public and private space blur, roads become largely private;
- lack of spatial definition—spread out—each home is separated from the other as much as land and infrastructure costs allow;
- single residential use;
- resident homogeneity—uniformity of house size and costs, separation of income and ages not commonly encouraged in proximity;
- amenities enrichment—carefully calculated according to return on investment of house values;
- separation rather than integration of subdivision from other land uses—distinctiveness is cosmetic;
- frontal display of house to street;
- homage to the car.

The delivery system comprises, essentially, a set of private companies which prepare and develop lands, and finance, build and market houses; and a set of public sector agents which establish public policies and regulate. Instrumentally speaking, the latter are comprised of municipal departments and a few, but key, regulatory boards made of citizen appointees. Provincial and federal agencies come into the picture as well, depending on circumstances. For example, since the early 1970s, the dynamic of Calgary city politics and planning administration have dictated that these basic components of the delivery system be formally harmonized. The City of Calgary negotiates annually with the property industry a Development Agreement which, among other things, spells out scheduling and cost sharing between private and public agencies in the provision of infrastructure; through the Agreement (and attendant political lobbying processes), the system procedures, rules, codes, and planning and design standards, and so forth, are revised or created anew. In theory, harmonization means that the particularized interests and objectives of the public and the private actors are transformed into joint interests and objectives. This occurs in practice; but rival or conflicting interests that cannot be reconciled tend to be put aside or ignored. What results is administrative-managerial efficiency.

There are a number of important features and consequences of this harmonization-for-efficiency. The first is that industry, not the municipal authorities, are the paramount planners and designers. That is, the City administration does not play a highly directive or even persuasive role in the execution of either site plans or urban designs, or in specifying what types or numbers of households shall be accommodated in any given residential development project (i.e., "community designs"); or in housing design *per se*. In effect, the City in most jurisdictions possesses little or no designing capacity to speak of and plays no role in experimental planning and design or research.

This is compounded in its effects on the general character of, and on the range of choices for, new housing construction by the fact that industry itself has little or no significant experimental tradition. What market research is conducted has focused not on fundamental psychographic factors or culture-specific, household-specific needs and preferences, but rather more often on preferences for cosmetic features in the fitments to houses. Although broadening somewhat, "house" too often continues to be conceived for the "typical family," long since disappeared from the demographic map. There is emerging evidence that some under-specified market niches exist that are not being considered.

2.2 SUBDIVISION CONTROL AND STANDARDS

Subdivision control is the tool developed in response to the need for community interests of cost and quality. The community has the authority to approve any plans for dividing land for

development to ensure plans meet local standards for health, safety and convenience. This control is tied to the province's power over the registration and certification of parcels of land for future sale, enabling control over the land use and timing of development. The province prescribes a procedure and the prerequisites for such approval. Substantive control is by means of plan appraisal of their content according to planning and engineering standards. Procedural control is a monitoring process, with prescribed steps to place scrutiny on those proposing the subdivision and the ultimate owners of the parcels. This process differs between communities and between provinces in respect to provincial planning institutions and concepts of subdivision standards. In general, however, they have much in common.

The examination of design of the proposed subdivision is central to the control process. The scheme is scrutinized according to planning criteria for form and density of housing street systems, open space and essential community services, engineering criteria pertaining to drainage, road constructions and installations of public utilities.

Residential communities are planned and built in a "back-to-front-end" manner. That is, large-scale site or area plans are devised, the area is subdivided into private lots, and servicing infrastructure is installed. Infrastructure and site development standards are acknowledged to be in the "Cadillac" category. Generally speaking, marketing strategies promote an increasing consumption of private house space and luxury "features" of houses rather than spatial and conservationist economies of building. Such regulatory and site development factors and market tendencies reinforce the consumption customs of affluent times, not the consumption behaviours or public policies fitting to the concept of sustainable development. Subdivision regularities and generous infrastructure standards combine to make adaptation to innovative community forms next to impossible. Housing is then distributed over the subdivision plane. The housing is "price-designed" for a narrow price range across an extensive spatial environment. Typical production runs in a residential project would be 50, 100 or even 200 units. Projects of this scale will be repeated in successive stages of construction across a sector of 100 to 500 acres.

A key factor in this process is the distinction between the companies who prepare the land and bring it onto the market as a subdivided, large-scale and "efficiently serviced" entity, and the companies which build and market houses . . . later. The house-builder obtains lots by purchase from the land-developer companies (N.B.: a few land-development companies are also house-builders). The house-builder is effectively dissociated from the front-end planning that determines the eventual shape, character and demographic-occupational composition of a neighbourhood. The house-builder has little manoeuvrability for experimentation in housing form or small-scale community design. House-builders

are given to judging their success in the marketplace by "what sold well last month." And, in turn, they judge their future prospects by the same token, not by systematic research into houseseekers' wants and preferences joined to serious design-development and test-modelling of alternative architectural forms of either house or neighbourhood.

It is with changing values, and therefore changing criteria, and the need for further specification, that many improvements in subdivision standards and process are being viewed as increasingly necessary if more sustainable forms of development are to be realized. To date, most Canadian subdivision design has been characterized as poor to mediocre in quality, with a pervasive utilitarianism attributed to the following factors:

(i) Subdivision plans call for special design skill and an awareness of what constitutes a good residential environment, but such skills are rarely evident among the surveyors, architects, engineers and planners who lay out subdivisions.

(ii) Those carrying out subdivisions continue to concentrate on the yield of lots from the site, often in disregard for the natural topography, amenities and balanced circulation systems.

There are many facets that contribute to the ultimate quality of residential environment resulting from a subdivision plan. The need for guidelines and manuals has been expressed particularly now, when a much greater degree of integration and site specific response is considered desirable and will increasingly be legislated. While many argue that the criteria and concerns for subdivision design and approval need to be greatly expanded, a review of a typical list from over a decade ago includes basic items that are consistently not addressed or are poorly handled in currently approved subdivisions (see Figure 1). The list also reveals implicit normative values which become specified in practice by rigid standards, i.e., What is "adequate" lot size? Housing types? "Adequate" utilities and road widths? "Sufficient" parking? "Attractive streetscapes"? "Best 'use' of climate"? (Shouldn't it *respond* to climate?). While considerations for a subdivision design are being expanded (see Listokin and Walker, 1989), no list will be complete.

Listokin and Walker (1989) describe four historic stages of U.S. subdivision controls. These roughly correspond with Canada's.

Stage I: 1920s - World War II, introduced enabling legislation and early ordinances.

Stage II: Post-World War II, provisions of municipal infrastructure through subdivision controls.

Stage III: 1960s-1970s, subdivision regulations as growth controls and protectors of the environment.

Ordinances typically contained provisions prohibiting development in wetlands or over aquifers, requiring that the amount of runoff after development not exceed the amount occurring prior to development, specifying that natural vegetation of a site be retained wherever possible, requiring that cutting and fulling be minimized and protecting the natural habitats of endangered species and other measures. Landscaping and screening standards were indicative of an interest in improving development design and creating projects that were perceived to be a community asset. There were lingering inadequacies in both statutes and practice. Many reports decried the wasteful and inefficient utilization of land with problems of large-lot zoning, increased utility and municipal capital and service costs, rising tax rates, environmental degradation, poor quality of services and socioeconomic exclusion.

Stage IV: A search for balance. This latest period is marked by a reaction against regulations seen as excessive, cost-inflating and arbitrary—and a search for reasonable and balanced standards.

2.3 SITE PLANNING PRACTICES, SITE DEVELOPMENT STANDARDS— ACHIEVING INFRASTRUCTURE EFFICIENCY—CONSIDERED MORE SUSTAINABLE?

There has been considerable debate over the past years around affordability, and how the sustainable development concept is to be applied to urban communities. Built forms (buildings and engineering works) and landscapes (including streetscapes) are the two main types of human "artifacts" in the urban environment whose patterns and relationships can be manipulated, designed or modified in order to manage the structure and state of ecological process. Implicit in this process is a concomitant institutional change in governance of these interrelationships. Changes to site development standards and procedures are widely recommended conditions of more sustainable practices.

From the late 1960s through the mid-1970s, many demonstration projects were undertaken utilizing innovative site development standards. The push for these came mainly from a desire of local and senior governments to enhance the delivery of affordable residential housing. (Affordability in terms of social equity and access is an important component of sustainable communities). At the same time, governments and professional associations (for example, American Society of Planning Officials [ASPO]) were equally concerned to demonstrate means by which certain factors of conservation—energy use, land, passive solar, *etc.*—could be introduced into subdivision and other development practices. Several large-scale projects and studies in Canada and the United States, therefore, set out to document the cost savings and benefits to be achieved. Frequently, these

projects and studies broke down the component costs with respect to public and private responsibilities.

A number of contributing factors for the focus on affordability and demonstration contributed to studies of, and experimentation with, more densely clustered, comprehensively planned neighbourhoods. Although numerous planning and design practices for lowering costs through the land-use and other regulatory processes are well-documented, few lasting changes in municipal regulations or in the form of residential communities delivered by industry have taken place.

Although other factors affect affordability, the literature review showed that most of the studies targeted potential savings from regulatory reform or relief as their main object. Cost savings achievable by revisions to site development and technical standards were found to be in the range of $4,000 to $10,000 per housing unit in studies completed in the 1980s in Australia, America and Canada. The savings were in some of the projects, passed on to the homebuyer.

Again from industry publications comes evidence of a shift in the development climate in the late '60s and early '70s, when a resurgent interest in affordability became clear. Canadian industry journals and planning articles reveal that in the early 1970s, awareness of how changes in regulatory instruments could benefit goals of affordability was growing.

A number of changes were implemented on a demonstration basis in various jurisdictions. By the 1980s, discussion of regulatory impacts on overall development costs was widespread.

From the mid-1980s on, some articles indicate that regulatory changes to accommodate land-use and technical innovations are no longer the focus. Rather, the roles and relationships of public and private players in the provision of social housing are increasingly examined. Concerns of the residential building industry have remained focused on government-related impediments to housing delivery up to the present. The "shotgun approach" and dilatory attention to development approvals is now commonly cited as an impediment to innovative or affordable standards. The Ontario Home Builders' Association, 1988, suggested a six-point program including:

- Streamline the zoning approval process.
- Change municipal planning rules for moderate-cost housing (approval of higher densities). . . (*Canadian Building,* October 1989).

More recently, a 1990 CMHC-commissioned study identified nine areas of innovative activities variously undertaken by Canadian municipalities to maintain or build lower-cost housing stock:

- political leadership and advocacy;
- planning and policy;
- regulations: standards and zoning;
- land and buildings;
- financing;
- taxation and fees;

- regulations: process; and
- information and related services.

(Hulchanski *et al.*, for CMHC, 1990).

The categories encompassing regulations cover such activities as:

> . . . revision of government regulations affecting land and buildings with the aim of: reducing the cost of new or rehabilitated housing; increasing the housing capacity of land within the municipality; inhibiting the loss of existing affordable housing; or providing potential incentives to residential development and preservation . . .

and:

> removing obstacles and . . . streamlining the municipal development approval process

(Hulchanski *et al.*, for CMHC, 1990).

This study found that innovative approaches varied with the conception of municipalities' role in provision of affordable housing. The authors stated that:

> . . . Canadian municipalities can play a much greater role in low cost housing than they traditionally have (Hulchanski *et al.*, for CMHC, 1990). (The same conclusion can well be reached now as to how municipalities could play a much greater role in sustainable community planning than they traditionally have).

In setting out prospects for the future role of municipalities in delivery of lower-cost housing, the study identifies the need for consistent political commitment and leadership as primary. Through such commitment, "experimentation among staff, community groups and the private sector" can be stimulated (Hulchanski *et al.*, 1990). As well, the NIMBY-focused political activism of citizens can be dealt with through sustained public education. Partnerships and collaborative efforts with senior levels of government will be necessary, for while municipalities can play a significant role in low-cost housing supply (and in more sustainable community delivery), the "superior tax base" of provincial and federal governments can contribute to policies which affect economic and social conditions external to the urban settlement.

The literature on "Green" or "Eco-Cities" and "Sustainable Development" of the last decade examines urban development forms (and, implicitly, development standards), from a number of perspectives: consumption of energy, land, capital and time, and effects on community environment, social networks, equity, *etc*. Other publications set out new, innovative and cost-effective designs generated by a concern for preserving the natural environment. Although the auto-dependent suburban community was one of the strongest trends in post-World War II home building, the critique of suburbia seen in the literature today is not new:

> Sprawling subdivisions destroy the countryside. They result in uneconomic, inconvenient and ill-serviced communities, block the future, and offer nothing of lasting value that cannot be provided more adequately by orderly growth (Central Saanich Capital Region Planning Board, quoted in *Canadian Builder*, December 1957).

The critique and the mass of research findings and innovative proposals notwithstanding, innovations have *not yet been widely adopted and/or regularized in practice*:

> Cluster development ranks right up there with citizen participation and inclusionary zoning as a planning *good*. . . . Yet over the years, despite an almost universal recognition of its virtues, particularly in preserving open space, compact residential development has had relatively little impact (R.E. Knack, *JAPA*, September 1990).

More recently, the literature shows growing awareness that, while innovations in subdivision, site development, building codes, engineering and other like standards are desirable, there are cultural factors and consumer preferences and behaviours at work in the observable inertia to generalized changes that would, to varying degrees, achieve greater affordability or sustainable development. In other words, technocratic design or planning innovations alone are insufficient, if not inadequate, instruments of change. Thus, substantial challenge to change in the 1990s will be better to identify the inhibiting human factors—the consumer factors—and to devise planning, design, building and marketing strategies that would help consumers (house-seekers) see their interests aligned with the goals of innovation.

Several articles identify processes and strategies employed by planners and housing advocates to create public awareness, strengthen political will and implement regulatory reform. Planners and developers alike are urged to recognize that:

> Planning regulations such as subdivision standards and zoning bylaws convey cultural values into our landscape . . . [and] embody powerful community values, and any models which might replace or supplement [our current development forms] must do the same if they hope to succeed (Grant, *Plan Canada*, January 1991).

Moreover:

> "If you start off building a community with very little sense of community on the part of the developer and the citizens," says sociologist Gottdiener, "then it's extremely difficult in the long run to put the pieces together so that the area matures in a way that people have a substantive quality of life that they're proud of" (W. Fulton, *JAPA*, July 1990).

Also, communities and the individual consumer must be made aware, and must be assured, that regulatory reforms, increased densities and affordable housing do not, *in and of themselves*, contribute to lower-quality developments and mean living environments. To this end, one emphasis of innovative standards should be on ensuring the acceptability and aesthetics of design (Wentling and Bookout, 1988). Put another way, municipalities must shift their traditional reliance on regulation and build up a *design culture* that leads, rather than reacts to or follows, industry norms and practices.

2.3.1. Profitability

Little literature addresses the question of profitability in relation to innovative, affordable, sustainable projects. Some documents do suggest that profits similar to those obtained on non-innovative projects can be maintained (this was especially noted for smaller developer-builders). Even if such levels could be obtained for the larger developers in the Canadian climate, there is still a question of how much of the cost savings would be passed on to the homebuyer should less costly development standards be institutionalized. It may be that the only way to ensure that such savings are reflected in housing prices is to allow relaxed standards of development only when the savings are tracked and substantiated for each affordable development, and where relaxed development standards are only allowed when housing prices reflect savings achieved.

As well, authors in a number of the previous studies cite others, or themselves state, that municipal governments' drive to obtain the highest possible taxation rate for new developments means that they encourage the most resource-consumptive and costly forms of development on the outskirts, rather than emphasizing responsible design for smaller, denser developments with mixed land-use and housing attributes. Recent research on European[2] and U.S. projects indicates viable and expanding market niches for ecologically sound housing and community planning (see Calthorpe, 1994; Deelstra, 1991; Novem, 1992; Perks and Van Vliet, 1994; Russell, 1995; Smyth, 1992).

2.3.2. Demonstration and Regulatory Changes

Numerous demonstration projects and case studies are available for both North America and overseas. In the U.S., the Department of Housing and Urban Development embarked on, and published results of, a major project carried out during the 1980s: the "Joint Venture for Affordable Housing" (JVAH) project. Local builders and planning authorities were invited to work together to propose, design, build and market affordable housing units. Changes to standards that could bring about cost reductions to the developer, and consequently to the homebuyer, were enunciated: cost savings could result from a greater efficiency of land-use and technical (engineering) changes to standards which reduce servicing costs.

Since land is the most significant cost component in developments (NAHB, 1987), changes that would reduce minimum lot sizes, frontages, set-backs, parking allotments, street widths and land dedications provided the greatest cost-savings. This is recently reconfirmed from the Ottawa-Carleton regional task force on alternative standards (1992).

Research revealed that (i) changes to land-use policies, modifications in servicing requirements; and (ii) alterations in the review-approval process could contribute the greatest cost savings to builders

and homebuyers. The techniques, practices and changes advocated to reduce housing development costs and increase affordability include the following:

- Zoning and subdivision regulations
- Processing of plans/permits
- Site planning
- Streets
- Parking
- Sidewalks and walkways
- Curbs and gutters
- Storm drainage systems
- Sanitary sewers
- Water supply
- Utilities/easements

A full list of the commonly proposed changes in each of these regulatory fields is not necessary. A sampling below confirms many are readily identifiable as also being supportive of sustainability design (*Affordable Housing* 1, 1987):

Zoning and subdivision regulations

- encourage by policy and incentives those plans that would increase density;
- preserve the desired amount of open space;
- avoid development plans with wide streets in large-scaled patterns;
- avoid large lots, deep setbacks and low density;
- encourage preservation of natural features in site plans;
- support cluster plans that increase density and create open space;
- support the design of privacy landscaping;
- reduce or eliminate setbacks from all four lot boundaries;
- allow alternative lot configurations.

Streets

- limit ROW to minimum widths necessary for street construction and maintenance;
- use easements instead of ROW for sidewalks and utilities;
- design streets for realistic anticipated use;
- reconcile street widths with number of travel lanes and only an amount of parking necessary in "average" rather than "exceptional" daily periods;
- reduce pavement thickness to match structural design with actual performance needs and realistic probabilities of a future need for upgrading;
- reduce radius requirements for bulb *cul-de-sacs*, or substitute hammerheads, T-turnarounds and islands.

Parking

- provide off-street parking where possible;

- use common driveways;
- design paving section to meet actual load requirements rather than general standards;
- eliminate curbs and gutters in parking areas;
- if curbs are required, allow roll curbs or other alternatives;
- if street parking must be used, limit to one side of the street;
- use unpaved shoulders for parking to reduce road pavement width;
- consider traditionally unused space, such as the centre of a *cul-de-sac* or court, for parking.

Sidewalks and walkways

- construct sidewalks on one side only; consider elimination altogether on lightly-travelled streets, especially where street lengths are short, eliminate sidewalks along dead-end streets and *cul-de-sacs*;
- replace infrequently used sidewalks on streets with pathways between groups of residences, bus stops, stores, playgrounds and other community facilities.

Storm drainage systems

- use performance requirements rather than prescriptive standards for all elements of storm drainage system;
- consider detention/retention basins, especially where regional-scaled management presents an opportunity.

CMHC's 1981 *Residential Site Development Advisory Document* outlines possible configurations for lots, particularly those which achieve higher densities. This document also identifies the reasons for incorporating a variety of dwelling unit types within a community:

- it stabilizes long-term demand for community services by attracting a variety of residents with different needs that change in a variety of ways over time;
- it enhances community identification by permitting different and changing housing needs to be met within the same community;
- it encourages social diversity by mixing age groups, income levels, occupations and activity interests within a single community;
- it provides a diversified living environment for residents;
- it offers buyers or renters real choice on the housing market (CMHC, 1981).

Density by Design, a 1987 Urban Land Institute report, documents design changes made to traditional housing forms to accommodate higher density and achieve greater affordability (Wentling and Bookout, 1988).

As with regulatory reforms, the cost savings attendant upon lesser site development standards have been well-researched and documented. One of the first studies to have attempted a comprehensive and primarily quantitative accounting of the major impacts of suburban development was the 1974 Real Estate Research Corporation report, *The Costs of Sprawl*. In this report the development costs of alternative patterns of urban land development are compared.

The report noted a growing literature on impact studies that incorporated both economic estimations and environmental factors. However, a difficulty in analyzing development impacts was (and is) the categorization and comparison of the many and varied housing forms and development patterns. Without a standard approach to breaking this continuum into appropriate and usefully comparable groups, differences in development impacts were (and still are) difficult to assess. The development patterns examined for this study consisted of the typical pattern of 20- to 40-acre subdivisions to be found in reality and a set of hypothetical site layouts of varying mixes of housing form and density. Canadian and Australian research estimated similar savings and benefits from regulatory changes to components of site development.

The studies and documentation reviewed, well-targeted reforms to the regulatory/standards regime could offer substantial savings in the costs of residential development. However, despite the knowledge of techniques to achieve cost savings (and increased sustainability) which has accumulated over several decades, few of the proposed reforms have been institutionalized by municipalities.

There has been a resurgence of interest in the search for alternative site development standards in various municipalities, more recently termed as "infrastructure efficiency" (Marshall Macklin Monaghan, 1992; Ottawa-Carleton, Regional Municipality of, 1991; Commission on Planning and Development Reform in Ontario, 1991). Consistently, the studies demonstrate savings in capital, maintenance and operating costs, and land costs through combining simple alternatives. The challenge is to combine an increased number of elements (practical and economical steps) to work together and modify development and planning codes and regulations and procedures. The changes most often proposed are usually incremental rather than radical. However, the suggested changes in smaller lot sizes, reduced road dimensions and ROWs and reduced set backs, have been slow to be implemented. Often performance standards are recommended as a preferred approach to allow creative and site-specific responses to achieve the desired result. A partial list of possible action items and site development alternatives that have been suggested as being more supportive of sustainability goals appears in Appendix 1. (Some are minor, and some more radical in their assumed impacts).

The precise benefits to affordability and sustainability in a particular context that can be attributed to site development standards commonly employed cannot be adequately determined

without comparative analyses made between conventionally-built projects and alternative built projects (preferably several distinctive types)—that would have explicit affordability and sustainability factors incorporated within them. Such alternatives have not been forthcoming from industry; nor have most cities given leadership in the direction by "modelling" forms of development conducive to achieving affordability policies or the goals of sustainability.

Currently in most jurisdictions, innovation or relaxation in subdivision and site development standards usually occurs by a system of "challenge and response." The developer challenges (proposes), the City responds (reacts). Responses are formulated only after finite analyses by a multiplicity of City agencies and departments can be completed, after much investment of professional resources by the proponents, and only after exhaustive cross-challenges and negotiations among and between the experts on both sides. This City procedure, described as flexibility and openness to *ad hoc* change and innovation, is only nominally a positive arrangement. In reality, it is an impotent policy for inducing affordability or sustainability. Corollative deficiencies in this City policy of "challenge and response" are: (i) The City itself brings to the negotiations *no concerted departmental vision* regarding affordability and sustainability plans and measures; (ii) City criteria for judging the merits of proposals are pre-eminently focused on the post-construction *administration costs* that will conceivably flow from the innovations (e.g., probabilities of corrective measures or repairs occurring, maintenance costs, work crew routines, *etc.*). Affordability accounting tends to be single-purpose, least-cost-administration accounting—with which system-wide and city-wide land, environmental and social gains or benefits cannot be equated in comparable and like terms. Sustainability accounting is absent.

Most Canadian cities are cautious, however, about making more substantive variances in the current standards. On the other hand, there is support for the principle of sustainability in many Canadian municipal administrations and some indications that they are receptive to innovation in standards, provided long-term maintenance costs for infrastructure will not be driven upwards. Industry positionings appear similarly reserved. Hesitancy exists as to who should initiate innovative measures for sustainable development and how to begin.

Innovations that could bring about increased housing quality, better residential amenity and ecological-environment performance, including reduced long-term maintenance, have not been systematically tested for consumer or community acceptance by most City administrations, or by the political process. On the industry side of the question, it has not yet been tested in the marketplace whether at least certain segments of the market will willingly pay more for certain innovations being proposed.

It seems clear that advancement of more affordable and more sustainable communities cannot occur without public education that clearly explains public-private cost trade offs and long-term environmental benefits (or conversely, the implications of forestalling innovative approaches to urban development and changes in the delivery system procedures). Generally, it is considered that public education is a role the municipality could and should be playing if sustainability is to be taken up as a local public policy goal in a perspective of global responsibility and creating opportunities for more fulfilling urban communities.

Overall impacts on sustainability that can probably or possibly be effected by physical site planning have not been quantified. The practical and political realities of an alternative multi-disciplinary land-use and transportation development process with the objective of achieving more sustainable urban development may not be accommodated within existing regulatory frameworks. In certain instances, policy boards may find it desirable to consider adopting a separate and distinct set of standards that would be applied. This is the case with the new ordinances (regulatory codes promoting some of the considerations more supportive of sustainability) adopted by a number of U.S. jurisdictions (See Kreiger, 1991), and is the case of Bamberton where approval was turned over to a provincial review board.

Planned Unit Development has been a common means (particularly in the U.S.) to modify normal zoning requirements and incorporate more innovative standards in the plan for a project. The developer builds within a set of requirements established especially for the project rather than in strict conformity with existing regulations. The incentive may be in achieving a greater mix of uses and an overall better or more marketable project. Often, however, it is a way of achieving more lots, and has resulted in other deficiencies concerning issues of community, security, exclusivity, affordability, *etc.* (MacBurnie, 1992; Moore, 1985; Solomon, 1992; Winburn, 1992). As Bookout (1992) explains, "for over 20 years planners and developers touted planned unit development (PUD) as better for suburbs. Many are now saying that suburban developments need a much finer mix of land uses, higher densities, more normal street layouts, more pedestrian activity, and more local characteristics than PUD's can provide." In reaction to PUDs, it has been suggested that suburbs should be modeled after early twentieth century towns supporting a stronger sense of place through layout of streets, arrangement of open spaces, appearance of streetscapes, and links to historical regional prototypes.

There has emerged over the past decade what many describe as a movement to formulate alternative strategies to contemporary suburbia, spearheaded primarily by architects among the design professions, influenced by aesthetic, cultural, socio-economic and environmental concerns (MacBurnie, 1992). Deficiencies of in the patterns of urban growth since the 'fifties have been summarized in a

plethora of popular texts on the subject from various perspectives (see Duany, 1991; Gehl, 1987; Spirn, 1984; Sennett, 1990; Jacobs, 1988; Hayden, 1984; Fishman, 1987; Fowler, 1993).

In North America, the traditional neighbourhood development and the pedestrian pocket have gained significant attention, re-examining important earlier planning ideas and projects and supporting the idea of the small town. The two strategies sharing considerable equivalence are well described in the literature. Neotraditional neighbourhood development plans appear to be gaining municipal support as local examples are being proposed in most regions. (For an explanation and discussion of these see, Duany, 1991; Kelbaugh, 1989; MacBurnie, 1992; Bookout, 1992; Gurstein and Curry, 1993; Fedorowick and Kehm, 1992; Kreiger, Van der Ryn and Calthorpe, 1986). While the scope of considerations in neotraditional project proposals is expanding, in practice, most fall short on significant sustainability features (see codes in Kreiger, 1991 and critiques by Okamoto, 1991; Hall Kaplan, 1992; Gurstein and Curry, 1993).

In Europe, the development toward sustainable communities has been more continuous, influenced by strong historic precedents, careful re-evaluation of modernism, coherent and proactive regional and neighbourhood planning policies, and an experimental institutional framework. While various models have been developed, North American and European projects and proposals share a number of similarities in principles and issues.

3.0 SUSTAINABLE DEVELOPMENT—SUSTAINABLE COMMUNITIES

3.1 THE ESSENTIAL PROPOSITIONS

The idea of *sustainable development* has its genesis in a crisis of conflict: conflict between the appetites and the production processes of the industrial economy, and a desire or need on the part of human communities to ensure that the earth's resources and its life-supporting ecosystems are judiciously conserved and nurtured.

Having regard for the accelerating rate of diffusion and an intensification of industrialization across the planet, and taking into account that growth is (seemingly) one of the imperatives of industrial economic development, the crisis of this conflict has assumed global proportions. Together with the problematic manner of exploitation and distribution of resources among the world's populations, the continued degradation of environments links together in a common condition all of the communities of the earth. In this perspective, nations, societies, communities and individuals are mutually affected by their economic and development behaviours.

To harmonize development with the imperatives of environmental health and stability, therefore, becomes everyone's charge. The U.N. World Commission and other authors have elaborated sustainability into a set of propositions for change. These touch on the purposes, practices and technologies of private economic development agents, and also address reform and alteration in the consumption behaviours of households and individuals. Directly or indirectly, they further address reform or restructuring the policies and practices of public institutions, those of municipal or local governments included.

Among these is the proposition that local communities must participate more fully in democratic decision-making, and thereby become more self-reliant and responsible, more mutually interdependent and custodial, where development and environment are concerned. In turn, communities and their support systems must become less consumptive and wasteful of resources. This particular proposition serves to acknowledge that, crucial though they are, and realizable though they may be, innovations in the direction of environmentally benign technologies at the level of industrial production will not in and of themselves suffice.

For sustainability to succeed, there must be pride of possession—"ownership" of the sustainable development concept. In this respect, possession must take hold in the individual, and it must reflect the situation and context of the place inhabited.

3.1.1. The Nine-Point Principles for Sustainability

The IUCN/UNEP/WWF publication (1991), *Caring for the Earth: A Strategy for Sustainable Living,* enumerates nine operational principles for a sustainable society:

1. Respect and care for the community of life
2. Change personal attitudes and practices in respect of consumption and waste
3. Enable communities to care for their own environments
4. Improve the quality of life in urban and rural settlements
5. Conserve the earth's vitality and diversity
   - conserve life-support systems
   - preserve and enhance biodiversity
   - ensure that uses of renewable resources are sustainable
6. Minimize the depletion of non-renewable resources
   - increase energy economisation, reduce energy consumption
   - minimize transport requirements, improve collective transport systems
7. Ensure that development does not destroy the earth's carrying capacity (keeping within nature's limits of tolerance)
8. Provide a national framework for harmonizing development and conservation
9. Create a global alliance for action, incentives, regulation and monitoring

From this set of principles for societal and industrial policies and actions, the linkage of urban development to global environmental concerns is then outlined. How these principles are being operationalized in urban settings is then briefly explained.

3.1.2. The Essential Propositions of Sustainability in Urban Settings

Urban development is inseparable from the industrial development process. When viewed as an institutionalized set of municipal administrative practices and technological norms in public planning that are married to the production processes of the property industry, urban development shares the characteristics of economic development institutions and industrial organizations. It is now widely recognized from this that the way in which cities and towns in Canada are planned, built and re-developed—and within them, residential communities—has produced many unbidden and nefarious environmental consequences (Rees and Maclaren, 1992; Commoner and Flavin, 1990; Brown, 1990; Lowe, 1991; Cadman and Pane, 1990).

Further, it is beginning to be acknowledged that planning in Canada has been bereft of substantive policy and visionary design content that might have produced counter-images and counter-

propositions to the "system-tech" principles that have dominated public planning practice for the past three or four decades.

Generally speaking, the planning and production of urban communities in Canada is a market-driven process. While municipal administrations mediate this market process by planning and development regulations and by controlling (to an extent) the pace and location of infrastructure investments, neither municipalities nor senior governments any longer play a significant or deeply meaningful, pro-active and inspirational role in stipulating the performance of residential community projects.

Two facets of the part to be played by urban development in the environmental crisis deserve particular mention. A major focus for implementing sustainable development should be on municipalities because that is where most development takes place and where most environmental problems originate. Global environmental problems are the sum of many local policies and actions. Therefore, local actions are important for the solution of global problems. Eighty percent of the Canadian population lives in urban areas, and growth in these areas is becoming progressively less sustainable: we are using an increasingly disproportionate share of the world's energy and resources while continuing to produce increasing amounts of waste. This includes consumption and waste in and of the cities themselves, and the contributions of the city to global environmental problems. Communities will need to be robust enough and capable of satisfying the new structural conditions which will come from solving global or international environment problems.

Sustainability presumes that development (and growth) can be brought into harmony with the planet's capacities, subject to modifications in industrial processes and practices, technological innovations, the exercise of commensurate public policy and regulation, and alterations in individual and community behaviours. Since sustainable use is applicable only to renewable resources, this implies using them at rates within their capacity for renewal. Sustainable development referring to sustainable subdivisions is used in this report to mean: improving the quality of human life while striving to live within the carrying capacity of supporting ecosystems. It should be recognized that there is no such thing as a sustainable city in strict thermodynamic terms and the ecological context of carrying capacity (Rees, 1992), i.e., if one means by "sustainable" the ability to maintain a constant flow of ecological capital from one generation to the next. It is an important distinction to note that in most of the current discourse, what is really being talked about is ways of reducing un-sustainability, rather than creating communities on the basis of positively conceived performance goals and criteria.

The concept of sustainable urban development further connects the environmental deprivations produced to date by resource development and human settlements, with a need and a desire to restore

our living environments to a healthy and ecologically-sensitive state. This extends to creating anew our models of settlement (urban) development—in other words, to reform our physical environment models, the manner in which they are produced, and the manner in which they are cared for (stewardship).

In this sense, the authors of the sustainable development concept posited as a *necessary condition* that local communities and local associations of people be given the means and the incentives to define for themselves, to act and to determine events that would meet the ends implied by sustainability. But, having regard for the present planning, design and delivery of residential communities in Canadian cities, people who would think globally are not in a position to act locally—that is, in any meaningful sense of decision-making roles or aspirations for self-reliance and responsibility. In subdivisions, community building and community living are totally separate. There are a number of hurdles, some set in place by local authorities and senior government.

3.1.3. Leads in Applying Sustainability to the Urban Context

In the literature on urban restructuring in European cities, Deelstra (1990), for one, presents six building blocks. These serve to classify the concerns and operational measures of sustainable urban planning and design as: water, energy, waste, greenery, materials and traffic. Other researchers and design strategists posit further divisions. But all recognize that in planning, design and implementation, all of the operational measures must be treated in an integrative fashion (Hahn, 1990; Lowe, 1991; Elkin and McLaren, 1991). Hahn (1990), for example, identifies three mutually complementary "fields of action":

- urban technology and urban design
- urban democracy and environmental communication
- urban economy and employment

He views these fields of action as a kind of mediative enterprise; mediating and reforming the pervasive condition of sectoral planning, sectoral policy and sectoral administration to be found in municipalities and senior governments. This, Hahn calls restructuring—a pathway for integrative public policy and design and administrative procedures that can generate more fully creative possibilities in building experimentation, and in ecologically-appropriate planning and design practices underwritten by community-based empowerment. He advises that only with a networking relationship within and between these three fields will strategies for ecological urban restructuring have a good chance for success.

Within the first field—urban technology and urban design—Hahn identifies nine (9) "building blocks" or areas of action. These are:

- architecture and building ecology
- electricity and heating
- water
- traffic
- avoiding garbage and establishing recycling
- green areas and urban vegetation/protection of nature
- urban climate and quality of air
- protection of soil
- protection of households from noise pollution

A categorization of sustainability features similar to, though more elaborated, than Hahn's are adopted by Perks and Van Vliet in their exposition of five Case Studies in Scandinavia and then applied in a Calgary proposal (see Table 1).

Similarly Gurstein and Curry propose eight components of sustainable communities when examining the proposed Bamberton project on Vancouver Island:

- incremental planning
- public participation
- local governance
- regional integration
- community economic development
- social equity
- environmental management
- built form

Grant (1993) suggests that "sustainable development implies adaptation and improvement in a context in which communities seek to protect natural processes and landscape function, and to conserve resources for future generations." She draws on the landscape ecology approach to develop a model of sustainable residential environments. It proposes and elaborates operating principles and aims suggesting that communities moving towards the sustainable development of residential environments are those which:

- maintain and restore natural processes and functions
- protect natural resources and resource lands for future generations
- minimize settlement impacts on natural systems
- reduce the use of resources (especially non-renewable)
- reduce waste outputs from residential developments
- increase public involvement in promoting sustainability
- promote efficiency, choice, and adequacy in housing

TABLE 1: CHARACTERISTICS IN PLANNING AND DESIGNING FOR SUSTAINABLE RESIDENTIAL COMMUNITY AND NINE PERFORMANCE PROPOSITIONS
1. **Community (Design):** Social fabric consciousness, developmental spirit and concrete objectives, stewardship roles defined and evolved, high group sensitivity to residents' satisfactions. ■ *Attend to community design in concert with land use and housing design.*
2. **Land and Community Space:** trade-offs from private space expectations to community spaces in earliest planning phases; early attention to urban design-spatial composition to achieve agreeable community spaces, ground linkages and networks. ■ *Develop community management commitments—beginning with user-participant planning and design at the initial stages (at least) of a project.*
3. **Housing and Other Built Forms:** Land-use allocation/plan-making and design of housing forms proceed in concert with each other. ■ *Use building materials that optimize ecological soundness or "returns" (design, production, transport and construction); includes programs and considerations for achieving useful life, re-use and retrofit of existing buildings, and re-use or selective disposal of materials in post-demolition or post-construction contexts.*
4. **Resources Conservation:** in all aspects of design and housing technologies, procedures and routines for household practices, and community education programming. ■ *Minimize energy consumption; use renewable energy. Minimize water consumption. Minimize waste.*
5. **Waste Management:** Disposal, recycling and re-use programs, and local organization. ■ *Minimize and control waste (from households and businesses, and from production processes of enterprises, including environment and landscape cleanups, and regulation of waste disposal and pollution discharges on the community site) and establish local re-use and recycling programmes and facilities.*
6. **Transportation:** "calm" traffic systems and street sizing, emphasis on pleasurable street environments and person mobility. ■ *Minimize both the on-site generation of vehicle trips and the nefarious impacts of transport on community life and environment.*
7. **Landscaping and Urban Greening:** Fit built forms and open space preservation to the land ecology of the site, "greening" (plantations) as a gesture to global environmental redress. ■ *Land uses and built forms are planned, designed, and developed integrally such as to support and/or regenerate vegetation and to nurture wildlife.*
8. **Community-based Food Production:** ■*Provide area for private gardens, allotments, greenhouse production units, and/or contractual associations for community purchases from nearby farm producers.*
9. **Protecting Soil, Air and Underground Water:** grey water recycling and irrigation, restoration of topsoils, sensitivities to cut/fill operations and replacements of plant materials. ■ *Discharges to be of sufficient quality not to impair beneficial uses, inhibit indigenous biota or produce adverse impacts.*

- provide healthy social environments

In a survey of three Nova Scotian municipalities she used a list of indicators (following IUCN, 1991) as an analytical aid. Primary indicators measure the conditions of the ecosystem or species. Secondary indicators measure human impacts while the tertiary indicators measure actions to reduce impacts (Grant, 1993).

3.2 MAIN PROPOSITIONS AND PERFORMANCE GOALS: A SUMMARY

An empirical study of more sustainable community projects identified nine categories of characteristics typically present. These are presented along with the main propositions that were emphasized and are suggested as the basis for demonstration (see Table 1) (Perks and Van Vliet, 1993).

It should be noted that these propositions are not all equally applicable at the subdivision scale or in the process as currently practiced. First a comment about planning and design.

3.3 EXPERIMENTAL PLANNING AND DESIGN

Van Vliet and Perks draw the following inference believed to have particular relevance for proposed innovation in the direction of sustainable residential community regarding the central role of an experimental perspective to be taken in the planning and design:

> *Projects demonstrating sustainability illustrate a type of urban planning founded in community performance goals rather than a mechanistic transcription of land-use planning principles, subdivision codes and site development standards.*

This approach shares with conventional municipal planning practices certain formal requirements, such as providing a land-use setting and infrastructure systems. On the other hand, urban ecological planning projects built and contemplated are centred on concerns for stipulating the performance of the built environment, the performance of its interstitial open spaces and habitats, and the performance (roles) of the community and its individual inhabitants.

The projects studied were considered to be experimental for the following reasons:

i. The goals, the technical norms, and the procedures for conceiving and implementing residential development now emerge from the planning process. Mechanistically processed municipality standards and codes of the day do not fully or rigidly govern the process. Standards and administrative rules do not pre-ordain the outcomes in their entirety.

ii. The participating residents themselves (the house-seekers' groups) have at the outset little or no empirical knowledge of how, in certain essentials, the community they are designing will

affect the way they carry on their lives; they can only speculate or imagine. Nor can they predict with certainty at the outset that their quantifiable or qualitative "targets" for ecological performance (e.g., reductions in energy consumption, specifying lands and improvements for habitat restorations or preservation, *etc.*) will be fully met. That is to say, can they be fully implemented? Will they work out as intended?

iii. "Experimental" typically characterizes the user-participant planning and housing design process that the houseseekers engage in, at the very outset of the project, including their negotiations with expert consultants, municipal officials, builders, *etc.*

3.3.1. Frameworks

Across the range of projects studied (and including those described elsewhere in the literature), performance goals tended to be articulated according to three conceptual frameworks:

i. the ecological system(s);

ii. the material and technologic-environmental proportions of the built artifacts;

iii. the common (or shared) elements of lands, spaces and buildings.

A fourth category of performance would be the role expectations for individuals, households and community groups. These point less to a stipulative, "goal-minded" framework at work that would determine, *a priori*, people's roles in the community than they do to a mediative or negotiating process. In brief, mediation depends reposes on situational factors in the project and on the varied capacities and exploratory inclinations of the house-seekers and advocates participating in the planning and design.

Ecological communities (and more sustainable subdivisions) are about discovering a new performance for environments that conduces to environmental stabilization or betterment—global and local. And they are about searching for enriched opportunities for human development achievable within the realm of residential community. Human development in this context inheres behavioral changes—i.e., roles to be played in the community, roles and attitudes to be assumed in one's personal life. But that is not all there is to it. The house-seekers involved recognize or intuit that there are human satisfactions and fulfilments to be obtained from the innovative community-environmental setting, and they set out to have these assets and attractions expressed in their plans. Such constitutes a genuinely participatory and democratic planning process.

Most authors agree that the system conception of performance is a normative one. It draws inspiration from natural ecologies or, perhaps more accurately, from the ecology of agricultural territories in which human settlements have achieved some kind of harmony with their biotic and

abiotic environments. System performance goals place in relief a sort of holistic ideal. They serve primarily as an instrument of education and awareness-building . . . a visioning device. In the later-dated projects where performance is receiving more applied attention, planners and designers tend to cite energy, water, nutrient cycle and food. The expressions "closing the loops" and "reducing inputs" are frequently used to interpret or specify the system performance. (It might be noted here that while the system or "loop-closing" framework can and does provide a strong normative vision for residential community planning and subdivision design, there are no scientific certainties about what a "good" or "proper" sustainability planning would constitute. The model for it is not natural ecology. Science has yet to provide an integrated framework from which to build or explicate an ecologically self-regulating urban system) (Perks and Tyler, 1992).

The other two frameworks for specifying performance goals—the buildings themselves, and the common lands, spaces and buildings—figure most pragmatically. The experimental planning and design ranges from urban design and landscape-ecology planning at the macro scale, through to housing forms and layout, and on through to house unit designs and such finite levels of performance as the technologies within the house, and the spatial adaptabilities of the house to changing needs and preferences.

The key implication of this experimental character of the planning and development process is that plans and community designs must be conceived for specific situations and specific contexts. An ecological approach demands site-specific thinking. It must first account for the natural resources and ecological regime of the site "as it is found," and then proceed to find adaptive forms of building and infrastructure that integrate rather than obliterate or radically convert. The planning and design will further account for the idiosyncratic and even marginal interests of the people involved in living there; with the various human resource capacities of the community that will develop there; with the scale of the development project, and its fit within the larger city or district context. This is consistent with various authors expressing the need for ecosystem planning as an alternative approach which modifies the decision-making framework and provides a sufficient rationale on which to base good land-use planning decisions (Fedorowick, 1992). The existing legislative framework has been marginally successful in protecting the loss of agricultural lands, important wetlands, forested ridges, *etc.*, on an individual basis; but the present sectoral approach is inadequate in addressing the cumulative impacts of development, and this is compounded by the decision-making process. (See Commission on Planning and Development Reform in Ontario to for recommendations addressing this problem).

In other words, an urban ecological planning does not lend itself to mechanistically-applied, generalized standards or planning procedures. This being the case, an experimental planning and design for establishing sustainability practices in the Canadian context is even more important.

3.4 TOWARDS AN IMPROVED PLANNING PROCESS

Sustainable community design is complex. It demands a greater and more successful integration of existing and additional planning considerations. Normally isolated technological disciplines, public agencies, private-sector builders and citizens must all work together. Although there is no formula for appropriate, more sustainable community design, there are alternatives available that can reverse and mitigate current practices.

For decades, various practitioners have argued that the current development process needs careful reconsideration and a major reorientation. Lucien Kroll (1986) referred to the early stage of subdivision as creating "sewer landscapes" where the planners, engineers and technicians are concerned with the technical issues of sewer layouts, storm-water runoff and turning diameters. The services wrongly guide the built form, and bring with them irrevocable and always hierarchical forms of organization, lacking in real texture, preventing a more essential urban order from crystallizing. Such an urban order arising from group intentions depends on urban instincts about proximities and scale relationships ultimately knitting together a whole territory. A new order as contemplated by issues of sustainability depends on new practices, new relationships; it cannot be imposed by rational procedures. It must grow from initiatives to form a mosaic, the essential image of the social fabric, the new tools, must be sympathetic to users. Camillo Sitte (and others since), before the turn of the century, described a clear view of the artistic qualities of urban spaces and offered concrete suggestions as to how the forming of the city ought to be organized. He pointed out the dangers inherent in allowing road and sewer considerations to act as the determining factors in urban planning, and advocated a reversal of the planning process. Requirements for safety-security, vehicle access and traffic convenience continue to predominate. Indeed, the planning system works mainly from a first established street-infrastructure layout, then "outwards" or "upwards" to resolve all other considerations of the built environment; a reverse process of working from house design to housing clusters to public spaces, and then "inwards" to street design, has often been recommended and has been applied successfully in other jurisdictions. For example, Jan Gehl (1987) starts with the pedestrian structure as the framework for design and Christopher Alexander (1987) argues that the correct sequence is pedestrian/public space first, buildings second and roads third. A few queries among many can be mentioned:

- Can the roadway requirements and performance standards of fire services, including associated vehicle technologies, be realistically altered?
- Can street design capacities and hierarchical channelling be altered?
- Can the planning method of creating residential communities be altered so as to begin with the qualities of places and spaces and housing groupings rather than with roadways?
- Can the delivery system—in particular, municipal authorities, be persuaded to design residential developments in a more satisfying, less "large" and "efficient" way? Will it be demonstrated that site preparations planning (residential subdivision, *etc.*) has to begin with the "design of house" for well-specified clients or client-groups, not with the planning of subdivisions first? And, in turn, that the planning of small, "micro" agglomerations or clusters of households must be the primordial level of planning which, in successive plan-design-develop steps, are aggregated into a neighbourhood community of substance?

Deelstra suggests a revised planning method for the development of sustainable environments. He emphasises the investigative, analysis and theme development phases as being underconsidered in the current planning/design process, and the need for greater control during implementation, with good management including evaluation of the execution, and, where necessary, a revisiting of steps for general and precision adjustment and change over the course of development. Some of the features that differentiate this from or augment the normal process are outlined according to seven steps.

1. *Analysis*

- A good understanding of the landscape structures (often underestimated) is a basic condition for later design decisions for siting of living environments housing, work, recreation and habitats and their connecting structures. Careful analysis of abiotic, biotic and anthropogenic structures is required (anthropogenic—cultural and historical perspective for insight into elements worthy of integration in the future landscape plans).
- The infrastructural analysis provides a framework for the land-use plan by identification of the different flows and movements (people and means of transport, raw materials and goods, water, energy, *etc.*) in the area to incorporate them in the main framework in such a way that no barriers are created. The flows and movements of people and materials clarify how the different sections of the area function as a whole. The routes through the area (people, energy, water, *etc.*) must be logical and functional. However, one of the important principles is that car traffic (due to its negative effect on the environment) is assigned a minor role in the traffic flows for raw materials, goods and people. Traffic connections analysis considers the

sequence of slow traffic, public transport, and then personal car. Where must future inhabitants have easy access (to work, facilities, urban centres *etc.*)? Where could attractive routes through the area be situated?, limitations lie?, *etc.*

- Energy infrastructures include local energy sources available (wind, sun, water, energy storage, geothermal, ground heat, *etc.*).
- Water infrastructure considers the possibilities for an integrated water management system: how the flow system can be suitable for use in natural, agricultural, industrial and urban surroundings; for management, for production, for recreation use in various seasons, for collection of rainwater, buffer and purification systems, re-use, *etc.*
- Analysis of the present and future living environments provides a picture of the requirements and indicates where areas may be situated and gives insight as to how they are set up, their position in the landscape and infrastructure framework. It includes an employment analysis including endurance and compatibility with nature and housing, accessibility factors, connections between places of work, nature living areas and other amenities. Areas for undefined future needs and functions should be designated.

2. *Theme development*: A primary concept for the land-use framework is developed from the results of the analysis. This includes preparation of charts for three main elements:

- Landscape development in and around the plan area, combining the data and commenting on how the landscape motives shall be incorporated in the development and in infrastructural and building projects.
- The important routes and infrastructures are developed in the landscape context so each element supports and lends strength to the other.
- The human living environment is in accordance with the other two.

These define the aspects that are to be supported, and those that are to undergo further quantitative analysis.

3. Within the theme development programme, the natural structure of the area is elaborated, and the suitable places for development of the various sorts of natural and semi-natural systems are indicated and supported in an ecological development plan. Historical characteristics of the area are carefully specified.

- Following the infrastructural facilities being elaborated, a "slow traffic plan" is developed to open up the area, a public transport plan and a selective car transport plan. The energy infrastructure is elaborated and quantified in an energy facilities and management plan (according to fossil, wind, sun waste heat, total energy system). Criteria include saving on

energy use, maximum use of flow sources, efficiency increase. The water system is elaborated and quantified for water collection, drainage, water cycles, nature development and water recreation in a water structure plan.

- The livable environment is elaborated in a habitation area plan with a detailed plan developed for different sections of the area. A plan of public facilities is elaborated, locating various facilities in accordance with the different residential areas and the route system. The result is a sequence of theme sectional plan charts in which the main elements of the general structure are specified, and the important aspects have been tested for feasibility of environment techniques, financing and the market (house-seekers/residents have been engaged in the process earlier on).

4. A synthesis results in the general land-use plan. The themes are elaborated and condensed into an urban development design which makes sustainable development possible within the connected land-use structures of the area.
5. Specific sections of the design are tested to determine feasibility and environment quality. Allotments studies are carried out and test allotments made. For the important parts of the plan a feasibility study is carried out to determine financial and sustainability aspects.
6. Adjustment of the preliminary plan. The design and precision is adjusted to become a definite land-use plan based on the choices and conclusions from the feasibility study. A phasing plan is established for the specific area plans, investment schedule and land exploitation. The phased execution and coherent exploitation procedure will increase the feasibility of certain elements of the general plan as it responds to resident/market concerns.
7. In turning the plan into a legal plan and implementation plan, special attention is paid to the formulation of specific methods of execution and regulations. In this way, many quality aspects for land use as well as the environment can be determined and protected. The clear sustainable development policy is described in the policy documents. Indicative sustainable goals are formulated for sectoral management, so a reference framework is created for future developments and activities. The plan plays attention to means and regulations which promote sustainability.

The phasing process makes it possible to incorporate new developments in environmental issues while the work is being carried out. This is important, since it is not possible to predict future developments in financial limitations and rules and norms becoming stricter. Also, application of unforeseen environmental measures not otherwise possible can become cost effective and feasible in a phased process.

To have land use and urban design as a jointly conceived programme would require an expanded procedure of plan development and project approval. Implementation of a more integrated design philosophy requires a clear process and specific tools. The stages of design review may involve difficult negotiations if private and public interests are to be reconciled. Design management by public authorities has been seen as a bold and unfashionable enterprise. Clients and entrepreneurs tend to resist the perceived encroachments of the state on individual enterprise. However, there appears to be wider public acceptance of this and other public interventions.

The alternative system goes beyond the partial improvements recommended by many, a process identifying performance standards for new development projects that describes characteristics to be incorporated, for instance as a check-list system, during project evaluation, addressing each desired or specified characteristic with points. Often, when these are tested, they still permit unsatisfactory results of siting, massings, overall integration and in details. The call for a thorough revision of standards and codes which has lately been widely advocated too often continues to accept development control personnel as enforcement bureaucrats rather than calling for greater sophistication. Better tools are needed that are both more comprehensive and more specific. Such systems should be one part of a wider process, the intent of which is to promote good design and collaboration to get the best out of a project by fitting resources to the project.

This more comprehensive and co-ordinated process would operate at scales of districts, neighbourhoods and streets, and at more detailed levels, as specific and direct control areas. The design programme would be contained in a narrative and diagrammatic document where intentions, goals and form of public environments, and identity of districts and neighbourhoods, would be described. Models could be chosen from existing developments, and reasons for success identified and compared. If systematic, this might help the refinement of existing guidelines, and might also furnish concrete examples to which applicants for development and their architects might be directed. More specific criteria than are currently offered would be useful, even including a pattern book of suggestions. Intentions and goals concerning social characteristics and environments would be part of this. City intentions concerning major districts and sites would be identified, and design policies, regulations and incentive programmes would be outlined.

Proposal intentions would trigger a briefing meeting. Participants would be owner and agents, planning officer, key department officials, community representatives and alderman. This would provide means by which intentions and goals between the owner and the city are considered and broad consensus achieved. The process would be creative, to provide resources to achieve good design, and

access programmes to enrich the project. Budget approvals would need to be in place for this process to proceed.

The concept would be further developed over time, considering: (i) central organizing principles of the scheme; (ii) its contribution and "fit" within the identity of district; (iii) land and building dimensioning in specifics; (iv) the social dimensioning-mix and profiles, activities intended; (v) significant environmental forces and impacts; (vi) preservation/ complement to existing site and community features; (vii) climatic issues and resolution; (viii) movements systems and services: retail and public; (ix) public infrastructure; (x) contribution of scheme to public space and public activities.

The design development would include, in addition to accurate, three-dimensional images and modelling of the site, studies of the larger context using figure/ground drawings, *etc.* Performance criteria would indicate edge conditions and relationships to neighbouring elements. This would include identification of transitional spaces, private, semi-private and public spaces, access and public ways, studies of light and shadow, *etc.*, and a landscape plan for private and public lands. Last in the design development would be considerations for maintenance and change.

The design and implementation would involve a design performance review by a board appointed to assess the proposal regarding fit and compatibility with surrounding structures and neighbourhood, scale and massing, plan and detailing at the street level, materials and finishes, signage, *etc.* Also reviewed would be the contribution to the identity of the district, its imageability and experiential qualities on walk-through, landscape, site developments, street furniture, *etc.* and how it contributes to the social environment and landscape structure. This must contribute to superior design and to a greater understanding of the significance of subtle small-scale design decisions in the overall quality of residential areas. Implementation commitments and maintenance agreements would be undertaken by the parties concerned to ensure that they have the power to operationalize critical components of the plan. Where part of the programme, this would include ongoing community development innovations in community management and organization.

3.4.1 Ecological Area Balance

European sources describe the importance of undertaking an "ecological area balance" during the analysis, theme development and synthesis plan stages. This is a further development of environmental impact assessment. Compensations are performed on the basis of quantified-calculable impacts. To these, commensurate restoration-replacement measures are matched. All direct and indirect factors are considered, such as fauna, landscape, agricultural interests (soil quality), ground-

TABLE 2: PROJECT CHARACTERISTICS IN PLANNING AND DESIGNING FOR MORE SUSTAINABLE RESIDENTIAL COMMUNITY SUBDIVISIONS (ADAPTED FROM PERKS AND VAN VLIET, 1993, [CMHC])

1. Community: Social, Developmental, Stewardship,and Residents' Satisfactions
■ demographic programming forms part of the planning (and an ongoing review) - most projects have a well articulated policy for social structure - households that reflect a mix of incomes - housing choices, for differing sizes and compositions of household - larger-scale projects undertake careful market research and/or publicity to attract residents at the time of planning—prepare illustrative planning documents providing the public with pragmatic information on project intentions—establish presumptive resident groups
■ undertakings that consciously seek to improve or enrich the context for mutually-supportive community living—variations in the scope from project to project - support for social contacts and small group organization (frequently, through provision of common facilities and buildings, outdoor social spaces) - provision for community organized day care at the neighbourhood level
■ each community group to have an organizational structure and defined procedures for decision making to strengthen and cohere the social environment - considerable variation in their procedures and strength of application - local housing association with expanded responsibilities and required resources - community land control (trusts)
■ user-participant/collaboration in planning, design and management - extensive resident participation in goal formation, planning, design and costing decisions, and in implementation strategies - building programme goals and architectural design are oriented consciously to a search for novel community or "common" contexts for social activities and mutual interdependence
■ resident stewardship of the local environments (and high rate of participation of the residents) - roles are defined to be manageable, according to persons' capacities—a balance or fluidity of roles and activities at three phases: - research and design - implementation and construction - maintenance and management, and anticipating future developments - grounds and common areas - expand/modify types of buildings - care and tending of small biotopes - generating revenue to operate community events and maintain community functions - programming neighbourhood events - opportunities for sweat equity in the production of houses and in private or community site improvements (at many of the projects studied)

	■ sharing - "common houses"—for workshops, gardening equipment, hobby spaces, for youth social space, and children's play
	■ employment in the residential community - "work at home" encouraged/provided for in some house designs - provisions for mixed-use areas, for business and small manufacture or service trades - local hiring incentives
2.	**Land and Community Space: Planning and Design**
	■ site selection and land allocations incorporate key elements for nature conservation and protection, and "greening" through landscape design
	■ land-use and site development planning aims at reducing the needs for transportation - access to services, *etc.* by establishing proximities - employment opportunities close to or at place of residence—locally available services receive detailed attention in siting and space allocations - regional planning discussions account for relationship between development density, land-use mix, building occupancy and transportation/circulation - energy and health impacts assessed re proposed planning and transportation projects - land use dedicated primarily to auto is reduced
	■ residential intensification—in creating new accommodation by infill, by building refitments and reuse, and by conversions to multiple housing
	■ favouring increased concentration within built areas of the city rather than expanding to outer districts - higher density residential forms - condensed allotment (housing lots, neighbourhood sites) - reduced setbacks - cluster developments
	■ structural intensification—multiple uses of space—proximity between housing, workplaces and services, systems - diversity of housing types, employment opportunities, *etc.* - allowance made for flexibility, adaptations, change and multiple activities
	■ space between buildings is finitely, carefully designed - courtyards, streets and their "edge" condition, yards, paths - ancillary buildings configured as integrated components of the plan that define and shape outdoor spaces - controls for retail/service and cultural uses on public pedestrian ways

■ high degree of design detailing given to the public realm—a recognition of the important function it serves in supporting community activity and sense of place, pride of place - careful spatial composition and dimensioning for different types of social activity/ interaction - safe pleasant pedestrian environment—trees, benches, public art, *etc.*
■ a variety of public, semi-public and private spaces that variously cater to *ad hoc* social activities and organized community events and activity - allowing for choices in participation or withdrawal to privacy - conscious recognition of need for experientially diverse life opportunities and ontological development of the person
3. **Housing and Other Built Forms: Plan-making and Design**
■ compact groupings allow greater amount of accessible, identifiably community open space - generally: cluster housing of 2-3 storeys with direct access to garden - zoning envelope for new construction to provide reasonable solar access, privacy
■ extensive provision of common facilities that supplement the residential unit—desire for enhanced sense of community and for savings of effort, time and household expenditures
■ housing design and layout - unit adaptability for expansion and alteration - attention given to optimal solar orientation; with fenestration, entrance sheltering, wind, *etc.*, designed site-specifically - avoidance of shadowing by neighbouring buildings - congregate forms of housing - adaptability provided by expansion & alteration change in use, multi-purpose rooms
■ materials, building technologies and construction methods - appropriate for local climate conditions and gradients - tested materials and finishes for safe, healthy buildings - maintainable buildings based on life-cycle costing considerations - healthy working conditions - indoor air quality, natural ventilation, daylighting
■ promote and favour environmentally-sound business practices - contracts given to "eco-sympathetic" firms (designers, building suppliers, *etc.*) - support given to networking - promotion of clean and safe industries - generally high-quality product design/performance - direct service audit/consultation service with job training and development

4.	**Resources Conservation: Design, Household Practices and Community Education**
	Energy ■ conservation through urban design - energy-efficient layout of neighbourhoods and houses, and setting energy efficiency targets - site planning: orientation (sun, shade, wind), and efficient land-use planning, architectural design controls
	■ efficient heat system with low emissions encouraged - district heating with low emissions - energy efficient cluster of buildings - energy storage, area zoning, heat exchange air/water - co-generation
	■ conserving heat energy - high building energy efficiency standards, high performance windows - construction systems (wall, roof, foundation) - heat reclamation (air, water)
	■ using renewable energies - passive solar/active solar technologies—solar access, photovoltaics - wind technologies - ground water heat transfer, geothermal - biomass fuel, local hydro power - space, fitments that allow for later up-grade to renewable
	■ conserving electrical energy - high efficiency appliances—visible metering - efficient lighting system, indoor/outdoor - optimizing daylighting - convenient alternatives (wind, solar, use of clotheslines)
	■ ventilation and air quality - heat recovery system - minimize off-gassing
	Water ■ reducing the consumption of potable water - water saving equipment in buildings - visible metering - low use fixtures (toilets/taps) - water conserving appliances, waterless toilets - grey water recycling opportunities - natural purification system at local level (e.g., waste water technology) - pricing according to use—high unit cost and tax supports conservation initiatives

- groundwater restoration and conservation
  - use of landscaping that requires least possible irrigation
  - rainwater collection
    - rainwater collection for gardens
    - storm-water infiltration ponds, protected and constructed wetlands
    - minimizing paving and installing porous surfaces
    - contour and plant green areas for retention and groundwater restoration

- nurturing/influencing livability, and education/awareness
  - making the water cycle visible through introducing decentralized water management system
  - enriched local environments by creating ponds and fountains
    - aesthetic environment
    - improve atmosphere by enhanced evapotranspiration—summer cooling

Land, see 2, 3, and 9

Education
- an "ecological community culture" to be established
  - pervasive environmental education and experiments, for adults as well as children in the school, founded in the context of their community (applies generally to changing behaviours)
  - prov./municipal-sponsored demonstration projects incorporate innovative design and systems
  - municipalities active in altering operations in local communities to reduce env. impacts
  - state, municipal and private programs to finance efficiency improvements (heat, light, water)

5. **Waste Management: Disposal, Recycling, Re-Use**

- build and maintain community awareness re waste reduction at the household, and in all community activities
  - high regulatory standards for disposal and fines
- recycling and reuse facilities or programmes
  - space and equipment for separation/storage
  - community operated—revenue generating
  - a local exchange trading system for reuse

- composting
  - accounted for in kitchen designs
  - opportunities provided at household yard and/or neighbourhood sites

- nutrient recycling
  - filtration bed for greywater
  - composting toilets (in some projects)
  - sewage sludge distributed to nearby agricultural lands

	■ education and experimental programmes (see 4 above) - focuses on personal and household consumption, and waste - demonstration of how to reuse, recycle
6.	Transportation: Traffic, Streets and Person Mobility
	■ pedestrian circulation commonly serves as a key organizing element for the layout of the buildings - pedestrian priority and continuity (network) and wheelchair accessibility
	■ provisions for separate cycling lanes or on streets, safe bicycle routes, storage throughout the community (secure, weather protected)
	■ street design—roads/utilities minimize energy use - exercising restraint in the design of street carrying capacities for vehicles - smaller street dimensioning than conventional planning standards—less are devoted to auto use/storage—centralized parking - street safety emphasis—children, mobility impaired - use of smaller security and utility maintenance vehicles (adaptation of technology to design of communities, not the other way round) - attention given to street aesthetic and pedestrian enjoyment - redesign, reconfiguration and traffic calming applied at infill and central area projects - careful detailing of edge conditions, quality materials for surfacing - cluster parking or reduced size—recycled materials used in paving
	■ induce less reliance on automobiles—minimize destination distance - convenient, relatively high access to efficient public transit for all - shared cars and smaller cars - public transportation service is a policy instrument, not simply a service "alternative" for the automobile; investment at the outset, not later—land use supports public transportation - reduced auto parking requirements—drive through service prohibited—range of residential parking policies—user pay, tax supports other modes/improvement studies - electronic communication network
7.	Landscaping and Urban Greening
	■ macro and micro climate conditions are accounted for as a normal part of planning and urban design policies - climate enhancements, mitigations are sought in urban designs
	■ optimizing the retention/preservation of local landscape features - supportive of wildlife, biotic communities—retain natural water courses—working landscape - enhancement and creation of ponds, wetlands, biotopes, watercourses - minimum grading and disturbance - identity and sense of place derived in part from landscape features - predesign analysis considers local resources - preserve buildings of value and cultural environments

■ environmental restoration/mitigation - tree planting and replacement of losses during development - removal and relocation in community of significant vegetation
■ energy and nutrient life-support systems - local area balance studies (procedures to maintain or improve natural environment)
■ common use of local native species and plant communities - low maintenance—meadows, hedgerows, trees, ground covers - familiarity among designers and many residents with the intentions of "permaculture" and "working with" natural processes (strong landscape design tradition)
■ unifying and space-shaping elements and edge conditions - a visually clear rural to residential-urban transition in the site planning - boundaries are implied rather than fenced or demarcated by streets - access to local parks/rec./open areas - paths for recreation walk/ski/cycle - land reserves for accommodating unpredictable future requirements or desires of the community.
8. **Community-based Food Production**
■ area provided for private garden allotments
■ greenhouses—attached to houses, atria/solarium spaces, stand-alone production greenhouses
■ opportunities for animal husbandry—food-producing landscape
■ contractual associations for community purchases from local farm producers
■ farmlands taken over by large scale projects may be retained in part and kept for active cultivation—private or community operated
9. **Protecting Soil, Air and Underground Water**
■ controls for disposal to soil, airborne toxics, aquatic systems—discharges of sufficient quality not to impair beneficial uses, inhibit indigenous biota or produce adverse effects
■ sensitivities to cut/fill operations and replacement of plant materials—sedimentation
■ agricultural mapped/designated—preservation and improvement of - forest land mapped/designated, reforestation - wetlands mapped/protected
■ use of organic techniques and biological controls
■ care taken and regulations in using chemicals, e.g., reduction of freon, solvents, heavy metals, *etc.*—regulated sale
■ air pollution—mobile sources (reduction in impact from motor vehicles) - stationary sources—disclosure policy—public health is priority—materials regulation—noise regulation
■ improved, separated storm water collection, ponding and natural purification wetlands
■ economics—taxing and fines to pay for cost of env. enforcement, regulation and provide economic incentives

water conditions, biotopes of special value, recreational interests, landscape character, views, *etc.* Where removal, destruction or significant impact is to occur, then commensurate restoration-replacement compensation measures matched to these must follow. For example, where a row of trees requires removal to locate a structure, replacement must be made elsewhere. Where a wetland area exists that would be impossible to replace, this would become the location for other features that support biota. The area balance method produces a comparative accounting between the areas used for development and other, negative alterations to the site, and the ecologically-positive changes. Positive changes or compensation means areas which are changed to a higher ecological value. The ratio between what is spoiled and what is improved is at least 1:2, preferably much higher. Alternative solutions for the area, including the possibility to taking no further action, should be compared. It is important to find the political acceptability and support to make these compensations.

3.5 REVIEW OF THE PROJECT CHARACTERISTICS

Table 2 presents a summary of features considered to be desirable in a more sustainable subdivision. These are based on actual built projects gleaned from a variety of sources. The main headings exhibit the rationale and/or the sustainability goal. The detailed features that follow indicate for the most part how these have been operationalized. It will be seen that among and between the nine main categories there are operational features listed which could bear being "repeated" from one category to another. The reader will note the difficulty presented in attempting to create a perfect taxonomy for sustainability planning and design performance criteria. (Other classifications—systems or procedural diagrams, for example—might conceivably offer a better way of classifying these for a planning and design process).

Not all of these features would be considered at the subdivision stage, however, or necessarily be considered applicable or appropriate to each subdivision. The listing serves as a synthesis of the information. The characteristics encompass the way in which planning of the projects is carried out, the performance goals, and as well, the performance criteria and targets—that is, the "next level" of specification beyond a goals statement.

The Table appears in a somewhat edited form to exclude those things that cannot be considered or anticipated during subdivision design. Community management and organizational considerations are omitted in places.

4.0 PROJECT PERFORMANCE

Many of the sources and reports on more sustainable planning and design initiatives are foreign. Examples of more sustainable prototypes and demonstrations exists in the U.S. in Germany, Poland, Australia, the Netherlands, Denmark, Sweden and Canada. (In addition, many examples of traditional indigenous developments display sustainability characteristics). These range from single structures to small clusters and major town extensions. These are characterized by social interdependence, affordability, co-design and local stewardship in their development and long-term management strategies. Their difference is the presence of ecological performance criteria—including building, land-use or site development controls that maintain airshed and watershed functions, landscape diversity and habitat functions, and that regulate energy use.

The degree and proportions of innovation among and between various projects researched varies quite widely. The common factor should be an explicit attempt to incorporate a sustainable development theme into the planning and design.

A second common factor is that the project proponents acknowledged and anticipated at the outset that the adoption of an urban ecological theme would entail—in one form or another, to one degree or another, a newly-defined role for the inhabitants in managing their households, their residential community, and the physical environments that give spatial definition, form and an "ecological character" to the community. This role is referred to by most authors as stewardship.

Arising from these two common factors, projects engage not only innovative physical planning propositions but also community design. By community design is meant accounting for, and reflecting in the physical environment, plans and building designs such elements as:

- a programme or a first-order specification of (varied) social and demographic composition;
- a concept for community—its organizational structure, its functioning and programme;
- expectations about mutual interdependence, and mutual assistance and support;
- expectations about household and individual behaviours and responsibilities regarding conservation, waste management, recycling, *etc.*;
- the sharing, use and maintenance of common buildings and spaces;
- a programme for community-based jobs and enterprises ("own work"); and
- (possibly) a formal consignment from the municipality to a community organization of certain functions customarily handled by the municipal administration.

4.1 INDICATORS OF SUSTAINABILITY AND MAKING COMPROMISES

Many authors point to the need for a more comprehensive set of sustainable community development principles or evaluative criteria for citizens, planners and land developers to use in guiding them in the creation of new communities, and these should also apply to the redevelopment of existing communities and urban neighbourhoods. There has been a search for indicators to specify and evaluate sustainability. Round Tables, both national and provincial, have taken this up and a number of lists have been developed: none claim to be complete or definitive. They can assist analysis and evaluation, but may often not be useful in specifying the response in practice in a particular situation. Grant (1992, pp. 29-35) presents a list in eight tables of those indicators found most relevant for measuring progress towards sustainability in developing residential environments. Information for some of the indicators is difficult to obtain, and greater quantification and elaboration is necessary before appropriate amounts can be determined for minimum requirements for certain policy initiatives, *etc.* This does not imply that we need await these further indicators or their measures to get on with the job at hand. Ecological urban restructuring can only be thought out theoretically to a limited degree. Active research and engagement in doing is one of the very best ways to discern, refine, apply and propel the development of useful indicators. Necessary solutions need to be approached by close connection between theory and practice, and the co-operation of different urban planning disciplines and other city actors. New planning procedures and new technologies must be developed and tested on a pilot project basis in order to achieve new solutions.

In built projects studied, goals are transformed into performance criteria and parametric targets with varying degree and effect. Their rendering into performance criteria (such as "build row or multiple dwellings with car storage off site;" "locate wetland habitats close to school site," *etc.*) and parametric targets (such as "reduce energy consumption of the household by 25%;" reduce transportation energy consumption by 30%;" "reduce waste generated *per capita* by 50%;" "build 75% row and multiple dwellings for mixed household types;" "impervious surface ratio of 5%," *etc.*) are necessarily situationally and contextually determined.

Once set, these criteria and targets may ultimately have to be compromised. In the reports and documents studied, the expressions "as much as possible" and "minimize" were commonly used to characterize the targets or the design criteria to be attached to performance goals.

i. This "stipulative tentativeness" reflects certain limitations of the ecological or scientific knowledge that the originators of the projects possessed at the time. It also reflects the state of technological or social (community) know-how among the proponents, the planners and the architects involved.

ii. Constraints or obstacles could be posed by the institutional environment to which the project proponents and their planners and designers had to respond (or conform). The availability and terms of investment capital, for example, serve to circumscribe the type or levels of experimentation being sought. The limited financial capacities of a houseseeker group could sometimes dictate that sub-optimal performance targets for energy conserving measures in building design had to be accepted. High expectations for enriching the established community environments with ecological-type components could be constrained by the financial status of the community residents. Certain small-scale projects may not offer the scope or economies of scale that would justify certain investments in innovative technologies.

iii. Site-specific and project-specific factors are instrumental in determining the outer boundaries of innovation or the extent of ecological enrichment.

iv. A project may have been implemented where a legacy of polluted or contaminated sites and buildings, or established infrastructure and transport systems that cannot be readily altered. Compromises are therefore made in the breadth and scope of innovations for sustainability.

5.0 THE CANADIAN DELIVERY SYSTEM

The Canadian delivery system in general appears to have minimal familiarity with sustainability innovations occurring in other parts of the world. Research on experts' perceptions of sustainable development in Ontario (Tomalty and Hendler, 1991), in Nova Scotia (Grant, 1993) in Calgary (Van Vliet and Perks, 19--), and among Canadian municipalities (Maclaren, 19--) revealed divergent interpretations, and also ambivalences and limits to imagination, concerning what a fully-featured sustainable community should achieve or could "look like." A recent study (Perks and Van Vliet, 1993) of the Calgary delivery system agents shows that well presented documentation, and case studies of examples elsewhere, can be very instructive to Canadian designers, planners and developers.

Highly-specific projects or a particular selection from among architectural- and technology-design features elsewhere cannot be borrowed *holus bolus* from one area and replicated in another. Policy formulation, and standards and norms of development, have to take into account the situational factors related to housing delivery, planning and design traditions, and daily life. For innovation to be successful, it has to be systematically consistent in terms of sustainability performance, as well as contextually adaptive and responsive.

Transfer or adaptation of a particular technological innovation can take considerable time in the Canadian residential delivery system, and this would be particularly true for fully-featured sustainability practices. The housing industry is by nature conservative in its perspective on consumer needs and preferences; it is a low-risk industry and municipal administrations do not conceive of themselves as leaders of value change or initiators of structural change that (for example) even the force of sustainable development logic might suggest. The criteria to determine whether a particular product or urban form or development and building practice has relevance for housing in Canada are numerous and complex.

Decision criteria and sustainability performance criteria are as likely to emerge from an intricate combination of social, political and fiscal forces as they are from singular factors of a scientific persuasion, such as resource conservation or global environmental degradation. Building sustainable residential community is as much about human development and community-building as it is about addressing global and local environmental-ecological resource base issues.

Projects considered more sustainable, both built and proposed, often repose on innovations in the nature of proactive partnerships between delivery system agents and the (so-called) consumers of housing or the house-seekers. They also repose on certain pre-conditions or institutional pre-dispositions, such as municipalities in the role of "R&D" agents in urban sustainability.

Since specific actions or reforms that address sustainability must come from an appreciation of local circumstance and situation, and from the driving forces of change in that circumstance, it is important to appreciate that there appear to be a number of conditions here in Canada that contribute to an explanation for the comparatively lesser success (than in, e.g., Scandinavia) for sustainable residential community-building.

5.1 MUNICIPAL CAPACITIES AND SOCIAL TECHNOLOGY: REFLECTIONS ON RESEARCH DESIGN

Social research and the world of urban planning and design practices are structured and managed according to a dualistic conception of learning and experimentation. There is one world of research and another of design. The two are presumed to orbit along rather independent courses of intellectual nourishment and development. The culture of municipal organization in Canada typifies this dualism: the more significant resource allocations and personal rewards are reserved for programmatic and organizational management, and for system-cost efficiencies, not for experimental research or experimental practice.

In Canadian city planning operations, for example, little or no continuous (longitudinal), thematically-focused or inter-sectoral research is done. This is especially true of experimental urban design and planning innovation. Research that does occur customarily takes the form of database-building, *ad hoc* data analysis in preparation of policy or expenditure initiatives, and projective forecasting. Such research and project monitoring typically have no ties to each other.

The development of municipal practice over the past two decades has been (essentially) in the direction of expanded regulatory and legislative procedures. Municipal planning practice is not now—as it was say 30 years ago—a stipulative practice of community design and housing (Perks and Jamieson, 19--). Moreover, only a few Canadian cities maintain a genuine urban design capacity. Therefore, the search for an "architecture and building ecology" capacity in municipal administrations is, in most instances, a fruitless exercise. Nor can one currently expect to find this capacity in the homebuilding industry.

This situation, and the absence of a tradition and a legitimacy for municipal research and design initiative are lamentable. They foretell an up-hill struggle for the urban ecological and sustainable development movements in Canada. Paradoxically, while R&D is a "known" and recognized enterprise in the domains of hard technology and industrial development in Canada, and one that can be readily supported by tax incentives and subventions, the concept of research-design-development as urban social technology enjoys no status to speak of (a situation remarked on by the Ontario Round Table reports of 1992).

Researching and designing are intertwined, mutually-informing and mutually-inspirational activities. This is especially so in an enterprise that would seek such profoundly integrative sets of ends and means as do urban ecological restructuring and building sustainable urban communities. The questions to ask of researchers are not necessarily known until the designer, in the process of his or her designing, discovers them and gives them form—not only form, but localized and specific meaning. Answers to questions obtained in research give rise to new questions for designing . . . and *vice versa*. Such propositions argue for *acting* more or less simultaneously on a number of fronts, as a properly strategic approach to pilot projects would dictate.

The process of researching→ questioning→ answering→ designing→ answering→ questioning→ designing→ questioning→ is in the nature of multi-disciplinary enterprise to which all urban ecology-directed, environment-founded projects are irrevocably wedded. Evidence of this research-design dynamic is apparent as the generating process in many of the projects purported to be more sustainable, regardless of location.

Frequently in these projects, means and ends are not dissociable. This is one of the reasons for an insistence on "user-participant" research and design in housing and community planning projects and generally on participatory planning and decision-making found in every study, and comparable expression, of ecological restructuring or sustainable development. Take, for instance, popular education and communication, one of the goals to which all sustainability projects are committed. At some stages of a model-project, education is as much—or more—a means as an end; education itself is as much a means for commitment-building and "winning" acceptance or success of the model-project as it is a virtue to be sought and made manifest in the sustainable society.

Designing with the householder's (house-seeker's) close involvement is one of the means to producing more satisfying house design. It is also an end, inasmuch as involvement transforms into community identity and commitment, into pride of place and greater human satisfaction. There is little recognition that this legitimate role for both the public and the private sectors needs to be expanded.

5.2 THE MUNICIPAL ENVIRONMENT FOR SUSTAINABILITY RESTRUCTURING

It goes without saying we need pragmatic, practicable organizational approaches to "entering," managing and completing the iterative process of research→ design→ research just outlined, i.e., for linking strategic goals on sustainability and developmental action at the local community level. It can be argued that this is what is implied when one encounters references to "restructuring." Thoroughgoing restructuring implies strategic perspective, if not strategic "plan." Such strategy is R&D dependent.

At the present time, although in several Canadian jurisdictions regulatory-type remedies are under study and in many others Round Tables are active, the Canadian situation in urban ecological restructuring is characterized by ambivalence and uncertainties at the level of *municipal policy.* The literature shows little evidence of strategies in the making. For example, as the Ontario Round Table (1992) states it, "Environmental policy is generally regarded as an add-on to other policy fields. The result is a systemic barrier to the development of sustainable development policies." It is noted however that the Ontario Round Table reports on restructuring at the municipal level give no recognition to the design-research role in property development.

There are comparable ambivalences and uncertainties within the residential delivery system about how to implement urban sustainability—even supposing the costs and the local political impacts of new municipal policies that seek to advance sustainable development could be formulated to the satisfaction of all of the key actors. And, where a climate of sympathy for sustainable development principles would appear to exist, there are still deep uncertainties about the concrete terms of industry-public sector partnerships that would have to be invented to support innovative sustainable development measures.

There is increasing realization of the need to demonstrate how these inertias or uncertainties can be broken through, better to inform communities and local governments on the pre-conditions for successful experimentation and correct directions. This leads to initiatives to model the management and social technologies for implementing sustainability and greater affordability in an existing urban setting. A key hypothesis made in some approaches—that appears empirically sound from the research into built residential communities, as well as being one of the doctrines of sustainable development—is that participatory processes of planning and design are necessary for developing and obtaining individual and collective commitments to community responsibility and strengthened self-reliance. A key methodological basis for municipal restructuring has, therefore, to be action research and development.

5.3 DELIVERY SYSTEM—HARMONIZATION AND EFFICIENCY, INTEGRATIVE MANAGEMENT

A paralysis of policy and strategy prevails. At one level of sustainability-thinking, there is a manifest preoccupation with the high-capacity, high-cost engineering standards of infrastructure and the "luxurious" design norms applied to site developments (land residuals between buildings, roadway proportions, water runoffs and collection, *etc.*). Neither greening for climatic controls nor environmental enhancements, permeable site-surfacing, storm-water ponding nor grey water systems, court forms of dwelling, or *Woonerven* (residential streets which prioritize recreation and non-motor

traffic) figure as commonplace, in the present idioms of residential planning and building codes. Few or no policy priorities or directives or incentive are given for passive solar gains or winter-city amenities that can be obtained through street patterns, house designs, landscape manipulations and design of social activity spaces at the micro-level. Shopping and community services are invariably located in concentrated forms at peripheral locations, not centrally; and these are automobile-dependent for access.

In addition to such factors as houseseekers' financial capacity, and in spite of recent low interest rates, part of the problem of delivering more sustainable housing is seen by industry to be linked to rigidly institutionalized and entailed procedures, rules, codes, site-development standards and servicing technologies. Factors such as these, it is said, inhibit or deter cost-effective residential development designs. Second, industry claims that their attempts to obtain relaxed conditions commonly meet with opposition by municipal actors in the delivery system, or result in frustrated negotiations. These two sets of problems are not well understood and have not been systematically researched. They involve objective factors of site-planning design, implementation procedures, costing allocations, *etc.*, and often subjective or perceptual factors about what consumers "demand" and prefer, marketing approaches of industry, and what municipal authorities consider efficient, equitable, *etc.* Third, there are built projects in many cities, where, in the past, cost-reducing site development approaches have been experimented with in the interest of achieving affordability and more satisfying community environments; these have not been well studied or assessed for their "successes" or "failures." ("Failures" have often been deemed those that cost the city inordinate amounts in replacement, repairs, upgrades, contributing to the cautionary municipal positioning).

These observations indicate that a more fully harmonized delivery system is yet to be achieved.

6.0 CONCLUSIONS

At this juncture, the "ecological dead end of modern planning" that Ekhart Hahn asserts is not as yet reality. At most, it is observed that the delivery system in Canada is preoccupied, but uncertain about, what the future holds, or in what direction the leap to sustainable development planning should be made. The failure of conventional analyses that is now being more widely acknowledged is creating a certain amount of "psychological space necessary for serious contemplation of alternatives" and for the emergence of a new development paradigm. Many recognize within the various sectors an increased willingness to contemplate alternatives. "Extensions of traditional analyses are essential in the transition to and as components of more radical interpretations of sustainable community development" (Rees, 1992).

The realization that this may require profound changes in existing power relationships, a reordering of cultural values, institutional reform and reconsideration of the social role of economic growth is not yet well understood, but is not so immediately challenged as a few years ago.

The following are some concluding points:

1. This absence of sustainable urban development policy and extensive application in the delivery system is understandable; as it now stands, sustainable development is less a fully articulated prescription for practices than it is an ideal or a goal. Moreover, it is also an appeal for changes in individual and corporate behaviours, and in the ways in which development decisions are customarily made by public and private institutions. The advancement of sustainable development principles along lines of operational change and action will most likely have to come from experimentation—from opportunistic pilot or demonstration projects—as much as from studied alterations in the standards, codes and procedures that regulate the delivery system.
2. There is a problem of developing within the delivery system a "futures" perspective. In this respect, the operational meanings and implications of sustainable urban development need to be better understood and articulated in "operational" terms in order to make feasible recommendations. The divergences of opinion and "positioning" of the various actors in the delivery system with respect to "things as they are" and "things as they might be" needs to be articulated locally, then debated among the local actors before meaningfully new directions can be proposed . . . before local policy or regulatory innovations can be recommended. Second, the key actors themselves will have to participate in the formulation of such recommendations; commitments between the actors have to be generated before change can be realistically contemplated.

Since ecological urban restructuring can only be thought out theoretically to a limited degree, necessary solutions are approached by close connection between theory and practice and the co-operation of different urban planning disciplines, and other city actors. Most of the research investigated confirms the need for intersectoral co-operation, the need for exchange of views away from a particular project proposal, and longitudinal research for further advancement on these issues.

New planning procedures and new technologies need to be developed and tested on a pilot project basis in order to achieve new solutions. In the absence of hard economic or costing data or theory about sustainability factors introduced into plans and designs in residential communities, it seems that most proposals for innovation will not, however, be implemented in the short or medium term. Joint "campaigns" to experiment and to promote may alter this positioning. The underpinnings of any campaign would be largely non-quantifiable values: (a) enhanced qualities in the immediate environments of homes and streets, *etc.*; (b) enhanced livability through better public environments and closer-knit community structures; (c) ethical and common-sense consideration for resources conservation, better waste control and management, and re-cycling. (Sustainable Development as it has been pronounced by leading proponents does not focus on ecology and natural resource conservation alone; it seeks, as well, social equity, democratic processes of choice and local self-management, and redress of economic inequalities).

3. Improved information about sustainability and affordability features in planning-design-construction of residential communities is needed, including clearer understanding of specific characteristics and environmental objectives, cost and economy factors, and housing and urban design characteristics. Further work with key indicators is needed to measure and monitor progress towards sustainability in urban development practice.

4. There is wide agreement in the literature about the view that communities undertaking their own environmental maintenance can contribute to sustainability. It would first have to be "demonstrated" as workable before being regularized in the system. Can such an innovation be implemented in the near term, in an existing community and in a newly conceived project, calling to attention different emphases and requirements?

5. Increasingly, researchers indicate that one important way to achieve innovations and overcome obstacles and challenges would be to build a demonstration community where sustainability and affordability features are as fully featured as possible in the market context and selected site situation. Municipalities and industry would have to advance these in partnerships that

bring various capacities and assets of the two together. User-participant design of housing and plan-making would be a crucial, if not necessary, condition for success in any demonstration project. It tests out the proposition that "market demand" for more sustainable and more affordable residential communities can be generated under conditions in which the customers themselves have a key part in determining the nature and form of the product.

6. There needs to be adoption by each province of an explicit sustainable development strategy as a provincial land-use policy of the Planning Act. Practices, procedures and regulations promoting sustainability need to be reviewed. Amendments to Planning Acts and other legislation are necessary to provide municipalities with authority, responsibility and the commensurate resources. Allocation of federal and provincial funds (transportation, housing, energy policy) should be tied to local land-use and transportation planning which creates more affordable, sustainable pedestrian-oriented and transit-oriented development. Jurisdictions would be encouraged or required to adopt draft model design guidelines. These would codify in clear ways the issues promoted in this and related studies (including concepts such as mixed-use zoning; walkability; compact floor plans; sensitive site design and coherent community plans, infill housing; dense, bounded and legible town centres; main streets; zero-lot-line housing; accessory units; lanes, *etc.*) that can be modified and adapted to community needs.

7. Municipal institutions have yet to introduce pro-active policies, programmes and procedures that would variously compel and induce sustainability experimentation and practices in the housing and property development industries, and the property industry awaits municipal and senior government leadership and pro-active initiatives. Municipalities have a vital role to play in the implementation of sustainable development through concerted local action.

   The following points need further investigation in each major municipality:

   - There is variable opinion among municipal officials and industry experts as to the value or benefit that should be attached to various innovations in site development standards or changes in municipal regulatory procedures that can be proposed. Can consensus be achieved on an extensive set of desirable and feasible innovations?
   - Are differing perceptions held among the key actors in the urban development delivery system with respect to responsibilities and interests of the actors in achieving better affordability and sustainability goals in the planning and implementation of residential communities? Is there a sense of common purpose or partnership between municipality and industry in meeting the challenges of affordability and sustainability?

- What and who are the obstacles to achieving innovations? Can the delivery system—in particular, municipal authorities—be persuaded to design residential developments in a more satisfying, less "large" and "efficient" way? Can it be demonstrated through experiment and market testing that site planning would better begin with the design of houses and micro-neighbourhoods for well-specified clients or client-groups, and then proceed to the striking of subdivisions?
- Are there persuasive demonstrations of innovation or cost-saving measures that can conceivably be argued for a particular city's context?

Economic barriers faced by urban ecology can be reduced by imposing various sanctions on projects and processes that are not ecologically sound and by directly supporting experimental projects, research, and planning and design process that is experimental and innovative. Municipalities can be key pivotal players by:

- making land available for a demonstration venue;
- removing land from existing regime of codes and regulations for controlled testing of alternatives;
- underwriting a competent planning and design team;
- alternatively establish on a performance bid basis to private sector developers, builders, having the private sector bid the right to develop according to responsible performance criteria—one can expect a wide range of solutions and ideas as in an architectural competition.

8. There is little evidence of residents' associations in Canada making demands on their politicians that would ensure the degree of integrated features becoming performance factors in the redevelopment of residential districts, or in the planning of new ones.

NOTES

1. The *delivery system* is defined here as the set of institutionalized arrangements, design-development practices and procedures, marketing strategies, regulations and codes, behaviours and preferences, roles and responsibilities that pertain among and between industry and municipality.

2. In the Netherlands and Denmark, where regulations provide, in principle, a good basis for the large-scale implementation of building methods which avoid damaging the environment (with regulations less stringent than in Germany) new "performance oriented" building regulations are now being prepared which offer favourable fringe benefits. The price level of environmentally sound construction methods is @<10% higher at present, due mainly to the restricted market—there are sufficient knowledge and techniques available, but the distribution of knowledge to both the "supply" and "demand" areas is minimal. Therefore, the translation of theory into practice does not take place on a wide enough scale.

APPENDIX 1

POSSIBLE ACTION ITEMS AND SITE DEVELOPMENT ALTERNATIVES

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POSSIBLE ACTION ITEMS AND SITE DEVELOPMENT ALTERNATIVES

This is a partial list to be read with reference to general practice. It is meant to be a quick overview of selected design considerations, not a set of guidelines. It includes in column 2 prospective changes in servicing standards, procedures or delivery innovations which would enhance residential development for sustainability. Certain items for increased affordability do not appear and/or may be part of practice in some jurisdictions. A number of essential town planning principles, community design and site planning considerations do not appear here. Also, issues of building massing, roofscape, character (scale, materials, *etc.*) and dwelling units are not addressed.

There are three types of land development standards:

i. Land use—type of use of land and dwelling, building density and height.

ii. Site-servicing—standards related to roads, storm, drainage, water supply, sanitary sewers and utilities.

iii. Site-planning standards—related to location of standard buildings, facilities and services.

Design of services is usually undertaken by consulting engineers who work to the engineering standards established by the municipality. Flexibility in the application or innovation of standards is quite limited. The purpose of design guidelines for subdivisions is to ensure that all development is designed and constructed to appropriate standards to ensure that upon acceptance the public responsibilities for maintenance will fall within normal, reasonable and tolerable levels. Engineering standards for residential developments can be divided into two general categories:

i. Performance standards (standards of design)—reflect the basic or generic principles involved in the design of the servicing element such as sizes of pipe required to accommodate peak flows, pipe gradients, number/spacing of valves, *etc.*

ii. Standards of construction (or construction specifications)—standards or specifications that deal with quality of servicing materials such as types of pipe, type of asphalt, *etc.*

Overall impacts on sustainability that can probably or possibly be effected by physical site planning have not been consistently quantified—the sustainability topic is characteristically "fuzzy" on factors of cost and benefit, and on where the cost accounting should fall.

1.	2.	3.	4.
ACTION ITEM	PROPOSED ALTERNATIVE/INNO-VATION	CURRENT SITUATION & DEFICIENCIES	DESCRIPTION/REASONS
A. Community Design			
1. Housing Types and Forms (residential lot and house designs and disposals)	■ diversity of housing types and prices (on five acres or bigger projects) ■ higher densities or "intensification" are implied here	■ limited *community criteria* in planning process, often resulting in homogeneous, land/resource consumptive subdivisions and not community-like neighbourhoods ■ zoning separates activities, accentuates automobile dependencies—creates excessive traffic, wide roads ■ traffic system designed to serve separation of functions ■ delays in approval due to unfamiliarity and perceived risk	■ mix of uses and activities reduces trip generation and therefore traffic/roadway requirements ■ cluster development can reduce length of roadway and utilities, can support identity, support variety in spatial function, and opportunities for social interaction ■ grouping of units to preserve land ■ different possible uses for same lot/parcel ■ responsive to changing demographics/preferences—should monitor relationship between housing needs and land development standards
2. Plan Making	■ entire site under a co-ordinated plan for the various property owners ■ direct control, and City offer incentives for innovative development, conservation and sustainability measures are applied	■ small projects with no integration ■ very limited or no sustainability performance criteria required ■ innovative applications reviewed on challenge and response basis—resulting in uncertainty and delay	■ ensures co-ordinated development across property lines ■ better fit with regional requirements ■ more efficient and of greater public benefit ■ common impact reports can be prepared ■ large projects phased ■ support to innovation
3. Design Guidelines	■ integration of complementary activities—variety of spaces—home, work, retail, and services	■ uni-functional residential development on large scale	■ planning by proximity
4. Density—Planning and Subdivision Regulations	■ target 2 x or 3 x the density, yielded by current policies, practices and delivery ■ establish minimum density levels	■ density criteria limited and seldom met in build out ■ current achievement less than 20 ppa (5 units/ha)	■ can yield lesser costs in streets and roads, in utilities, in combined residential units construction and site improvements ■ neighbourhood operating and maintenance costs can be reduced in single-family clustered schemes and in schemes with widely mixed densities. ■ residential community forms that mix a range of densities and wide choice of housing types; community environmental costs can be reduced ■ supports transit

5. Demonstration Projects	■ demonstration projects City/Industry partnerships—affordability and sustainability	■ little encouragement for experimentation and demonstration	■ make visible to politicians, consumers, *etc.* what can be achieved; give leadership to industry re sustainability and affordability
6. Plan Approval	■ housing program and concept layout approval prior to subdivision	■ housing/community form and details not certain at time of subdivision	
7. Urban Cultivation and Farming	■ encourage urban cultivation, food production and farming ■ a specified land area(s) dedicated, with future opportunities for under-glass enterprises	■ limitation of intensive cultivation to ag. and urban reserve zones as a discretionary use ■ promotes replacement of ag. land by residential	
8. Wildlife Habitat and Greening	■ locate development in areas where predevelopment productivity is lowest ■ ecological performance standards ecological area balance	■ environmental reserves required ■ not adequately considered	■ mapping/designation of habitat and landscape function ■ classifies impact of development on eco-system performance ■ (see also Environmental Reserves #13)
B. Land Subdivision & Development Standards (N.B. see below for infrastructures, roads, *etc.*)			
9. Land-use, Site-servicing, Site-planning	■ smaller lot sizes, on average	■ inflexibility all zones R-1 to RM-2 dimensions are fixed ■ lot averaging in subdivisions not fully exploited	■ results in 8 - 10% reduction in total cost of land dev. (reduction from 750 m^2 to 500 m^2 resulted in savings of 8.5% of the total cost of land development).
10. City Fees to Developer/Builder	■ development levy—use graduated levy according to checklist achievement of affordability and sustainability policy objectives and guidelines	■ municipality-industry "development agreements"	■ change fee system from unit cost fee revenue to City, to a system with incentives and design performance-related criteria
11. Zoning A	■ pedestrian scale is specified	■ distance to local services is not a factor ■ distance to a transit stop is a factor but the quality of the pedestrian experience and amenity is under-considered	
Zoning B	■ replace exclusionary zoning with policy targets for building projects (floor space, housing units, and types, *etc.*). Targets partly aimed at satisfying sustainability criteria and or affordability applied to areas of specified min. acreage/sq. meters.	■ zoning separates activities, creating excessive traffic flows and extensive system of wide roads ■ inhibits innovative housing options which may enhance affordability, reduces residential impact on natural environment ■ encourages NIBYISM ■ inflexible to market and other changes or special circumstances	■ better accessibility ■ distributes/balances traffic volume ■ mixing facilities in proximity reduces need for added parking ■ better utilization of public transit

12. Amount/allocation	■ site-by-site study for appropriate allocation and not blanket % requirement over large Area Plans or districts	■ required but at times underutilized	■ recreational, env. reserve, storm water, *etc.*
13. Environmental & School Reserves/Layout & Use	■ multiple use for sites and buildings and integrated more effectively within built areas	■ at times the school reserve is never utilized yet never changed to another use. School reserves too often stand separated with too few opportunities to use spaces and facilities or combined, partnership use of facilities	
14. Site Development Standards and Controls—Setbacks	■ reduce/eliminate setbacks where excessive, to conserve land and to improve streetscape	■ uniform application of set backs to street and sideyard ■ side setback = unusable space ■ design constraints—limitation of building envelope ■ reduced privacy	■ more useable site and yard, conserves land, improves streetscape, less unusable space ■ typically no minimum from street—zero lot line and Z configs. ■ detailed design to provide privacy ■ privacy landscaping
15. Site Development Standards and Controls	■ solar orientation ■ house lot and street orientation to maximize passive solar energy gains —15-25% of south	■ not regulated, no incentive for developers, builders	■ improves outdoor climate ■ reduces energy load
16. Land Preparations	■ reduce grading disturbances to natural land form, adapt street and residential layout more sensitively to site conditions	■ often extensive grading modifying site	■ can reduces costs, also better sustainability/land conservation
17. City Financed Improvements (on-site and/or off-site)	■ developer levies to ensure direct costs passed to consumer	■ estimated 45% of infrastructure, *etc.*, costs to city recovered from general tax payer and not the home buyer at first instance	■ full costing to consumer ■ would promote support intensification, city wide development, reduce road extensions, *etc.*
C. Roads, Streets & Traffic			
18. Street Layout	■ interconnected network dispersing trips in connected pattern ■ roads laid on contours ■ converge to commercial and public institutions ■ smaller block size	■ hierarchical roads/streets that collect, channelize and concentrate trips and volumes ■ topography not important site planning factor ■ circuitous patterns discourage pedestrian movement	■ street system and landmarks should orient residents ■ supports mixed-use environments ■ less traffic congestion ■ shorter routes and travel times
19. Street Types and Design Commercial *Main Street*	■ located in centre of commercial area—emphasis on pedestrian quality, two lanes, slow traffic, street parking, and good shopping environment	■ pedestrian poorly accommodated	■ wide sidewalks, few/no curbcuts, trees, awnings, arcades, seating ■ many shops, min. setback, min frontage, many openings face street ■ serves multiple functions as "mainstreet"

Residential Street Speed	■ travel and parking lanes ■ slower with physical elements to assure design speed equals travel speed	■ streets are generally designed exclusively for traffic efficiency	■ reduces speed by strategically placed trees crosswalks, *etc.*, play areas
Street Environment	■ design for all users—pedestrians, cyclists, children, handicapped, *etc.*, with attention to reduced car speeds, safety—traffic-calming design where appropriate	■ hierarchy of street types ■ design speed determined by projected volumes and types of current users of the street■ does not account for changing behaviour ■ high road environment standards—typically 40-50 km/h min.	■ road environment standards have been questioned ■ shade trees ■ serves as public space ■ establish coherent connected neighbourhoods with variety of street spaces and streetscapes
Lanes	■ reinstate lanes	■ residential streetscape dominated by garages and curbcuts	■ supports streetscape as social space ■ rear living units face lane in pleasant alternative realm ■ can mediate between different building scales
20. Street Construction	■ reduce pavement thickness to match structural design with actual performance needs and realistic probabilities of a future need for up-grading	■ high roadway standards (see also items 18, 19, 20)	
21. Street Width	■ design widths of overall street and travel lanes to smaller dimensions	■ width based on larger flows between separated activities	■ Reducing pavement width from __ m to __ m
22. ROW Width	■ reduce ROW dimensions to minimum necessary for actual vehicle volumes and lesser speed-efficiency performance, for achieving traffic calming		■ Reducing residential ROWs from __ m to __ m ■ Reducing arterial ROWs for minimum flanking waste land/landscape ■ tighter/more intensive built form, and reduced street paving costs and ecological impacts of paved surfaces
23. Curbs and Gutters	■ on short residential streets eliminate curb and gutter on one side, or use roll curb ■ eliminate curbs and gutters in parking areas		■ three foot shoulder or armoured grass to protect grass from parking damage ■ allows runoff to enter ground water recharge
24. Intersection Dimension Curb Radii	■ facilitate pedestrian and vehicle movement—minimize dimensions ■ use tighter radius for better security and convenience for pedestrians at crossings (could include throttle design)	■ selected to insure in-lane turning movements for all types of vehicles ■ avoid turn lanes	■ considers impacts on pedestrian street crossing times and types of vehicles expected to generally use street ■ may require smaller equipment-cleaners, fire, snow (local snow storage)
25. Street Lighting	■ more and smaller streetlights of lesser wattage and scale	■ few, large, high and efficient luminaries, excessive standards	■ more satisfying outdoor environment

26. Parking ▪ size ▪ residential environments ▪ commercial environment	▪ small parking lots integrated with area ▪ joint use parking ▪ not at street strip mall, rather behind buildings or structured parking encouraged	▪ large parking lots impose on landscape ▪ separate parking requirements for each use and no mechanism to determine ▪ surface parking is norm dominating frontages ▪ interrupt pedestrian paths and impact residential areas	▪ reduce parking spaces and land dedicated to this use ▪ increases activity, security ▪ pedestrian friendly street fronts
27. House Unit Vehicle Parking	▪ if no lane-encourage side yard common (joint) driveways—with garage at rear with allowance one car street parking (assumes max. 2 per)	▪ rigid parking requirements	▪ no parking requirement for small size units with very good access to transit
28. Visitor and Household Excess Parking	▪ one visitor parking /4 units in ROW but outside carriageway in small groupings ▪ on-street parking space		▪ for parking, paths, streets—specify materials and vegetation to reduce "heat island" ▪ use traditionally unused space, such as the centre of a *cul-de-sac* or court, for parking
29. Parking Surfaces	▪ design parking area section and surfacing to meet actual load requirements rather than general standards ▪ tree planting to provide __% shade, reduce visual impact ▪ parking and path surfaces designed for permeability of water or for storm water retention	▪ large continuous surfaces for peak parking requirements ▪ often beamed to separate and seldom planted	▪ for parking, paths, - use design and materials for permeability (or paved with provision for storm water retention) ▪ (walkpaths/bikeways 2" asphalt or crushed shale on compacted base) ▪ recycled and durable materials reduce asphalt use ▪ pedestrian quality and reduce surface temp
30. Bicycle Traffic	▪ design streets and other links with commuting cycle lanes/paths (includes dedicated lane on certain streets) and open space	▪ tend to be recreational—less direct, and often narrow	▪ important alternative to auto for local and work trips ▪ clear signage
31. Bicycle Storage Regulations	▪ revise building requirements for cycle to ensure/secure cycle storage, especially commercial, retail, schools, parks, multi-unit housing, transit stops, *etc.*	▪ sufficient bicycle storage ▪ bike parking not specified/required in regulations	▪ supportive facilities at work, (showers) storage
32. Sidewalks and Walkways	▪ continuous and co-ordinated sidewalks/paths ▪ off-grade paths and crossings only in exceptional circumstances ▪ in certain situations eliminate sidewalks—see list for variant solutions ▪ often discontinuous	▪ width and location within street ROW—typically four foot minimum; encouraged outside ROW or to undulate	▪ pedestrian convenience for attainable destinations ▪ construct sidewalks on one side only ▪ all together on lightly-travelled and short streets ▪ along dead-end streets and *cul-de-sacs*
33. Sidewalks Dimension/Construction	▪ limit width with enlargements at retails and commercial frontages		▪ ensure pedestrian continuity ▪ alternative materials and permeable surfaces

34. Transit Stops, Access and Facilities	■ safe crossings, attractive and comfortable facilities	■ City transit prescribes routes, stop locations and min. facility requirements	■ not sufficient to be significant alternative to auto ■ loading zones, cycle storage
D. Infrastructure & Utilities ■ technical criteria govern regardless of performance ■ ability to cost-save by downsizing is diminished ■ resource conservation efforts are limited			
35. Sewage Treatment	■ encourage de-centralized treatment—small plants (600-800 units and up) sewage lagoons, reed bed wetlands, solar aquatic treatment, nutrient recycling	■ removal from locality to distant central treatment plants—large collector systems—sewage sludge for agriculture	
36. Grey Water	■ local separation and use of grey waters	■ no separation	■ nutrient recycling ■ water conservation
37. Storm Water Management *Drainage*	■ using performance requirements in site-specific contexts rather than uniform, prescriptive standards for all elements of the storm drainage system. ■ goal of no increase in runoff from new development	■ high prescriptive standards ■ high sewer volumes	■ reduces sewer volume. Potentially reduces design from five-year storm/deep system to a two-year storm/limited system. ■ Where municipalities allow: reducing the design from a five-year storm, deep system with downspouts and foundation drains leading by gravity to storm sewer, to a two-year storm limited system, with foundation drains to sanitary sewers and downspouts to a surface drainage and infiltration system
38. Storm Ponds	■ eliminate enclosed storm system—detention/retention basins where regional-scaled management presents an opportunity, hold and filter runoff before release/percolate to ground	■ detention ponds allow for some retention but only above peak flows and only temporarily with release to piped system—construction cost is high and environmental resources value is limited	■ roadside ditches, swales, instead of storm sewers ■ eliminate detention ponds
39. Constructed Wetlands	■ constructed wetland biotopes and rainwater ponds	■ retention of runoff to create aquatic resource is often ignored	■ diverse landscape function
40. Water Meters	■ City requires water metering (user pays, reduces consumption)	■ individual or no meter	
41. Utilities/Easements	■ place utilities in easement instead of ROWs	■ practice contributes to excessive ROW widths	■ saves land, contributes to streetscape
E. Landscape/open space/recreation (yards, parks, street residuals)			

42. Public Parks and Squares	■ public foci for neighbourhoods along public street, easily accessible from residential and retail area	■ often are residual areas used as buffers or distant preserved natural areas	■ reinforce area for informal activities and events ■ at a prescribed size and distance
43. Open Space Vegetation	■ hardy regional plant materials lower maintenance design to reduce costs, increase diversity and enhance habitat. Emphasis should be on natural processes, other activities should be allowed within parks, i.e., community allotments gardens, food producing landscape, small animal livestock, urban farms, neighbourhood composting.	■ some natural retention—emphasis is on horticulture with only recent and limited reference to natural processes ■ technical standards based on horticultural techniques—high maintenance ■ limitation of activities allowed within public parks	■ possible higher first costs for lower annual maintenance costs ■ increase diversity and enhance habitat
44. Private Yard Space	■ city incentives and encouragement for vegetative cover fitting arid climate	■ practices of extensive grassed lawns and exotics that require irrigation	■ barrier to nutrient restoration
45. Public Facilities and Services	■ encourage alternatives re police, fire, solid waste, library, health care, government/community	■ technical criteria govern	■ high technical optimality may conflict with other concerns ■ commitment to technology may limit choices
46. Maintenance of Community Environment	■ reduced crew size devise maintenance and operation with more community stewardship	■ centralized maintenance	■ cost economies—local resident responsibility ■ parklands, streets, recycling, refuse ■ and use smaller city workcrews
F. Development/Building permits			
47. Building Approval Process	■ inspection should not inhibit innovation—negotiable regulations ■ reg. review—reduce duration, streamline requirements ■ review costs = fees per permit ■ ensure they result in housing types, forms and tenures that meet current and future needs of community	■ multiple scrutinies of plans ■ delays increase costs	■ approvals of innovations is time-consuming and costly for developer - number of required permits - number of agencies - types of information and detail ■ delays affect financing charges ■ tracking system to monitor ■ allocation of staff resources review ■ ensure cost effectiveness—system to evaluate and monitor ■ builder fees for servicing/infrastructure in combination with small lots avoids sprawl and supports affordable housing

APPENDIX 2

SELECT, PARTIALLY ANNOTATED BIBLIOGRAPHY

APPENDIX 2

SELECT, PARTIALLY ANNOTATED BIBLIOGRAPHY*

Design cuts across the issues in urban sustainability as it is an integrating function. I have tried to avoid obscure items, and highly repetitive content. I have chosen to include a number of European sources, not so that readers will seek them out, but to indicate the gaps that exist in Canadian literature, and the focus on research and residential development abroad in contrast to the situation here. Accessible works, more detailed, and reporting on projects built or in process, are becoming available. The literature has a paucity of hard design with sustainability characteristics, i.e., methods, tools, techniques and results. In particular, there are few built examples of integrated projects, and documentation on these usually is incomplete or slow in being distributed. Evaluation and assessment methods remain very sketchy.

Some of the literature, theory and practice deals with urban redevelopment, ecological restructuring. I have chosen not to limit the information potentially informing subdivision design to that referring to greenfield sites. Certain characteristics of sustainability will be easiest to achieve in a new development, but the retrofitting of existing built areas will receive increasingly extensive consideration. Other concerns are summarized:

1. A problem with the implication of the subdivision topic is that it implies acquisition and designation of lands, albeit by a more sustainable method (read reduced impact), when this continued acquisition implies the contradiction of continued expansion (read growth).

2. As development is redirected to reconstruction, renovation of the urban area through intensification measures, overhauling suburbia, *etc.*, there will be a shift in focus from new subdivisions to subdivision redesign and restructuring intensification, redevelopment.

3. By most accounts, there are similarities and parallels in method and process. At this early stage of application, communication and exchange, it is important to evaluate both directions to find clues and leads of value in each and as a critical positioning to check for the process being adopted.

Only the recent literature deals with this subject specifically. The general area is not a new interest; there is a significant history behind it, from environmental site planning and response to local conditions, climate, terrain, *etc.* (see McHarg, 1992; Lynch, 1971; Lyle, 1981; Simonds, 1986). Earlier accounts, theory, case studies, are in the area of environmental planning, ecological landscape design and site planning, ecosystem planning, new towns and utopian communities. In general, the problem cannot be interpreted as a lack of guidance or lack of guidance available. It is a problem in application and in specification of performance criteria, and in the particular methods of responding to these additional considerations. The next steps to application in practice and to useful post-occupancy assessment have been rare. In most cases, sustainability features have been rejected outright, not out of lack of knowledge or awareness that there are better ways to do things, but out of chosen social and economic imperatives that placed little value on application. There are weaknesses in some of the applications; their adoption will require them to be given priority in the education of engineers, planners, architects and business managers. As this base of literature is updated, much useful and

*Entries are annotated where references are in languages other than English, unpublished, or otherwise difficult to locate.

more substantial material is expected to emerge. Many agree, however, that many valuable leads to conception and practice can be found in early writings. The application to local conditions takes creativity and sensitive insight by the practitioner and the willing client. There are not, and never will be, a fully comprehensive set of design rules for ecological planning.

It is hoped that greater emphasis on the ecological will contribute to increased diversity, identity, authenticity and more meaningful productions than have characterized subdivision design and residential development in Canada or the U.S. to date.

Reference to other works will be found the literature reviews and bibliographic compilations in this series. Again, because design cuts across many fields, it is suggested that the other subject areas be reviewed.

> *Elegant solutions here will be predicated on the uniqueness of each place within its social, political, institutional, economic, technological and ecological context. The ecological would be where climate, landform, soil, groundwater, vegetation, etc. can form the basis of community form and contribute to uniqueness.*—John Todd

The bibliography is divided into 8 parts:

1. General
2. Site Planning, Landscape, Greenspace
3. Ecological Engineering
4. Transportation, Streets
5. Bioclimatic
6. Neotraditional Town Planning
7. Innovative Projects
8. Projects, Plans

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we gain from that work, show our relations with others and reflect our goals as a society. In building community environments should:

- affirm sacredness of world in hearts and actions
- be related to people, places and things with honour, and respect
- re-evaluate the real goals of our lives, determine what appropriate roles work, eliminate the patterns which do not well serve those goals
- acknowledge our responsibilities to creation and act as advocates for those parts (unable to speak to their own needs and role) of creation affected by our actions
- employ consensus decision making acknowledging the needs and input of all
- curtail patterns of over-consumption of goods and resources
- provide opportunity for rewarding and contribution work
- give priority to equity of economic and political power
- transform current business patterns and goals into patterns that support a sustainable view of our workers and the well-being of all people
- act as advocates for the less fortunate for humane living, working and environmental conditions
- initiate the transition from legalistic to moral and spiritual controls for our actions
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Water: conservation and reclamation
Solid waste: reduction, reuse and recycling
Toxics: management and reduction
Transportation: efficiency and alternatives
Open Space: preservation and acquisition
Energy: efficiency and production
Urban Forestry, Land Use: stewardship and the planning process
Greenhouse Gases: reduction and ozone protection
Air Quality: pollution prevention and mitigation
Environmental Management: making policies stick
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- a neighbourhood centre within five minutes walking distance (approx. quarter-mile radius) for the majority of residents;
- streets laid out in well-connected patterns, at a pedestrian-friendly scale with alternate auto and pedestrian routes to all destinations;
- streets treated as complex public spaces with traffic and parking and as integral part of area consisting of trees, sidewalks and buildings;
- streets are relatively narrow and streetscapes well-defined by buildings and trees along them;
- on-street parking is permitted;
- bicycles considered an integral part of transportation mode mix and street and sidewalk design includes facilities for them;
- buildings are generally limited in size, with building uses interspersed;
- squares and streets form public commons surrounded by larger shops, offices and apartments;
- civic buildings often placed along the squares or street termination.

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8. SAMPLING OF PROJECTS

The "sustainable paradigm" has catalyzed a response to the challenge of adapting and restructuring urban-industrial cultural landscapes. Examples of prototypes and demonstration projects are finally appearing and in process in many places. A review of these initiatives indicates the vision is emerging. The following is a list of projects (built, in progress and proposed) reported in the literature to have sustainability characteristics. They are divided by location: Canada, U.S., Australia and Europe. No critical analysis of these projects and the practices underlying them is made. Some of them indicate promising changes. The innovative thinking behind some of these plans reflects some reorientation of industry to housing markets. These are *attempts*: few would claim to represent a fully integrated range of characteristics or features. The list is not comprehensive. It is presented here to give an indication of the types of projects proposed or in process. Documentation on current practice is difficult to obtain.

8.1 Canada

Westridge, Okotoks, AB.
Concept Plan of Profin Developments. Design: Jenkins and Sturgess Architects Ltd., Calgary. A reworking of a 40 ha site incorporating many of neotraditional planning principles. 100 homes in phase 1 and 2. Townhousing and commercial uses proposed in later phases.

McKenzie Towne, Calgary. Carma Developers Ltd.
The plan is a significant departure from Carma's usual approach to greenfield residential development. DPZ's approach is a further development of their TND concept, developed and modified over the years. Infrastructure costs are expected to be less than conventional greenfield-type developments. Zoning is more fine-grained; neighbourhoods are given a higher degree of self-sufficiency in regard to daily resident need—access to basic retail and community services. The proposal involves adjacent land owners on 2,200 acres for approximately 25,000 population.

Markham, City of, Ontario.
1,500 acre subdivision on the west bank of the Rouge River in Markham. The Ontario Housing Ministry is acting as the developer of the site. Construction is to start in 1995. A. Duany design.

Bamberton, north of Victoria, BC.
See description Dauncey, 1991, 1993; South Island Development, 1991.

Ryder Lake Uplands, Chilliwack, BC.
A comprehensive planning process by Cascadia Planning Groups for a study area of c. 10,000 acres north of Chilliwack, using neo-traditional and sustainable principles.

Morrison Common, Sixth Line Project Neighbourhood, Oakville, Ontario.
Berridge Lewinberg Greenberg Ltd. see this project (192 units on 6.4 ha) serving as a prototype for a new generation of suburban projects.

Aurora, Ontario.
Proposal for a 200 unit development within the Oak Ridges Morraine area (Yip, 1994).

Seaton, Pickering Township, Ontario.

A new town by the Province of Ontario on currently agricultural land in the municipality of Pickering, east of Toronto. The original plan for a population of 90,000 (in conjunction with a proposed airport), was a standard plan. Recently there has been a complete reworking of it, to be more responsive current trends and forces, by means of a planning ideas competition. We await the results.

Markham, City of, Ontario.
1500 acre subdivision on the west bank of the Rouge River in Markham. The Ontario Housing Ministry is acting as the developer of the site. Construction is to start in 1995. A Duany design.

Bois-Franc, Ville de Saint Laurent, Quebec.
Plan by D. Arbour & Associates. Redevelopment by Bombardier of 500-acre abandoned airport site. Planning for the 8,000 units (21,000 population) began 1991, with target completion 2008. The urban design concept is relatively progressive relates well to adjacent municipally planned Nouveau St-Laurent neighbourhood. Includes architectural performance criteria.

8.2 United States

See Neotraditional section for projects. These include *Seaside*, FL; *Kentlands*, MD; *Tannin*; *Blount Springs*; *Mashpee Commons, etc. Avalon Park* east of Orlando assimilates a regional shopping mall with department stores into the street pattern for the surrounding community.

Windsor Gate District.
400 acres in the centre of St. Louis, MO.

Capital Renaissance Project.
Trenton, NJ, 640 acres.

Nance Canyon, CA (6000 acres).
Master Plan and Solar Code and Landscape Code. The street network orientation and Solar Code maximize the possible solar potential of each lot. The grey water and storm water are recycled through on-site decentralized biotic wetlands and reused in landscape irrigation. The holding ponds extend the native habitat. The Landscape Code increases foraging by extending the flora into the built fabric landscaping (ref. James, Kaufman, AIA, Sacramento CA), rep for DPZ.

Kentlands, WA (Joseph Alfande & Company, DPZ design).
352-acre site in outer Marylands suburbs of Washington, DC with approval for 1600 units, 2.1 million sq. ft. of commercial. Winburn leader of Kentlands development team. Summer 1992, all roads, water and sewer infrastructure completed. Pre-existing buildings renovated for civic functions, 300 units were occupied. The destinies of the town centre and office components are undecided. Child centre and neighbourhood store late 1991. The project was taken over by the Chevy Chase Bank in 1991.

Laguna West, CA. (River West Development, Calthorpe & Assoc. designed).
800-acre site near Sacramento, CA. The final phase of Laguna Creek. Approvals for a total of 3,370 units including 1,858 single-family units and 1,512 multifamily units. The dominant element is the single-detached house and lot. The mixed-use core accounts for 10-15% of area (4-6 acres of 40-acre site). Peter Calthorpe complains that houses are not differentiated from suburban norm. Laguna West, CA. Early plan in *Landscape Architecture* (July 1990). See Calthorpe (1993).

Lexington Park, FL.
10,000 acres. 20,000 homes and 30,000 jobs in six pedestrian pockets joined by a bus loop. Each pocket to serve a different use.

LUTRAQ, Portland, OR
Demonstration project sponsored by 1000 Friends of Oregon based on a study of alternative land-use and transit options to an expensive roadway bypass. Based on a mixed-use pattern supporting light rail and bus network and rearranging expected 20-year growth.

Village Homes, Davis, CA.
Michael Corbett was designer/developer of Village Homes: 200+ homes on 70 acres. Energy-conscious land use with houses in clusters. Clearly illustrates the substantial improvements that can be made in the patterns of development and building, working within but overcoming objections of the planning institutional setting, constructed using conventional financing and building practices and conforming to then current regulations. This was a commercially viable concept which attracted residents by the logic/grace of design. More intensive land use, smaller lots with common areas, greenbelt, community facilities and agriculture (community farm of 15 acres with orchards, vineyards, vegetable plots and edible landscape). Backyards open to common greenbelt to provide feeling of space. A sidewalk/bikeway in greenbelt. Street width reduced from typical 32 to 20-25 ft., in cul-de-sacs not connected on a grid. Parking is in parking bays. Reduced area under hard surface. Storm water swales, minimum and porous surfacing. Thought at the time to be a significant precedent, many were surprised it has not been replicated. For the detailed home designs, see Bainbridge (1979). More current assessment: see Hamilton article in Gilman (1993).

South Brentwood Village, Brentwood, CA by Calthorpe & Assoc.
140-acre plan, under construction plan in PA. Refined from pedestrian pocket concept, includes a mix of townhouses and detached houses on varying size lots. Parks and tree-lined streets and parking lots.

Contra Costa County New Town, CA.
Initial plans for new town of 30,000 near San Ramon. Holds potential for incorporating ecologically appropriate features. The town is intended to create a better jobs-housing balance in the San Ramon Valley, "within a five minutes" commute of 100,000 jobs. A mix of apartments attached homes, and single-family homes with many residences within walking distance of village centre. Twenty-five percent of development to be set aside for "affordable housing." Due to size, receiving opposition from area residents (*San Francisco Chronicle*).

Civano-Tucson Solar Village.
A public-sector initiative responding to increasing environmental and societal costs of urban growth. The public sector role is to provide the leadership and incentives which encourage local builders and developers to build neighbourhoods of this quality. Planned as biking/pedestrian-oriented community, with employment and shopping opportunities available internally. The mixed-use project is planned for 820 acres on Tucson's southeast side. Project for some 5,000 residents in 2,300 units in neighbourhood clusters around 60% open space. The business district will provide employment for 1200 with home/studio professional offices encouraged by zoning and building ordinances. Design parameters include sufficient solar electric generating capacity to supply the village's total energy use of approximately five megawatts with excess into the grid to balance CO_2 produced necessary for night time use. There is a large number of partners involved. Assisted by Arizona Energy Office, Metropolitan Energy Commission, 50 public/private organizations and strong citizen participation. This

partnership could serve as model for other cities. City Council approval for the Development plan set performance targets for:

- energy—reduce consumption by 75% and generates as much energy with solar powers as is used from the grid;
- water—reduce consumption by 65%;
- solid waste—reduce landfill burden by 90%;
- air pollutants—reduce *per capita* generation by 40%;
- Jobs/housing—create one job within walking distance for every two housing units built.

Cerro Gordo.
Now referred to as an eco-village, planned for up to 2,500 people on 1,200 acres near Eugene, OR. First planned in the early 1970s, construction delayed to 1989 and today consists of less than 20 homes and a few workshops.

LA Eco-Village.
Ecocities Council developed strategies for creating a sustainable neighbourhood in the damaged area of Los Angeles. Eleven acre community to product up to 70% of its own food, reduce water use by 90% and energy consumption by to up to 75%. Performance objectives:

Ecological systems—organic food production 40% in gardens and orchards

- water conservation—reduce by 90%
- alternative energy systems—passive solar, reduce conventional energy use by 75%
- solid waste—landfill-destined wastes will be 90% lower
- non-toxic building materials
- transportation—minimize use of auto; use non-polluting fuels, transit, vehicle pools

Social Design features—co-housing cluster

- collaborative design and building
- shared values
- consensus decision process
- ongoing education and training
- intergenerational, mixed income and multi-cultural population
- community-owned center

Economic considerations—homeownership opportunities

- socially responsible investment opportunities
- mixed-use neighborhood provides sustainable enterprise opportunities
- local exchange trading system
- non-monetized social services.

Modesto, CA.
A master plan for development of an "urban village" to establish a mixed-use, pedestrian-oriented community on 1,784 acres. Eight thousand residential units with up to 700,000 sq. ft. of commercial space, an industrial/business park, schools, parks and other community facilities. The plan calls for 25% affordable housing. Each dwelling over 800 sq. ft. assessed approx. $600 to create a loan fund to assist families with down payments.

Proposal for Presidio Town: San Francisco, CA.
Called by its proponents as a model of sustainable development in a park setting. The proposal was developed by a committee of members of Urban Ecology, Berkeley, consultants to communities that want to design and build more sustainable developments. The proposal is based on design principles, community participation, phased restoration and development, and careful preservation of its history. To be built through an ongoing participatory process.

Sea Ranch, CA.
5000-acre tract begun in 1965 on a plan by Lawrence Halprin, along a state highway on the Pacific coast. Half built out with 30% year-round residents. With the design review not rejecting lower quality submissions, changing management, and scant appreciation of the demonstration, architecture has resulted in mediocrity. The project lacked a community heart, and relied on adjacent towns for shopping/services. Current proposal for a Sea Ranch Village, community centre around the lodge to include shops and meeting hall along a "main street." Creators agree there should be more attention to communal concerns and resident workshops would have begun earlier.

Playa Vista, Los Angeles, CA.
The site is 930 acres bordering the ocean. Owner: Summa Corporation. Proposal for a comprehensively planned community with five million square feet of office space (including 2 million existing on the site), over 13,000 residential units (60 units per gross acre), 600,000 square feet of community-serving retail; 1,050 hotel rooms, 700-ship marina, as well as civic and cultural uses. Two hundred and sixty acres (40%) of land will be preserved and restored as wetland. Lengthy workshops with all segments of the community were held in the very early stage. A fluid planning approach open to evolution and improvement was taken, with the view that the project would be an asset to the existing community. The developers engaged urban designers, landscape architects and town planners to develop the plan creating mixed use, variety of types and cost of housing integrated, commercial uses within walking distance, incorporating transportation planning initiatives which would reduce traffic impacts associated with conventional development strategies. A comprehensive strategy for dealing with ecology emerged, including solid waste and waste water treatment facilities, natural systems for storm water purification, restoration and expansion of the Ballona Wetlands. The vision for the project is a low-rise compact urban framework intended to maximize the efficiency of the infrastructure and fostering a strong sense of community was compatible with the neighbors' desires for reasonably scaled buildings. Measures to reduce traffic congestion and air pollution impacts were:

- linkage of jobs and housing
- mix of land uses
- establishment of a viable pedestrian environment
- internal transit system
- transportation Demand Management

Dry Creek Ranch.
1,500-acre community planned by Calthorpe Associates in northern Sacramento County, CA, one of three transit-oriented developments under a single community plan. Dry Creek Ranch will feature a transit station in its commercial core providing bus service to light rail transit station two miles away.

Tucson Solar Village.
Near Tucson, AR. 820-acre community, planned by 5000 residents, to begin in 1993.

Tryon Farms.

162-acre residential development near Michigan City, IN, attempts to reconcile agriculture, wetlands preservation and development. Thomas Forman of Chicago Associates Planners & Architects. The project entails 8-10 housing settlements of about 12 units each on 28 acres, leaving 34 acres of existing wetlands and 100 acres for sustainable agriculture, prairies and restored wetlands. The property is within the Michigan City limits, close to schools and shopping with a commuter train 10-minute bike ride away. *Progressive Architecture*, 3,93: 79.

Woodlands New Community.
142,000 on 18,000 acres. Houston, TX. *Land Planning and Design Principles*, 85 pp. *Guidelines for Site Planning*. 61 pp. Woodlands Development Corporation, 1974 (see Lang and Armour, p. 270).

Eco-village at Ithaca, NY.
A proposed community based on ecologically and socially sustainable principles has purchased 165 acres of on West Hill in Ithaca. Eighty percent of land to be reserved for natural areas, permacultures, organic farming and recreation. Qualified density of co-housing clusters on remainder around common house with child care. Buildings to be energy efficient and resource conserving.

Coldsprings Villages, FL.
Designated by the state of Florida for its outstanding planning, governmental co-operation and preservation of resource and high quality of life. A network of mixed-use centres. Duany as a consultant. DPZ involved project.

Rocky Hill, CT.
Project called "Sky View at Rolling Greens" by Zane Yost and Associates, using the "Not Lot Concept." One hundred and thirty single-detached houses with small private yards, with the underlying land remaining undivided, eliminating side and rear-yard requirements and permitting greater density. The size and location of the Not Lots can be easily adjusted for changing conditions unlike conventional condominium ownership.

8.3 Europe

Principles supporting transit access, proximity to services, the quality of the public environment, protection/integration of natural areas, reducing reliance on the car and innovative practices have been central to planning in a number of European countries.

Netherlands:

Ecolonia, Alphen-aan-den-Rijn, the Netherlands.
A demonstration project for energy-saving and environmentally aware building and living. Developed by Novem, the Netherlands agency for energy and the environment, following a feasibility study in 1989, carried out by Bouw-fonds, Building Fund for Dutch Municipalities, and the Ministry of Economic Affairs. The plan was by Lucien Kroll with design undertaken by various architects. Smallness of scale is an important element to motivate concern for one's place in nature. The project of 110 units is part of a c. 300 dwellings plan.

Het Groene Dak in Utrecht.

There are many new and proposed ecological housing estates in the Netherlands encouraged by innovative design competitions and municipal policies. This one consists of five two-three storey rowhousing blocks with 66 units of eight dwelling types integrating many ecological features. Sponsored by Stuurgroep Experimenten Volkshuisvesting Utrecht.

Schiedam.
Energy conservation has long been promoted in this municipality by strict local regulations resulting in various projects. Woudhoek Noord, 76 family units and 108 apartments is one example.

Amersfoort, Arnhemare, Enschedea, Roermond.
Have subdivision plans with more sustainable housing estates being developed by a number of architects.

City Fruitful, Dordrecht.
A highly creative proposal for 1700 units with extensive glass house cultivation developed on the themes of energy, ecology, economy and emotions.

Denmark:

Torsted Vest, Horsens.
See Perks and Van Vliet, CMHC report for the most accessible information in English.

Egebjerggaard, Ballerup.
See Perks and Van Vliet, CMHC report.

Blangstedgaard, Odense.
Good example of integrated suburban development. Transit access, reducing reliance on the auto and proximity to services have been central to planning for decades.

England:

Poundbury in Dorchester.
A master-plan by Krier incorporates a process of urban reconstruction. It grafts new quarters onto the existing town; each being less than 100 acres and 500-800 households. Each quarter is self-sufficient in education, employment, shopping and leisure. Implementation is in four phases over 10-15 years. Krier has drawn up the master plan in consultation with the developer, local authorities and other concerned bodies. Andres Duany drafted the Urban Code to ensure compliance with the master plan, while the actual building will be undertaken by various architects and builders.

Sweden:

A number of earlier new towns (examples near Stockholm are Vallingby, Kista, Akalia, Husby), more recently Skarpnak, urban intensification projects (Sodra Station) and numerous housing estates have many sustainability planning characteristics.

Various eco-villages.
See Gilman, 1991; Perks and Van Vliet, 1993; Günther, 1989.

Germany:

The Schafbruhl project in Tübingen. 1984-85. 100 unite in nine four-storey blocks in compact plan.

Literature on the *IBA exhibition* (Berlin, 1987), includes projects with sustainability features. These have widely influenced urban ecology initiatives elsewhere. there are many other housing estates and buildings with high environmental requirements; however, a paucity of literature in English.

Austria and Switzerland:

Puchenau II Garden City in Puchenau, Austria. 1979-, 750 units.
Like early examples elsewhere, although not explicitly describes as "sustainable settlement," basic fundamental principles of sustainable settlement design have been implemented here on a larger scale. Although certain aspects of implementation do not live up to current standards of sustainable standards of sustainable architecture, key principles are realized in exemplary ways.

Annignerblick, Eco Village in Guntramsdort, Austria. 1992-, 86 units.

Stallenmatt Housing, Oberwil, Switzerland. 1989-91, 64 units.

Greece:

Solar Village in Attica, Greece. 1984-1988, 435 units in 30 buildings.

8.4 Australia

Adelaide Multi-function Polis (MFP).
to house about 100,000 people; proposed in 1987, undergoing evolution—would combine the best of tested urban addressing: energy efficiency, livability and charm—a mosaic of villages that integrated Technopolis (new technologies, materials and export industries), Biosphere (world environment management) and Renaissance City (arts, education, tourism, recreation and health)—in design it is a retrieval of traditional village—villages from a few to 10,000 residents; would be mixed-use, laid out on a grid and centred around a square, physically separated by forests, lakes and open fields, and linked with each other. First phase is a 1840 ha site of 17,000 dwellings over 1000 ha. The proposal is meeting mistrust and concern about reliance on Japanese funding and retirement residents (see article, *Urban Land* [February 1993] by David Salvesden, "Adelaide's City of the Future").

The Halifax Project, Adelaide.
Eco village proposal for the redevelopment of a large centra urban block.