

# A Regional Design Technique for An Urban Fringe Area with Application of Environmental Attractiveness and Vulnerability Models: A Case of the Kingston Ponds Community, Massachusetts, U. S. A.

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## I. Introduction

The proposal for Kingston Ponds Community offers a comprehensive arrangement of infrastructure and land uses for leisure and working activities. Jobs, recreation, shopping, community services and a variety of residential styles are interconnected by convenient systems of pedestrian open spaces, public transportation and local roads. Water, waste disposal and a combination of septic and sewer services will be provided on site. As an independent urban/suburban entity, Kingston Ponds capitalizes on the mutual benefits of compatible integration with existing town of Kingston, the resources of the South Shore, and the metropolitan area of Boston.

Kingston Ponds Community represents a melding of environmental consideration, land use locational criteria, and existing site amenities through a sensitive and innovative design process to ensure an economically, ecologically, visually and functionally sound response to the pressures for urban growth. The proposal reflects a market strategy

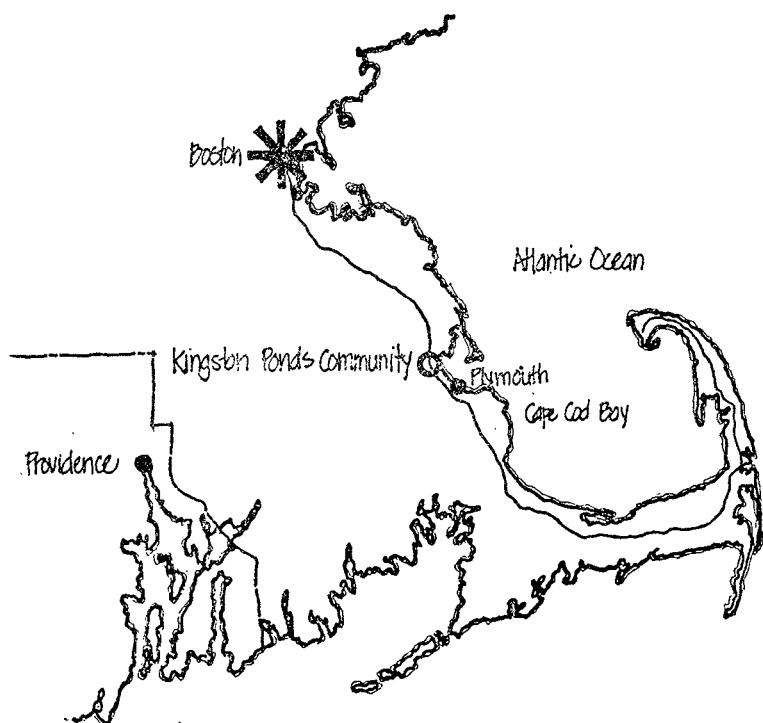
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aimed toward the maximization of investment returns through product quality and community acceptance.

## II. Regional Setting

The study area under consideration includes the town of Kingston, Massachusetts plus approximately 3,797 acres of the towns of Duxbury, Carver, Plimpton, and Plymouth. The roughly rectangular 17,352 acre tract lies approximately 2.5 miles south of Boston with 38 miles frontage on Kingston Bay. The majority of the area's 5000 residents are concentrated in and around the historic settlement of Kingston in the northern sector of the site. The sparsely populated morainal topography of the southern region is characterized by hummocky landforms and ground water lakes.

State Route 3, a principal arterial, passes through the eastern portion of the site linking Kingston with Boston to the north and Plymouth to the south. The town road network, though efficient in the north, provides only minimal access in the south.



A single track of the New York, New Haven and Hartford Railway enters the site from the west and continues south paralleling the coast to Cape Cod.

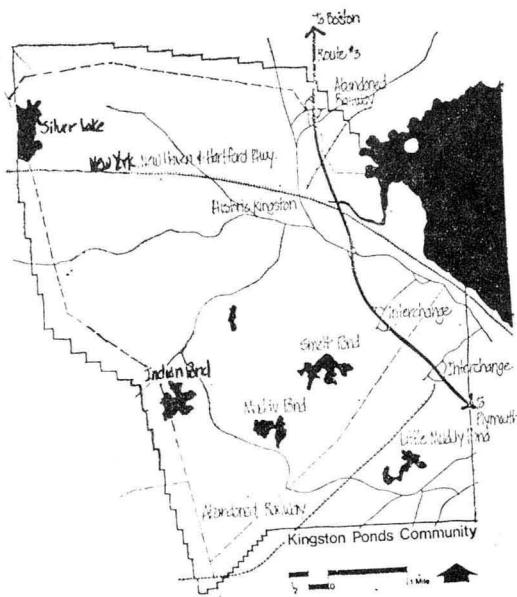
### III. Program Statement Phase I

I was retained by a New England investment and development corporation of February 6, 1975 to analyze development potentials in the town of Kingston, Massachusetts. Phase I of the effort concluded on March 12, 1975 with the submission of recommendations concerning land acquisition and design for a multi-use development with a target population of 12,000 over a ten year implementation period.

At the outset of Phase I the potential for a second increment of development was made clear, although no program requirements for Phase II were known at that time. The planning process for Phase I, therefore, proceeded to produce an independently workable first stage community with the flexibility to accommodate a rational second stage of expansion of, as yet, undetermined content and magnitude.

Phase I planning was further tempered by the knowledge of existing proposals for an east-west connection of interstate 495 and a north-south utility corridor scheduled for construction through Kingston in the early 1990's. It was felt that considerable client

**Town of Kingston**



influence could be exerted over the utility corridor location. No such advantage existed over the highway routing, with the exception of the common knowledge of its east-west orientation and its necessity to terminate at an existing Route 3 interchange.

### 1. Program Phase I

Land Use	# of Cells	Acreage	Units
Sand & Gravel	15	37.05	1
Conservation	200	494.00	—
Regional Recreation	80	197.60	—
Water Recreation	40	98.80	—
Housing(low density)	200	494.00	200
Housing(med. density)	150	370.50	300
Garden/Townhouses	42	103.74	1530
Housing(high rise)	10	24.70	10
Elementary School	10	24.70	3
High School	25	61.75	1
Light Industry	30	74.10	1
Research Industry	20	49.40	5
Neighborhood Commercial	10	24.70	5
Regional Shopping	20	49.40	1
Spray Irrigation	80	197.60	1
Sanitary Landfill	20	49.40	2

### 2. Design Process Phase I

The design process for the first phase of development for Kingston Ponds Community followed a cautious path. The emergence of spatial concepts and physical forms was deliberately delayed. It was felt that a thorough understanding of client needs, development of a solid design sequence, analysis and evaluation of all existing data should be completed prior to the formulation of concepts for land use or infrastructure arrangements. Initially, a large effort was undertaken to formulate mutually agreeable goals which led to the establishment of firm criteria for future decision-making.

A two-part design approach was then conceived: first, a contiguous development site

woule be proposed, and second, land uses would be allocated within that area.

Operationally, the design process relied upon data and models developed by the Harvard Graduate School of Design. The data and models were manipulated both by hand and by IMGRID computer methods as appropriate at various stages in the planning sequence and were instrumental in the streamlining of the design process timetable.

These functions were carried out on a one hectare grid which was projected over the site and established the standard allocating units for all land uses.

### I. Establish strategy

#### A. Develop Goals concerning

1. Profit
2. Community compatability
3. Environmental compatability

#### B. Develop Decision-Making Criteria to

1. Maximize attractiveness
2. Minimize vulnerability

### II. Establish General Process Sequence— “Select area for development, then allocate uses within the area”

### III. Select Contiguous Area for Development considering

- A. New attractiveness model
- B. Existing & future circulation patterns
- C. Potable water availability
- D. Septic capability
- E. Vulnerability
- F. Existing development & wetlands patterns

### IV. Develop Design Concepts considering

- A. Attractiveness-- the existing “Omnibus” models
- B. Attractiveness-- new model
- C. Future attractiveness projection-- “Omnibus” models
- D. Vulnerability
- E. Design judgment

### V. Cell Allocation— Phase I

#### A. Sequentially according to

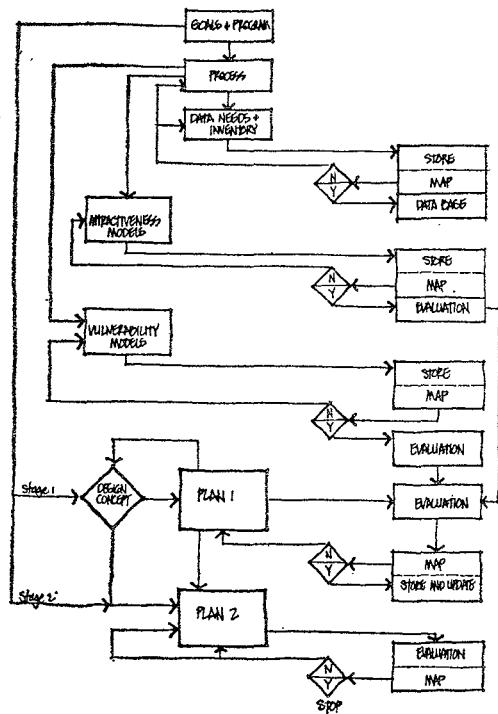
1. Profitability

2. Impact

B. Geographically according to

1. Design concept
2. Attractiveness— present
3. Attractiveness— projected
4. Vulnerability

### Design Process Diagram



### IV. Site Selection

The first task in selecting a suitable site for Kingston Ponds Community involved a general analysis of the land use attractiveness and environmental system vulnerability models developed for the town of Kingston by the Harvard Graduate School of Design during 1974. This analysis revealed basic inconsistencies between the outputs of several models and the task of selecting a site for a large scale development. The graphic outputs of most attractiveness models were inextricably tied to the existing land use and infrastructure patterns and thus exhibited a somewhat misleading bias toward existing built

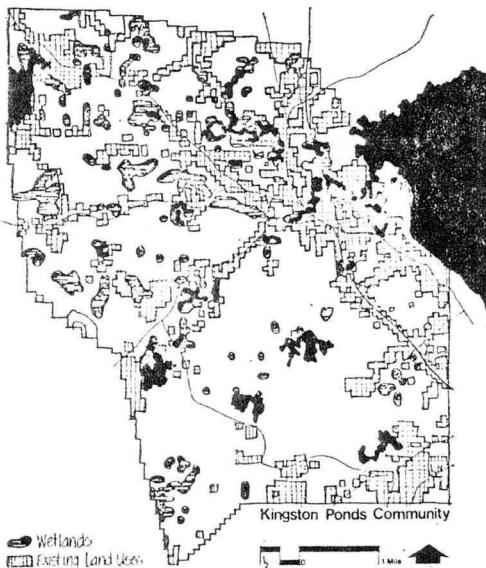
-up areas. Furthermore, in the evaluation of the impacts of land uses on vulnerability models the ameliorating effects of infrastructure improvements to be included in a macro scale development were not considered.

Consequently, a new attractiveness model was created according to the IMGRID format to clarify the natural site characteristics affecting the desirability for development. This model highlighted the spectrum of natural site data included in the individual land use models and avoided all issues of proximal interrelationships. The model rejected land currently occupied and wetlands from further consideration. A second model was created to determine suitabilities for septic system operation.

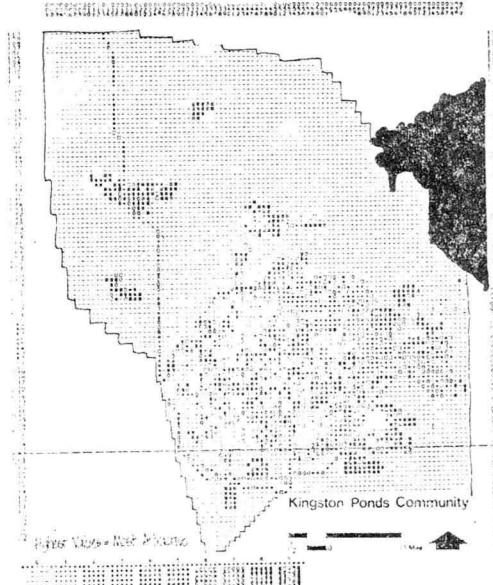
Evaluation of these models in the context of existing circulation patterns, proposed circulation improvements, potable water availability and natural system vulnerability yielded an overwhelming preference for location in the less developed southern sector of the town.

### Site Development Constraints

Existing Land Uses & Wetlands



Attractiveness II



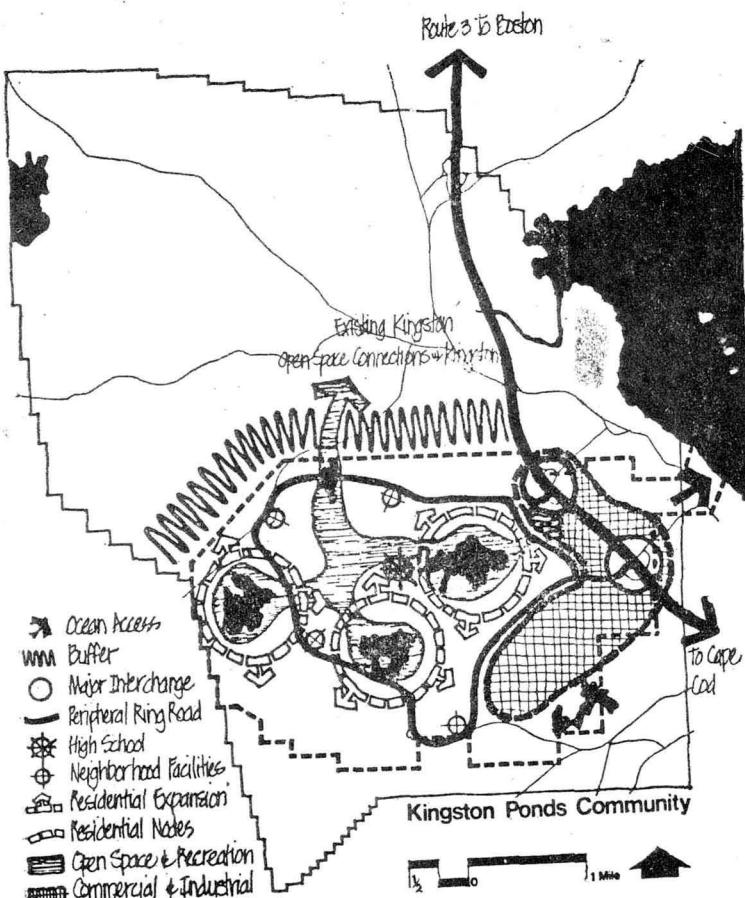
### V. Design Concept

The spatial concepts which served as the framework for the physical arrangement of

land uses in the Kingston Ponds Community were developed as a direct iteration of an intensive analysis of the stage I program in terms of the attractiveness, vulnerabilities, and amenities of the selected site.

The two interchanges included within the site's bounds are densely developed for the intensive, vehicular-oriented activities of industry and regional shopping. Separated to the west, water features are focal points for nodes of housing. The most intensive residential uses are located adjacent to water bodies or in connection with shopping facilities, with densities decreasing in peripheral locations. Educational facilities are sited to minimize distances to residential concentrations with the elementary schools dispersed to serve the housing nodes and the high school located centrally in the plan. The less attractive sites for development were organized into conservation/recreation network providing uninterrupted

## Concept



pedestrian circulation between all points of interest including residential, institutional and commercial land uses. The open space network also serves to interconnect legally protected open spaces throughout the town, thus providing a major communication link between the proposed development and the existing town of Kingston. A peripheral circulation system provides vehicular access to the site and route 3. Support activities such as spray irrigation and sanitary landfill are arranged to maximize service efficiency and minimize environmental degradation. The composite concept functions both to satisfy the requirements of its components and to allow for maximum expansion capability.

## VI. Landuse Allocation Phase I

Having proposed a general area for development and established site-specific design concepts, a further analysis of the Phase II landuses was conducted to explore the potential benefits and/or hazards in siting a program of such complexity. It was determined that the sequence of allocation could tremendously affect the success of that effort, and that such ordering should parallel our perception of the relative significance of individual land uses. It was clear that there existed two specific dimensions of land use significance. First, different uses carried different residual land values and, thus, represented a varying range of potential profitability. Second, the implementation of different land uses would evoke different degrees of environmental impact. Accordingly, a hierarchy of allocation was compiled which ensured first attention to those uses representing greatest profitability and/or greatest potential for environmental degradation. The program requirements for individual land uses were then sited according to sequence on the bases of design concept, existing attractiveness, potential attractiveness, and vulnerability.

The mechanical process of locating specific land uses involved a hand method of overlaying computer generated attractiveness and vulnerability model outputs. This method was tempered by a thorough understanding of the cumulative effects on model outputs to be expected from changes in land use or infrastructure patterns.

Often when inconsistencies arose between model outputs and development concepts, design judgment provided the rationale for decision making.

## Allocation Sequence

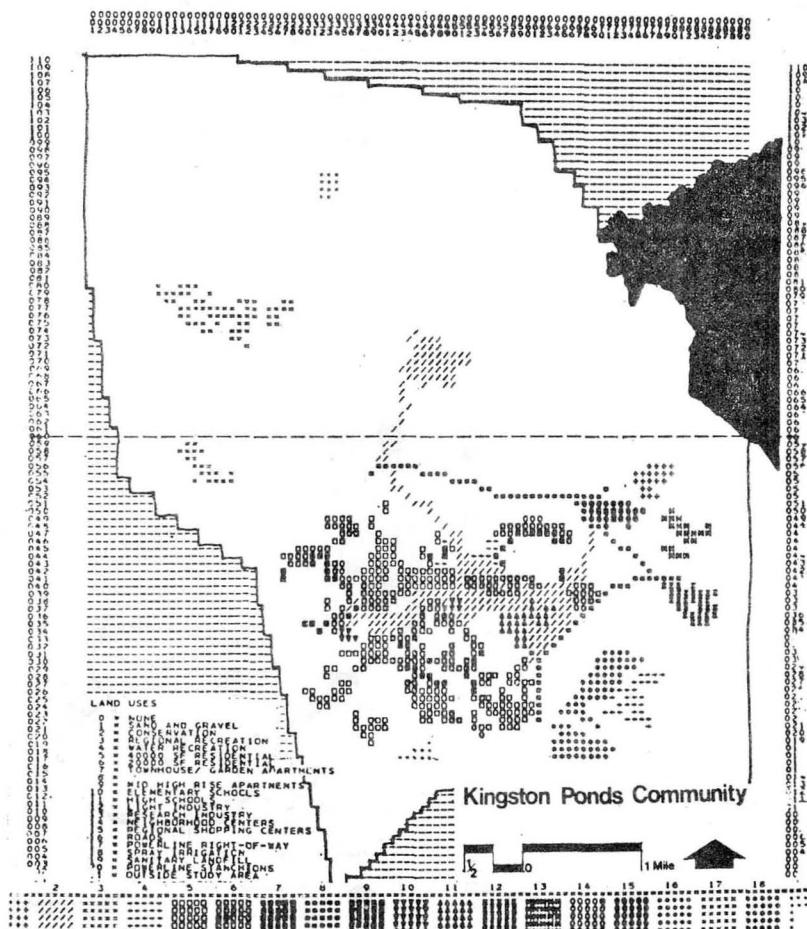
## First Priority

Regional Shopping  
 Light Industry  
 Research Industry  
 Mid-High Rise Residential  
 Sand & Gravel  
 Roads

## Second Priority

Garden/Townhouses  
 20,000 s.f. Housing  
 40,000 s.f. Housing  
 Neighborhood Commercial

## Land Use Allocation I



## Third Priority

Conservation  
Regional Recreation  
Water Recreation  
Elementary School  
High Sohool

## Fourth Priority

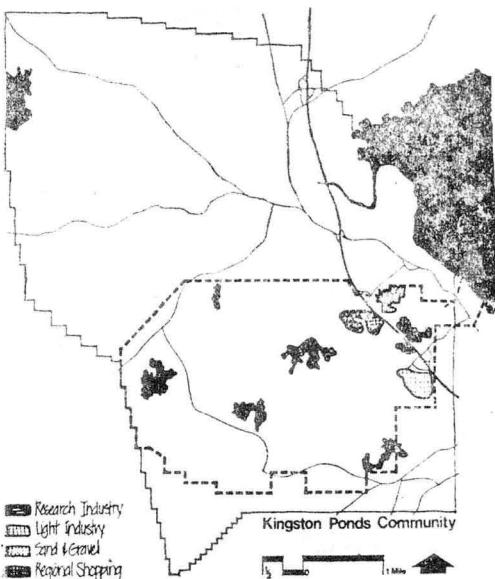
Spray Irrigation  
Sanitary Landfill

**VII. Summary Phase I**

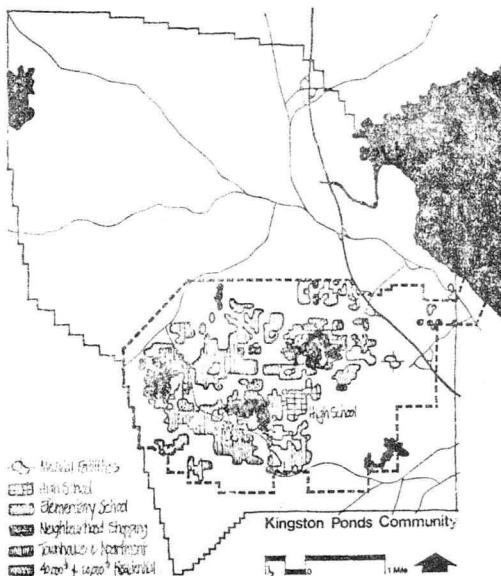
Evaluations of land use attractiveness and environmental impacts were accomplished by computer comparison of the Phase I Program allocation with attractiveness and vulnerability models developed by the Harvard Graduate School of Design. Generally, high attractiveness was noted for high priority land uses. The lower attractiveness, characterizing residential land uses, was partially attributable to the inability to indicate the construction of local roads in the allocation process. Thus, large proposals for lower density housing suffered in evaluation from a computer misconception of their inaccessibility. The lower

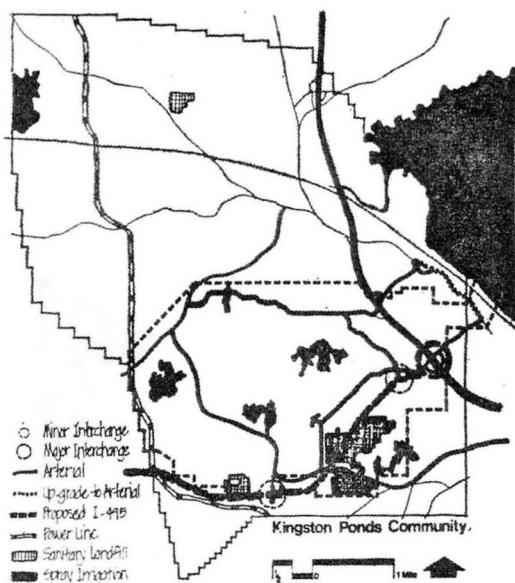
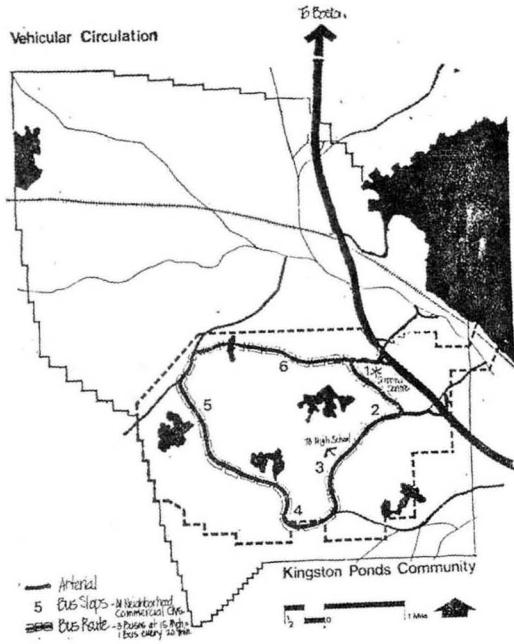
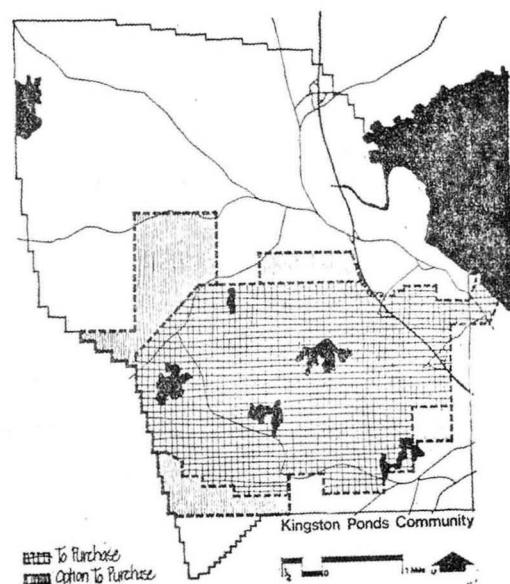
**Components - Phase**

## Industrial &amp; Commercial



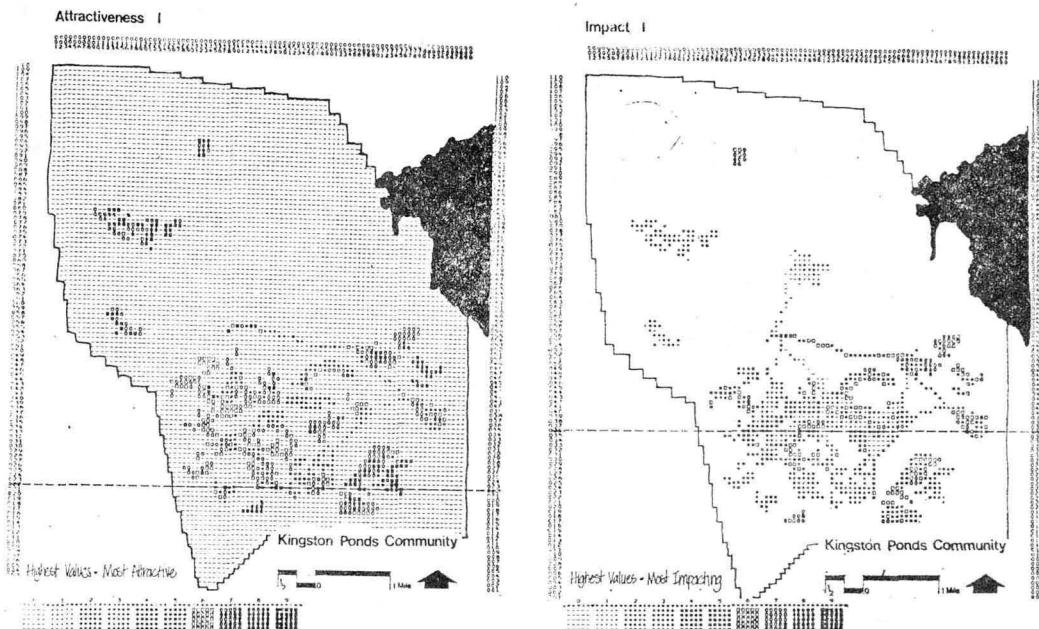
## Residential &amp; Neighborhood Facilities



**Infrastructure****Vehicular Circulation****Open Space & Recreation****Land Acquisition Proposal**

priority land uses ranged from average to high in attractiveness with the exception of spray irrigation. In the allocation for that facility a less desirable construction site was selected in order to preserve design concept integrity and minimize collection line length.

Overall, the evaluations for impacts were less favorable than those for attractiveness. The choice of a relatively virgin area for development necessarily maximized the requirements for change which resulted in high potential impact ratings.



In defense, though, the compact configuration of the proposal and central control over construction phasing would allow economic incorporation of engineering controls (storm sewers, artificial recharge, silting ponds, hydroseeding) to ameliorate the effects of development in a sensitive area.

In summary, the Phase I proposal adheres closely to the previously established concepts of spatial relationship, functional efficiency and expansion capability. It is strongly felt that the advantages of site contiguity and central control make feasible the successful solution of environmental problems, and that the market attractiveness of each land use is significantly enhanced by its inclusion in a comprehensively planned community.

### VIII. Program Statement Phase II

With the submission of the Phase I recommendation I was presented with the Phase

II expansion program for the Kingston Ponds Community. This program, to be implemented by 1990, represented a 1492.64 acre multi-use expansion of the Phase I plan. The essential elements of the Phase II contributed growth to all existing land use categories. New requirements include a major north-south power line, an east-west connection of Interstate 495 and a mass transit stop along the existing New York, New Haven and Hartford rail corridor.

The power line requirement included allocation for right-of-way and stations to be located at maximum intervals of 1000 feet. The Interstate 495 termination would be made at either the northernmost or southernmost access to Route 3. In addition, sand and gravel operative in 1974 were available for reuse.

### 1. Program Phase II

Landuse	# of Cells	Acreage	Units
Sand & Gravel	15	37.05	1
Conservation	200	494.00	—
Regional Recreation	100	247.00	—
Water Recreation	20	49.40	—
Housing (low density)	100	247.00	100
Housing (med. density)	50	123.53	100
Garden/Townhouses	32	79.04	—
Housing (high rise)	10	24.70	10
Elementary School	5	12.35	1
High School	5	12.35	Addition
Lt. Industry	20	49.40	6
Research Industry	20	49.40	5
Neighborhood Commercial	2	4.94	1
Regional Shopping Center	10	24.70	Addition
Spray Irrigation	20	49.40	Addition
Transit Station	3	7.41	1
Sanitary Landfill	10	24.70	1

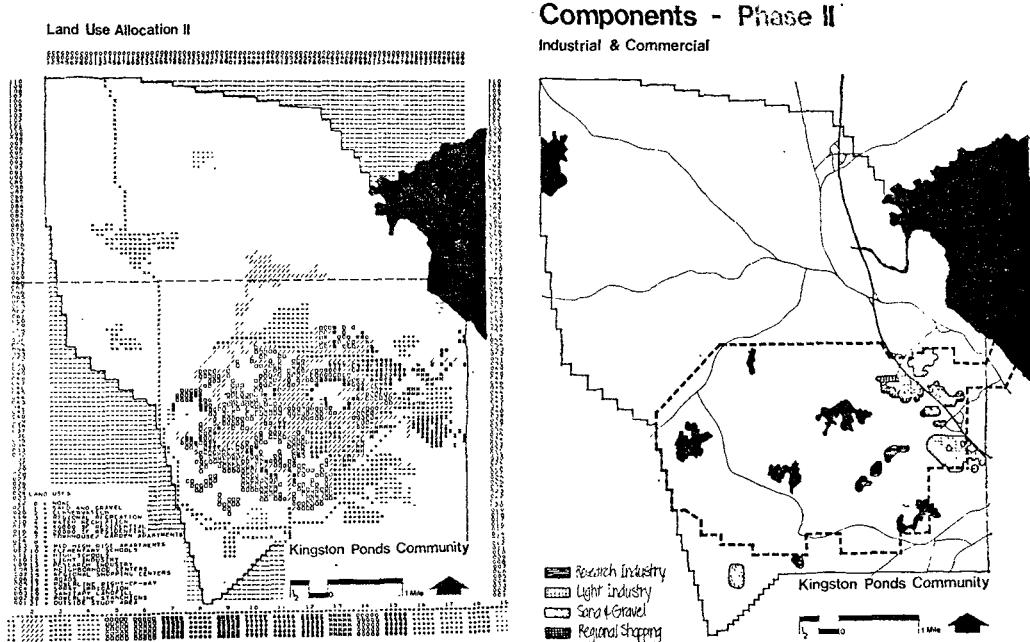
Plus power light-of-way, power line stanchion, interchange, interstate right-of-way and arterial right-of-way as needed.

## 2. Design Process Phase II

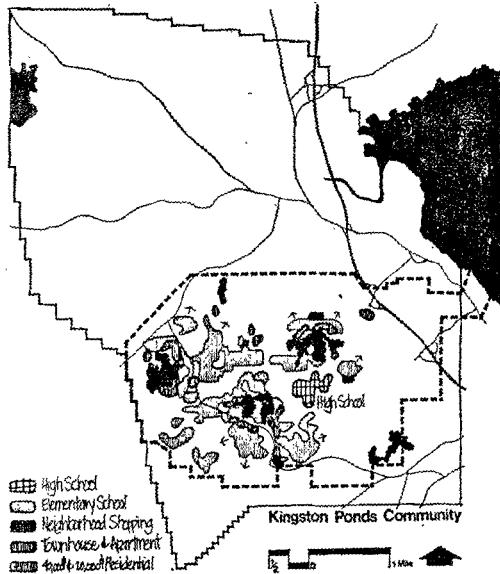
The design process for Phase II attempted to maintain and strengthen the concepts established during Phase I. This effort addressed not only the maintenance of the spatial and functional continuity of the previous plan, but also attempted to perpetuate flexibility for future growth. Consequently, a general strategy of filling in the existing land use patterns and reserving peripheral sites for expansion was adopted.

The phase I circulation system was significantly improved by the incorporation of the Interstate 495 connection and the transit stop. Conceptually, the new highway skirts the southern boundary of the site. Two new interchanges provide access to the major industrial commercial complex and to the principal north-south arterial through the Kingston Ponds Community.

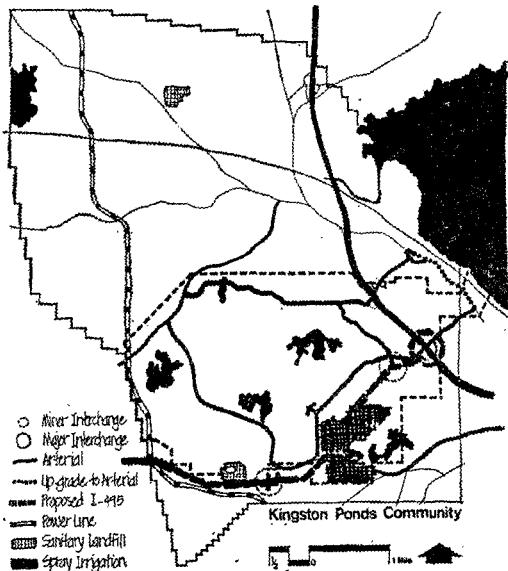
The transit stop, on the immediate eastern boundary of site, becomes a contiguous community asset by a natural extension of the orbital bus system implemented during Phase I. This evolution opens a highly attractive parcel for another increment of commercial and residential expansion to the east of Route 3, bordering the ocean. The power line proposed along the western town boundary, minimizes visual impact to both the existing settlement of Kingston and the new development.



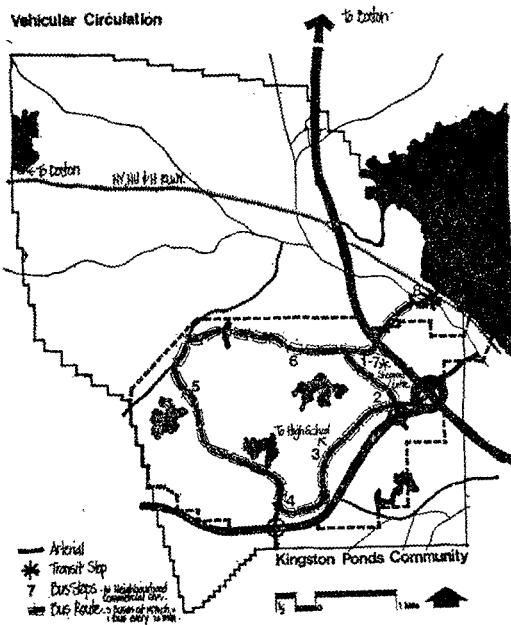
Residential &amp; Neighborhood Facilities



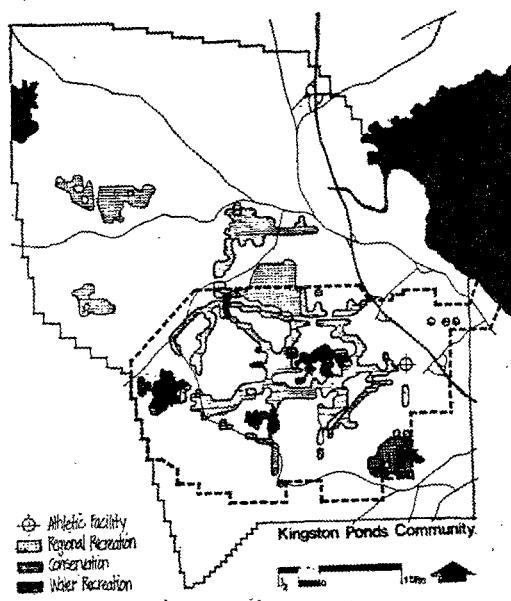
Infrastructure



Vehicular Circulation



Open Space &amp; Recreation

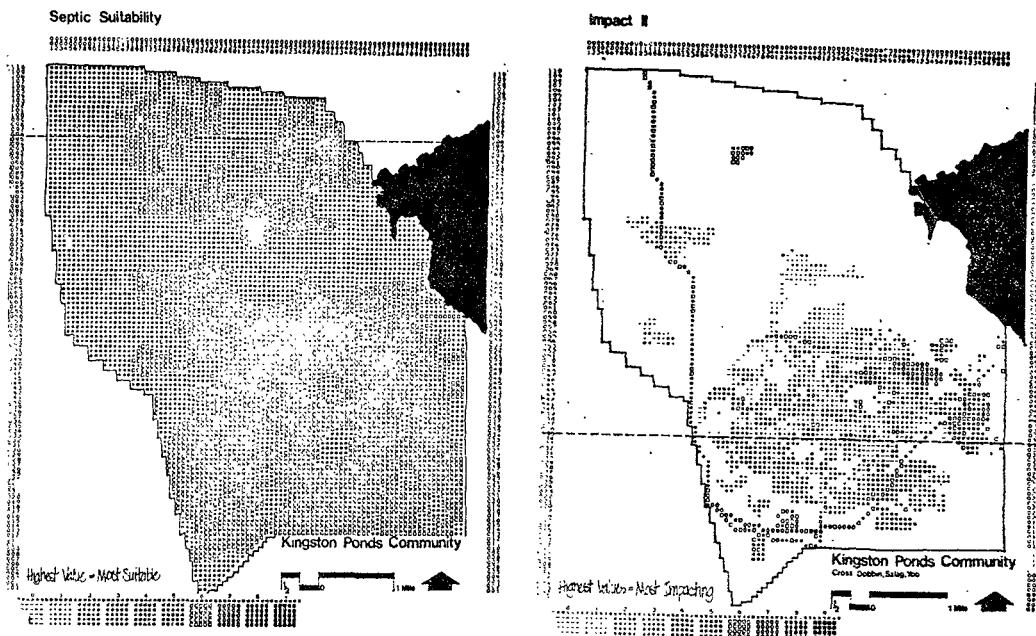


## IX. Summary Phase II

The procedures used in evaluating the Phase I proposal were applied to Phase II. The cumulative results are illustrated on the following diagrams. As in Phase I, many low ratings are a reflection of an inconsistency between the design team's criteria for land use allocations in the context of a compact development, and the original model's criteria for evaluating isolated facilities.

Generally the first priority land uses improved in attractiveness during Phase II. Adjusting the evaluation models to more specifically respond to compact development strategy would reflect even higher evaluations. Ratings for second priority uses retained constant but, as described in the Phase I Summary, are misleadingly low. Third priority evaluations remained constant or improved. Again, greater flexibility in model and/or data base adjustment may have resulted in truer, and higher ratings.

As in Phase I, the computer impact evaluation process was insensitive to infrastructure improvements and construction controls which I feels could be economically incorporated to ameliorate the adverse effects of change on natural systems. Most controllable are issues of soil erosion, surface water quality, ground water quality, and run-off. The specific evaluations for social impact and cost evidenced unusually high projections of community compatibility and return on investment.



## X. Conclusion

The Kingston Ponds Community is a two-phased proposal for a long range, planned development based on sound design concepts and implementing a full program of industrial, commercial, residential and support land uses. The site selection and land use allocation procedures were tailored to minimize environmental impacts and to maximize the quality of community living.

Particular emphasis has been directed toward availing the existing area residents of recreational, institutional and economic improvements without disturbing the amenities they presently enjoy.

I feels strongly this proposal offers a rational response to the pressures for urban growth which concurrently ensures quality development minimizes environmental degradation, increases the tax base and minimizes the costs of community services.

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