Predicting the Visual Quality Impacts of Development: A Simulation of Alternative Policies for Implementing the Massachusetts Scenic and Recreational Rivers Act[1]

Carl Steinitz[2/]

Abstract: An implementation work program has been developed by the Massachusetts Department of Environmental Management (MASS D.E.M.) for the Massachusetts Scenic and Recreational Rivers Act, and the North River has been chosen as the pilot project area. The question which has been posed by MASS D.E.M. is: "What will be the impacts of eleven alternative implementation policy scenarios on new development, and thus on the visual qualities of the North River?" Components of the scenarios include building performance standards, zoning changes, and conservation purchases. The Harvard Graduate School of Design (GSD) research team has translated scenarios into model constraints and has tested the effects of these added constraints on housing development and its consequent visual impacts. The policy implications of the results have been analyzed by the author while MASS D.E.M. has had the responsibility for actual public policy. This paper summarizes the study process, findings, and conclusions.

1.0 THE MASSACHUSETTS SCENIC RIVER PROGRAM AND THE NORTH RIVER DEMONSTRATION PROJECT

The Massachusetts Scenic and Recreational Rivers Act was passed by the legislature in 1971 to protect the Commonwealth's irreplaceable river resources. The Commissioner of the Department of Environmental Management is to select rivers and streams for inclusion in a statewide system of scenic rivers. Each scenic river or stream will be protected by regulatory orders specifying conditions for development and other alterations of the river or adjacent land within the scenic river corridor up to 100 yards on each side of the natural bank of the river. These orders will be recorded at the registry of deeds with the property of each owner whose lands fall within this zone.

The demonstration project on the North River consists of a detailed study of the characteristics of the North River and its surrounding watershed to determine the appropriateness of and scope that orders of conditions will take on the river. This study and subsequent implementation process for the river corridor will serve as a model for the designation and protection of other scenic and recreational rivers and streams of the Commonwealth. The outstanding scenic and environmental qualities of the North River, its historical and cultural amenities, and the broad base of support from landowners, citizens, local officials, and regional planning agencies have combined to make the selection of the river as a demonstration project both an appropriate and timely choice. The North River is the major relatively undeveloped tidal river in southeastern Massachusetts. It is located in Figure 1. In an area presently experiencing substantial pressure for development, the river and the surrounding environment still offer an outstanding diverse landscape quality.

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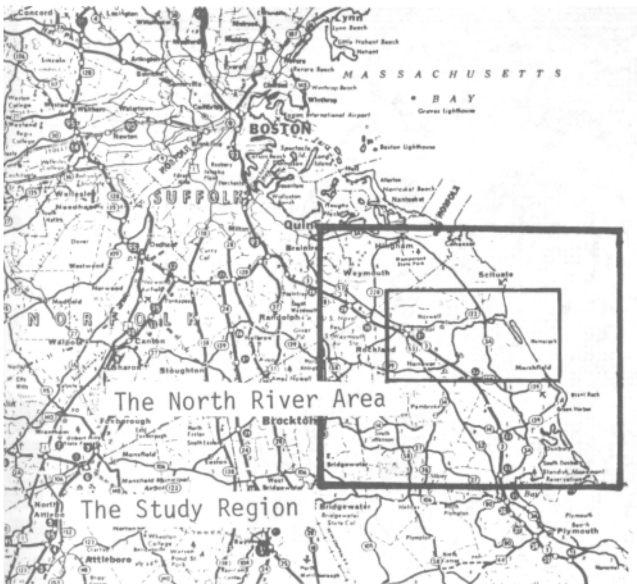
[2/] Professor of Landscape Architecture and Director of the Landscape Architecture Research Office, Graduate School of Design, Harvard University, Cambridge, Mass.

Figure 1 --Study Area Location Within the Boston Region



The area included in the research program is located in the southeast sector of the Boston metropolitan area. The total data area measures 756 square kilometers (or, at the scale of the data, 75,600 one hectare cells). All of the methods used in this study have been operated on this data base. However, for the purposes of this paper, the figures are presented in a graphic format which focuses on the immediate North River area.

2.0 THE STUDY METHOD

As an integral part of the state's river corridor study, the research team has simulated the effects of various regulatory policy scenarios proposed for the implementation of the Massachusetts Scenic Rivers Act upon the North River. The research team has developed and organized a series of computer models that analyze the processes or urban development, the social, fiscal, and environmental evaluations of these changes, and the legal constraints upon them. These twenty-eight land use allocation and impact evaluation models share technical infrastructure consisting of a computer data base, a variety of spatial and other analysis programs, and a series of computer graphic and other output devices. The intent of the research was not to develop a single model, but a series of discrete, yet interrelated models that could be combined in a number of ways depending on the kinds of information desired, or the type of policy questions being addressed. In the proper combinations, the models may be used for such tasks as planning-simulation, projection, plan evaluation, gaming, optimizing and the exploration of new legal and implementation tools. The models have been used to address growth-related issues in the study area in a series of workshops and case studies (Steinitz and Brown 1977).

For the issues addressed by this study, two of the models have been used. A series of alternative policy scenarios have been designed and used as constraints to the allocation of new housing by the Housing Model. The resulting development patterns have then been comparatively evaluated for their visual impacts on the scenic river by the Visual Quality Evaluation Model.

2.1 The Housing Allocation Model (Brown and Wilkins 1979)

Given expected regional demands[3], the dominant component of development in the North River will continue to be new housing. The Housing Model attempts to simulate the working of the market mechanism to determine the future residential development pattern. The basic assumption of the model is that developers choose sites which maximize the profits from development. The model allocates twelve types of houses to sites so as to achieve the maximum rate of return on investment for the developer. At the same time, the mix of houses built must satisfy the demand and the land developed must not exceed the capacity of available land. The model allocates a total of seven single family and five multiple-family structure types, each distinguished by their floor area and construction quality. There are four major submodels, the Development Cost Submodel, The Sales Price Submodel, The Housing Demand and Supply Submodel, and The Allocation Submodel.

Data on a large sample of housing transactions were collected from within the study area and have served as the basis for the calculation of the Sales Price Submodel (Li and Brown 1978). The difference between the expected selling price and the development cost divided by the cost gives a measure of the rate of return which is shown in Figure 2 for large one acre single family housing in the North River area. The darker areas show cells from which the developer will receive the

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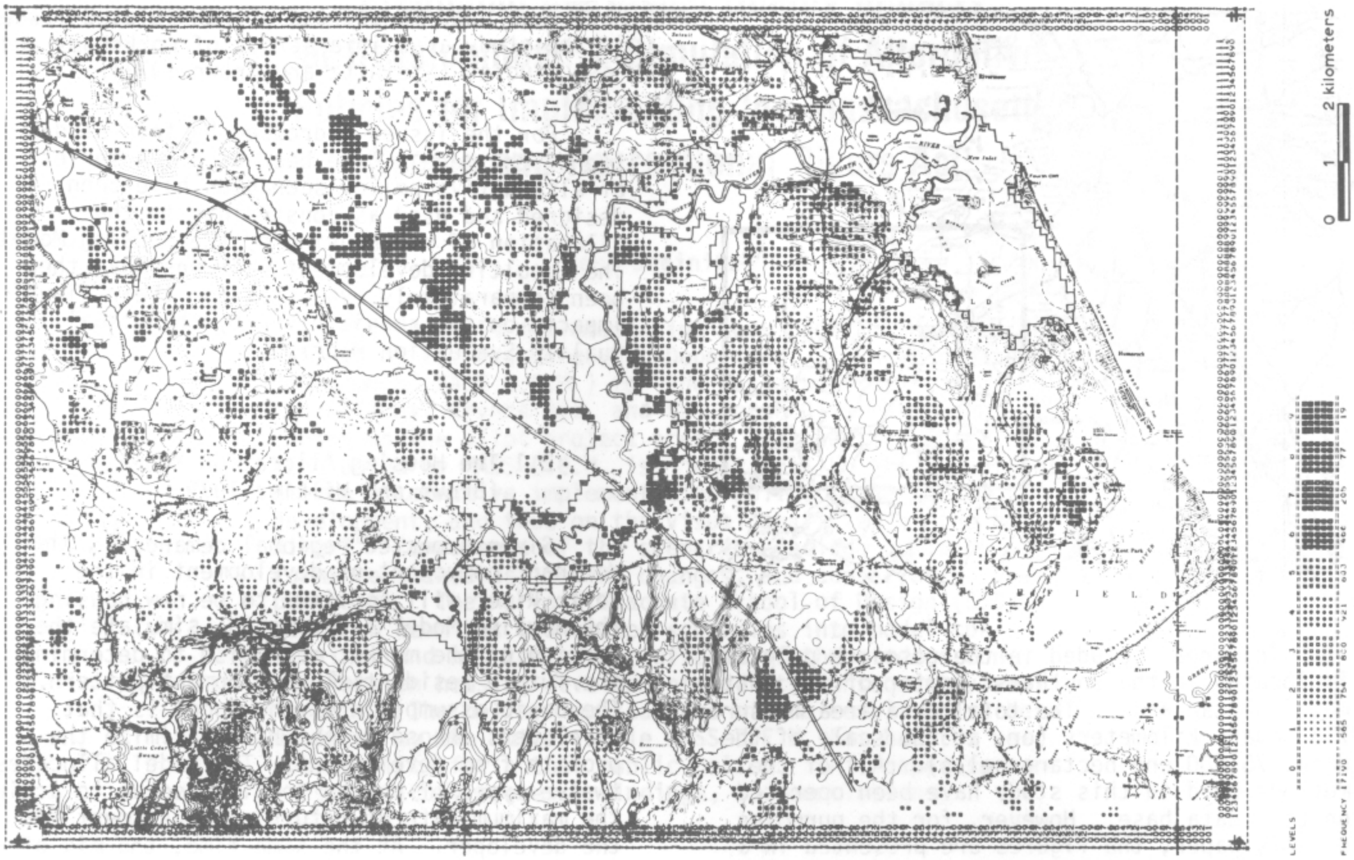
[3]For these scenarios we used ten and twenty year population increases based on an interpolation of state and federal predictions for the study region; 42,500 between 1975-85 and 49,000 between 1985-95.

Figure 2 --Rate of Return
Type 2, Single Family Housing
one unit per acre



highest rates of return. A similar calculation is made for all other structure types. The location of new housing is determined in the Allocation Submodel. The rates of return for each housing type for each developable cell are ranked in descending order. The highest return activities are assigned for development as long as the demand for the housing type has not already been satisfied by earlier assignments, the cell has not already been assigned to another housing type, and the activity does not violate local zoning. The list of ranked activities is examined until none will satisfy any of the tests.

2.2 The Visual Quality Evaluation Model (Steinitz 1979)

Once the land use pattern is altered by the new development allocated by the Housing Model for 1985 and 1995, the Visual Quality Model is used to evaluate the impact of that change on the scenic character of the study area. The model postulates that the visual quality of an area (or the visual impact of change) is to be evaluated in terms of how people perceive and "like" what they see as they look from the places in which they are located.

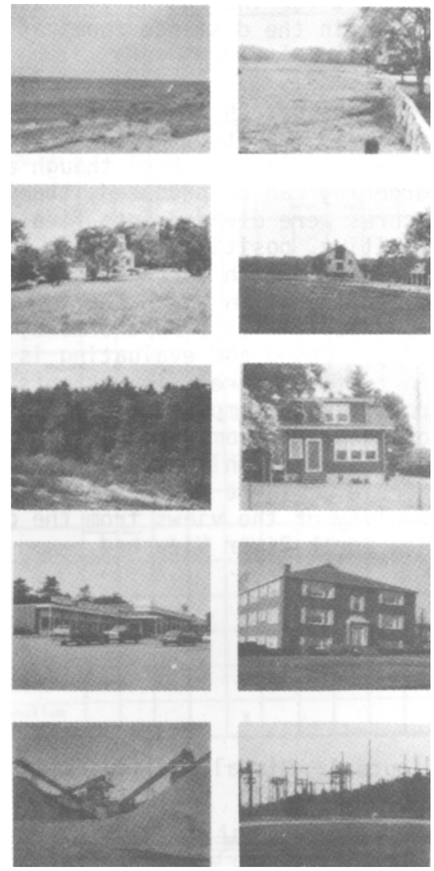
The Visual Quality Evaluation Model has two basic stages: description and evaluation. The first includes the identification of the intervisibility of places (the pattern of what can be seen from any cell of group of cells), and is accomplished with a flexible searching process. The model requires the user to provide the locations of views to be analyzed, the visually dominant land use and land cover types of each hectare cell, and data files which describe the visual topography (including various height and blocking factors associated with land use and land cover). In its descriptive output, the visual quality analysis model describes the area seen from view origins in terms of what area and what types were seen and how much these were visible.

The pattern and content of the area seen from any view origin cell are established through a computer program which searches out along rays extending from that cell. The user can specify the range of angle, distance, and density of coverage which are desired for any search. The program records the user-specified analyses as it processes the searches from each origin cell in turn. The model produces in a mapped format the pattern of development and landscape types recognizable from any set of view origins. It also produces (optional) tabular output for each view origin in which each 450 octant and radial distance zone is described in terms of the distribution of types within view.

In its evaluative output, the model identifies the visual preferences <u>of</u> the seen cells and the visual quality of the views <u>from</u> any origin or set of origins. The model recognizes that places are perceived and evaluated differently as a function of their type and distance from the observer. Therefore, the model describes and evaluates the land use and landscape types in more aggregated groups as distance increases from the origin cell. Each of the 267 land use and landscape types has been assigned preference ratings as a function of its distance to a view origin. The ratings are based upon the literature (Frederick and Steinitz 1974) with extensive photographic-interview field studies as a verification of the preference evaluations. A five-level rating system is used: most positive, positive, neutral, negative, and most negative. The model is organized around three user-defined distance zones: near (0-200 m.), middle (200-800 m.) and far (800-2600 m.). Thus, each type can have up to three preference ratings. In general, as distance increases, the ratings tend away from the extremely positive or negative groups and towards the neutral. Figure 3 illustrates selected near-view preferences, indicating in effect the visual preference of a cell for a viewer located in it.

What is the quality of the views from the origins within the North River Viewshed? The evaluation of the quality of the view <u>from</u> a cell involves the entire capabilities of the visual model discussed to this point. We have concluded from the literature and our own interviews that visual preference evaluations tend to neutralize as the viewing distance increases. The rate of neutralization tends to be a function of the visual dominance of the structure of the landscape type. Very dominant elements, such as large industrial buildings, tend toward a neutral preference more slowly as the viewing distance becomes greater. A second conclusion, at which we arrived from the literature and our interview-based observations, was that visual diversity, or the number of different visual elements in a view, acts as a magnifier of visual preference. Views tend to have higher visual quality ratings if they have a greater diversity of positively preferred types and they tend to get worse ratings if they have a greater diversity of negatively preferred

Figure 3 -- Selected Preference Ratings



Most Positive

Positive

Neutral

Negative

Most Negative

elements. Based on the hypothesis that visual quality is a function of the land use and landscape types being seen, their preference ratings, their distance from the viewing origin, and their positive and negative diversity, the most successful explanation of the photograph-based interview evaluations of visual quality is the formulation:

Using a scale for preference of most positive = +2, positive = +1, neutral = 0, negative = -1, and most negative = -2:
View Quality = for the near view zone,

(total positive preference score) x (number of positive and neutral types seen)

+

(total negative preference score) x (number of negative types seen)

+

for the middle view zone, *(the above calculations) ÷ 3*

+

for the far view zone, *(the above calculation)* ÷ 9

Mid and far view distance zone scores are divided by three and nine respectively to correct for increasingly greater numbers of cells in the distance zones as defined for this study.

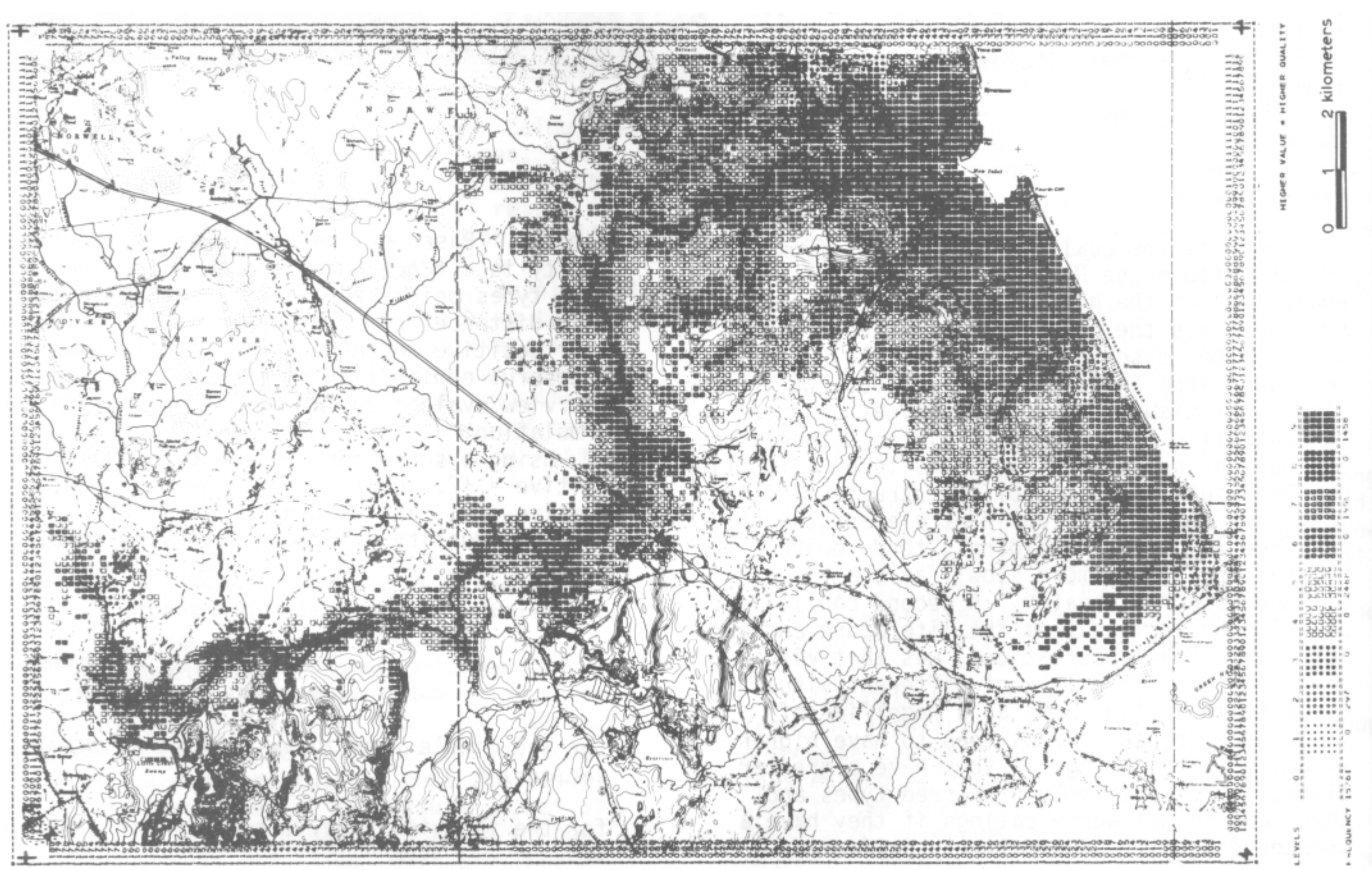
The search procedure was applied to all cells in the study area and view quality scores were calculated. Even though a strict rank ordering can be produced, the view quality scores were divided into five ranges of most positive, positive, neutral, negative, and most negative, which correspond to the more aggregated levels in which the interviewees tended to group photos. Furthermore, while the process of searching and evaluating is organized by forty-five degree view octants, and it is possible to compare the "best view" octant or quadrant from a point with its "worst view" evaluations, only average results are reported herein. Figure 4 shows the existing visual quality of the views <u>from</u> the origins within the North River Viewshed.

3.0 THE ALTERNATIVE REGULATORY APPROACHES AND THE SCENARIOS

The implementation scenarios which have been simulated in this study combine several regulatory approaches proposed by MASS D.E.M. and the various public committees associated with the North River Pilot Project and some suggested by the research team. They include proposed soil erosion controls and tree cutting limitations, proposed underground utilities, and proposed zoning changes in the corridor and viewshed. These implementation approaches are described in <u>Draft</u>: <u>Scenic River Protective Order Under Mass. G.L. c21, s. 17B, for the North River</u>, MASS D.E.M., 1978, and are selectively applied to the river corridor and viewshed.

The scenic corridor of the North River has been defined in the Scenic and Recreational Rivers Act, G.L. Ch. 21, Sec. 17B as being "...rivers and streams of the commonwealth or portions thereof, and such contiguous land not to exceed one hundred yards on either side of the natural bank of such river as the commissioner reasonably deems it necessary to

Figure 4—Visual Quality, River View Area 1975



protect by such order." The term "river" is interpreted as being defined by the natural bank, as shown by the mean annual high water line which in tidal portions is the same as the mean annual high tide. It is also the landward edge of the salt water vegetation. This zone comes under the potential jurisdiction of the regulatory process. The viewshed lies outside the corridor and has been defined by MASS D.E.M. on the basis of a field survey taken from the North River at mid-tide in November 1977.

Tree-cutting controls: Draft Protective Order, Sec. 8C2, calls for the maximum preservation of existing vegetation in the corridor. It calls for various non-cleared setbacks and is intended to maintain treed "screens" between new development and the North River. Erosion controls: Draft Protective Order, Secs. 8ClE and 9E, propose controls which will minimize soil erosion during the construction process. Underground utilities: Draft Protective Order, Sec. 5G, proposes that wire utilities be placed underground. When applied, these three regulatory approaches result in additional costs which are calculated for each housing type and location and which then influence the housing allocation model. They are known as the "housing costs." Zoning changes: Several zoning changes within the corridor and the viewshed are proposed and tested in the various scenarios. These include changing all zoning in the corridor to 1 unit/½ acre, 1 unit/l acre and 1 unit/2 acre minimum residential density, and changing all zoning in the viewshed to 1 unit/½ acre and 1 unit/1 acre minimum residential density. These new constraints are entered in their applicable locations into the zoning matrices which limit the availability of sites for the housing types. Conservation and recreation purchases: Scenario #5 tests the effects of a major and immediate public open space allocation program including a new regional park, state conservation land, town parks and town conservation land. The locations are entered into the data base prior to the housing model, and thus become a constraint by being unavailable for development.

3.1 The Alternative Regulatory Scenarios

When taken in various combinations, as specified by MASS D.E.M. and shown in Table 1, there are eleven scenarios which have been tested in a ten-year simulation, with four of these having been simulated for twenty years as well. The scenario numbers refer to specific computer simulations and are adopted for the convenience of the research team. Their presentation follows an order reflecting the potential effectiveness of the regulations being simulated.

Table 1--The alternative policy scenarios.

Alternative Regulatory Approaches		Alternative Policy Scenarios										
	simu-lated for:	scenario number										
	10 yrs / 20 yrs	1 / 1a	2 / 2a	3 / 3a	4	5	7	8	9	10	11	13 / 13a
Corridor	2-acre Zoning									X		X
Corridor	1-Acre Zoning	X		X		X	X	X			X	
Corridor	1/2 -Acre Zoning				X						X	
Corridor	Tree Cutting			X	X	X	X	X	X	X		X
Corridor	Erosion Control			X	X	X	X	X	X	X		X
Corridor	Underground Utilities			X	X	X	X	X	X	X	X	X
Corridor	Conservation/Recreation Purchase					X						
Corridor	Development Ban		X									
Viewshed	1-Acre Zoning	X	X	X	X	X		X	X	X	X	X
Viewshed	½ Acre Zoning						X					
Viewshed	Tree Cutting							X				X
Viewshed	Erosion Control							X				X
Viewshed	Underground Utilities							X				X
Viewshed	Conservation/Recreation Purchase					X						

For example, Scenario 1 is based on the assumption that there will be no changes in the existing constraints to development and that there will be no new regulatory measures associated with any implementation program of the MASS Scenic and Recreational Rivers Act. In effect, Scenario 1 presents a trend projection which predicts future regional development on the basis of current policies. The results of this trend projection are the base against which the impacts of alternative policies and regulatory practices associated with the Scenic Rivers Act can be measured. Among the existing development constraints simulated in Scenario 1 are the current one acre zoning pattern, septic tank regulations, and building cost constraints associated with wetlands, exposed bedrock, difficult soil conditions, etc. Scenario 1 has been simulated for a ten--year demand for new housing. Scenario la follows the same assumptions and has been extended to twenty years.

For the benefit of reader sanity, we present only the new development results in map format for the "Full Draft Protective Order" (scenario 3 and 3a). A comparative evaluation of all the scenarios will be made in the final section of the paper.

Scenario 3 represents the proposal by the Mass. Department of Environmental Management.

It is also interpreted as being the maximum extent of the legislative authority to implement the Mass. Scenic and Recreational Rivers Act. It proposes to change all zoning in the corridor to one unit per acre minimum residential density and it proposes to add housing cost constraints to represent the minimum cutting of trees, erosion controlling construction practices, and the provision of underground utilities. No new controls are proposed for the viewshed. Scenario 3 has been simulated for a ten year demand period. Scenario 3a operates on the same assumptions and it has been simulated for a twenty year period. Figure 5 shows the 1975 housing pattern by type in the DEM corridor and viewshed. Figure 6 shows the total housing pattern in 1995, including the additional development simulated in Scenario 3 and 3a. Thus, Figures 5 and 6 illustrate the ends of one growth sequence based upon one regulatory scenario.

These figures should not be misinterpreted. They do not predict that the areas which are simulated as being developed will in fact have their current ownership transferred and become developed. The basic assumption of the Housing Model is that the rate-of-return in the long run dominates the decision to develop housing and that the owner typically will be prepared to sell when the price is right." The simulations are a reflection of development pressures and not of actual development decisions.

4.0 COMPARISON OF THE SIMULATION FINDINGS

When comparing the simulation results, two aspects of the regional context must be kept in mind. First, the D.E.M. corridor area contains a very small percentage of the developable land in the Boston Region's South Shore. However, it represents almost half of the South Shore's area whose views would be evaluated as having most positive visual quality. Thus, a small percentage of the region's growth, if located in the North River corridor, can have a major impact not only on the river itself but also on the image of the region's principal scenic asset.

Second, the D.E.M. corridor has a limited "capacity" for development. Even though most people have a sense of this zone as being "natural" and "scenic," its land area is already almost 40% controlled by urban land uses. If its entire capacity is developed, the D.E.M. corridor could be 70% "built up." The remaining land is either unsuitable for non-sewered development or already in conservation and recreation land uses. Thus the implementation of the Scenic and Recreational Rivers Act is considering a river whose land edges have a potential of being between 40% and 70% developed. Given the large regional demand for new housing, the key issues will be the rate that development fills the area to capacity, its location, the types of housing that are located, and its population consequences. These in turn will profoundly affect the visual character and quality of the river corridor and viewshed.

4.1 Changes in Development

Table 2 shows the land area of the D.E.M. corridor whose development has been forecast by the Housing Model in each scenario and the percent of the developable land capacity of the corridor which has been built upon. The range is considerable. Table 3 also shows the number of new housing units and the new population which have located in the D.E.M. corridor in each scenario. Two important conclusions can be drawn from this table. First, it is clear that the different scenarios produce a wide range of land development and new population growth in the D.E.M. corridor. Second, that the development capacity of this zone will be completely filled within twenty years unless stronger measures than currently exist or that are proposed in the <u>Draft Protective Order</u> are taken. Furthermore, if the existing zoning for residential densities were to be relaxed as in Scenario 12, the development capacity might be reached within ten years.

Table 2--Land area developed in each scenario and new residential units and new population in each scenario.

Scenario	Ha. Developed in Corridor	% of 212 ha. Developable "Capacity" in Corridor[1]	New Units in Corridor	New Population in Corridor
1	163	77	348	1218
12	234	100+	818	2863
4	231	100+	924	3234
3	97	46	194	679
5	47	22	92	322
8	97	46	194	679
7	97	46	194	679
9	91	43	40	840
10	0	0	0	0
13	0	0	0	0
2	0	0	0	o
1a	196	92	498	1743
3a	222	100+	442	1547
13a	3	0	3	11
2a	0	0	0	0

Scenario 1 C,V: Trend Projection, no change; 10/20
Scenario12 C: Zoning 1/2 Acre /10
Scenario 4 C: Zoning ½ Acre, Housing costs /10
Scenario 3 C: Zoning 1 Acre, Housing Costs, "full order" 10/20
Scenario 5 C: Zoning 1 Acre, Housing Costs, C,V: Cons., Rec. Purchase /10
Scenario 8 C: Zoning 1 Acre, Housing Costs, V: Housing Costs /10
Scenario 7 C: Zoning 1 Acre, Housing Costs, V: Zoning ½ Acre, /10
Scenario 9 V: Housing Costs /10
Scenario13 C: Zoning 2 Acre, Housing Costs
V: Zoning 1 Acre, Housing Costs /10
Scenario 2 C: No Development 10/20

Figure 6--Existing Housing Mass. D.E.M. Corridor and Viewshed 1975

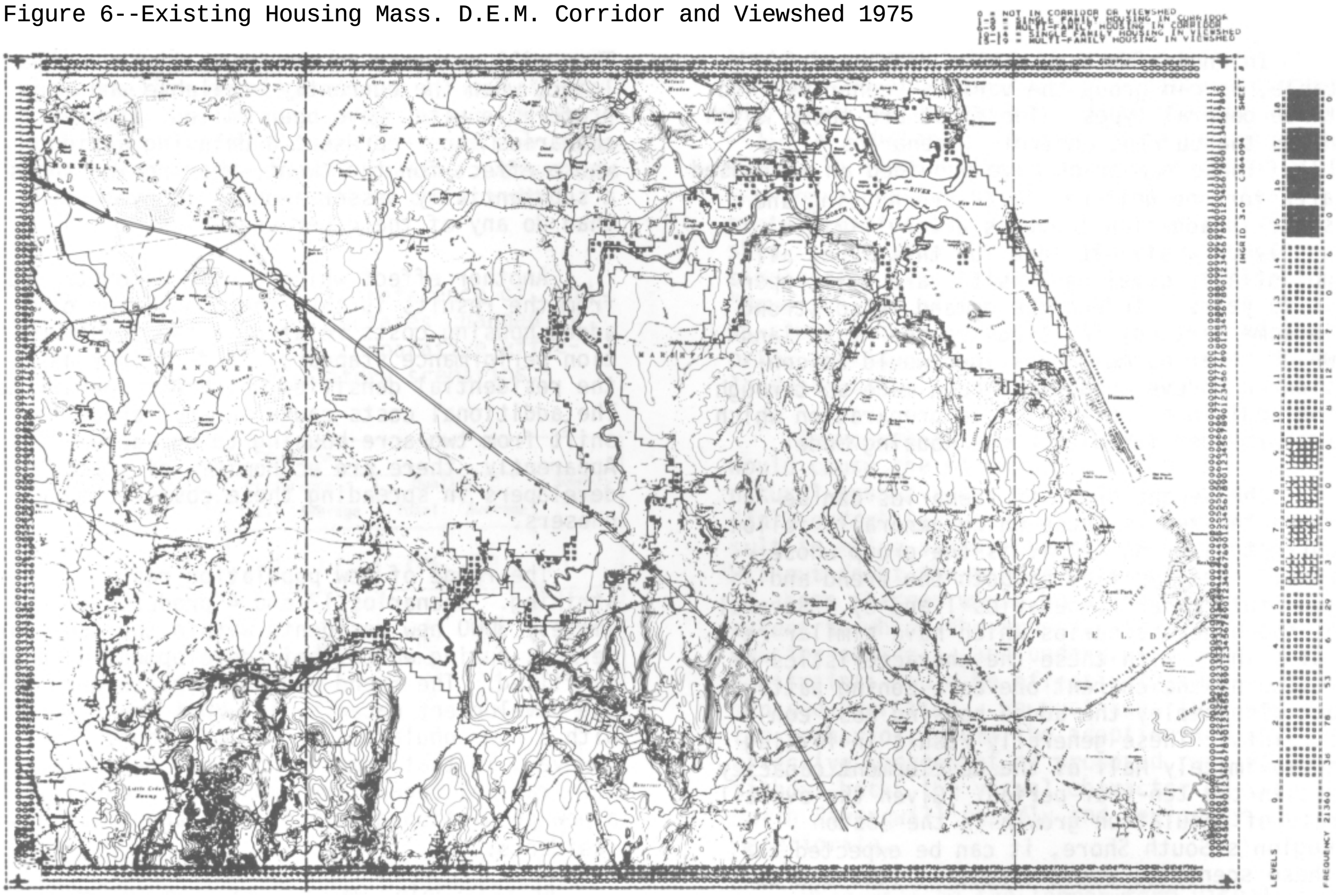
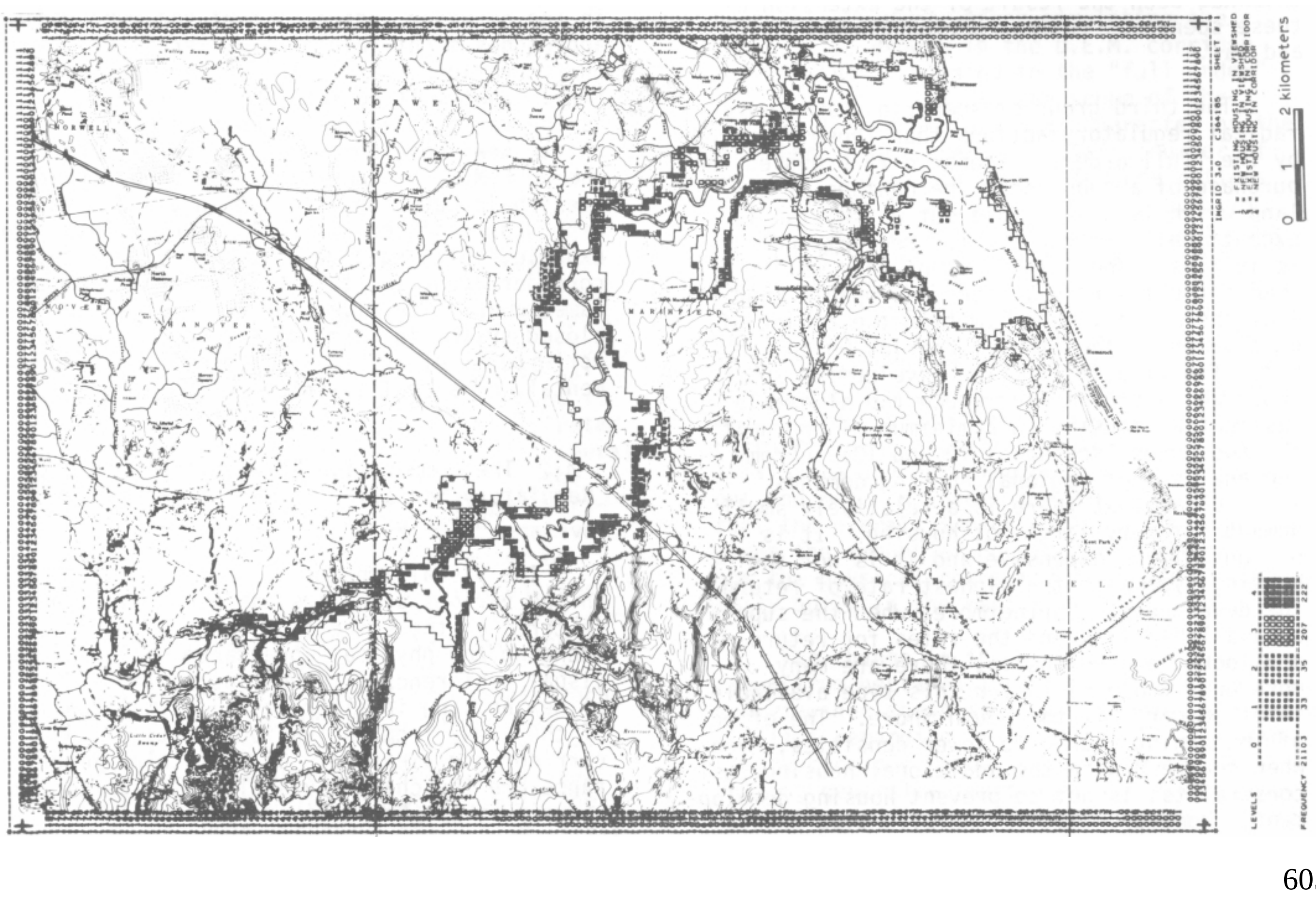


Figure 6—Scenario 3a, "Full Order" Total Area of Housing Development 1995



In analyzing the results displayed in the table, we can group the various scenarios into three general types. The first are those which relax the current controls (scenarios 4 and 12). These scenarios have provided an increased area for one unit per half-acre housing and since in addition there is a very limited supply of available land for this type, all potentially developable sites are built upon in 10 years. Indeed the demand is so strong in some parts of the study region that land which under normal conditions would be considered undevelopable has been made so through the additional costs of site preparation which are provided for within the Housing Model.

The second group of scenarios can be characterized as those which generally follow current patterns. This is the group whose results are typified by both the trend and the "full order" (scenarios 1 and 3). Several of the other scenarios which have similar results share with these the characteristics of following the current one-acre zoning patterns, but also employ the added housing cost constraints. These generally result in filling approximately half of the development capacity within the ten-year period. Given the overall rate of population growth in the Boston Region's South Shore, it can be expected that these scenarios would virtually fill the development capacity in about twenty years and this has been the result of the extension of these scenarios to that period (scenarios 1a and 3a).

The third group of scenarios takes more radical regulatory actions than those proposed by the "full order." Scenario #5 proposed the purchase of a substantial percentage of the land which is developable but which also is exceptionally attractive for recreational activities. The net effect of this was to remove the majority of the developable land from the market, thus limiting the amount of development. The other scenarios which are very effective in limiting development are those which propose to reduce the allowable residential density to a minimum of one unit per two acres (scenarios 10 and 13). From the analysis of regional housing demands it is clear that there is a relatively small demand for very large lot housing. It is obviously very expensive and it is not the housing type with the highest rate of return for developers. Furthermore, when the supply of available land and the rates for return are looked at regionally, there are many more profitable sites for this type available in other parts of the South Shore. The effect of the zoning change to lower densities, even when combined with the additional housing cost constraints, is not to prevent housing development. However, that is the effective result. They will not come to the North River until later, when the currently available and more preferable sites have been filled. These scenarios thus represent a delaying action, whose effect for the twenty-year period shows a substantially lesser amount of development than do any of the other scenarios.

Another effect which can be demonstrated from the results is that the imposition of added housing costs related to the construction performance standards tend to increase the residential densities which get constructed. The additional costs cause several areas to shift from two-acre housing to one-acre. Apparently, there are economies of scale to developers in spreading these costs to purchasers.

The range of new population results is striking. Scenarios 12 and 4 produce approximately 3000 new residents within the ten-year period, during which their development capacity is filled. The trend and the "full order" fill the development capacity in about twenty years, with a new population growth of around 2000. However, in that same twenty-year period, the more radical regulatory approaches result in a new population growth of only about 200 new residents.

At this point we must caution against the simplistic conclusion that smaller growth in the corridor indicates that the more radical approaches might result in better fiscal impacts on the various towns. This may or may not be true. What must be kept in mind is that as the various regulatory approaches shift new development from or toward the D.E.M. corridor and viewshed, there are "chain reaction effects" in all of the other parts of the regional market. Thus, for example, shifting development away from the corridor might shift it to other parts of the same towns. The river corridor is neither a closed system in terms of its housing market nor in terms of any of its economic, environmental, or social systems.

4.2 The Comparative Effectiveness of the Regulatory Scenarios in Managing the Scenic Character of the North River

The visual impacts of the new development in the various scenarios can be analyzed both in terms of the effects of new housing in changing the physical appearance of land (its visual preference), as well as by the effect of new housing in altering the visual quality of the views from the various parts of the corridor and viewshed. Of particular importance are the changed visual qualities of the views from the North River itself. Two measures have been chosen as being desirable: (1) a smaller negative change in the visual preference evaluations of the views of the land in the corridor, and (2) a smaller negative change in the visual quality evaluations of the view from the land in the corridor.

Table 3--Existing visual preference of, and visual quality from, hectares changed by new development. The comparative effectiveness of the regulatory scenarios.

D.E.M. Corridor						
	# of ha.	Preference		Quality		Summary Rank
Scenario	Developed	Total	Average	Total	Average	
1975 Total	1905	2297	1.2	2116	1.1	
1975						
1	163	160	1.0	63	0.4	9
12	234	209	0.9	107	0.5	11
4	231	210	0.9	105	0.5	11
3	97	103	1.1	34	0.4	5
5	47	33	0.7	38	0.8	4
8	97	103	1.1	34	0.4	5
7	97	103	1.1	34	0.4	5
9	91	94	1.0	32	0.4	8
10	0	0	-	0	-	1
13	0	0	-	0	-	1
2	0	0	-	0	-	1
1995						
1a	196	178	0.9	82	0.4	4
3a	722	205	0.9	99	0.4	4
13a	3	3	1.0	0	-	2
2a	0	0	-	0	-	1

Key: most positive = +2.0
positive = +1.0
neutral = 0.0
negative = -1.0
nest negative = -2.0

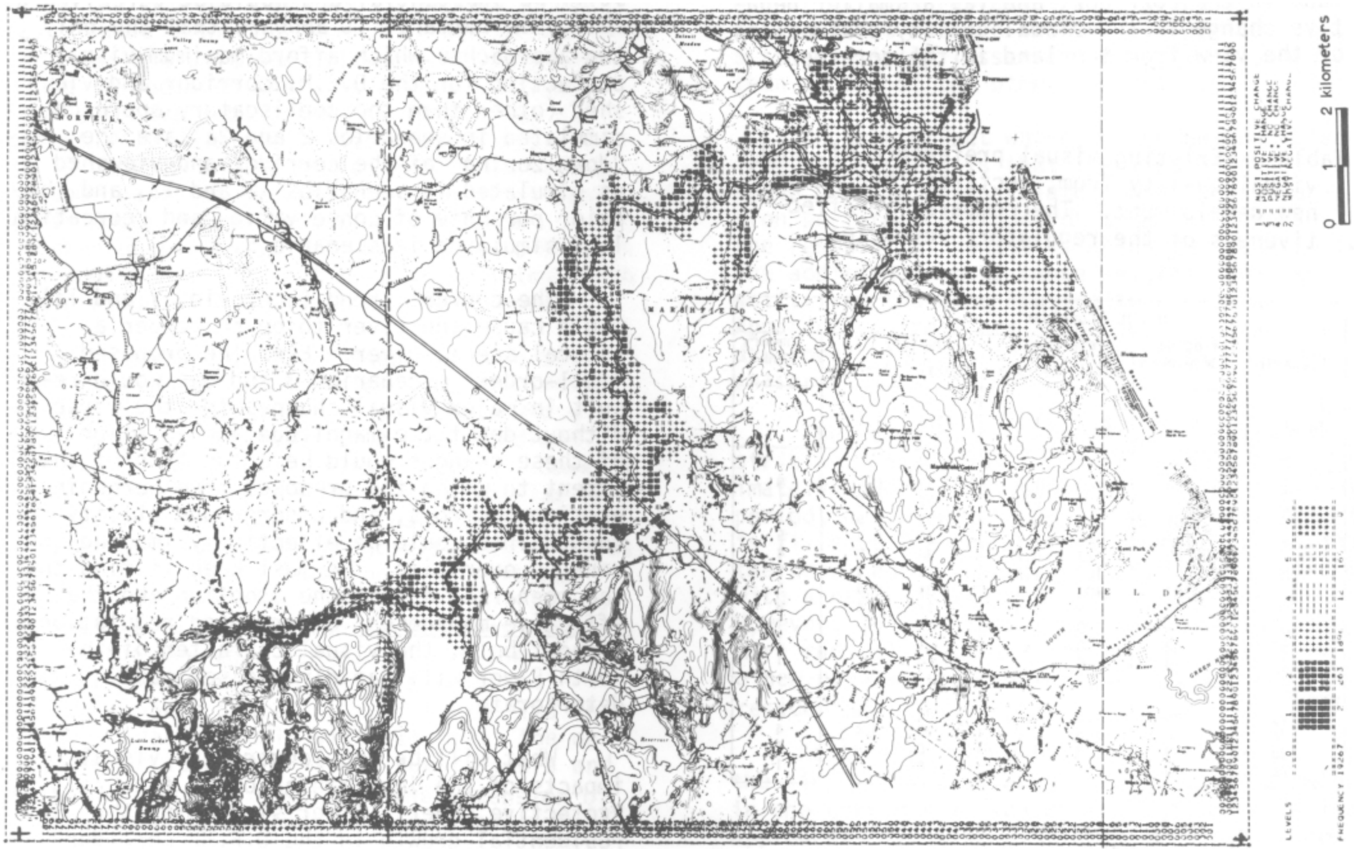
Table 3 shows the change in visual preference and visual quality. The values for both preference and quality shown on Table 3 have been calculated as the sum of the values for those cells which have been changed due to new development. The D.E.M. corridor currently has generally positive preference and visual quality evaluations. Its developable land is a mix of neutral (forest) and positively rated areas (open and agricultural land). In general the new development is being located in the predominantly forested portions of the corridor and the viewshed. The greatest negative impact on the existing visual character of the North River is caused in those scenarios which have allowed the more intensive half-acre dousing and which as a result have had the maximum development (scenarios 4 and 12). The other scenarios which attempt new scenic regulations all have lesser impacts than does the current trend within the first ten-year period (scenario 1) and also within the twenty-year simulation (scenario la). However, with the exception of those scenarios which effectively limit development through prior purchase of land or two-acre zoning, the negative changes in visual preference and visual quality would still be substantial and would be perceived as such. In summary, it appears that the only two approaches which afford maximum visual protection for the D.E.M. corridor and viewshed (other than the confiscatory approach simulated in scenarios 2 and 2a) are the "down-zoning" of the corridor and viewshed as simulated in scenarios 10 and 13, and the prior purchase of conservation and recreation land simulated in scenario 5.

The current trend (scenarios 1 and la) would cause the river to be no longer a natural scenic river. Even the proposed "full-order" (scenarios 3 and 3a) would result in major visual changes for the worse. Without doubt the magnitude and location of these changes would be a function of the extent to which the proposed tree screening, erosion controls, and underground utility constraints could be effectively imposed and managed over time. We must keep in mind that the scenarios assume the adoption and the effective management of proposed regulations. Without both, the visual character of the North River will rapidly and seriously deteriorate.

What will be the longer-term visual impacts of the implementation of the Draft Protective Order? After simulating the residential growth in the D.E.M. corridor and viewshed according to the "full order" in scenarios 3 and 3a, the scope of the potential changes in visual character of the area becomes clearer. The large number of negative changes in the preference ratings of the views of hectares in the D.E.M. corridor and viewshed directly reflects the amount of new housing which changes the currently "positive" open and agricultural land and "neutral" forest to "negative" evaluated housing. There is no doubt that this visual preference evaluation reflects a current attitude of residents in the study area towards stereotypical new housing types. Furthermore, the challenge to produce excellent local site and building design can be possibly put and met. However, the likelihood is high that the overall impact will indeed be negative, given the amount of housing which is projected, and the physical character of the housing typically built in the region.

The change in the visual quality of the views from hectares in the D.E.M. corridor and viewshed shown in Figure 7 reflects a major conflict regarding "whose views?" The land in the corridor which is newly developed as lousing generally improves its views. Trees are newly cut (even within the scope of the

Figure 7 --Scenario 3a, "Full Order"
Changes in Visual Quality
1975-1995



draft regulations), and highly valued water and wetland views are opened from what was previously dense forest. These views are the private gain of the house-owner. The negative visual quality changes are all views from the river wetlands--the very conditions which the public enjoys and which the Massachusetts Scenic and Recreational Rivers Act is intended to protect. There is a tradeoff between the private gain in visual quality of the person who clear cuts to achieve a view of the river and the private and public loss of the people who then see his building from what otherwise was a most positively evaluated "natural" landscape. This is the essence of the problem, and underlines the central importance of enforcing regulations in the public interest.

It appears from the results of the scenarios that the various cost constraints which represent construction performance standards (erosion controls, underground utilities, and tree screening) will not be effective in reducing development. Neither do these constraints have a major impact on the location of new housing. It appears that the added costs can be absorbed by the consumer in a higher price of housing. If the proposed regulations can be rigorously enforced, they will result in new development which is in conformity to the performance standards and their intent. However, the major issue with regard to these construction performance regulations will be whether an implementation process can be organized which will in fact enforce the Draft Protective Order over the long term. If the Scenic and Recreational Act regulations are not managed or if they are ineffective, we can foresee the change of the North River from its current rural and relatively undeveloped character to a much more highly developed urban river within a 20-year period. It will then no longer be a "Scenic River."

POSTSCRIPT

This paper presents a summary of what was a much more complex and detailed study, particularly as related to the results associated with each scenario. These were presented in a report (Steinitz 1978) and in public presentation to various committees associated with the North River. The principal findings and arguments pertaining to the effectiveness of the regulatory scenarios were understood. However, the development-related scenic management decisions taken by the local towns and subsequently reflected in the North River Management Plan (Massachusetts Department of Environmental Management 1979) were based upon only the implementation of construction-related controls rather than zoning or land purchase changes. To quote from the Plan, "These results were presented to the advisory committee, but the local consensus was that they wanted to maintain the one-acre zoning and were willing to accommodate the increase in development to saturation along the river."

Malum est consilium, quod mutari non potest.

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