

SITE ALLOCATION ACCORDING
TO IMPACT/USER PREFERENCE

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ABSTRACT

This study illustrates a method of generating alternatives for selecting architectural planning sites, using a digital computer. The method attempts to determine the optimum locations, for specified land uses, according to priorities established by the user. Alternative locations are generated by varying the priorities. The variables used as input are subcategories of the following:

1. topography (eg. slope)
2. surface features (eg.vegetation cover type)
3. ecological impairment criteria
(eg.slope erosion)
4. land use proximity
(eg.distance of housing to commercial areas)

The output identifies locations which are capable of (a) supporting the activity, (b) meeting the proximate restrictions imposed by the user, and (c) allowing the sites to recover ecologically.

The user has complete freedom to establish the priorities of both land use, and their respective requirements in terms of site characteristics.

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1.0 Intent

The intent of this study is to develop a method to assist in land allocation, specifically in the north.

To be of use, the model must reflect the user's values, and show the consequences of those imposed values. The method should be able to provide the results in a reasonably short time, in order that the user may spend the majority of his effort in making decisions, not evaluating them.

This method incorporates the notion that designers and policy makers think in terms of priorities rather than in weighted values. The methodology will incorporate the notion of prioritizing or rank ordering to allow the user to relate to the model more quickly and with less indoctrination.

One of the problems occurring in northern 'development' is that of ecological damage or impairment. Damage will occur the moment man sets foot in the area, and assuming he will, the user must decide how much damage will be tolerable. To accomplish this, the user must have some way of determining the effects of the land uses on the site, and studying the effects of various alternatives.

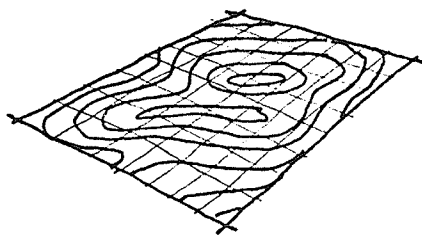
Distance relationships also play an important part in land use allocation. In general, land uses are not allocated to a specific area or location to stand by themselves as separate entities. The location, in most cases, is highly dependent on the distance relationships to other land uses.

This method will use the notion of prioritization, for both land uses and site attributes, in allocating land uses. The procedure will attempt to minimize ecological impairment and maximize positive site attributes, while maintaining the proximate relationships between land uses.

2.0 Introduction (State of the art)

A common technique associated with land use allocation is symographic mapping (Steinitz, 1970). This technique is used to generate a map, describing the site in terms of criteria established by the user. A single map is generated for each particular land use. The user then must work manually in specifying the locations of the land use.

An analogy of this technique is the overlaying of colour coded acetate maps, to determine the 'optimum' areas for placement. Each map represents a variable, such as topographic slope, orientation, surface drainage, etc. It is assumed, for any such study, that all the variables, taken together, describe the site.



The symographic technique consists of taking the overall site/area, and dividing it into cells.

The cell size is generally determined by the type and quality of information or data available, and also according to the needs of the land use or activity being placed.

Each variable is, in turn, described by its attributes (eg. depth to water can be described by the following attributes; water, 1'-2', 2'-4', 4'-6', ..., 10'+). For ease of manipulation by the digital computer, the attributes are assigned corresponding status levels.

The status level is an integer, in this case ranging from 0 to 9. Each cell within a variable map is assigned a status level to correspond with the attribute. A coded data map is generated for each site variable. All the variable maps constitute a description of the site, in terms of the variables the user feels relevant to the land use.

Each variable is then assigned a weighting factor. The weighting factor is to represent the relative importance of that variable within the system, and is generally established to an accuracy of one or two decimal places.

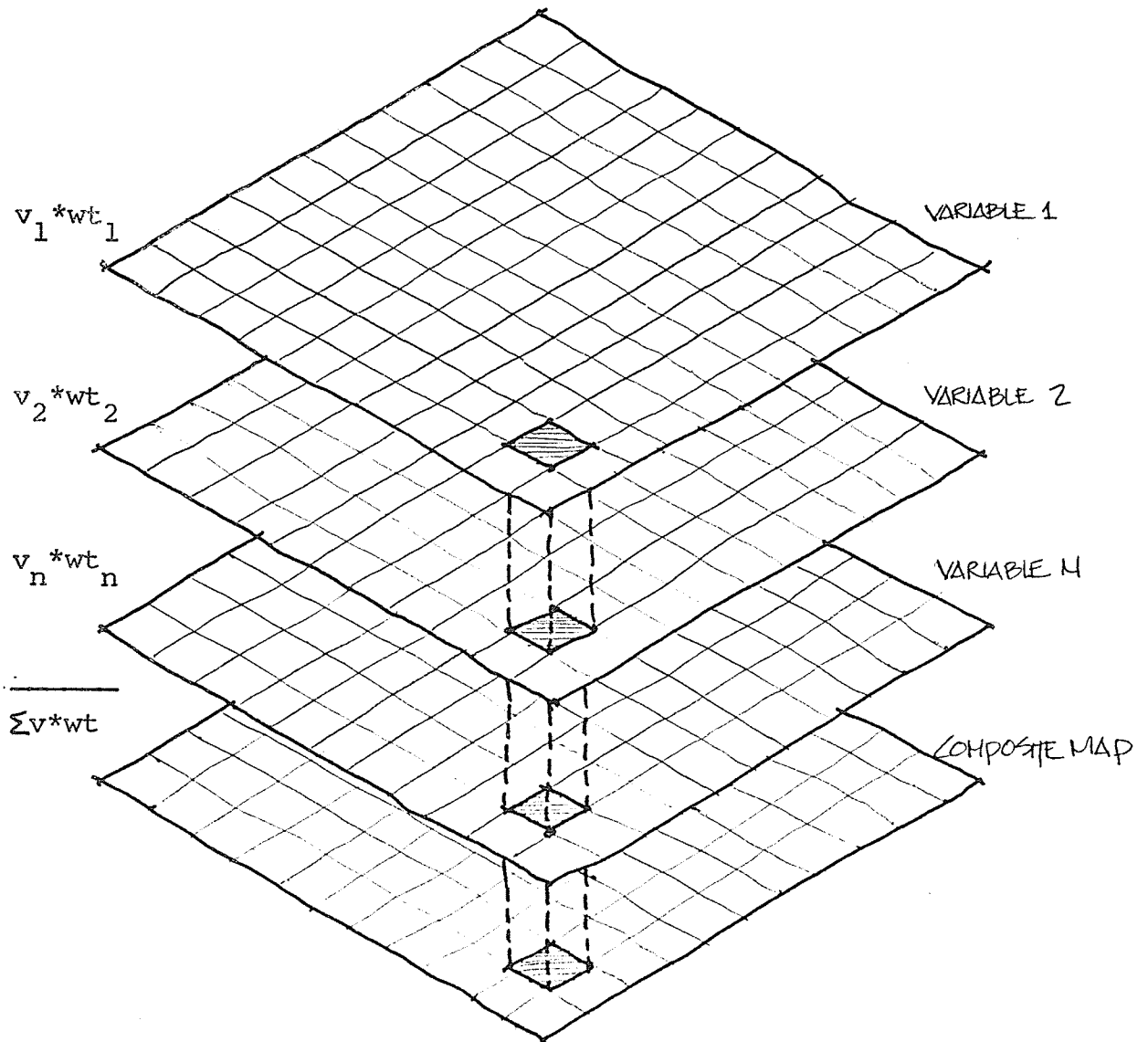
The composite map is generated in the following manner: For each cell, within the site, the following equation is evaluated and its result is assigned to the corresponding cell in the composite map.

$$v_1 * wt_1 + v_2 * wt_2 + \dots + v_n * wt_n = \text{sum See fig. 2.0.a}$$

v_n = status level of that cell, with respect to variable n

wt_n = weighting factor of variable n

The procedure is repeated until each cell has been evaluated. Then the cell sums are scaled down to fall between 0 and 9.



The resulting map represents an evaluation of the site, by cells, according to desirability for a land use (or the degree of capability of fulfilling the specified requirements of that land use). The integer 9 represents locations which are most capable, while 0 represents locations which are least capable of fulfilling the requirements. Other composite maps would have to be generated for each subsequent land use.

A digital computer is utilized for analyses of this type. Its use is beneficial when the amount of data is great, and the model becomes complex. The digital computer is an ideal tool for exhaustive and complicated numerical manipulations. However, the capabilities of the digital computer are not limitless. The time/cost restrictions become apparent when sorting through massive amounts and/or layers of data.

One of the inherent difficulties of the symographic technique is the derivation of a precise weighting factor for each of the site variables. It is possible for experts to disagree as to what the weights should be, and generally a compromise must be reached.

Another problem is that of the number of

composite maps generated. If the number of land uses to be located is great, the number of composite maps is equally great, and could become unweildly when an attempt is made to locate the land uses according to other criteria (eg. proximate relationships).

Heuristics added to a procedure of this type could increase the efficiency of the model, reducing the 'run' time necessary for the digital computer. In effect, some of the constraints of time and cost could be alleviated. The heuristics employed would reduce the number of cells to be evaluated, as there is no real need to evaluate cells that would seem not to lead to worthwhile or acceptable locations.

3.0 Endogenous Input

A methodology has been established for describing the site in terms of its variables, although the accuracy or reliability is yet to be proven. At present the concept of cells is being questioned, because they are not a natural configuration, and do not reflect the nature of the site accurately. Currently, some of the work in this area involves the use of polygons (irregular areas) to describe the site.

Another problem is that of the number of attributes describing any particular variable. It now appears that ten attributes may be too many to associate with particular variable. This is due to the fact that it is quite difficult to differentiate many states of one variable, when conducting field surveys.

The problem of the number and type of variables to be used for the allocation model is also important. The analysis for each land use may require different variables, and these must be established and coded.

For the purposes of this study, the descriptive technique utilized by the symographic methodology will be used. A data bank, consisting of selected

variables, already exists, describing an area surrounding Leaf Rapids, Manitoba. The data was collected, prepared and coded specifically for a land use allocation application using the symographic technique (Johns, 1972).

Because of the availability of the Johns' data, and the similarities in intent, the Leaf Rapids area was chosen for an illustration or test of the method proposed in this study. An alternative to the symographic technique is being put forward in this study: the model results can be compared then to the results obtained by Johns.

The land uses dealt with, by Johns, in his study, and to be used in this model are the following:

1. multiple family housing
2. single family housing
3. active recreation
4. passive recreation
5. commercial
6. industrial

The variables associated with the land uses,
and to be used in this study are:

1. topographic slope
2. slope orientation
3. surface drainage
4. subsurface drainage
5. depth to bedrock
6. soils by composition
7. vegetation stability
8. vegetation preference
9. visual access to unique landscape features
10. visual absorption
11. perceptual carrying capacity

The attributes and corresponding status levels
associated with those variables to be used in this study
and as used in the Johns' study are:

- 1) topographic slope
 - 0 open water
 - 1
 - 2 0%-4%
 - 3 4%-8%
 - 4
 - 5 8%-12%
 - 6 12%-16%
 - 7

- 8 16%-20%
- 9 20%+

2) slope orientation

- 0 water
- 1 north
- 2 north east
- 3 north west
- 4 flat
- 5 east
- 6 west
- 7 south east
- 8 south west
- 9 south

3) surface drainage

- 0 water
- 1 poorly drained wetlands
- 2 swales
- 3
- 4
- 5 minor surface runoff
- 6 drainage pattern
- 7
- 8
- 9 well drained

4) sub-surface drainage (watertable)

- 0 open water
- 1 0'-2'
- 2
- 3 2'-4'
- 4
- 5 4'-6'
- 6
- 7 6'-8'
- 8
- 9 8'+

5) depth to bedrock

- 0 open water
- 1 rock outcropping
- 2

- 3 3'
- 4
- 5 5'
- 6
- 7 10'
- 8
- 9 10'+

6) soils by composition

- 0 open water
- 1 organic peat or no soil cover
- 2
- 3 silts and clays
- 4
- 5 sands silts and clays
- 6
- 7 poorly graded sand (gravel)
- 8
- 9 well graded sand (gravel)

7) vegetation stability

- 0 open water
- 1 low vegetation cover including underbrush, herbacious plants, muskeg, and bog.
- 2 underdeveloped, dwarf or stagnating coniferous trees
- 3 young coniferous trees in dense stand
- 4 overmature coniferous in dense stand
- 5 open black spruce, white spruce and jackpine forest with no understory regeneration
- 6 open black spruce, white spruce, and jackpine with good understory regeneration.
- 7 open or closed deciduous stand, with or without understory regeneration
- 8 mixed deciduous and coniferous trees with no understory regeneration
- 9 mixed deciduous an coniferous trees with healthy understory regeneration.

8) vegetation preference

- 0 water (see variable 7 for listing
- 1 group 1 of groups)
- 2 group 2
- 3 group 3
- 4 group 4
- 5 group 5
- 6 group 6
- 7 group 7
- 8 group 8
- 9 group 9

9) visual access to landscape features

- 0 water
- 1 environmental visual nuisance
- 2
- 3 no features outside normal
- 4 view of marshland
- 5 view of stream (intermittent)
- 6 screened view of ravine, hill or kettle
- 7 direct visual access to ravine, hill or kettle
- 8 screened view of water
- 9 direct visual access to water

10) visual absorption

- 0 water
- 1 least absorptive
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9 most absorptive

- 11) perceptual carrying capacity
- 0 open water
 - 1 no possibility of major, moderate or minor buffers
 - 2
 - 3 major buffer distance 90-150 yds
 moderate buffer distance 25-40 yds
 minor buffer distance 15-20 yds
 buffer capability lost -15 yds
 - 4
 - 5 major buffer distance 70-80 yds
 moderate buffer distance 15-25 yds
 minor buffer distance 5-10 yds
 buffer capability lost -10 yds
 - 6
 - 7 major buffer distance 45-60 yds
 moderate buffer distance 10-20 yds
 minor buffer distance 5 yds
 buffer capability lost 5 yds
 - 8
 - 9 major buffer distance 30-35 yds
 moderate buffer distance 5-10 yds
 minor buffer distance 5 yds
 buffer capability lost 5 yds

4.0 General Modelling Technique

4.1 Priorities

In developing a model using prioritizing as a criteria for land use allocation, I have made certain assumptions. The first of these assumptions is that no two land uses may have the same priority, or be of equal importance.

It is acceptable to say that no two land uses are equally important. When allocating land uses according to site variables and distance relationships, the situation of being able to locate two equally important land uses becomes the exception rather than the rule. One of the few conditions where this exception would occur is if the requirements of the activities are identical. Then, practically speaking, the two land uses are also identical.

The question that must be asked by the user is: if the requirements of both activities or land uses cannot be met simultaneously and to the highest degree, which of the land uses is to receive the greatest consideration?

In prioritizing the site variables, the above does not hold true. Two variables may actually be of

equal importance. But, due to the specific methodology to be employed, the final effect of that equality will not differ significantly from that of one variable being placed immediately ahead or below the other. This apparent lack of sensitivity is only superficial. The evaluation of a particular cell will allow for two possibilities. The first is that all requirements are fulfilled; the second is that the most requirements possible have been fulfilled. If the first case is true, whether there were two equal variables does not matter. If the second condition is true, and the requirements of one of the 'equal' variables was that last fulfilled, and that cell was chosen for placement, then it would appear that all other locations failed to fulfill even the first 'equal' variable.

4.2 Heuristics

Heuristics can be generally defined as a strategy, shortcut or "trick" which quickly narrows the search for a productive or acceptable solution. Heuristics do not guarantee that the optimal solution, or any solution, will result; but, do generally lead to an acceptable or reasonable solution.

The heuristics utilized, within this model, should quickly direct the search and evaluation procedures to areas, within the site, which have a high possibility of fulfilling the criteria established by the user, thus eliminating time and effort spent evaluating cells in areas where the possibility of an 'acceptable' result is low.

4.3 Distance Relationships

By imposing distance relationships, the number of cells or locations that need evaluation is immediately reduced. This is true if the imposed distance limits are short, relative to the size of the site being investigated.

For this study, if distance relationships exist between two or more land uses, it will be assumed

that only two conditions are possible: 'fit' or 'misfit'.

The distance relationships will narrow the search within the site to an area defined by the distances allowed, or desired, by the land uses.

Within these limits, a great number of possible land use arrangements still exist. (If n designates the number of land uses, then the number of possible permutations is at least n factorial.)

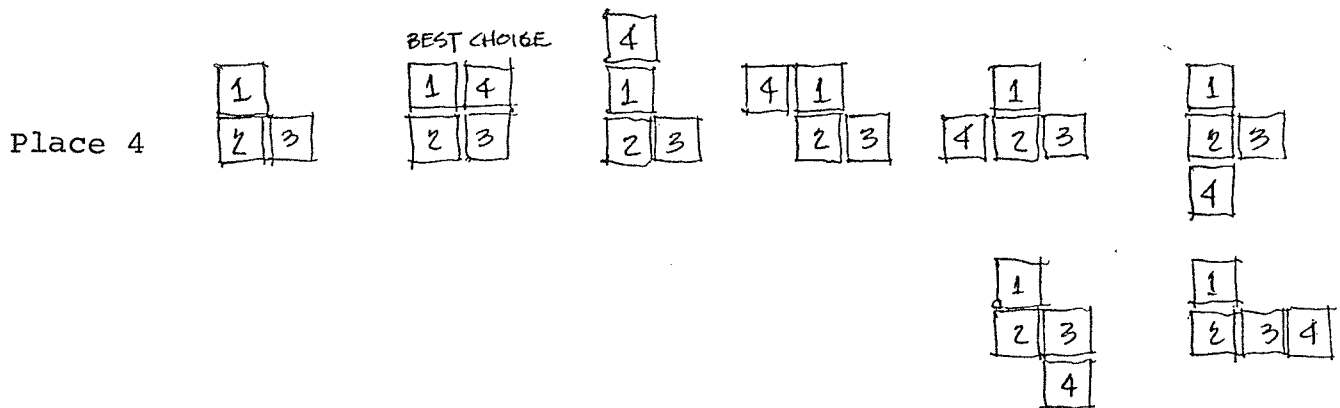
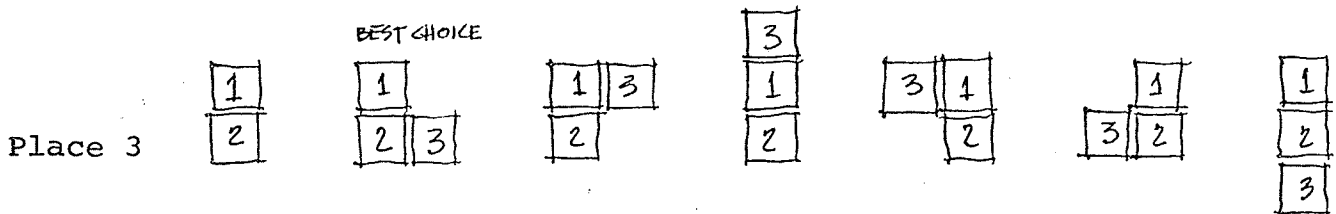
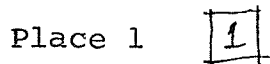
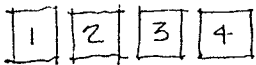
In order to evaluate each possible permutation, the time and cost involved could be inhibitive. Therefore, a further heuristic will be employed in the spatial allocation procedure. The heuristic to be used in this study is commonly referred to as the 'additive' method (Tawfik, 1970). This procedure begins by placing the first priority land use within the spatial framework, then by placing the second priority land use within the distance requirements, if any, and so forth until all activities have been located. This method greatly reduces the amount of arrangements to evaluate.

The weaknesses of the additive method generally involve those associated with heuristic procedures. The first is that there is no promise of a solution,

the second that the resulting solution is not necessarily optimal; but is generally, at least, acceptable.

Additive method

ORDER OF PLACEMENT



FINAL RESULT

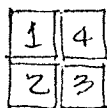


Figure 4.3.a

4.4 Termination Criteria

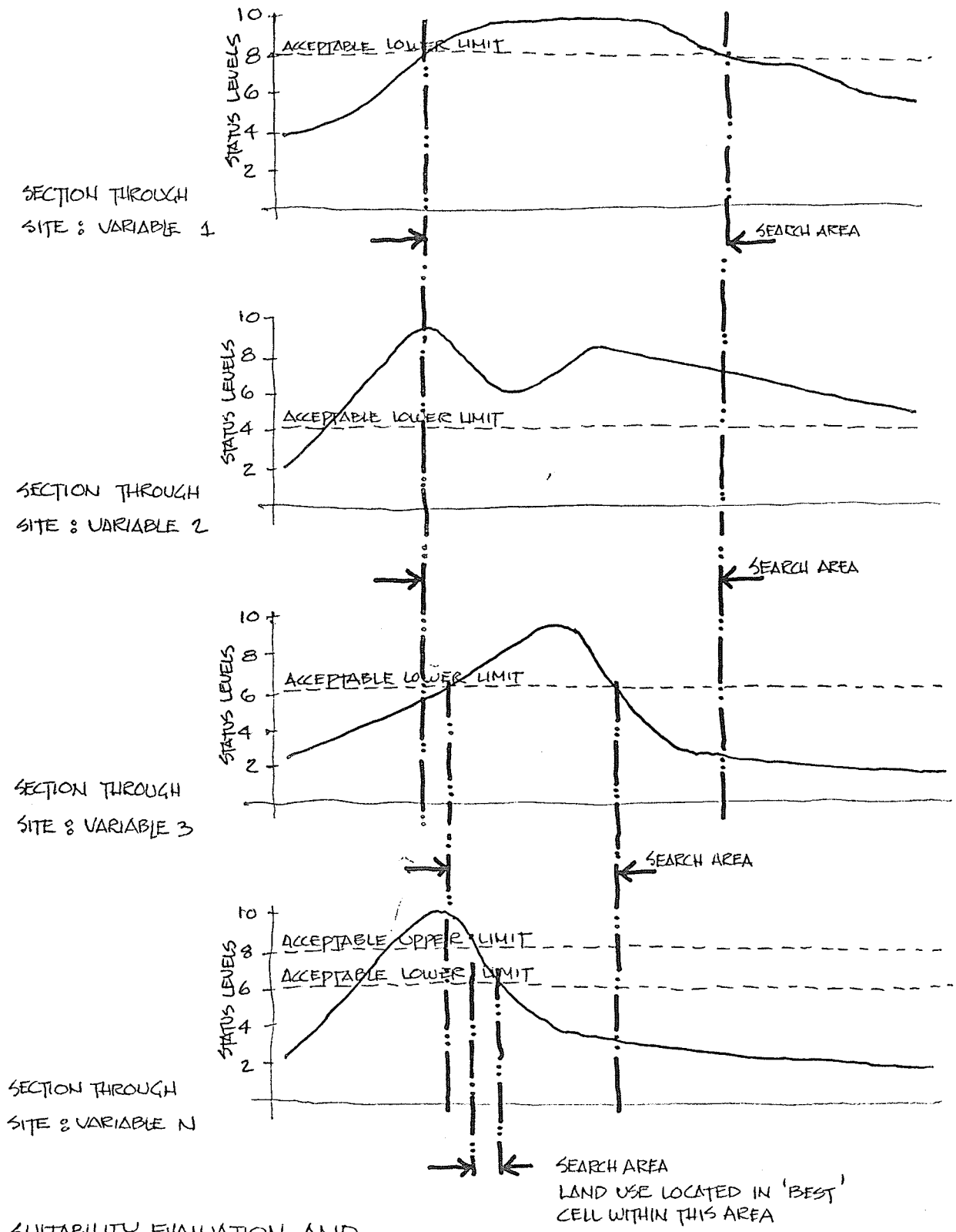
In effect, the termination criteria tell the search procedure when to stop searching for new cells or locations. Termination criteria may be described as those characteristics of a cell or position which are acceptable or reasonable.

Within this particular model, the termination criteria will consist of:

1. minimum and maximum distances between activities. (Distance relationships between land uses; eg. commercial to industrial)
2. acceptable status levels for variables
3. a limited diameter search pattern

By introducing 'acceptable' status levels for the variables, the search can be made to be much shorter and more restrictive. (eg. If the user can define or describe the conditions (status levels) which he feels are acceptable, cells not displaying those characteristics need not be evaluated.) See figure 4.4.a

By placing a limit on the diameter of the search pattern exhaustive evaluation is terminated. Within the limits imposed on the search pattern, cells may be evaluated and the 'best' chosen.



SUITABILITY EVALUATION AND
SEARCH AREA DEFINITION EMPLOYING UPPER & LOWER LIMITS
ON STATUS LEVELS.

Figure 4.4.a

4.5 Capability/Suitability/Impairment

The term capability will be used to refer to the ability of the natural resources of a cell to support some type of 'development' or intervention.

Capability will be measured from least capable of supporting a particular land use to most capable of supporting that land use.

Suitability will be the collective measure of all variable capabilities, with respect to a particular land use. Suitability measures will not be used overtly within the methodology, but will be used implicitly in determining whether or not a cell fulfills the prescribed requirements. See fig.4.5.a

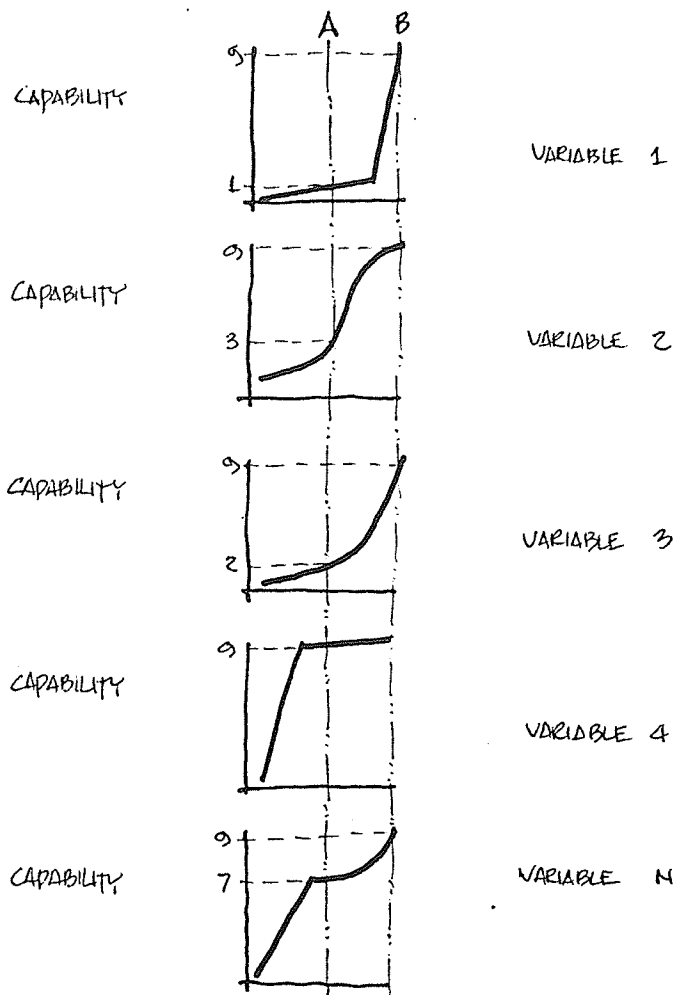
Impairment will be defined as damage to the ecological system, specifically within the cell being investigated. The measure of impairment will reflect the damage experienced if a particular land use is imposed on a cell, having a prescribed variable attribute.

The capability of a particular variable attribute, to support a given land use, may then be plotted in graph form against the ten status levels, representing the attributes.

The resulting graph will represent the degree of fulfillment of the land use requirements by the attributes of the variable. See figure 4.5.b

The degree of impairment can also be plotted against the attributes or status levels. The impairment curve will define the points above which regeneration will occur, and the complexity of the ecosystem will not degenerate. See figure 4.5.c

The capability and impairment curves may then be compared by the user, to determine what the acceptable status levels should be. From a glance, it is possible to see which attributes are highly capable of supporting the land use, and at the same time impairing the ecosystem the least. See figure 4.5.d



Suitability of location A
 capability 1 = 1
 capability 2 = 3
 capability 3 = 2
 capability 4 = 9
 capability n = 7
 Suitability (sum) = 22

Suitability of location B
 capability 1 = 9
 capability 2 = 9
 capability 3 = 9
 capability 4 = 9
 capability n = 9
 Suitability (sum) = 45

Therefore 'B' location is preferred for land use placement, because of its higher suitability rating.

Figure 4.5.a Suitability Evaluation

Figure 4.5.b

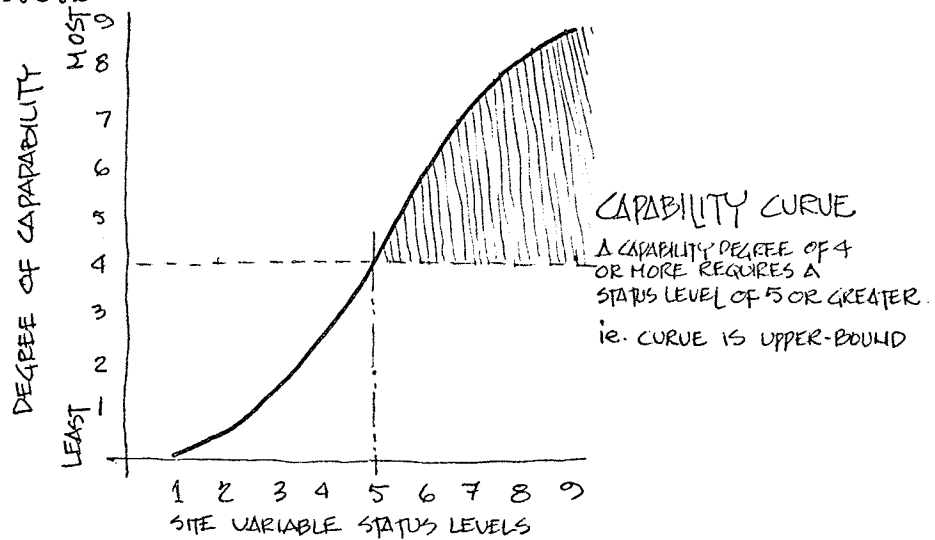


Figure 4.5.c

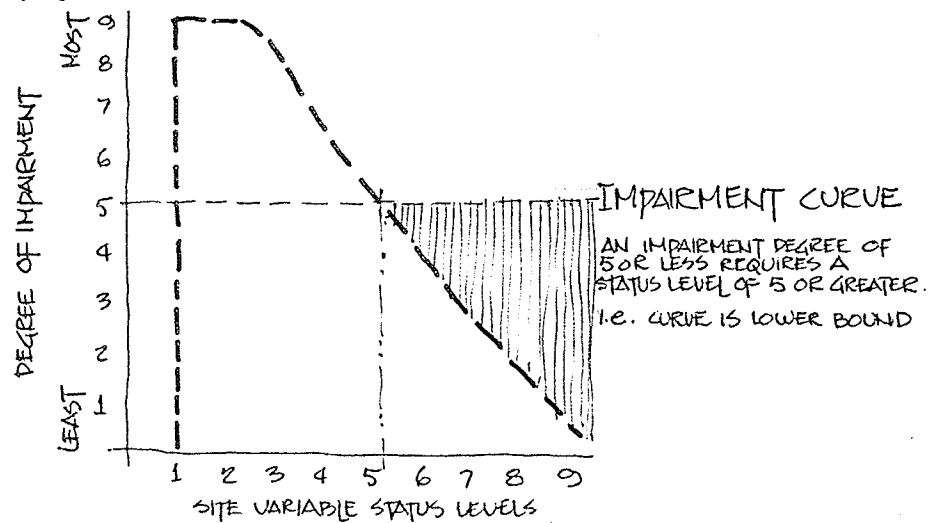
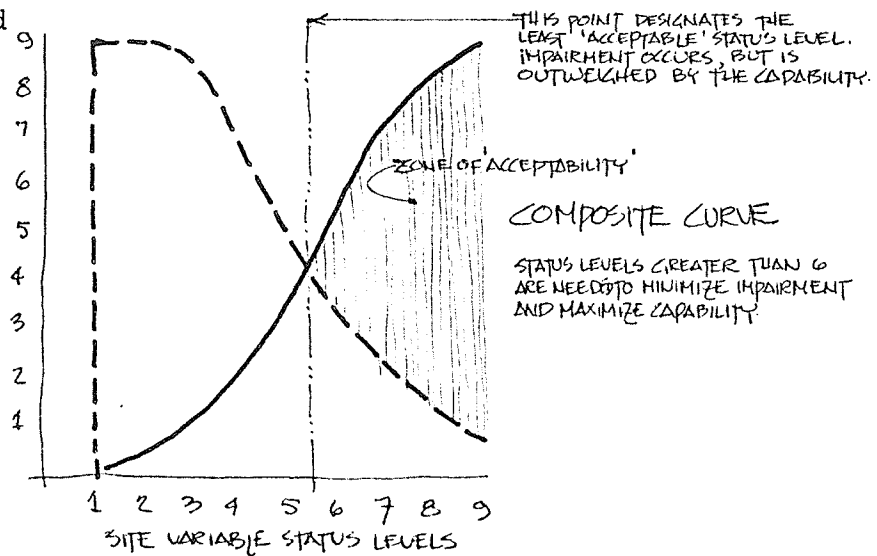


Figure 4.5.d



5.0 Exogenous Input

5.1 Land uses

The land uses will be rank ordered according to their relationships, either to each other, or to the site, or a mixture of both; but in any case, the ranking will be done according to the users' preferences.

For the purposes of this study, the land uses will be ranked in the following order:

1. multiple family housing
2. commercial
3. active recreation
4. single family housing
5. light industrial
6. passive recreation

5.2 Site variables

The site variables will be ranked according to their relationships with each particular land use, again according to the preferences of the user. The site variables to be used are the following:

1. topographic slope
2. orientation of slope
3. surface drainage

4. depth to bedrock
5. subsurface drainage
6. soils by composition
7. vegetation stability
8. vegetation preference
9. visual access to landscape features
10. visual absorption
11. perceptual carrying capacity

The site variables will be ranked in the following manner, with respect to each individual land use: (The author assumes here that he is the user: any arrangement is permissible.)

1. multiple family housing
7,1,3,4,5,6,9,10,8,2,11
2. commercial
9,7,1,3,4,5,6,2,8,10,11
3. active recreation
7,1,3,5,2,4,6,8,9,10,11
4. single family housing
7,1,2,3,4,5,6,9,8,10,11
5. industrial
7,1,3,4,5,6,2,8,9,10,11

6. passive recreation

9,1,3,7,4,8,6,5,10,11,2

5.3 Distance relationships

Relationships between activities will be measured in terms of flight-line distance. There will be a maximum allowable and a minimum allowable distance established between land use pairs. The possible conditions are:

1. no maximum distance restrictions
no minimum distance restrictions
2. maximum distance restrictions
no minimum distance restrictions
3. no maximum distance restrictions
minimum distance restrictions
4. maximum distance restrictions
minimum distance restrictions

In the case where the imposed distance constraints are too restrictive, the maximum distance limits will be removed, and a location sought outside that limit. If it is still not possible to locate the activity

due to proximate restrictions, the minimum distance restrictions will then be removed.

It seems necessary, for each cell evaluated, to compare the distance between that cell and every located, minimum distance related land use member to the allowable specified distance. As minimum distance constraints may require an extremely large amount of calculations, a heuristic has been utilized to reduce the amount of work required in determining whether or not a location is outside of the minimum allowable distance limitations.

To reduce the effort required, and hopefully achieve a comparable result, the located land use, to which the current land use is related by a minimum distance constraint, will be utilized as the search origin. The search area will consist of cells at a distance of at least the minimum allowable distance, and within the maximum.

The search routine will be structured so as to allow a minimum distance constraint only with the highest related land use. This is done because minimum distances will not be measured, as they are automatically

incorporated in the search diameter, about the search origin. The subsequent location will be outside the prescribed minimum distance.

All distance constraints will be given in units of cell size.(ie. the dimension of the cell, 200 feet.)

The distance limitations to be used for this study are listed in Table 5.3.a.

Table 5.3.a

Distance relationships (to be used for this study)

maximum distance limitations:

	passive recreation	single family housing	multiple family housing	active recreation	commercial	light industrial
passive recreation						
single family housing		10	20			
multiple family housing		20	2	12	15	
active recreation			12	2		
commercial			15		1	
light industrial						1

Minimum distance restrictions:

passive recreation						
single family housing						
multiple family housing			15			
active recreation						
commercial						
light industrial						

5.4 Status levels

Each site variable may have one or more sets of limits, above or below which the requirements of a particular land use will be fulfilled. These limits may define both adequate and acceptable capability and suitability ratings for a particular land use, with respect to the site variable under investigation. These 'acceptable' status levels will be recorded for each site variable, with respect to each land use, along with the desired or optimum status level. These limits are recorded in table 5.4.a., the first column representing the maximum, the second the optimum, and the third the minimum allowable.

	max.	opt.	min.	light industrial	commercial	active recreation	multiple family	single family	passive recreation
topographic slope	3, 1, 1	2, 1, 1	9, 9, 5	3, 1, 1	9, 9, 5	3, 1, 1	9, 9, 7		
orientation of slope	3, 2, 2	3, 2, 2	4, 1, 1	3, 2, 2	4, 1, 1	3, 2, 2	8, 8, 5		
surface drainage	9, 9, 7	9, 9, 6	3, 2, 2	9, 9, 5	9, 9, 5	9, 9, 5	9, 9, 5		
sub-surface drainage	9, 9, 7	9, 9, 7	9, 9, 7	9, 9, 7	9, 9, 7	9, 9, 7	9, 9, 5		
depth to bedrock	9, 9, 7	9, 9, 1	9, 9, 7	9, 9, 7	9, 9, 7	9, 9, 7	9, 9, 7		
soils by composition	9, 9, 7	9, 9, 2	9, 9, 7	9, 9, 7	9, 9, 7	9, 9, 7	9, 9, 7		
vegetation stability	9, 9, 1	9, 9, 1	9, 9, 7	9, 9, 6	9, 9, 5	9, 9, 5	9, 9, 5		
vegetation preference	9, 9, 1	9, 9, 1	9, 9, 1	9, 9, 5	9, 9, 5	9, 9, 5	9, 9, 5		
visual access to unique feature	9, 9, 1	9, 9, 1	9, 9, 1	9, 9, 5	9, 9, 5	9, 9, 5	9, 9, 5		
visual absorption	9, 9, 1	9, 9, 1	9, 9, 1	9, 9, 1	9, 9, 1	9, 9, 1	9, 9, 5		
perceptual carrying capacity	9, 9, 1	9, 9, 1	9, 9, 1	9, 9, 1	9, 9, 1	9, 9, 1	9, 9, 1		

Passive Recreation to Use
All Left-over Land.

Table 5.4.a Status Levels

6.0 Specific Modelling Techniques

6.1 Search origins

A search origin will be defined as the point, location or cell from which a search pattern will be generated.

In attempting to locate the first priority land use, only site variables may be taken into consideration, as no other land uses have been located, and distance relationships cannot be evaluated.

Within the site, many possible 'acceptable' locations may exist. These locations, or aggregations of locations may be spread out over the complete site. It is therefore necessary to determine which of the locations is more suitable for the land use.

This location will be determined by the number of optimum status levels immediately surrounding that location. The distance from that location to optimum status level value cells of all other site variables will also be taken into account. The distance measure should reflect the number of cells to be searched before an acceptable location is found.(ie. As the distance increases, the number of cells to search will also increase.) See figure 6.1.a.

The search diameter will be approximately ten cells. That is, it may be possible that each cell, within an area covered by one hundred cells, will be evaluated if no 'acceptable' locations are found sooner. Therefore, it would not be necessary to find more than one concentration of optimum status levels within a ten by ten area, provided that the highest concentration is found within that area.

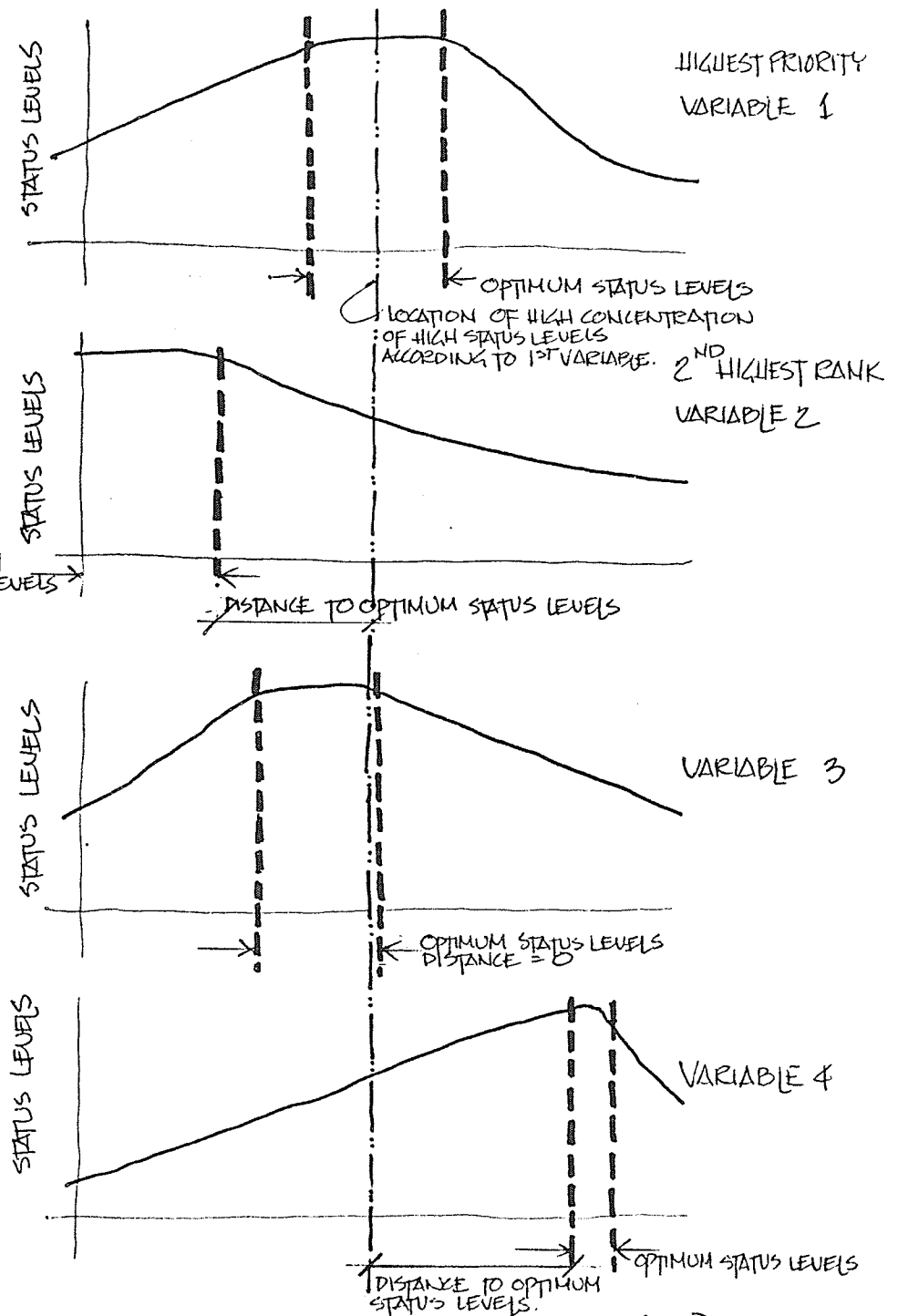
The complete site under investigation will be subdivided into a super grid composed of cells of one hundred acres. This grid will in turn be superimposed over the data grid cells.

In this model, the size of the extra large grid cells will be eleven cells by thirteen cells. This size will be used because it closely approximates the ten by ten; as well as being a convenient size to cover the Leaf Rapids site/area.

The data map representing the highest ranking site variable will be taken from the data bank, and the large grid superimposed on it. See fig.6.1.a. The highest concentration of optimal status levels is then found within each large grid cell. A search origin is then

Ranking Search Origins

SECTIONS THROUGH LARGE GRID CELL



DISTANCES ARE SUMMED; SHORTEST DISTANCE (SUM) IS RANKED FIRST.

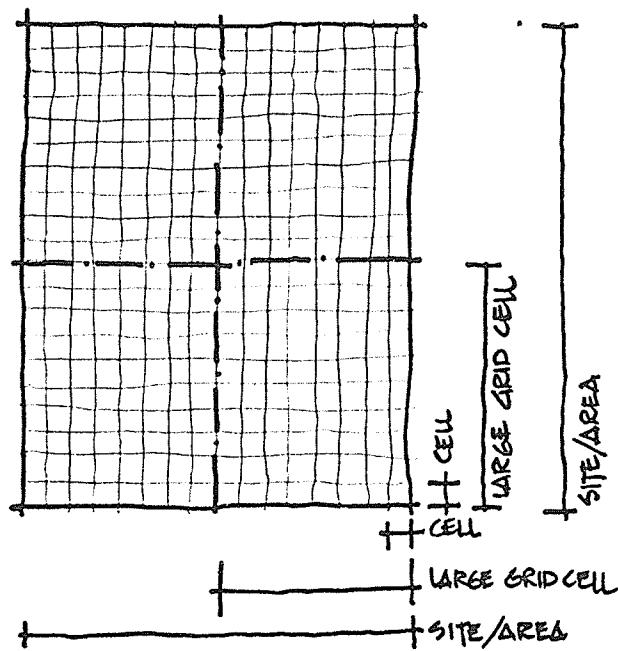
Figure 6.1.a

located, as close to the middle of each concentration as possible.

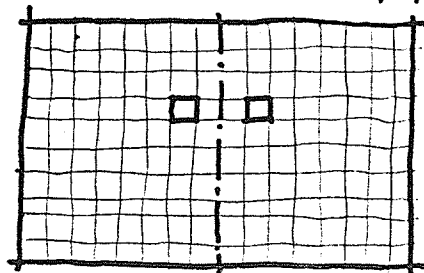
Locating the high concentrations can still lead to inaccurate or misleading results. Concentrations, in two neighbouring large cells, grouped close to their common boundary would seem to indicate a concentration of optimal status levels across that boundary. In order to account for this eventuality, the search for the concentration will overlap the large grid boundaries to a depth of two cells. This will allow a search origin to be located on the boundary, and also allow two large grid cells to specify the same search origin. See fig.6.1.b

The search origins obtained by the above method must then be ranked according to the possibility of acceptable locations to be found quickly in their immediate surroundings. The ranking will be done according to the distance to optimal status level cells of the remaining site variables. The shortest distance will be ranked first, and used as the search origin for the location of the first priority land use, as well as other land uses related by distance to the first located land use. See figure 6.1.a.

In the case where the land use being located has no distance relationships to previously located land uses, new search origins will be established and ranked, using the map representing the highest ranked variable associated with that land use.

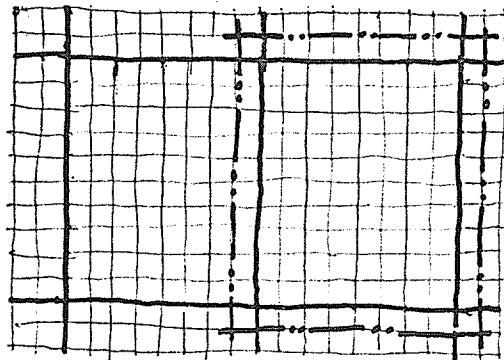


TWO LARGE NEIGHBOURING GRID CELLS



THE TWO CELL LOCATIONS INDICATE THE RESPECTIVE HIGH CONCENTRATIONS WITHIN THE TWO LARGE GRID CELLS.

THIS WOULD SEEM TO INDICATE A HIGH CONCENTRATION OF HIGH STATUS LEVEL VALUES ACROSS THE BOUNDARY BETWEEN THE LARGE GRID CELLS.



SOLID LINES INDICATE BOUNDARIES OF LARGE GRID CELLS.

BROKEN LINE INDICATES OVERLAPPING AREA WITHIN WHICH HIGH CONCENTRATION OF OPTIMUM STATUS LEVELS IS FOUND.

Figure 6.1.b

6.2 Distance Relationships

Distance relationships will be evaluated in terms of 'fit' or 'misfit'.

Assuming that a land use has been located on the site/area, a check will be made to determine whether any distance relationships exist between those land uses already located and the land use being located.

If no distance relationships exist between them, a search origin will be sought according to the highest priority site variable associated with the current land use. That land use, and all its 'members' will be located according to site variables alone.

The highest ranking located land use will be checked first. If a maximum allowable distance restriction exists, it will be compared to the distance between the cell under investigation and the location of the already located land use.

If the distance between the two cells is outside the allowable limits, a new location or cell will be sought by the search procedure. If the new location is within the proximate limits, then the procedure will be repeated for the next ranking located land use, until all located land uses have been checked

according to the distance relationships between themselves and the land use being located.

The distance between the new location and all related located land uses is thus compared to the allowable distances imposed by the user. If the location is within all the limits, the placement will then be evaluated with respect to the site variables.

However, if the location falls outside any of the imposed limits, another location or cell will be sought and this procedure repeated.

It is possible to impose distance relationships or constraints too restrictive to locate a land use. If this situation occurs, the maximum allowable limit will be removed and a location sought.

6.3 Suitability Evaluation

Assuming that the cell is within the distance limits imposed by the user, it will be evaluated according to suitability, or the collective capabilities of the site variables.

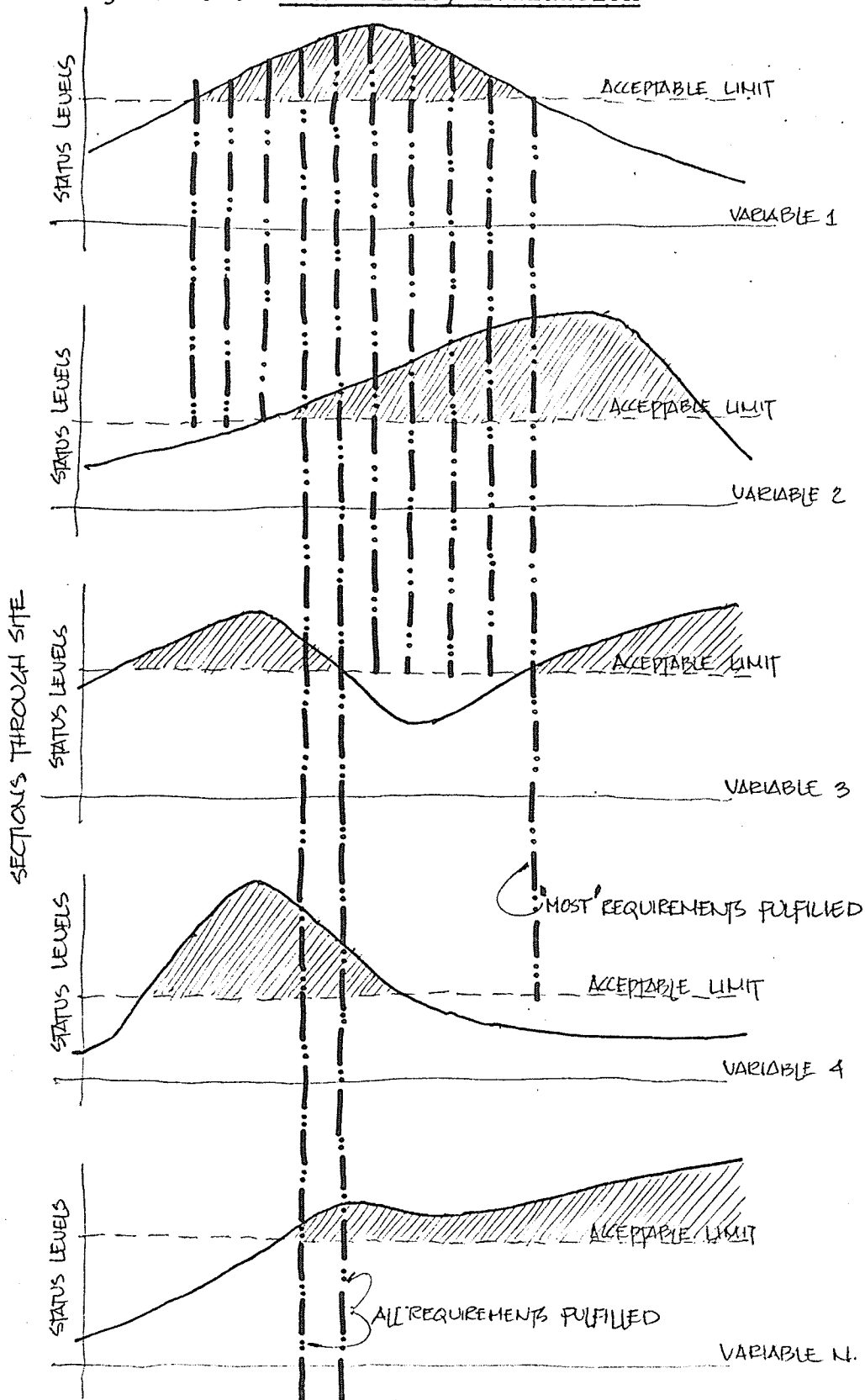
The map representing the highest ranking site variable, associated with the land use being located, is taken from the data bank.

The status level of the corresponding cell in that map is compared to the acceptable limits specified by the user, for that site variable. If the status level is within those limits, then the map representing the next ranking variable is taken from the data bank. Again, the status level of the cell is compared to the allowable limits imposed on that variable. The status levels of that cell are summed as each variable is checked.

Provided that the status level of each site variable is within the imposed limits, the cell becomes a possible land use location. If a number of such locations are found, the land use will be located on the cell having the highest status level sum.

If no possible locations are found, within the distance limits, then the land use will be located on the cell fulfilling the most requirements. See fig.6.3.a

Figure 6.3.a Suitability Evaluation



SHADED AREAS REPRESENT 'ACCEPTABLE' STATUS LEVELS WITHIN THE SITE. IF THE BROKEN LINE PASSES THROUGH THE ACCEPTABLE LIMIT, THEN THE REQUIREMENTS OF THAT LAND USE ARE FULFILLED AT THAT LOCATION.

6.4 Search Procedures

Provided the land use being located is the first to be located, or if it is not related by distance to any previously located land uses, a search origin will be sought according to the locations of concentrations of optimum ststua levels.

But; if the land use being located is related by distance to some previously placed land use or land uses, then the location of the highest ranking related land use will become the search origin.

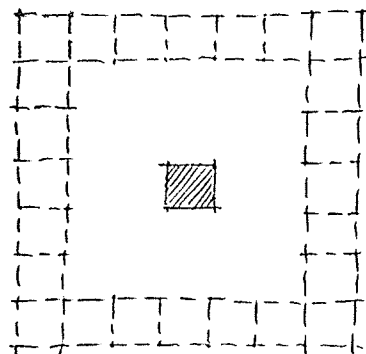
The search procedure consists of passing the locations of cells within the search area to the distance evaluator. The first time, each cell, within a ring at a radius of the maximum allowable distance (or minimum), surrounding the search origin, will be passed to the evaluator. The cells chosen in this manner describe a ring about the search origin. See fig.6.4.a Possible locations within this ring will be noted, and the 'best' cell used as the the land use location.

If no possible locations are found within the ring, then the radius of the ring is decreased (or increased in the case of minimum distance) by one cell, thus allowing the evaluation of cells adjacent to the

to the first ring. If no locations are found, the ring may be decreased until only the search origin remains. In the case of minimum distance, the maximum diameter will be the minimum plus at least five cells, if no maximum distance is specified.

Having located the first member of a land use, all remaining members will use the location of the first member as a search origin, assuming they are related. This should decrease the number of cells searched, as members of one land use are generally required to be located closer together.

Figure 6.4.a Search Ring About Search Origin



7.0 Programming Technique: (See fig.7.0.a,7.0.b,7.0.c)

First; the highest priority land use is taken from the data/input, along with the highest priority site variable associated with that land use.

Second; if no activities have been located previously, or if the activity being placed has no relationships to activities already located, the placement procedure adopted is unique, in that the site variables alone determine the 'maximized' location.

Third; if only the site variables are to be used for the land use placement, the matrix representing the highest priority site variable will be divided into area/cells of approximately 100 acres. A location which provides the greatest possibility of fulfilling the requirements of that land use, with respect to that particular site variable, will be sought in each area/cell. This location will become the 'search origin'.

Fourth; the search origins will then be ranked according to the possibility of all site variables fulfilling the requirements of that land use, at a location near the search origin.

Fifth; the highest ranking search origin will be used as the starting point of the search procedure, in an attempt to locate the activity.

Sixth; if activities have already been placed, and the current activity is related to one or more of them, according to proximate restrictions; then the location of the related activity of highest priority will be used as the search origin, and the search procedure will be initiated.

Seventh; the search procedure will consist of passing the cells, within the search area, to the evaluator. If all cells of the search area have been evaluated and no 'acceptable' locations have been found, the search area size may be increased, or the proximate restrictions may be loosened or removed, all depending on why no 'acceptable' locations were found.

Eighth; the evaluation procedure will evaluate the proximate restrictions between the cell being evaluated and the search origin. The distance between the

two cells will be calculated and compared to the allowable distance between the two activities.

Ninth; if the measured distance is within the imposed limits, then the same evaluation is carried out between that cell, and the location of the next highest ranking, located land use. This procedure is repeated until there are no more related and located land uses.

Tenth; if the evaluator encounters the situation where the distance between the location of the cell and the location of the related land use is not within the allowable distance limits, control will be passed back to the search procedure.

Eleventh; if a location is within all allowable distance limits, that location or cell is further evaluated according to the restrictions or requirements set by the land use with respect to the site variables or capabilities.

Twelfth; in the capability evaluation, the

matrix representing the highest ranking site variable, with respect to the land use being currently located, will be used first.

Thirteenth; the status level within that matrix, at the location being evaluated, will be compared to the input/data levels which define the 'acceptable' limits within which the status level may fall, if it is to fulfill the requirements of the land use. Each land use may have different 'acceptable' limits, for each site variable.

Fourteenth; if the status level of that location falls within the 'acceptable' limits, the same procedure will be carried out with the next highest ranking site variable.

Fifteenth; if the status level fails to fall within the acceptable limits, then the rank of the last site variable passed through will be recorded along with the location, and control will be passed back to the search procedure.

Sixteenth; if the location is acceptable through all variables, all the status levels will be summed and recorded, along with the location, and control passes to the search procedure again.

Seventeenth; when the search area limits are reached, and 'acceptable' locations exist, that location, within the distance limits, with the highest status level sum will be used as the location of that land use.

Eighteenth; in the case where no 'acceptable' locations exist, the location with the most variables searched will be used as the land use location. The most searched variables seem to point to the location where the greatest number of site variables fulfill the requirements of the current land use.

Nineteenth; these procedures are repeated until all land uses have been located.

Figure 7.0.a

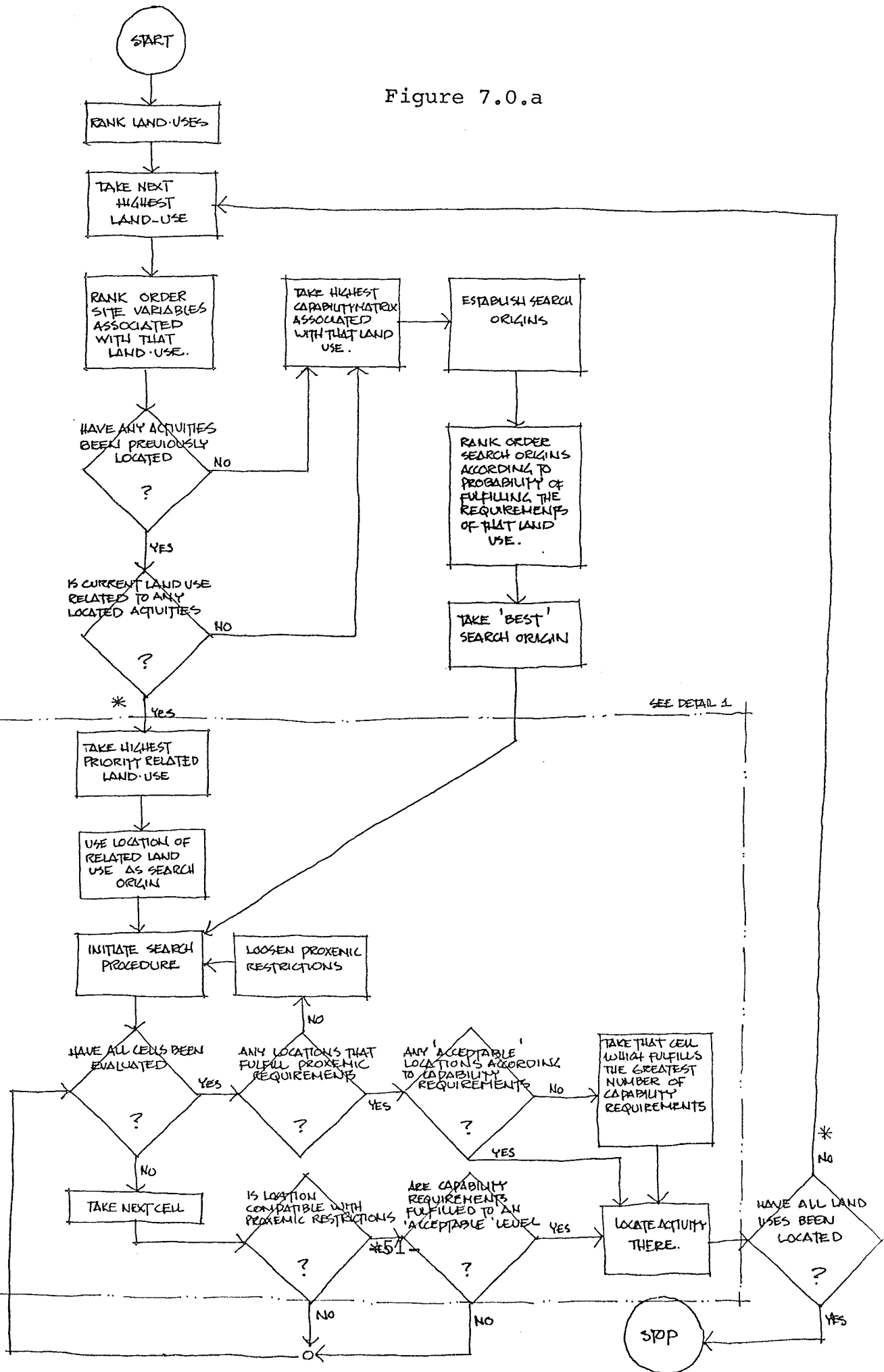
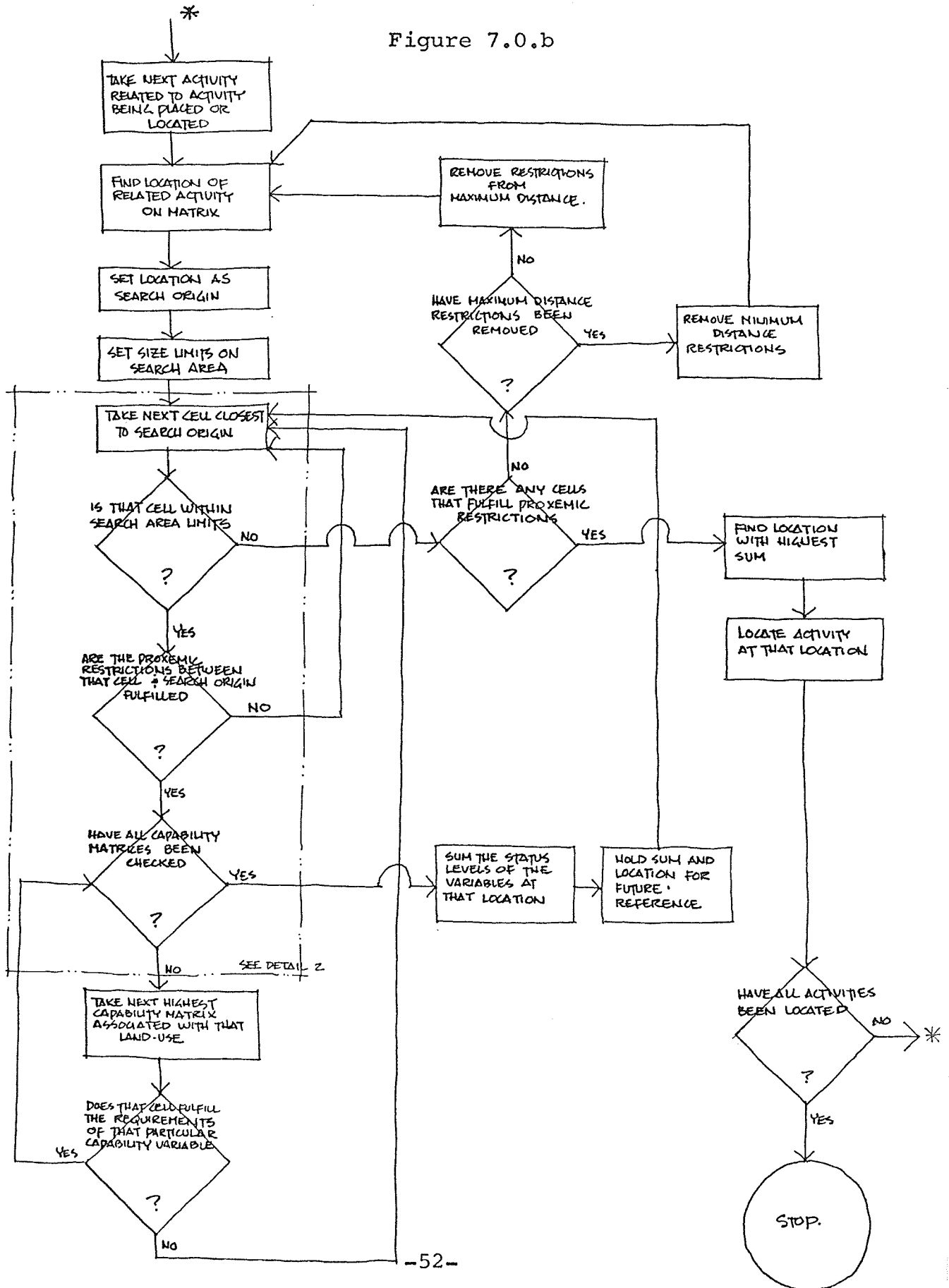


Figure 7.0.b



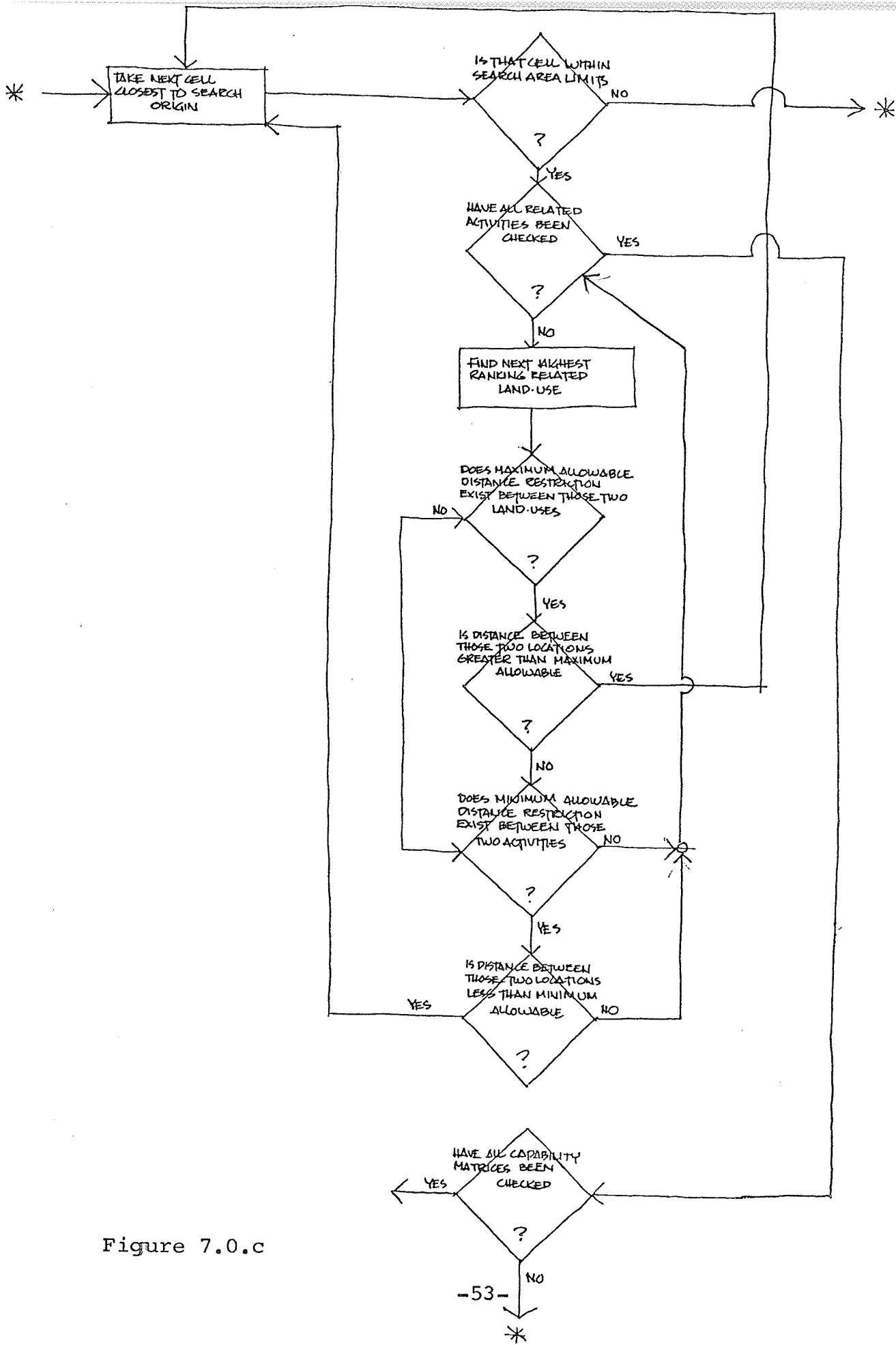


Figure 7.0.c

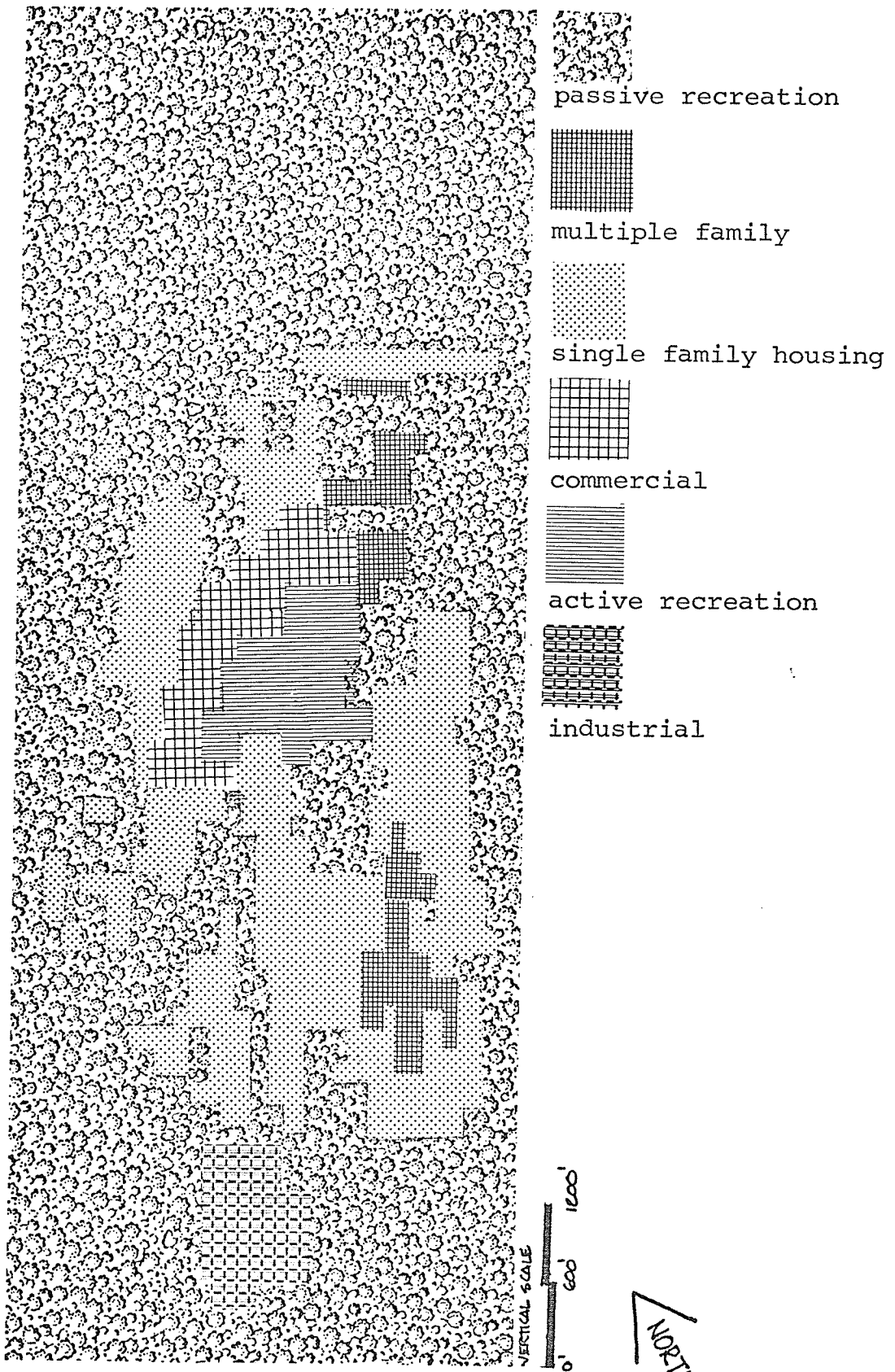
8.0 Conclusions

8.1 Plan 1: control plan See Map 8.1.a

The cells chosen for active recreation reflect very restrictive requirements for the site variables, within the area described by their proximate requirements or relationships to the multiple family housing. In order to improve the capability/suitability ratings, there are two possible choices. The first is to increase the permissible area for location (relax distance relationships) or relax the requirements of the site variables. In the case of active recreation, it may be necessary to investigate the requirements of the second ranking variable, and subsequent variables.

The locations for cells allocated for commercial land use also appear too restrictive from the fifth ranking variable on.

Single family residential housing was the most poorly located according to suitability/capability. Eighty-six percent of all chosen cells fulfilled only the first ranking variable. The restrictions placed on the second variable need investigation, for possible relaxation, and possibly some of the subsequent priority variables.



Map 8.1.a

Note: Scale and legend apply to all maps in section 8.0

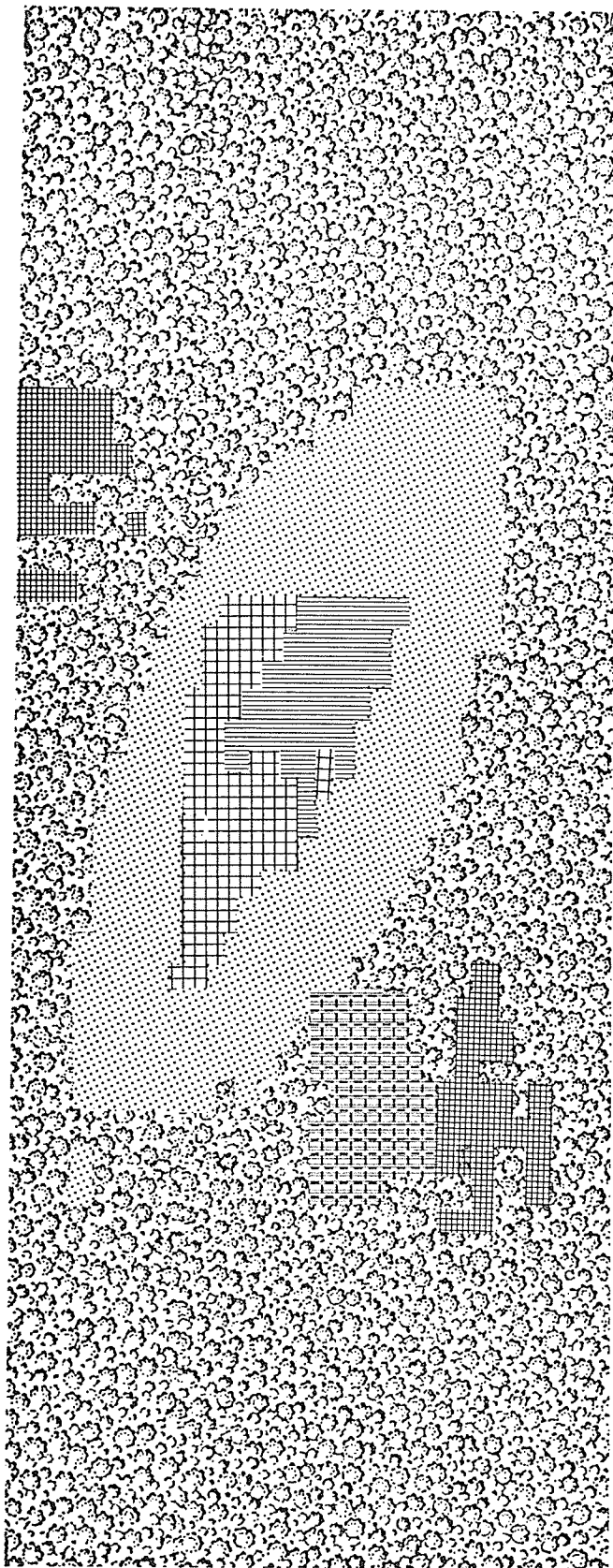
8.2 Plan 2; Change in proximate relationships See Map 8.2.a

By increasing the minimum allowable distance between the two groups of multiple family housing, the second group failed to find any locations fulfilling the requirements of more than the first three ranking variables.

The distance relationships imposed upon both active recreation and commercial land uses, with respect to the multiple family housing, severely limited the area for their location. Consequently, the suitability/capability ratings of the chosen cells were very low, with the majority fulfilling the requirements for only the first four variables.

Single family housing still remained poorly located, although somewhat worse. It was worse because fifty-eight percent of the located cells failed to fulfill even the first priority variable. This was due probably to the extremely limited area, imposed by proximate, relationships, within which locations could be sought.

As the industrial land use was not related by distance to other activities, and was allowed to seek its own location, the majority of cells fulfilled at least the first six variables.



Map 8.2.a

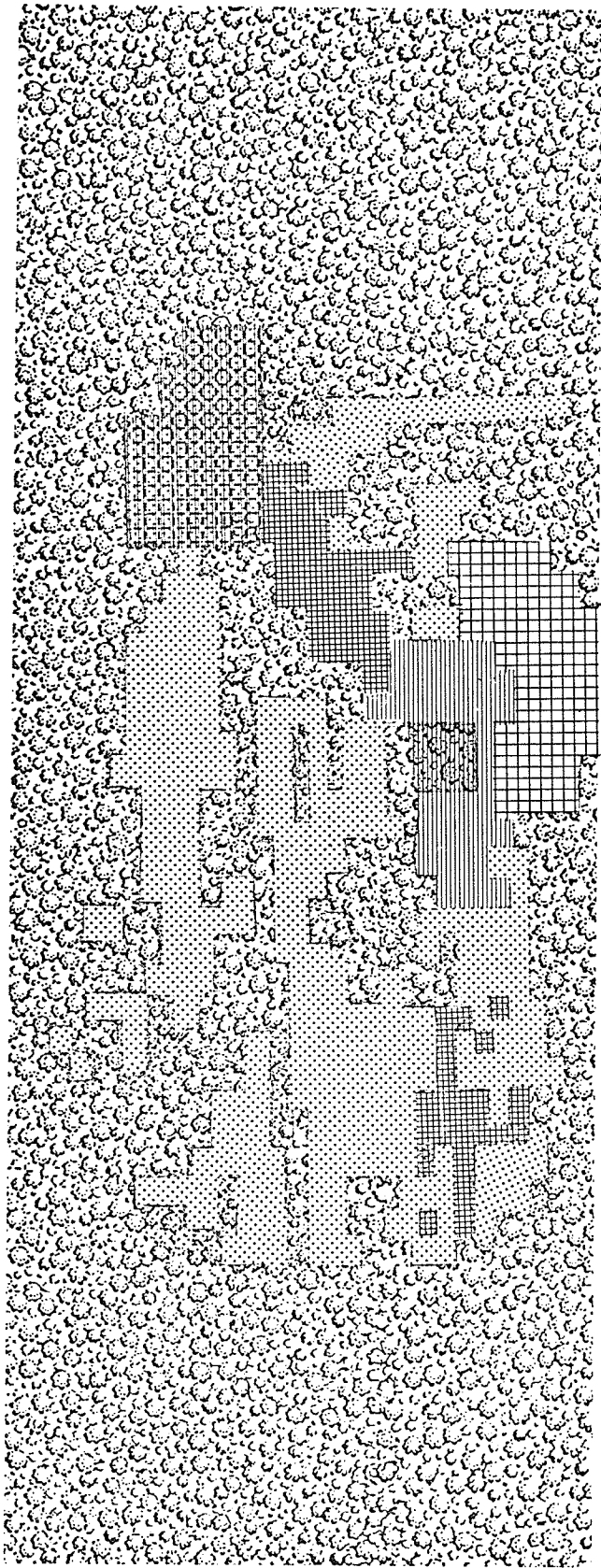
8.3: Variable priority change See Map 8.3.a

In the case of variable priority changes, the site variables associated with the multiple family housing were assigned different ranks or priorities. The first priority variable seven, was changed to become the second ranking variable, while the previous second ranking variable became the first priority.

Active recreation cells generally fulfilled only the first three variables. This would seem to indicate requirements are too restrictive on the fourth and perhaps subsequent variables. The proximate restrictions may also be too restrictive.

Seventy six percent of cells chosen for commercial fulfilled only the first variable requirements. It would seem that the requirements of the associated site variables are too restrictive.

Single family housing was located at locations eighty nine percent of which failed to fulfill the first variable. Therefore, at least the requirements of the first priority variable must be relaxed.

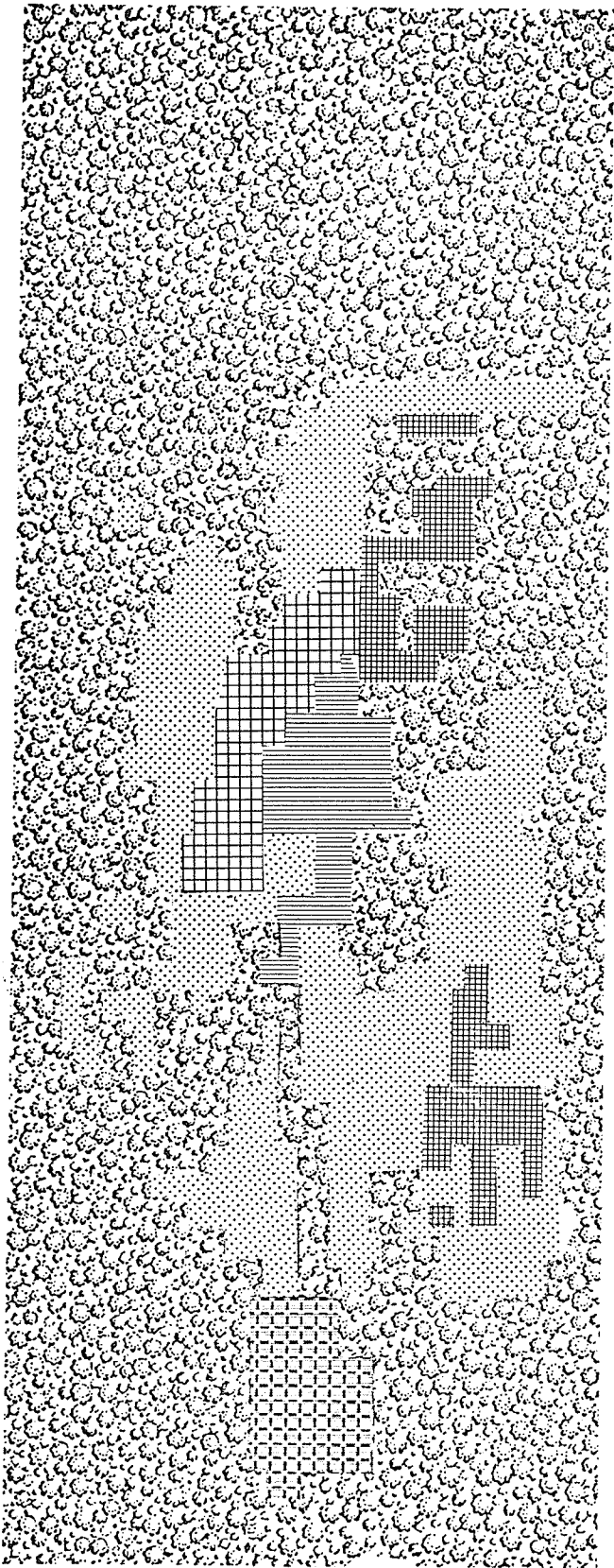


Map 8.3.a

8.4 Plan 4: Variable priority change See Map 8.4.a

In this case, site variable priorities were changed for the active recreation land use. The first priority variable, nine, was changed to third priority, while the third priority variable, one, became the highest priority.

All activities were located in the same general area, although some of the individual cells of the active recreation did shift location, though not markedly.

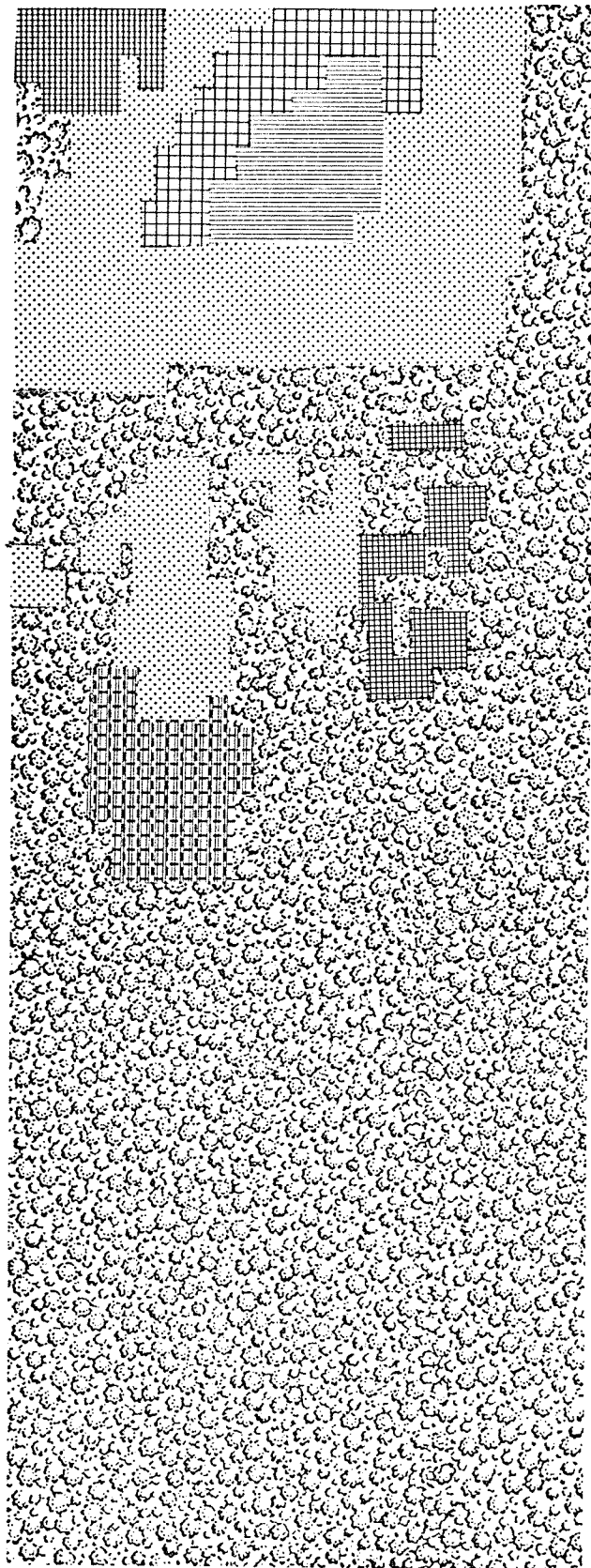


Map 8.4.a

8.5 Plan 5: Change in optimal status levels See Map 8.5.a

Optimal status levels for the highest priority variable were changed, from one to two, with respect to the highest priority land use, multiple family housing. The whole plan was shifted to the north end of the site. The degree of fulfillment of capability/suitability remained generally the same as in previous 'runs'.

The shift in location is probably due to the fact that in the first run, the optimal status level of the highest priority variable was one, and there did not exist any cells with that status level. Consequently the locations were found according to the remaining variables. The second run utilized a status level of two, of which there were many cells, concentrated near the north of the site/area.



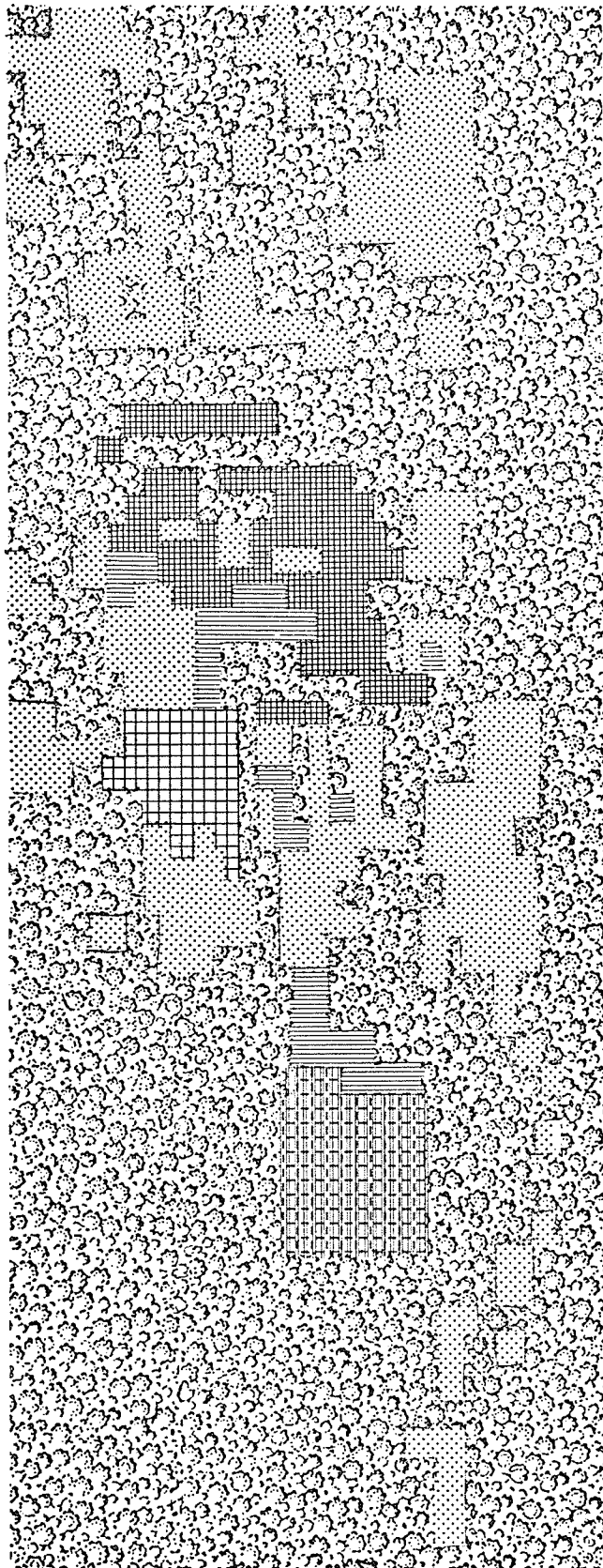
Map 8.5.a

8.6 Plan 6: Land use priorities changed See Map 8.6.a

In this case, the order of land use placement was changed. Commercial was located first, with multiple family, active recreation, single family housing and industrial were located in that order.

As the order of placement affected the possible proximate relationships, these too were changed, although an attempt was made to keep them as close as possible to those utilized in the control 'run'.

Capability/suitability ratings remained generally the same as in the control run.



Map 8.6.a

9.0 General conclusions

1. Requirements of variables for single family housing seemed to be overly restrictive. A majority of cells failed to fulfill the first variable. It could be that this variable should not be ranked as the highest priority variable. Assuming it must be ranked as the highest, the 'acceptable' limits must be increased to provide a wider range of 'acceptable' cells.

2. The system is biased in location towards the top left hand corner. This is due to the programming technique utilized for choosing evaluated cells.

The biety occurs when all evaluated cells have the same suitability/capability rating. In this case, the first cell chosen, at the top left corner of the search area will be used as the location of the land use.

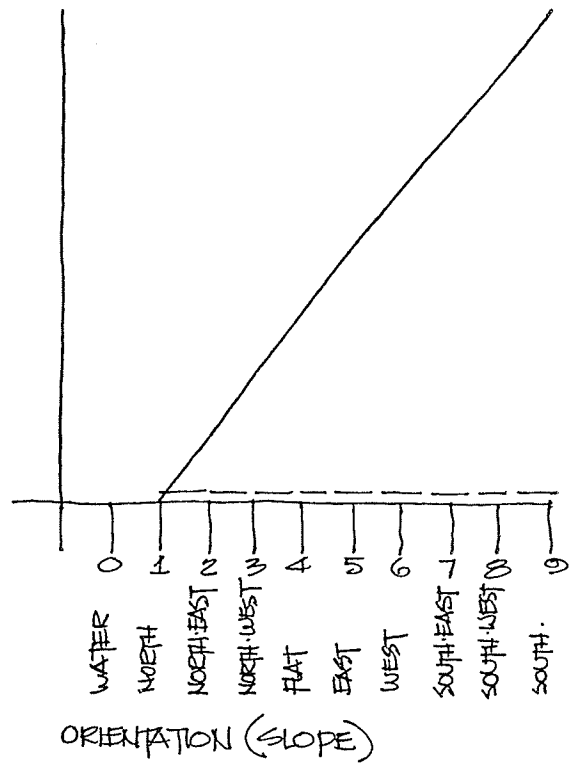
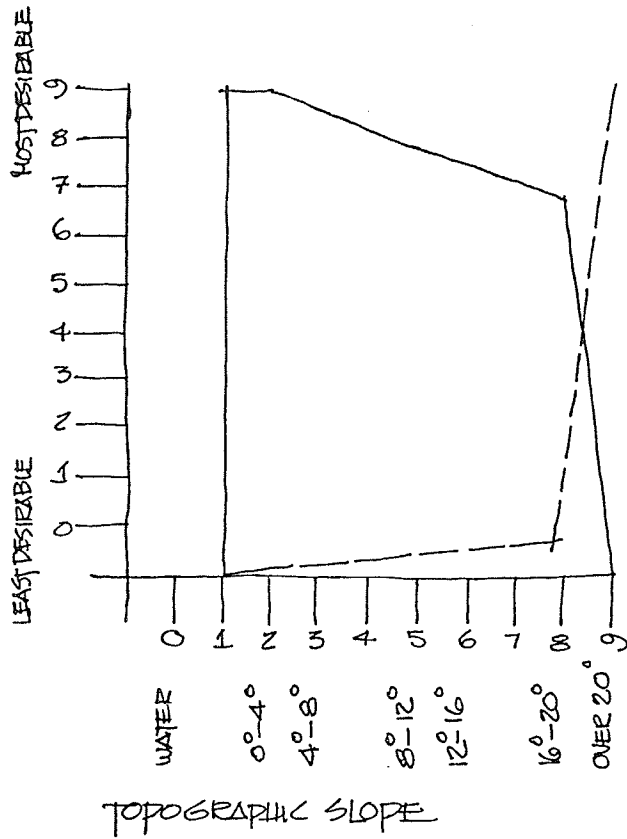
3. The system does appear to choose the 'best' cells from the areas designated or described by the proximate relationships.

10.0 Recommendations

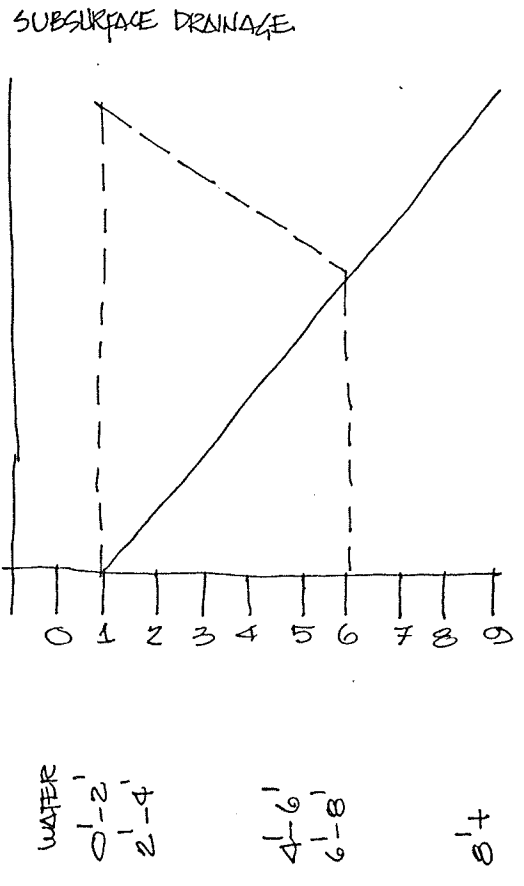
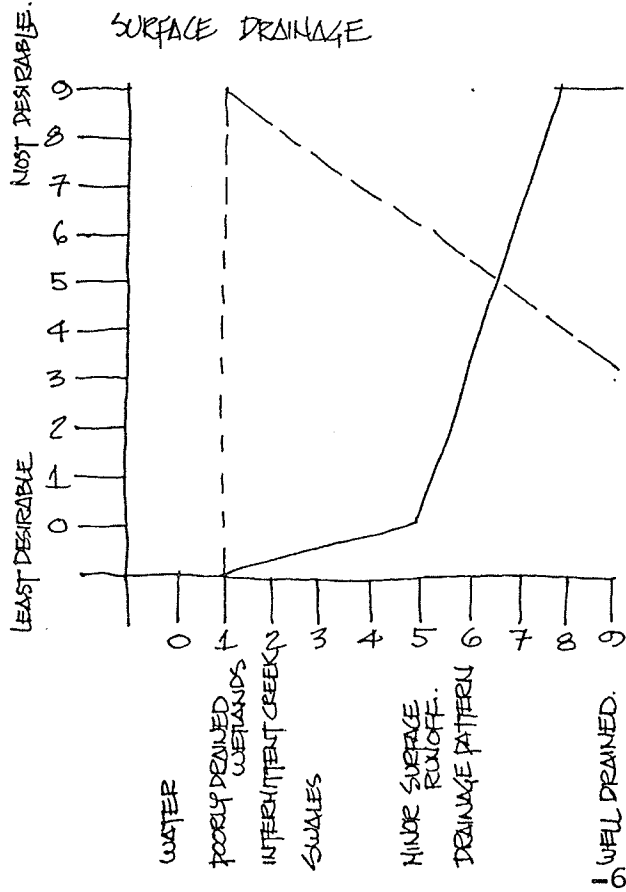
1. It would be beneficial to be able to reverse the procedure within the system, so as to be able to use the locations of the land uses as input, and the priorities used, in establishing those locations, may be derived. This would function as an evaluating technique whereby plans could be analyzed to produce their imposed priorities.
2. The suitability/impairment curves (fig.4.5.a,b,c and Appendix A) are in great need of future work to enable designers and users to more precisely define suitability and impairment.
3. A method should be devised to evaluate minimum distances without checking every previously located and related land use: this would reduce the large amount of 'run' time used in this routine.
4. In order to make the model more sensitive to proximate relationships, it would be advisable to increase the number of land use groups. (eg. single family housing: ten groups of 28 cells, instead of one group of 280 cells.)

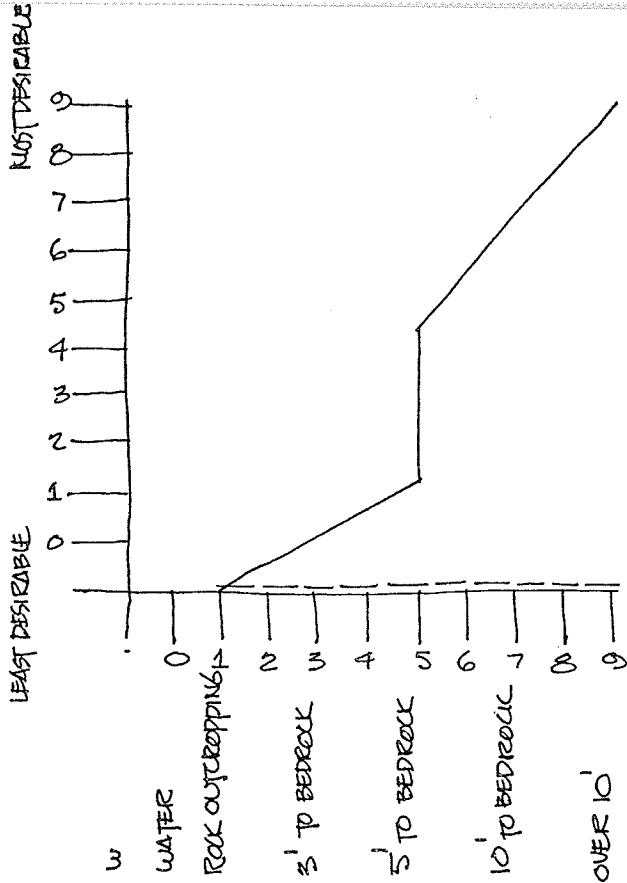
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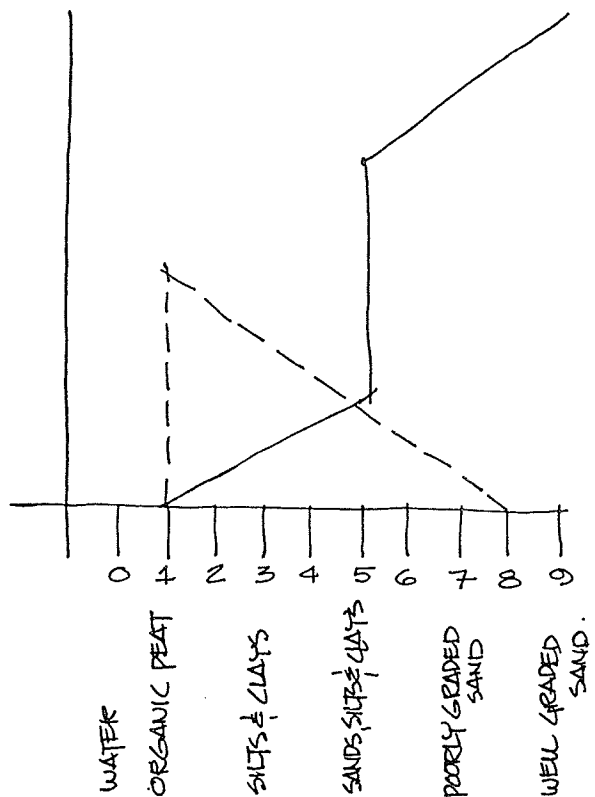


SINGLE FAMILY HOUSING.





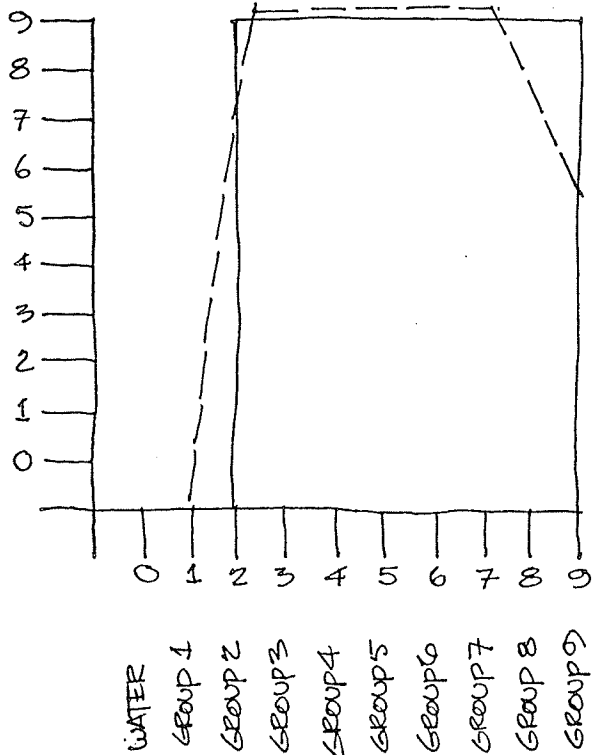
DEPT TO BEDROCK



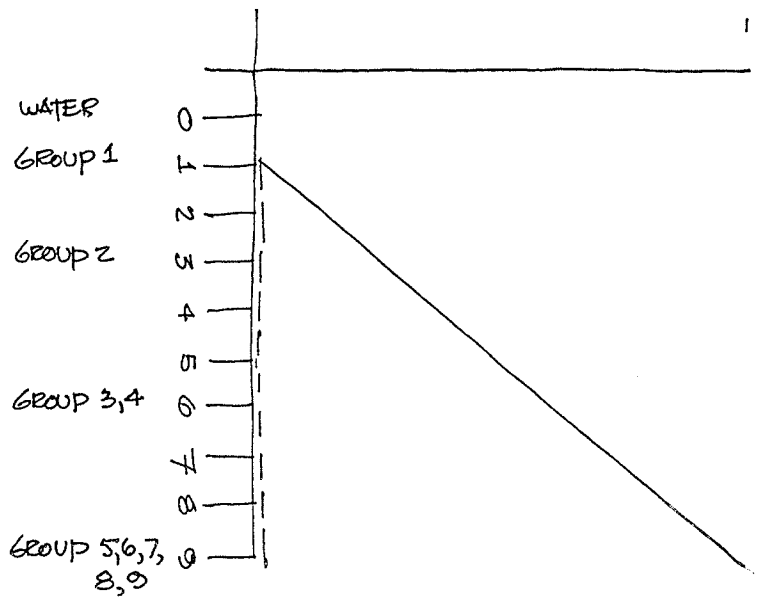
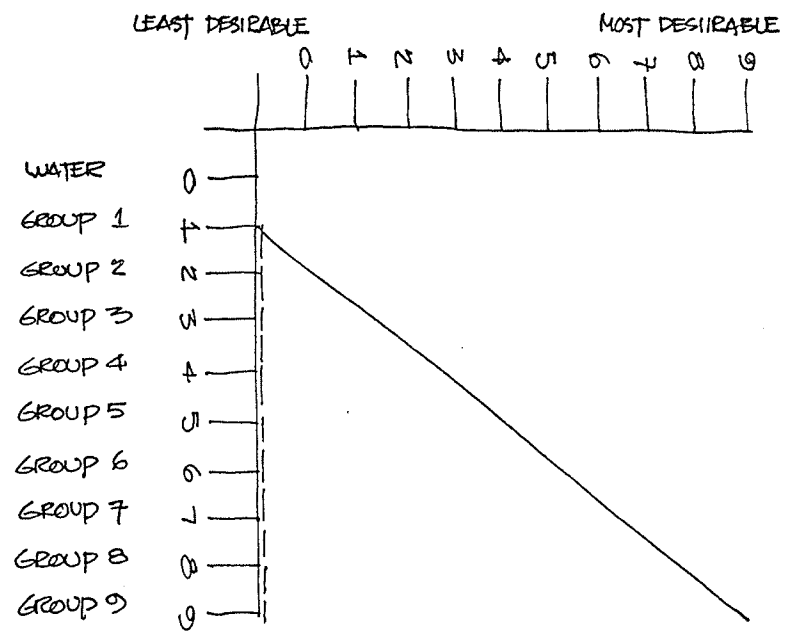
SOILS BY COMPOSITION.

SINGLE FAMILY HOUSING.

VEGETATION STABILITY.



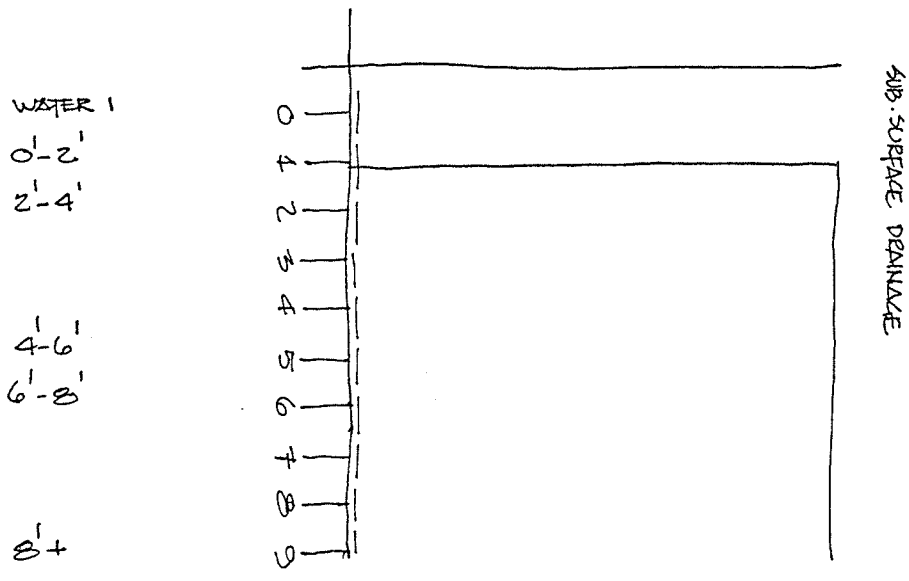
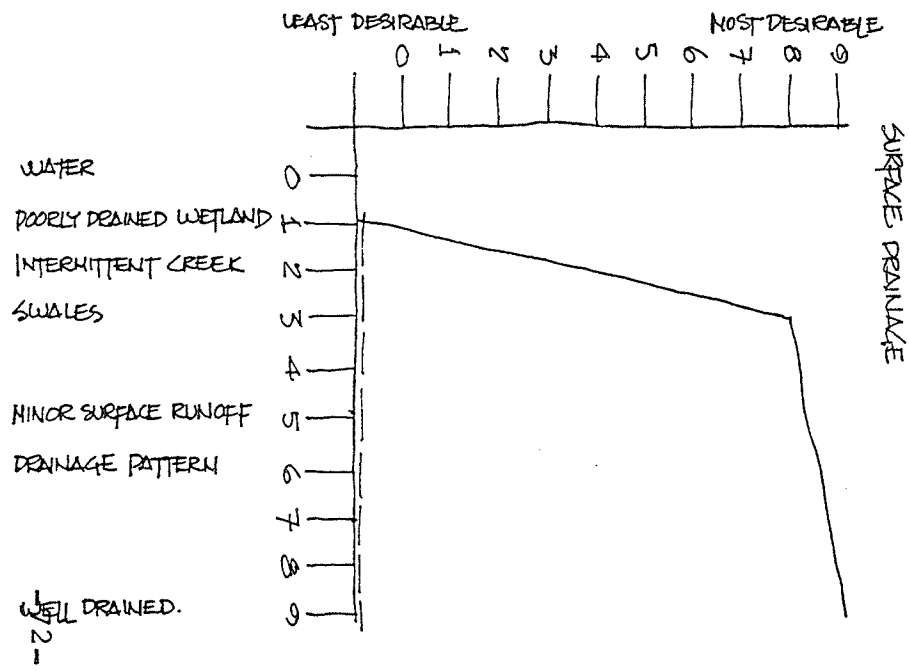
- GROUP ONE: LOW VEGETATION COVER, MUSKEG & BOG.
- GROUP TWO: UNDERDEVELOPED, DWARF OR STAGNATING CONIFEROUS TREES.
- GROUP THREE: YOUNG CONIFEROUS TREES IN DENSE STAND
- GROUP FOUR: OVERMATURE CONIFEROUS IN DENSE STAND
- GROUP FIVE: OPEN BLACK SPRUCE, WHITE SPRUCE AND JACKPINE WITH NO UNDERSTORY REGENERATION.
- GROUP SIX: OPEN BLACK SPRUCE, WHITE SPRUCE AND JACKPINE WITH GOOD UNDERSTORY REGENERATION.
- GROUP SEVEN: OPEN OR CLOSED DECIDUOUS STAND
- GROUP EIGHT: MIXED DECIDUOUS AND CONIFEROUS TREES WITH NO UNDERSTORY REGENERATION.
- GROUP NINE: MIXED DECIDUOUS AND CONIFEROUS TREES WITH HEALTHY UNDERSTORY REGENERATION.



VEGETATION PREFERENCE

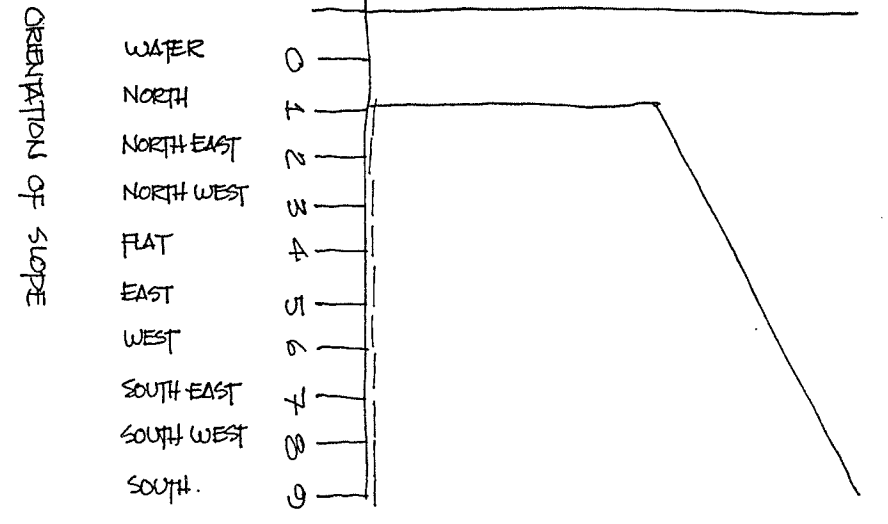
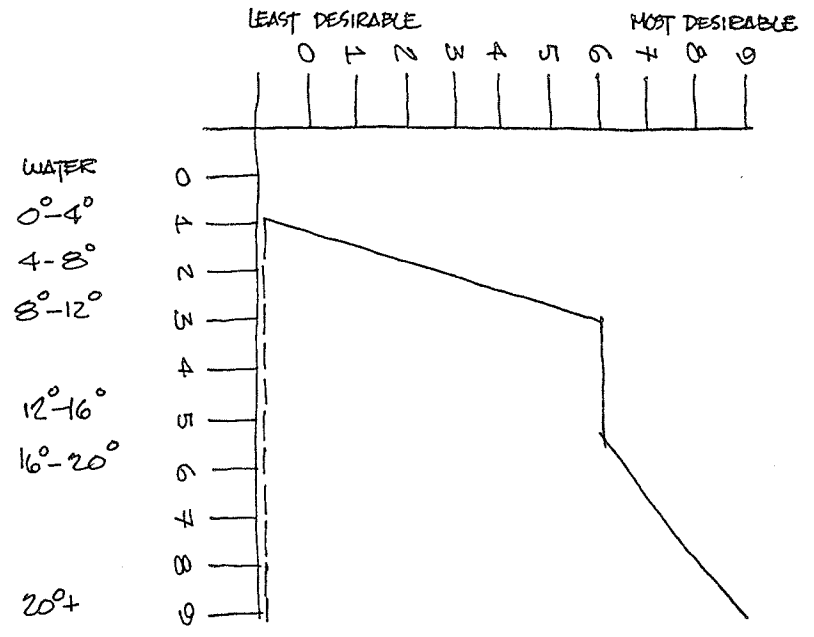
SINGLE FAMILY HOUSING.

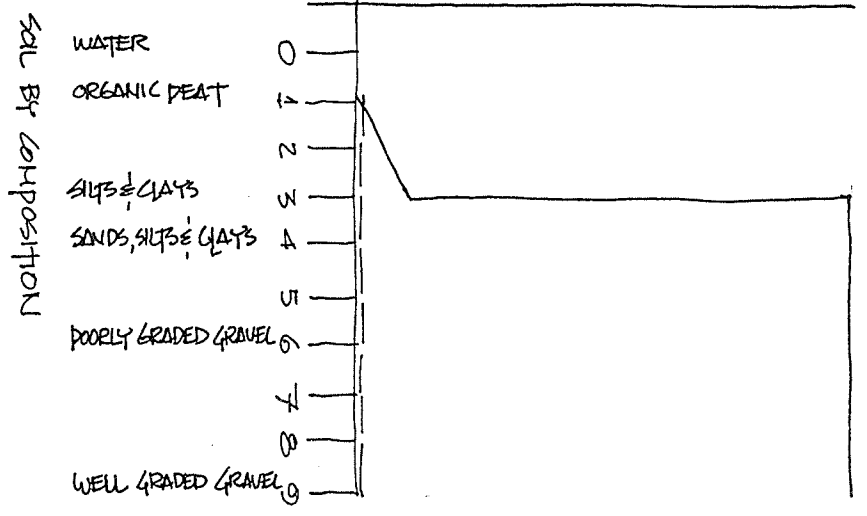
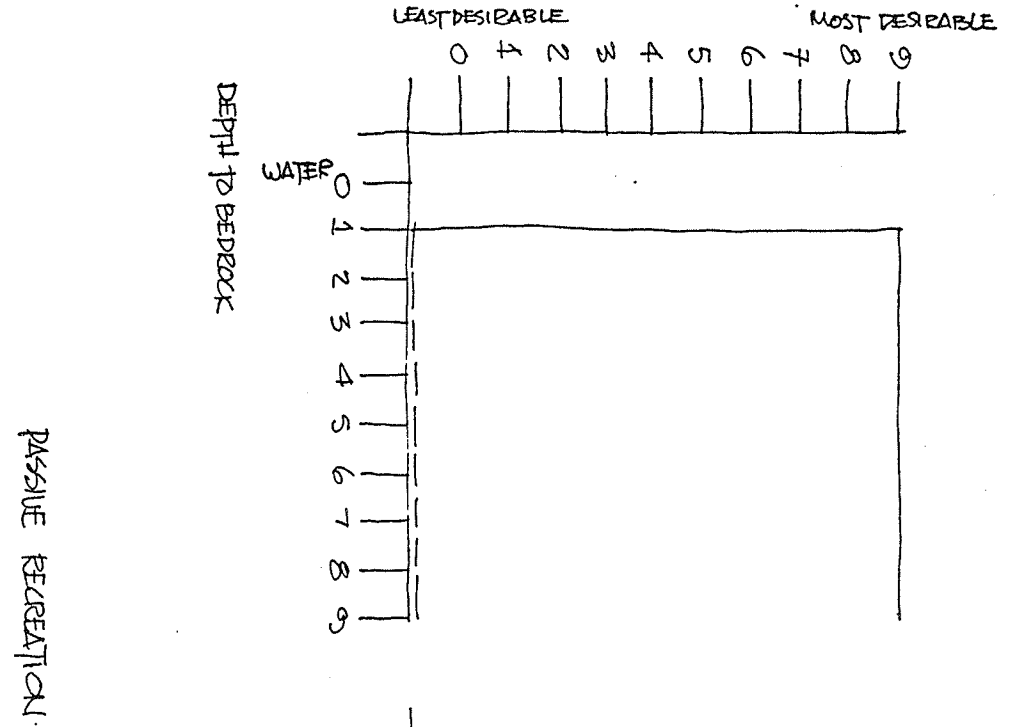
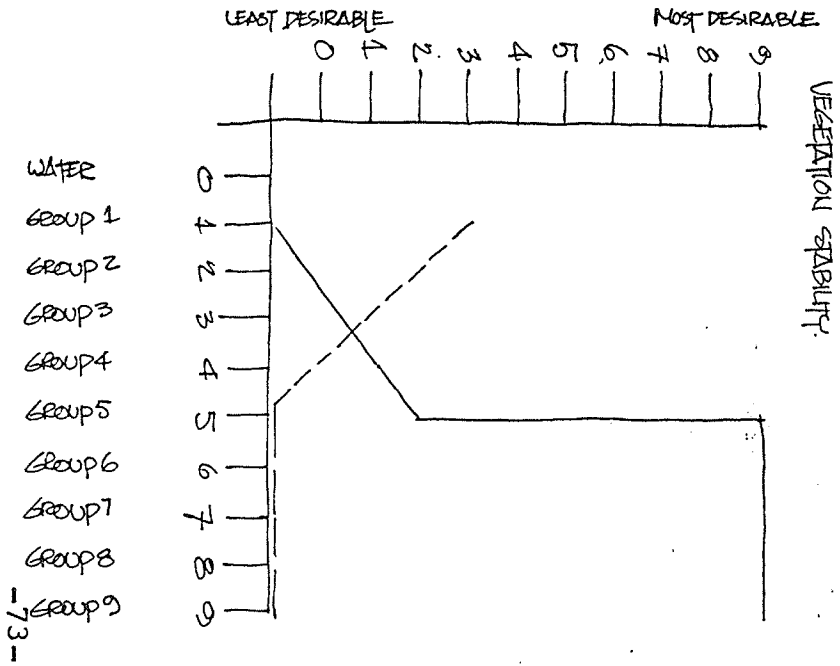
VISUAL ABSORPTION BY VEGETATION.

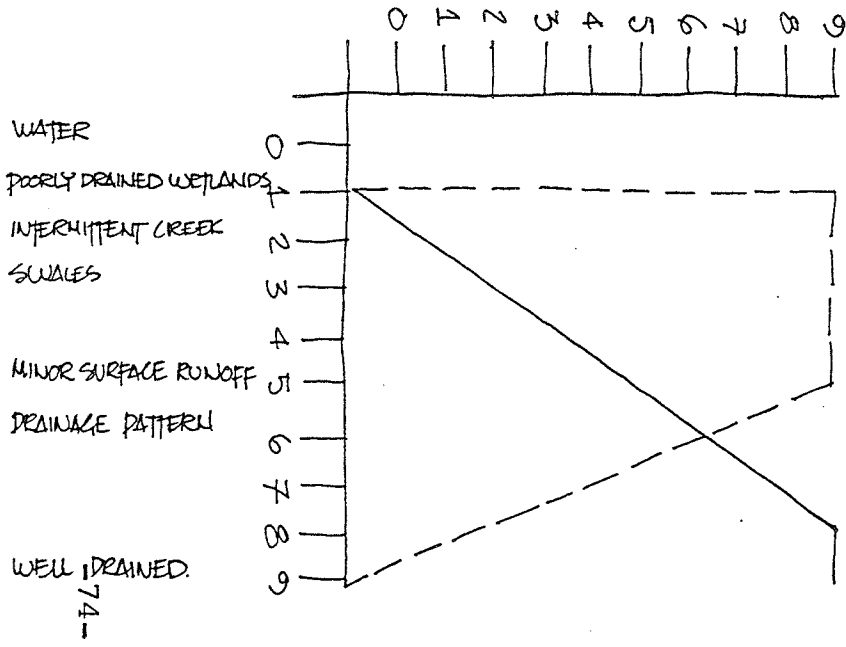


TOPOGRAPHIC SLOPE

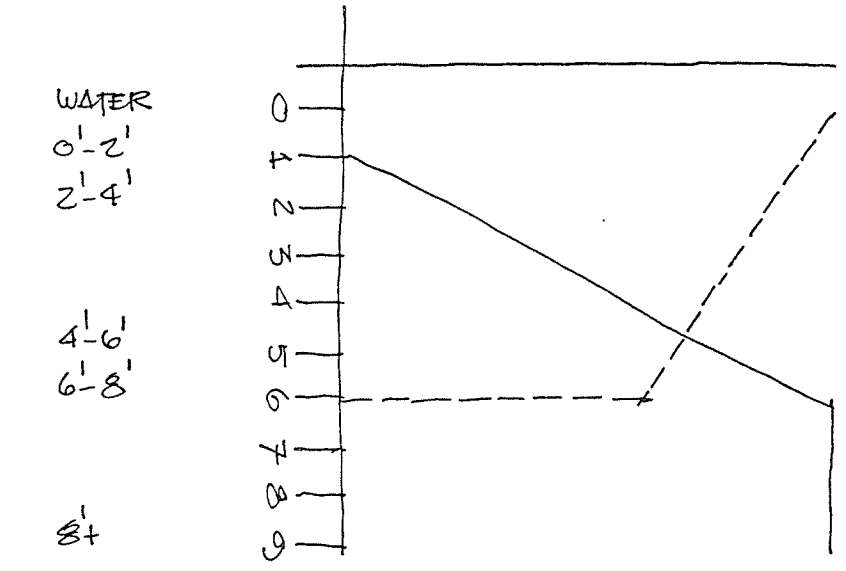
PASSIVE RECREATION.







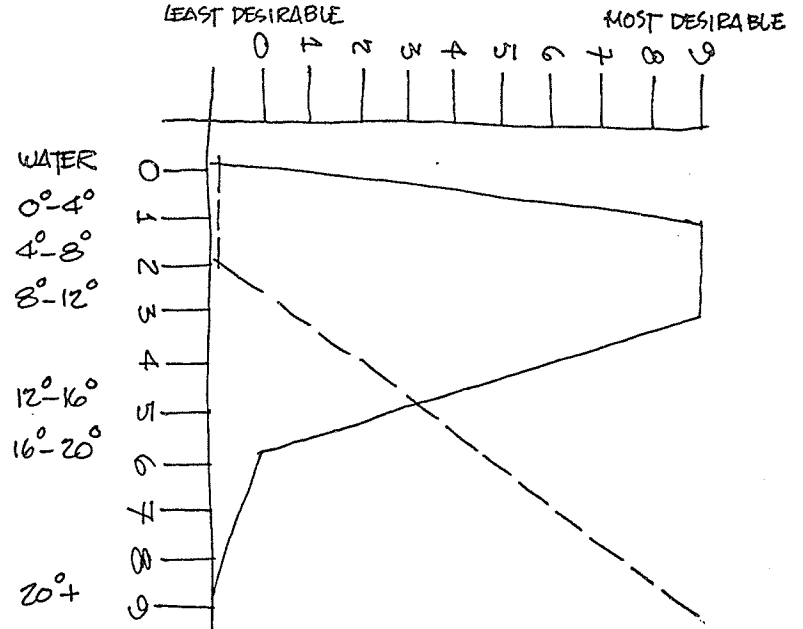
SURFACE DRAINAGE.



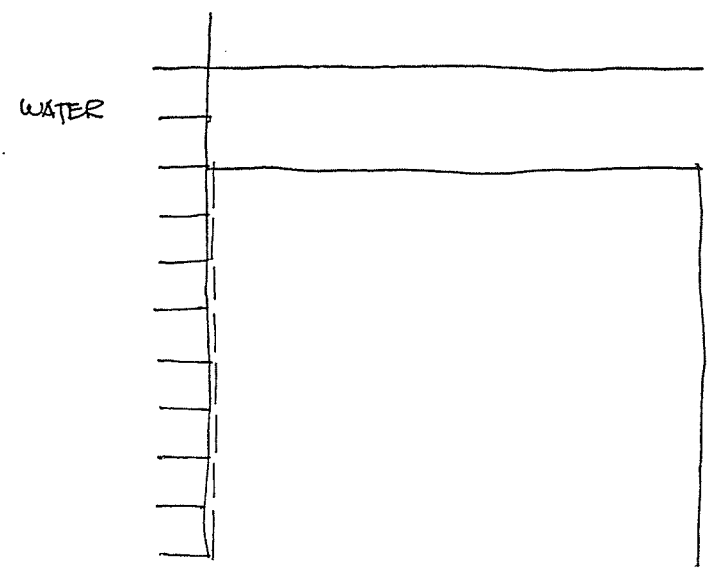
SUB-SURFACE DRAINAGE

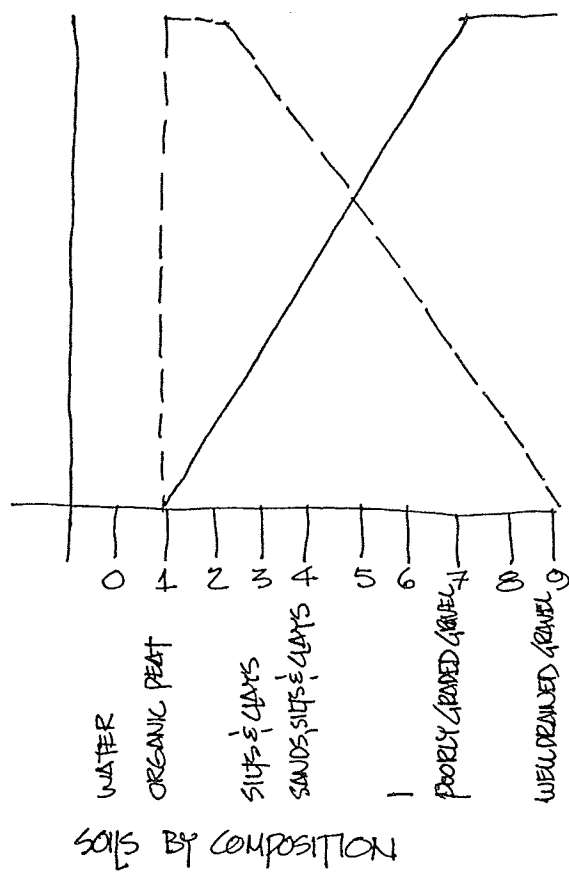
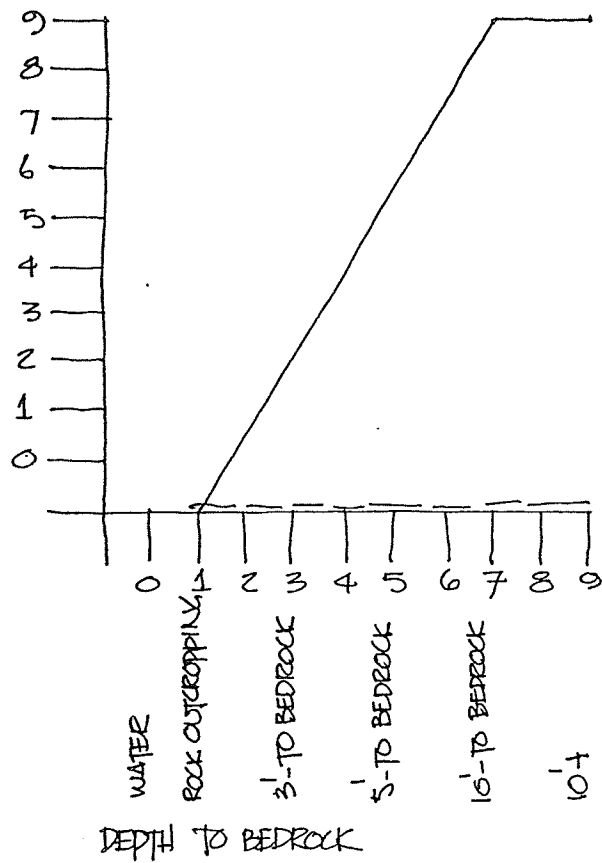
INDUSTRIAL & COMMERCIAL

TOPOGRAPHICAL SLOPE

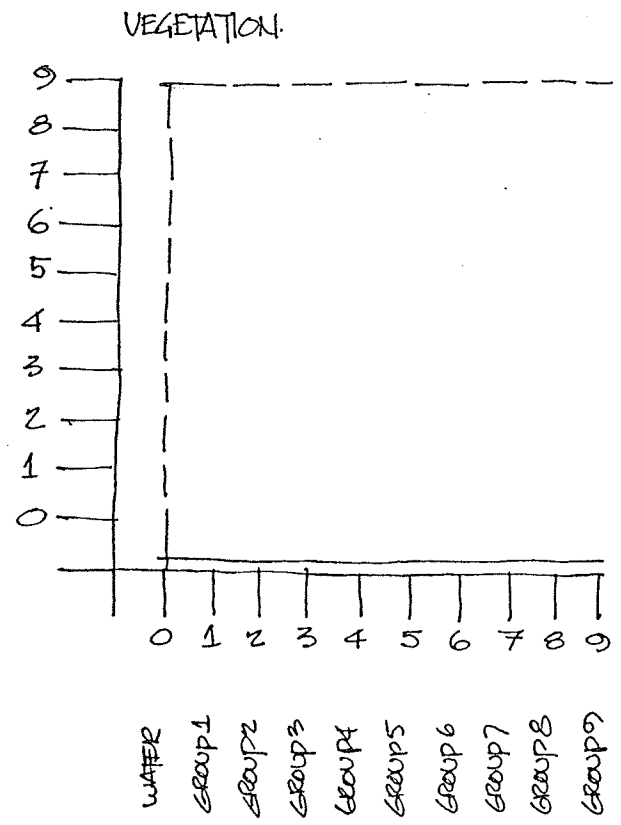


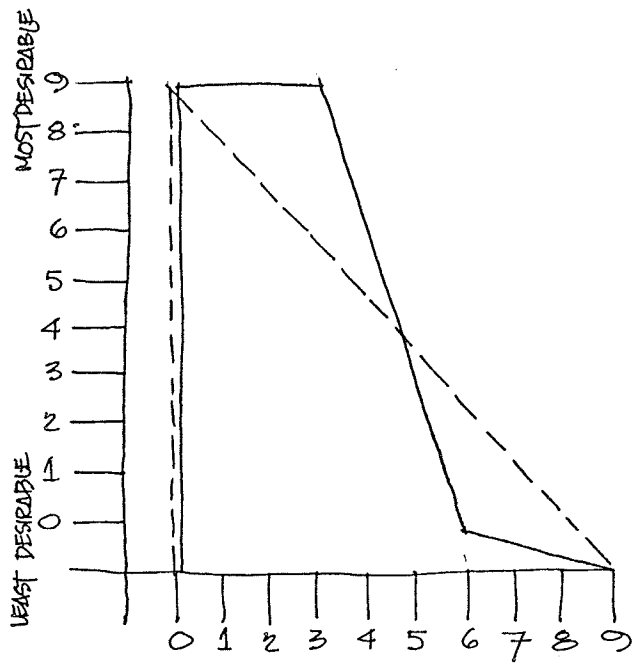
ORIENTATION OF SLOPE





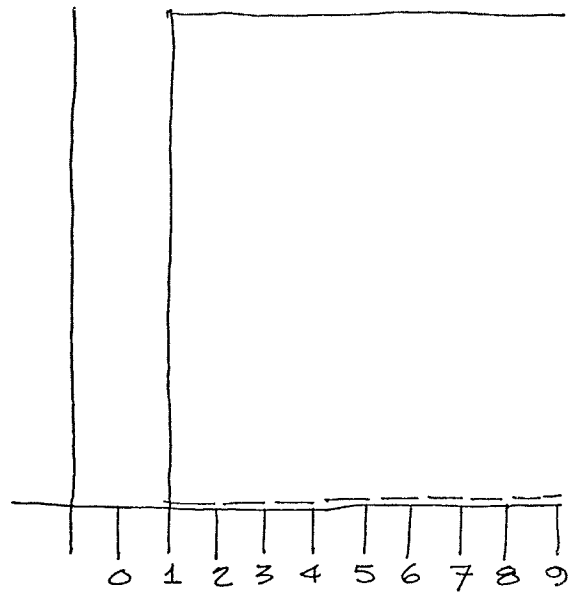
INDUSTRIAL. $\frac{1}{2}$ COMMERCIAL





WATER
 0-4°
 4-8°
 8-12°
 12-16°
 16-20°
 20°+

TOPOGRAPHIC SLOPE.

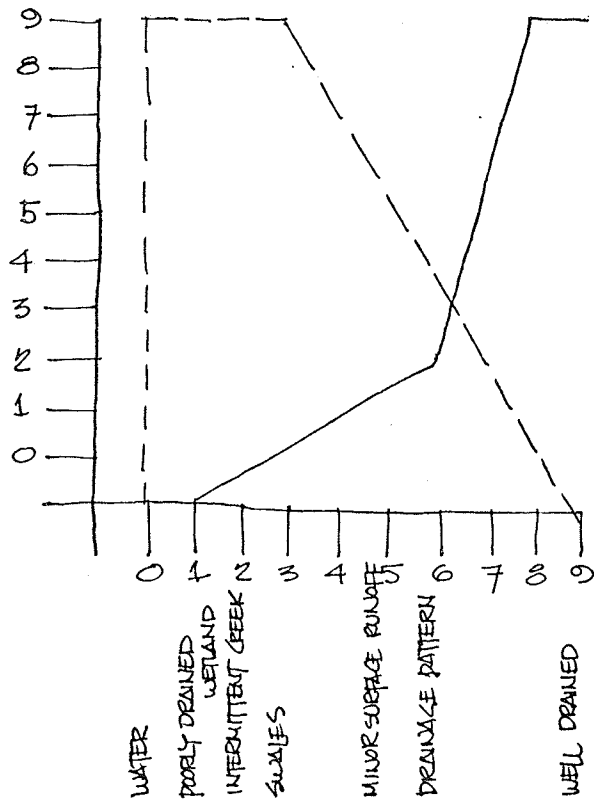


WATER

ORIENTATION

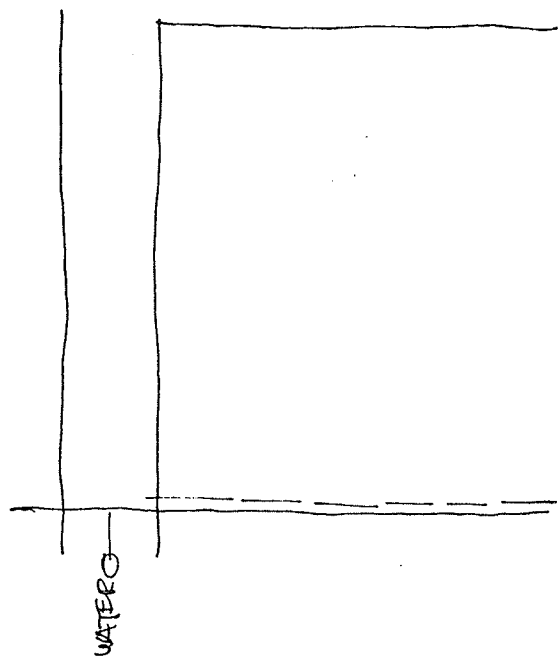
ACTIVE RECREATION

SURFACE DRAINAGE

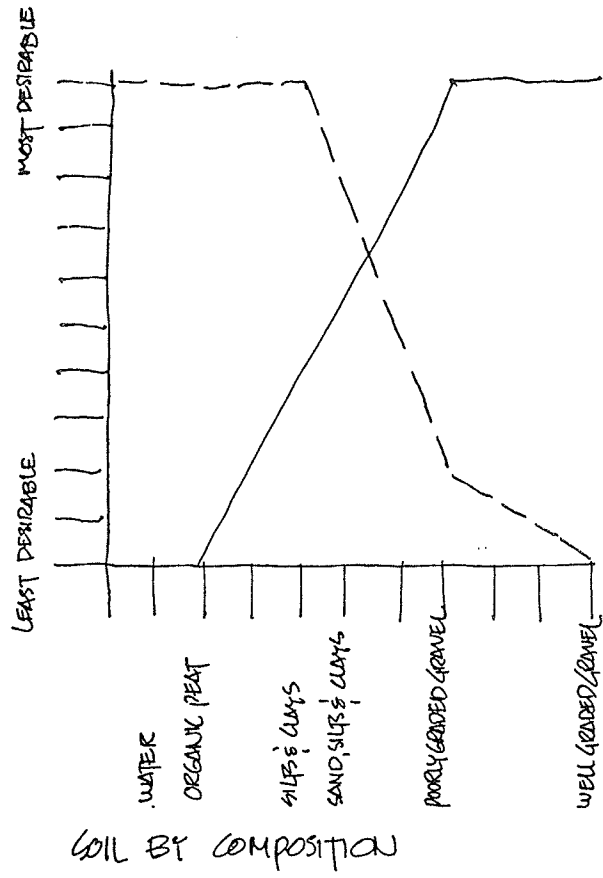


WATER
 PROBABLY DRAINAGE
 WETLAND
 INTERMITTENT CREEK
 SWALES
 MILD SURFACE RUNOFF
 DRAINAGE PATTERN
 WELL DRAINAGE

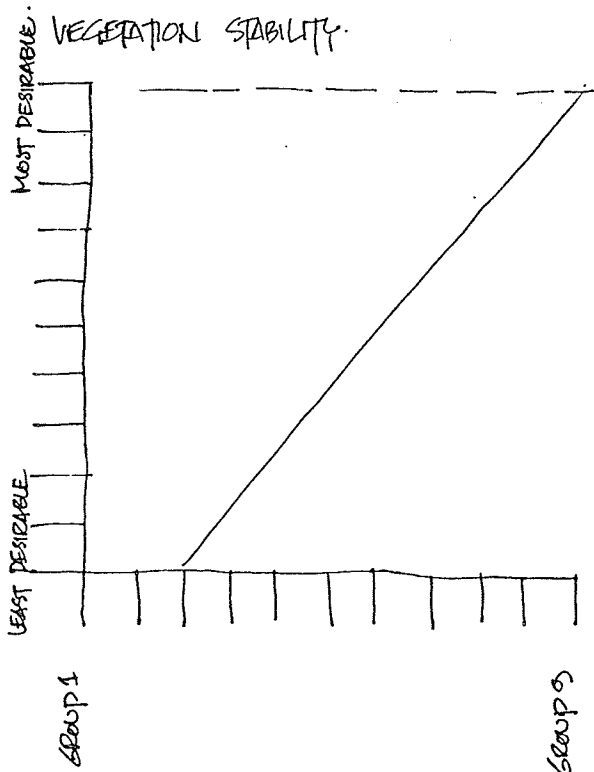
SUB-SURFACE DRAINAGE.

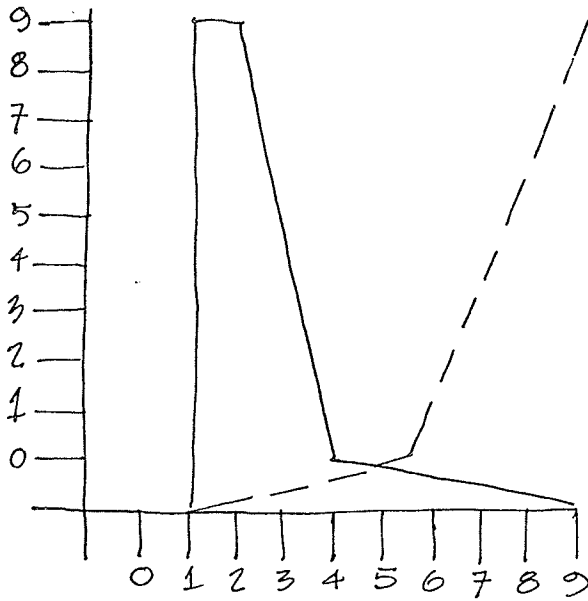


WATER



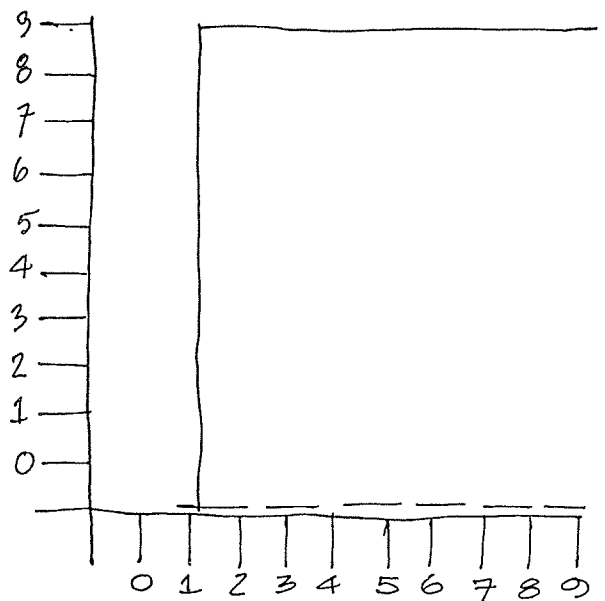
ACTIVE RECREATION.





WATER
 0°-4°
 4°-8°
 8°-12°
 12°-16°
 16°-20°
 20°+

TOPOGRAPHIC SLOPE



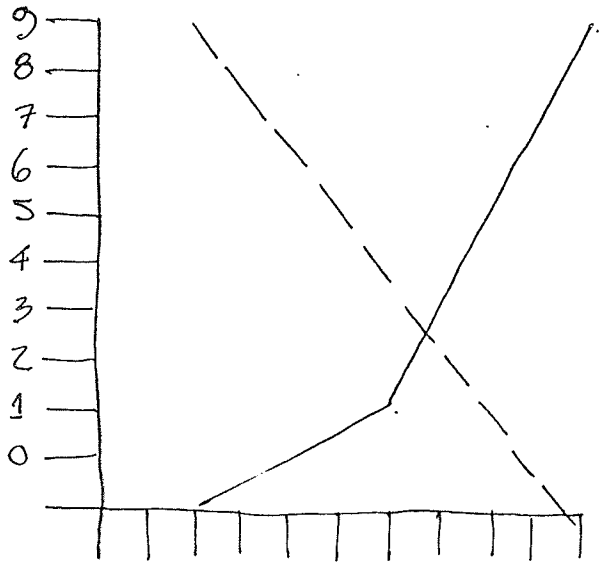
WATER

ORIENTATION

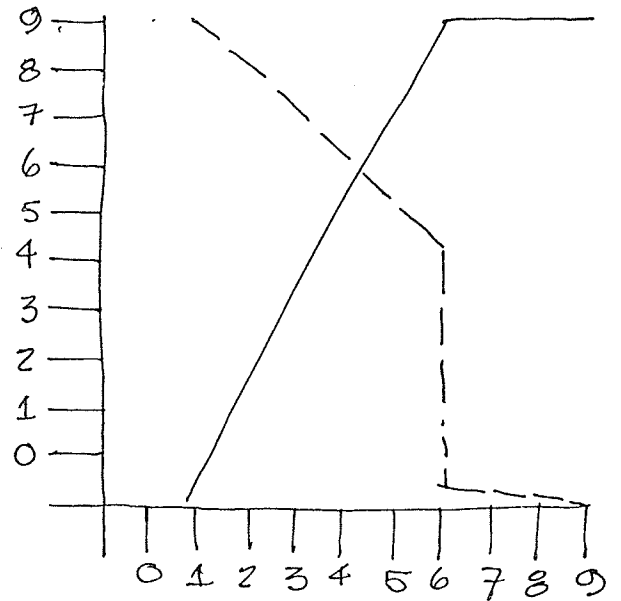
MULTIPLE FAMILY HOUSING

SURFACE DRAINAGE

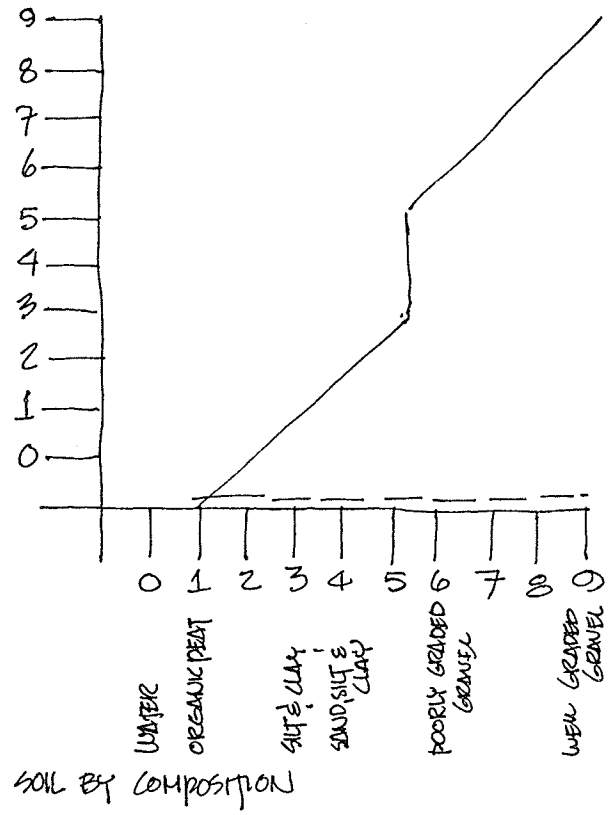
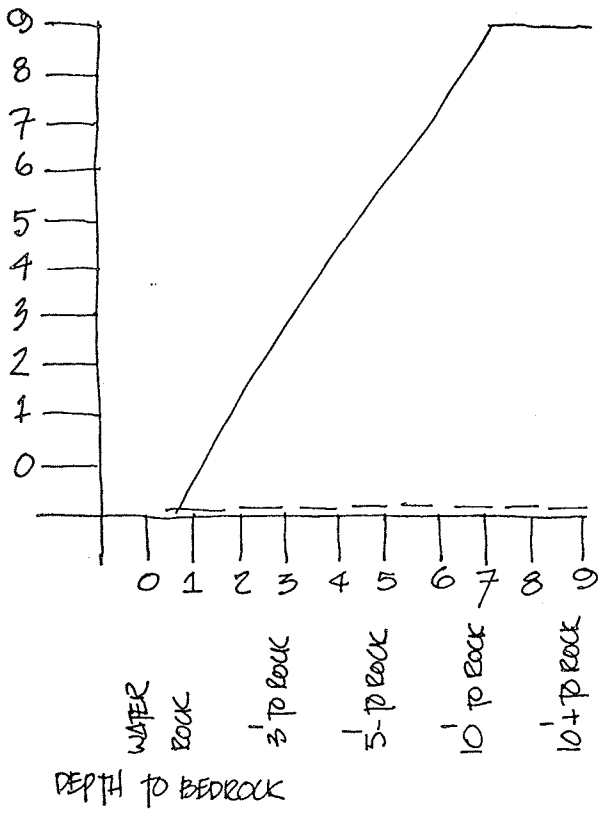
SUB-SURFACE DRAINAGE



WATER
 0
 POORLY DRAINED WETLANDS
 INTERMITTENT CREEKS
 SWALES
 MILD SURFACE PATTERNS
 DRAINAGE PATTERNS
 WELL DRAINED

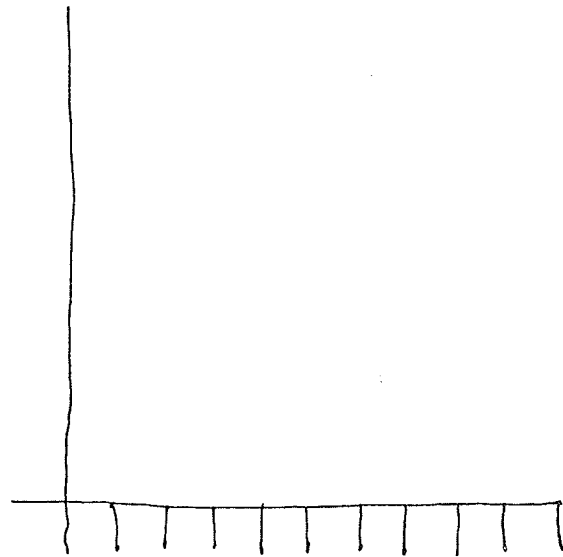
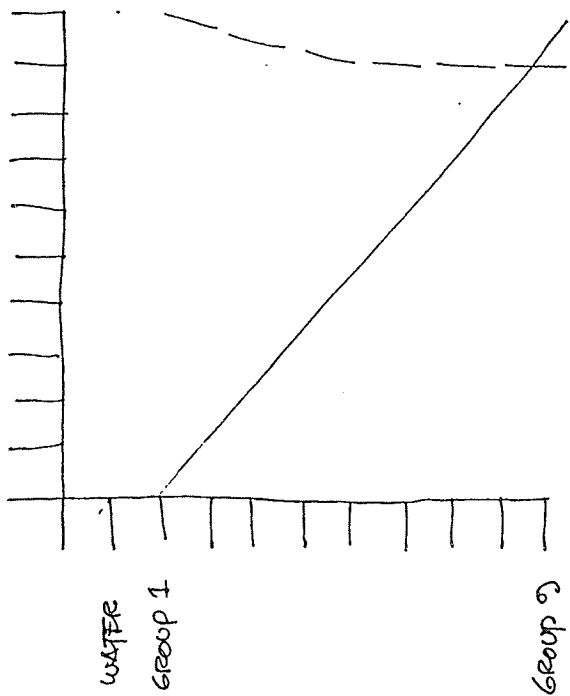


WATER
 0'-2'
 2'-4'
 4'-6'
 6'-8'
 8'+



MULTIPLE FAMILY HOUSING

VEGETATION STABILITY.



633233232223222233322236620086233
323322232332333523222588666653533
322222333534533553225956680066522
23322222558865533235353660066533
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22222233333986323323335660068666
2222222223669332233335650068666
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23336332322333332222328685556533
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Topographic slope.

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252552221157552221514455455333333
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46366664644333334442341575555522
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Slope orientation

999996999991999999111115550039999
99999699911999991111555990039999
1999996666619999115559990039999
11999999991161199555999990099999
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Surface drainage.

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Vegetation stability.

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Vegetation preference.

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Visual access to unique landscape features.

655335551676558866678863320035555
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Visual absorption.

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 57771175355599919775553797779555
 11571577737799991977777797797911
 113551135139999917977557799999511
 135537117137999911955557999999155
 555535317757999991955555999999155
 155153133577799991791177999991155
 115531135537779991771179999511155
 55157711553559999191197999535555
 511151135535579999177157555395555
 511155157555579999175115597771555
 111153551355779999155115533777555
 111151551555779999175511137153555
 111111111757579999195511557515555

Perceptual carrying capacity.

C-1 Control plan (Input)

Maximum allowable distances (in cells)

	multiple family housing	multiple family housing	active recreation	commercial	single family housing	industrial
multiple family	2	-	12	15	20	-
multiple family	-	2	12	15	20	-
active recreation	12	12	2	-	-	-
commercial	15	15	-	1	-	-
single family	20	20	-	-	10	-
industrial	-	-	-	-	-	1

Minimum allowable distances

multiple family	-	15	-	-	-	-
multiple family	15	-	-	-	-	-
active recreation	-	-	-	-	-	-
commercial	-	-	-	-	-	-
single family	-	-	-	-	-	-
industrial	-	-	-	-	-	-

Variable order (Priority)

	multiple family housing	multiple family housing	active recreation	commercial	single family housing	industrial
first	7	7	9	7	7	7
second	1	1	7	1	1	1
third	3	3	1	3	2	3
fourth	4	4	3	5	3	4
fifth	5	5	4	2	4	5
sixth	6	6	5	4	5	6
seventh	9	9	6	6	6	2
eighth	10	10	2	8	9	8
ninth	8	8	8	9	8	9
tenth	2	2	10	10	10	10
eleventh	11	11	11	11	11	11

C-2 Change in distance relationships

	multiple family	multiple family	active recreation	commercial	single family	industrial
multiple family	2	-	12	15	20	-
multiple family	-	2	12	15	20	-
active recreation	12	12	2	-	-	-
commercial	15	15	-	1	-	-
single family	20	20	-	-	10	-
industrial	-	-	-	-	-	1

multiple family	-	20	-	-	-	-
multiple family	20	-	-	-	-	-
active recreation	-	-	-	-	-	-
commercial	-	-	-	-	-	-
single family	-	-	-	-	-	-
industrial	-	-	-	-	-	-

C-3 Variable priority change(multiple family)

Variable order

First priority	1	7	9	7	7	7
Second	7	1	7	1	1	1
Third	3	3	1	3	2	3
Fourth	4	4	3	5	3	4
Fifth	5	5	4	2	4	5
Sixth	6	6	5	4	5	6
Seventh	9	9	6	6	6	2
Eighth	10	10	2	8	9	8
Ninth	8	8	8	9	8	9
Tenth	2	2	10	10	10	10
Eleventh	11	11	11	11	11	11

multiple family
multiple family
active recreation
commercial
single family
light industrial

C-4 Variable priority change (active recreation)

Variable order

First priority	7	7	1	7	7	7
Second	1	1	7	1	1	1
Third	3	3	9	3	2	3
Fourth	4	4	3	5	3	4
Fifth	5	5	4	2	4	5
Sixth	6	6	5	4	5	6
Seventh	9	9	6	6	6	2
Eighth	10	10	2	8	9	8
Ninth	8	8	8	9	8	9
Tenth	2	2	10	10	10	10
Eleventh	11	11	11	11	11	11

multiple family
multiple family
active recreation
commercial
single family
light industrial

C-5 Change in optimal status level

Optimum status levels

Variable 1	2	2	9	2	9	2
Variable 2	2	2	1	2	8	2
Variable 3	9	9	2	9	9	9
Variable 4	9	9	9	9	9	9
Variable 5	9	9	9	9	9	9
Variable 6	9	9	9	9	9	9
Variable 7	9	9	9	9	9	9
Variable 8	9	9	9	9	9	9
Variable 9	9	9	9	9	9	9
Variable 10	9	9	9	9	9	9
Variable 11	9	9	9	9	9	9

multiple family
multiple family
active recreation
commercial
single family
light industrial

C-6 Change in land use priorities

Land use priorities

First priority.....Commercial
 Second.....Multiple family
 Third.....Multiple family
 Fourth.....Active recreation
 Fifth.....Single family
 Sixth.....Industrial

Maximum allowable distances

Commercial	1	10	10	10	25	-
Multiple family housing	10	2	-	-	-	-
Multiple family housing	10	-	2	-	-	-
Active recreation	10	-	-	5	-	-
Single family housing	25	-	-	-	10	-
Industrial	-	-	-	-	-	-
	Commercial	Multiple family	Multiple family	Active recreation	Single family	light industrial

Minimum allowable distances

Commercial	-	-	-	-	-	-
Multiple family housing	-	-	-	-	-	-
Multiple family housing	-	-	-	-	-	-
Active recreation	-	-	-	-	-	-
Single family housing	-	-	-	-	-	-
Light industrial	-	-	-	-	-	-

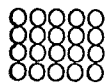
Commercial
Multiple family
Multiple family
Active recreation
Single family
Light industrial

D-1 Control plan

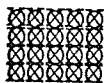
Capability analysis of locations

<u>Land use</u>	<u>No.of variable requirements fulfilled.</u>	<u>Percentage of cells in this category.</u>
Multiple family	9	52 %
	6	16 %
	5	16 %
	2	16 %
	Total	100 %
Multiple family	9	28 %
	6	36 %
	4	8 %
	3	8 %
	2	8 %
	1	12 %
Total	100 %	24 cells
Active recreation	3	15 %
	2	12.5%
	1	72.5%
Total	100 %	40 cells
Commercial	11	4 %
	4	60 %
	1	36 %
Total	100 %	50 cells
Single family housing	11	4 %
	7	2.5%
	6	2 %
	4	.25
	2	.25
	1	86 %
	0	5 %
Total	100 %	280 cells
Industrial	11	52.5%
	6	45 %
	1	2.5%
Total	100 %	40 cells

LEGEND



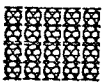
Single family housing



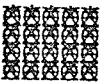
Active recreation



Multiple family housing



Commercial



Industrial

D-2 Change in proximate relationships

Capability analysis of locations

<u>Land use</u>	<u>No. of variable requirements fulfilled.</u>	<u>Percentage of cells in this category.</u>
Multiple family	9	52 %
	6	16 %
	5	16 %
	3	16 %
	Total	100 %, 24 cells
Multiple family	3	12 %
	0	88 %
	Total	100 %, 24 cells
Active recreation	3	2.5%
	2	40 %
	1	57.5%
	Total	100 %, 40 cells
Commercial	11	4 %
	4	38 %
	2	6 %
	1	52 %
	Total	100 %, 50 cells
Single family housing	11	.5%
	2	1.5%
	1	40 %
	0	58 %
	Total	100 %, 280 cells
Industrial	11	15 %
	6	50 %
	5	10 %
	1	25 %
	Total	100 %, 40 cells

D-3 Variable priority change(multiple family)

Capability analysis of locations

<u>Land use</u>	<u>No.of variable requirements fulfilled.</u>		<u>Percentage of cells in this category.</u>
Multiple family	6		52 %
	5		8 %
	3		16 %
	2		8 %
	1		16 %
		Total	100
Multiple family	9		52 %
	6		16 %
	5		16 %
	2		16 %
		Total	100
Active recreation	3		22 %
	2		27 %
	1		51 %
	Total	100	%, 40 cells
Commercial	4		2 %
	2		12 %
	1		76 %
	Total	100	%, 50 cells
Single family housing	11		3 %
	7		.5 %
	6		.5 %
	3		.5 %
	2		6.5 %
	0		89 %
	Total	100	%, 280 cells
Industrial	11		1 %
	6		47.5 %
	5		2.5 %
	2		7.5 %
	1		41.5 %
	Total	100	%, 40 cells

D-4 Variable priority change (active recreation)

Capability analysis of locations

<u>Land use</u>	<u>No. of variable requirements fulfilled.</u>	<u>Percentage of cells in this category.</u>
Multiple family housing	9	52 %
	6	16 %
	5	16 %
	2	16 %
	Total	100 % , 24 cells
Multiple family housing	9	4 %
	6	36 %
	4	9 %
	3	9 %
	2	12 %
	1	14 %
	0	16 %
Total	100 % , 24 cells	
Active recreation	3	15 %
	1	35 %
	0	50 %
Total	100 % , 40 cells	
Commercial	11	6 %
	4	62 %
	1	32 %
Total	100 % , 50 cells	
Single family housing	11	4 %
	7	1 %
	6	.5 %
	4	.5 %
	3	.5 %
	1	5.5 %
	0	88 %
Total	100 % , 280 cells	
Industrial	11	52.5 %
	6	45 %
	1	2.5 %
Total	100 % , 40 cells	

D-5 Optimal status levels changed

Capability analysis of locations

<u>Land use</u>	<u>No.of variable requirements fulfilled.</u>	<u>Percentage of cells in this category.</u>	
Multiple family housing	9 m	56	%
	6	20	%
	3	8	%
	1	16	%
	Total	100	%, 24 cells
Multiple family housing	9	8	%
	6	36	%
	4	8	%
	3	8	%
	2	12	%
	1	16	%
	0	12	%
Total	100	%, 24 cells	
Active recreation	3	3	%
	2	5	%
	1	92	%
Total	100	%, 40 cells	
Commercial	4	6	%
	2	12	%
	1	82	%
Total	100	%, 50 cells	
Single family housing	6	1	%
	4	1.5	%
	3	.25%	
	2	.25%	
	1	50	%
	0	47	%
Total	100	%, 280 cells	
Industrial	11	6	%
	6	37	%
	2	57	%
Total	100	%, 40 cells	

000000001111111122222222333333
123456789012345678901234567890123

1	00000000000000000000000000000000	1
2	00000000000000000000000000000000	2
3	00000000000000000000000000000000	3
4	00000000000000000000000000000000	4
5	00000000000000000000000000000000	5
6	00000000000000000000000000000000	6
7	00000000000000000000000000000000	7
8	00000000000000000000000000000000	8
9	00000000000000000000000000000000	9
10	00000000000000000000000000000000	10
11	00000000000000000000000000000000	11
12	00000000000000000000000000000000	12
13	00000000	13
14		14
15		15
16	000 0000 0	16
17	C 0000 0 C 0000	17
18	000 0 0000 0000	18
19	0 00 0000 00000000 00	19
20	000 00000 00000	20
21	000000 0 00 0000	21
22	000000 00 0000	22
23	00000000 0000	23
24	00 00000000	24
25	000000000000	25
26	000000000000	26
27	000000000000	27
28	000000000000	28
29	000000000000	29
30		30
31		31
32		32
33		33
34		34
35		35
36		36
37		37
38		38
39		39
40		40
41		41
42		42
43		43
44		44
45		45
46		46
47		47
48		48
49		49
50		50
51		51
52		52

000000001111111122222222333333
123456789012345678901234567890123

D-6 Land use priorities changed

Capability analysis of locations

<u>Land use</u>	<u>No. of variable requirements fulfilled.</u>	<u>Percentage of cells in this category.</u>
Commercial	4	58 %
	1	42 %
	Total	100 %, 24 cells
Multiple family	9	2.5 %
	6	35 %
	5	7.5 %
	3	7.5 %
	2	5 %
	1	5 %
	0	37.5 %
	Total	100 %, 40 cells
Multiple family	6	58 %
	0	42 %
	Total	100 %, 24 cells
Active recreation	3	26 %
	2	34 %
	1	40 %
	Total	100 %, 50 cells
Single family	11	6 %
	7	2 %
	6	2 %
	4	1 %
	2	4 %
	1	85 %
	Total	100 %, 280 cells
Industrial	11	15 %
	6	58 %
	5	5 %
	2	2.5 %
	1	14.5 %
	Total	100 %, 40 cells

COMPILER OPTIONS - NAME= MAIN,OPT=C2,LINECNT=60,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,IO,NOXREF

C
C SITE ALLLOCATION ACCORDING TO IMPACT/USER PREFERENCE
C
C USE(N):VECTOR OF RANKED LAND USES
C VAR :NUMBER OF MATRICES OR VARIABLES
C USES :NUMBER OF LAND USES BEING PLACED
C IMAP :IROWS IN MATRIX
C JMAP :JCOLUMNS IN MATRIX
C CELLS :NUMBER OF SEARCH AREAS IN MATRIX
C LOC(N):VECTOR CONTAINING LOCATED LAND USES
C IHIGH(N):I LOCATIONS OF SEARCH ORIGINS
C JHIGH(N):J LOCATIONS OF SEARCH ORIGINS
C IRANK(N):LOCATION OF RANKED SEARCH ORIGINS
C JRANK(N):LOCATION OF RANKED SEARCH ORIGINS
C ICELLE :NUMBER OF SEARCH AREAS IN I DIRECTION
C JCELLS :NUMBER OF SEARCH AREAS IN J DIRECTION
C MAXDIS(I,J):MATRIX OF MAX.ALLOW.DISTANCES
C MINDIS(I,J):MATRIX OF MIN.ALLOW.DISTANCES
C CNTR :COUNTER ON NO.OF LOCATIONS EVALUATED BY CAP.
C BST(CNTR) :VECTOR OF NO. OF MATRICES PASSED THROUGH
C IBST(N) :HIGHEST I LOCATION FROM BST(CNTR)
C RADIUS :SEARCH RADIUS ABOUT SEARCH ORIGIN IN CELLS
C ORD(I,J) :I SPECIFIES PASS NUMBER,J SPEC.CURRENT USE
C LEVEL(I,J):I SPECIFIES VARIABLE,J SPEC. USE
C LEVEL GIVES CURRENT ACCEPT.VALUE,ORD GIVES VARIABLE

0002 INTEGER DIST(12)
0003 INTEGER ACCEPT
0004 INTEGER USES,VAR,CELLS,RADIUS
0005 INTEGER IRANK(12),JRANK(12)
0006 DIMENSION MAP(11,6)
0007 DIMENSION IPLAN(460),JPLAN(460)
0008 INTEGER CNTR
0009 INTEGER LOC
0010 INTEGER A
0011 INTEGER USE,CAP, BST
0012 INTEGER BEST(121),IBEST(121),JBEST(121)
0013 COMMON BST(121),IBST(121),JBST(121)
0014 COMMON CAP(52,33,11)
0015 COMMON MAXDIS(6,6)
0016 COMMON MINDIS(6,6),LOC(460)
0017 COMMON NUMBER(6)
0018 COMMON ICOUNT(52,33)
0019 COMMON IPX(52,33)
0020 DIMENSION USE(6)
0021 DIMENSION ORD(11,6),LEVEL(11,6)
0022 DIMENSION IHIGH(12),JHIGH(12)
0023 DIMENSION IROW(12),JCOL(12)
0024 DIMENSION MAXLEV(11,6),MINLEV(11,6)
0025 LOGICAL*1 MMAP(33),
1ICHAR1(7) / ' ','0','0','0','0','0','0' /,
1ICHAR2(7) / ' ','*','*','X','X',' ','X' /,
1ICHAR3(7) / ' ',' ',' ',' ',' '=' , ' ','*' /,
1ICHAR4(7) / ' ',' ',' ',' ',' ',' '=' /
0026 DIMENSION ISTORE(33)
0027 DIMENSION IBORD(2,33)
0028 DO 30 I=1,460

```

N 0029      LOC(I)=0
N 0030      39      CCNTINUE
N 0031      DO 49 I=1,11
N 0032      REAC(5,3005)(MAP(I,J),J=1,6)
N 0033      3005   FCRMAT(6I2)
N 0034      49      CCNTINUE
N 0035      DO 1 K=1,11
N 0036      DC 1 I=1,52
N 0037      READ(5,1000) (CAP(I,J,K),J=1,33)
N 0038      1      CCNTINUE
N 0039      READ (5,2000) (USE(I),I=1,6)
N 0040      DC 2 I=1,6
N 0041      READ (5,3000) (MAXDIS(I,J),J=1,6)
N 0042      2      CCNTINUE
N 0043      DO3 I=1,6
N 0044      READ (5,3000) (MINDIS(I,J),J=1,6)
N 0045      3      CCNTINUE
N 0046      DO 4 I=1,11
N 0047      READ (5,2000)(ORD(I,J),J=1,6)
N 0048      4      CCNTINUE
N 0049      DO 44 I=1,11
N 0050      READ(5,3000) (MAXLEV(I,J),J=1,6)
N 0051      44     CCNTINUE
N 0052      DO 41 I=1,11
N 0053      READ(5,3000)(MINLEV(I,J),J=1,6)
N 0054      41     CCNTINUE
N 0055      READ(5,4000) (IROW(I),I=1,12)
N 0056      READ(5,4000)(JCOL(I),I=1,12)
N 0057      READ(5,2001)(NUMBER(I),I=1,6)
N 0058      2001  FCRMAT(6I3)
N 0059      1000  FCRMAT(3X,33I1)
N 0060      DO 249 I=1,2
N 0061      READ(5,6001)(IBORD(I,J),J=1,33)
N 0062      6001  FCRMAT(33I1)
N 0063      249   CCNTINUE
N 0064      2000  FCRMAT (6I2)
N 0065      3000  FCRMAT(6I2)
N 0066      4000  FCRMAT(12I2)
N 0067      5000  FCRMAT('0',' CURRENT LAND USE IS ',1I2)
N 0068      6000  FCRMAT('0',' VARIABLE = ',1I2,' MAXIMUM LEVEL =',1I2,'
1 MINIMUM LEVEL = ',1I2)
N 0069      7000  FCRMAT('0','RANKED ORIGIN ',1I2,2X,1I2,' , ',1I2)
N 0070      8000  FCRMAT('0',' LAND USE ',1I2,' LOCATED AT ',1I2,',',1I2)
N 0071      9000  FCRMAT('0',' SEARCH ORIGINS ARE ',1I2,',',1I2)
N 0072      1100  FCRMAT('0',' 1ST LOCATED USE RELATED TO ',1I2,' IS ',
1I2,' AT ',1I2,',',1I2)
N 0073      1200  FCRMAT(' ',33I1)
N 0074      1300  FCRMAT('1','VARIABLE NUMBER ',1I2,/)
N 0075      1400  FCRMAT('0','DISTANCE ',1I1,' IS',1I5)
N 0076      DC 52 K=1,11
N 0077      DO 52 I=1,52
N 0078      CAP(I,33,K)=CAP(I,32,K)
N 0079      52     CCNTINUE
N 0080      USES=6
N 0081      VAR=11
N 0082      JMAP=52
N 0083      CELLS=12
N 0084      JMAP=33

```

```

0085      RADIUS=5
0086      ICELLS=4
0087      JCELLS=3
0088      DO 45 K=1,VAR
0089      WRITE(6,1300) K
0090      DO 45 I=1,IMAP
0091      WRITE (6,1200) (CAP(I,J,K),J=1,JMAP)
0092      45      CONTINUE
0093      WRITE(6,3004)
0094      DO 55 I=1,6
0095      WRITE(6,2100) (MAXDIS(I,J),J=1,USES),(MINDIS(I,J),J=1,USES)
0096      2100   FORMAT('0','  MAXDIS  ',6I2,'  MINDIS  ',6I2)
0097      55      CONTINUE
0098      DO 42 I=1,VAR
0099      WRITE(6,1500)(MAXLEV(I,J),J=1,6),(MINLEV(I,J),J=1,6)
0100      1500   FORMAT('0',' MAXIMUM STATUS LEVEL ',6I3,' MINIMUM STATUS LEVEL '
0101      42      CONTINUE
0102      1410   FORMAT('0',' BEST VALUES ',///)
0103      1409   FORMAT('0',6I3)
0104      1411   FORMAT('0',' VARIABLE ORDER ',///)
0105      WRITE(6,1410)
0106      DO 53 I=1,VAR
0107      WRITE(6,1409)(MAP(I,J),J=1,6)
0108      53      CONTINUE
0109      WRITE(6,3004)
0110      WRITE(6,1411)
0111      DO 54 I=1,VAR
0112      WRITE(6,1409)(ORD(I,J),J=1,6)
0113      54      CONTINUE
0114      WRITE(6,3004)
0115      MI=1
0116      DO 20 MM=1,6
0117      IC1=0
0118      IK=0
0119      DO 13 I=1,IMAP
0120      DO 13 J=1,JMAP
0121      IPX(I,J)=0
0122      ICOUNT(I,J)=0
0123      13      CONTINUE
0124      KKK=0
0125      IF(MI.EQ.1)GO TO 26
0127      56      CONTINUE
0128      MI=MI
0129      IF(LOC(1).EQ.C)GO TO 6
0131      DO 5 NN=1,MM
0132      IF((MINDIS(NN,MM).GT.0).OR.(MAXDIS(NN,MM).GT.0))GO TO 10
0134      5      CONTINUE
0135      6      CONTINUE
0136      NN=MM
0137      N=1
0138      CALL ORDER(N,MM,K,MAXA,MINA,ORD,MAXLEV,MINLEV,USES,A,MAP)
0139      WRITE(6,5000) USE(MM)
0140      WRITE(6,6000)K,MAXA,MINA
0141      CALL BESTT(IMAP,JMAP,K,CELLS,IHIGH,JHIGH,ICELLS,JCELLS,IROW,JCOL
0142      1,A)
0142      DO 21 I=1,CELLS
0143      WRITE (6,9000) IHIGH(I),JHIGH(I)

```

```

N 0144      21  CONTINUE
N 0145      CALL TOTDIS(VAR,MM,IFHIGH,JHIGH,DIST,CELLS,
N 0146      DO 22 I=1,CELLS
N 0147      WRITE (6,1400) I,DIST(I)
N 0148      22  CONTINUE
N 0149      CNTR=1
N 0150      KC=0
N 0151      222 CONTINUE
N 0152      DO 7 MN=1,CELLS
N 0153      NM=(CELLS+1)-MN
N 0154      I=IRANK(NM)
N 0155      J=JRANK(NM)
N 0156      WRITE(6,7000) MN,IRANK(NM),JRANK(NM)
N 0157      CALL SERCHI(I,J,KK,LL,II,JJ,RADIUS,CNTR,NN,
N 0158      IMM,IMAP,JMAP,VAR,ORD,USES,N,BEST,IBEST,JBEST,
V 0160      IIK,ICNTR,IPLAN,JPLAN,USE,MINLEV,MAXLEV,MAP,M1,IC)
V 0161      IF(BEST(1).GT.0)GO TO 15
V 0162      7  IF(KC.EQ.1)GO TO 129
V 0163      CONTINUE
V 0164      KC=1
V 0165      DO 126 I=1,52
V 0166      DO 126 J=1,33
V 0167      ICOUNT(I,J)=0
V 0168      126 CONTINUE
V 0169      GO TO 222
V 0170      129 CALL NXTBST(CNTR,KK,LL,J)
V 0171      CALL PRT(USE,MM,KK,LL)
V 0172      GO TO 15
V 0173      10  CONTINUE
V 0174      9  CONTINUE
V 0175      IF(NN.EQ.MM)GO TO 208
V 0176      DO 209 KIM=1,460
V 0177      IF(LDC(KIM).EQ.USE(MM))GO TO 207
V 0178      209 CONTINUE
V 0179      GO TO 208
V 0180      207 NN=MM
V 0181      KKK=0
V 0182      208 CONTINUE
V 0183      CALL REPET3(NN,IPLAN,JPLAN,I,J,&6,KKK,K)
V 0184      MP=K+1
V 0185      12  CONTINUE
V 0186      NJ=10*NN
V 0187      WRITE(6,1100)USE(MM),NJ,I,J
V 0188      N=1
V 0189      CALL ORDER(N,MM,K,MAXA,MINA,ORD,MAXLEV,MINLEV,USES,A,MAP)
V 0190      CNTR=1
V 0191      CALL SERCHI(I,J,KK,LL,II,JJ,RADIUS,CNTR,NN,
V 0192      IMM,IMAP,JMAP,VAR,ORD,USES,N,BEST,IBEST,JBEST,
V 0193      IIK,ICNTR,IPLAN,JPLAN,USE,MINLEV,MAXLEV,MAP,M1,IC)
V 0194      IF(IC.GT.1)IC1=IC1+IC
V 0195      IF((MM.NE.NN).AND.(IC1.GE.40))GO TO 142
V 0196      IF((KKK.GE.5).AND.(IC.GT.0))GO TO 142
V 0197      IF(BEST(1).EQ.0)GO TO 77
V 0198      GO TO 15
V 0199      77  CONTINUE
V 0200      KKK=KKK+1
V 0201      IF(KKK.GT.(NUMBER(NN)-1))GO TO 140

```

```

C206      IF(LDC(MP).EQ.0)GO TO 14
C208      GO TO 9
C209      140  CONTINUE
C210      IF(IC.EQ.0)GO TO 141
C212      GO TO 142
C213      141  IK=IK+1
C214      WRITE(6,7777)IK
C215      7777  FORMAT(' ',1I3,' DISREGARDING RESTRICTIONS')
C216      KKK=0
C217      GO TO 9
C218      142  CONTINUE
C219      DO 137 KIM=1,460
C220      IF(LDC(KIM).EQ.USE(MM))GO TO 14
C222      137  CONTINUE
C223      CALL NXTBST(CNTR,KK,LL,J)
C224      IF(ICOUNT(KK,LL).EQ.0)GO TO 77
C226      CALL PRT(USE,MM,KK,LL)
C227      LCC(MI-1)=USE(MM)
C228      IPLAN(MI-1)=KK
C229      JPLAN(MI-1)=LL
C230      DO 139 IL=1,52
C231      DC 139 JL=1,33
C232      ICOUNT(IL,JL)=0
C233      139  CONTINUE
C234      KKK=0
C235      DC 138 K=1,VAR
C236      CAP(KK,LL,K)=USE(MM)
C237      138  CONTINUE
C238      GO TO 26
C239      14  CONTINUE
C240      DC 32 KM=1,5
C241      CALL NXTBST(CNTR,KK,LL,J)
C242      IF((ICOUNT(KK,LL).EQ.0).AND.(KK.GT.(NUMBER(NN)-1)))GO TO 141
C244      IF(ICOUNT(KK,LL).EQ.0)GO TO 77
C246      CALL PRT(USE,MM,KK,LL)
C247      IPLAN(MI-1)=KK
C248      JPLAN(MI-1)=LL
C249      LCC(MI-1)=USE(MM)
C250      ICOUNT(KK,LL)=0
C251      DC 321 K=1,VAR
C252      CAP(KK,LL,K)=USE(MM)
C253      321  CONTINUE
C254      CALL REPET1(MM,MI,&20,&322)
C255      322  CONTINUE
C256      IF(MI.LT.4)GO TO 9
C258      32  CONTINUE
C259      GO TO 9
C260      15  CONTINUE
C261      IF((KK.EQ.0).OR.(LL.EQ.0))GO TO 20
C263      IPLAN(MI-1)=KK
C264      JPLAN(MI-1)=LL
C265      LCC(MI-1)=USE(MM)
C266      WRITE (6,3000) USE(MM),KK,LL
C267      ICOUNT(KK,LL)=0
C268      DC 25 K=1,VAR
C269      CAP(KK,LL,K)=USE(MM)
C270      25  CONTINUE
C271      IF(LDC(2).EQ.C)GO TO 27

```

```

0273      IF(NN.EQ.MM)GO TO 241
0275      GC TO 242
0276      241  CONTINUE
0277      IO=0
0278      IM=MM-1
0279      DC 24 JI=1,IM
0280      IC=IO+NUMBER(JI)
0281      24  CONTINUE
0282      IF(LTC(IO+2).EQ.0)GO TO 27
0284      242  CONTINUE
0285      DO 29 IJ=1,3
0286      CALL REPET1(MM,MI,&20,&243)
0287      243  CONTINUE
0288      CALL NXTBST(CNTR,FK,LL,J)
0289      IF((ICOUNT(KK,LL).EQ.0).AND.(KK.GT.(NUMBER(NN)- 1)))GO TO 140
0291      IF(ICOUNT(KK,LL).EQ.0)GO TO 77
0293      CALL PRT(USE,MM,KK,LL)
0294      IPLAN(MI-1)=KK
0295      JPLAN(MI-1)=LL
0296      LOC(MI-1)=USE(MM)
0297      ICOUNT(KK,LL)=0
0298      DO 33 K=1,VAR
0299      CAP(KK,LL,K)=USE(MM)
0300      33  CONTINUE
0301      29  CONTINUE
0302      GC TO 26
0303      27  DO 275 I=1,52
0304      DO 275 J=1,33
0305      ICOUNT(I,J)=0
0306      275  CONTINUE
0307      26  CONTINUE
0308      CALL REPET1(MM,MI,&20,&56)
0309      20  CONTINUE
0310      WRITE(6,3004)
0311      4001  FORMAT(' ',10X,I3,3X,33A1,3X,I3)
0312      4002  FORMAT('+ ',16X,33A1)
0313      4003  FORMAT(' ',16X,33I1)
0314      4007  FORMAT('0')
0315      DO 201 I=1,2
0316      WRITE(6,4003)(IBCRD(I,J),J=1,33)
0317      201  CONTINUE
0318      DO 300 I=1,IMAP
0319      DO 210 J=1,JMAP
0320      IF(CAP(I,J,1).GE.10)GO TO 211
0322      ISTORE(J)=1
0323      GO TO 210
0324      211  ISTORE(J)=(CAP(I,J,1)/10+1)
0325      210  CONTINUE
0326      DO 220 J=1,JMAP
0327      MMAP(J)=ICHAR1(ISTORE(J))
0328      220  CONTINUE
0329      WRITE(6,4001) I,(MMAP(J),J=1,JMAP),I
0330      DO 230 J=1,JMAP
0331      MMAP(J)=ICHAR2(ISTORE(J))
0332      230  CONTINUE
0333      WRITE(6,4002)(MMAP(J),J=1,JMAP)
0334      DO 240 J=1,JMAP
0335      MMAP(J)=ICHAR3(ISTORE(J))

```

```
0336      240  CONTINUE
0337      WRITE(6,4002)(MMAP(J),J=1,JMAP)
0338      DO 250 J=1,JMAP
0339      MMAP(J)=ICHAR4(ISTORE(J))
0340      250  CONTINUE
0341      WRITE(6,4002)(MMAP(J),J=1,JMAP)
0342      300  CONTINUE
0343      WRITE(6,4007)
0344      DO 310 I=1,2
0345      WRITE(6,4003)(IBORD(I,J),J=1,33)
0346      310  CONTINUE
0347      50  CONTINUE
0348      WRITE(6,3004)
0349      3004 FORMAT('1')
0350      59  CONTINUE
0351      999 CONTINUE
0352      STOP
0353      END
```

```

0002      SUBROUTINE SERCH1(I,J,KK,LL,II,JJ,RADIUS,CNTR,NN,
          1MM,IMAP,JMAP,VAR,ORD,USES,N,BEST,IBEST,JBEST,
          1IK,ICNTR,IPLAN,JPLAN,USE,MINLEV,MAXLEV,MAP,M1,IC)
0003      INTEGER A
0004      INTEGER BST,CAP
0005      INTEGER USE(6)
0006      DIMENSION IPLAN(460),JPLAN(460)
0007      INTEGER ORD(11,6),USES,MINLEV(11,6),MAXLEV(11,6)
0008      INTEGER RADIUS,CNTR,VAR
0009      INTEGER SUM
0010      INTEGER DEPTH
0011      INTEGER STORE
0012      INTEGER BEST(121),IBEST(121),JBEST(121)
0013      DIMENSION MAP(11,6)
0014      COMMON BST(121),IBST(121),JBST(121),CAP(52,33,11),MAXDIS(6,6)
          1,MINDIS(6,6),LOC(460)
0015      COMMON NUMBER(6)
0016      COMMON ICOUNT(52,33)
0017      COMMON IPX(52,33)
0018      IC=0
0019      II=1
0020      IF(MINDIS(NN,MM).GT.0)II=MINDIS(NN,MM)+5
0022      I2=II+5
0023      IF(MAXDIS(NN,MM).GT.0)I2=MAXDIS(NN,MM)
0025      IY=I2
0026      5  CCNTINUE
0027      DO 50 DEPTH=I1,I2
0028      ICNTR=0
0029      DO 1 IJ=1,121
0030      BEST(IJ)=0
0031      1  CCNTINUE
0032      IF(MINDIS(NN,MM).GT.0)GO TO 2
0034      IX=(IY+1)-DEPTH
0035      MINJ=J-IX
0036      MAXJ=J+IX
0037      MINI=I-IX
0038      MAXI=I+IX
0039      GO TO 3
0040      2  CCNTINUE
0041      MINJ=J-DEPTH
0042      MAXJ=J+DEPTH
0043      MINI=I-DEPTH
0044      MAXI=I+DEPTH
0045      3  CCNTINUE
0046      CALL TEST(MINI,MAXI,MINJ,MAXJ,IMAP,JMAP)
0047      IF(MAXJ.EQ.33)GO TO 15
0049      DO 10 III=MINI,MAXI
0050      ILL=MAXJ
0051      KKK=III
0052      IF((IK.EQ.0).AND.(IPX(KK,LL).EQ.1))GO TO 10
0054      IF(CAP(KK,LL,1).GE.10)GO TO 10
0056      IF(ICOUNT(KK,LL).GT.0)GO TO 10
0058      CALL EVAL(I,J,KK,LL,II,JJ,RADIUS,CNTR,MM,IMAP,JMAP,VAR,
          1 ORD,USES,N,BEST,IBEST,JBEST,IC,ICNTR,IK,IPLAN,JPLAN,USE,
          1MINLEV,MAXLEV,MAP,M1,NN)
0059      10  CCNTINUE
    
```

```

0060      15      CONTINUE
0061          IF(MINJ.EQ.1)GO TO 25
0063          DO 20 III=MINI,MAXI
0064          KK=III
0065          LL=MINJ
0066          IF((IK.EQ.0).AND.(IPX(KK,LL).EQ.1))GO TO 20
0068          IF(CAP(KK,LL,1).GE.10)GO TO 20
0070          IF(ICCUNT(KK,LL).GT.0)GO TO 20
0072          CALL EVAL(I,J,KK,LL,II,JJ,RADIUS,CNTR,MM,IMAP,JMAP,VAR,
1 ORD,USES,N,BEST,IBEST,JBEST,IC,ICNTR,IK,IPLAN,JPLAN,USE,
IMINLEV,MAXLEV,MAP,M1,NN)

0073      20      CONTINUE
0074      25      CONTINUE
0075          IF(MINI.EQ.1)GO TO 35
0077          DO 30 JJJ=MINJ,MAXJ
0078          KK=MINI
0079          LL=JJJ
0080          IF((IK.EQ.0).AND.(IPX(KK,LL).EQ.1))GO TO 30
0082          IF(CAP(KK,LL,1).GE.10)GO TO 30
0084          IF(ICCUNT(KK,LL).GT.0)GO TO 30
0086          CALL EVAL(I,J,KK,LL,II,JJ,RADIUS,CNTR,MM,IMAP,JMAP,VAR,
1 ORD,USES,N,BEST,IBEST,JBEST,IC,ICNTR,IK,IPLAN,JPLAN,USE,
IMINLEV,MAXLEV,MAP,M1,NN)

0087      30      CONTINUE
0088      35      CONTINUE
0089          IF(MAXI.EQ.52)GO TO 42
0091          DO 40 JJJ=MINJ,MAXJ
0092          KK=MAXI
0093          LL=JJJ
0094          IF((IK.EQ.0).AND.(IPX(KK,LL).EQ.1))GO TO 40
0096          IF(CAP(KK,LL,1).GE.10)GO TO 40
0098          IF(ICCUNT(KK,LL).GT.0)GO TO 40
0100          CALL EVAL(I,J,KK,LL,II,JJ,RADIUS,CNTR,MM,IMAP,JMAP,VAR,
1 ORD,USES,N,BEST,IBEST,JBEST,IC,ICNTR,IK,IPLAN,JPLAN,USE,
IMINLEV,MAXLEV,MAP,M1,NN)

0101      40      CONTINUE
0102      42      CONTINUE
0103          IF(BEST(1).GT.0)GO TO 45
0105          IF(IC.GT.100)RETURN
0107          GO TO 50
0108      45      STORE=BEST(1)
0109          DO 41 K=1,ICNTR
0110          WRITE(6,1000) IBEST(K),JBEST(K),BEST(K)
0111      1000  FORMAT (' ',' POSSIBLE LOCATION ',1I2,',',1I2,
1' CAPABILITY SUM IS ',1I3)

0112      41      CONTINUE
0113          DO 46 K=1,ICNTR
0114          IF(STORE.GE.BEST(K+1))GO TO 46
0116          STORE=BEST(K+1)
0117      46      CONTINUE
0118          DO 47 K=1,ICNTR
0119          IF(BEST(K).EQ.STORE)GO TO 48
0121      47      CONTINUE
0122      48      KK=IBEST(K)
0123          LL=JBEST(K)
0124          GO TO 100
0125      50      CONTINUE
0126      100     CONTINUE

```

```
0127 IF((IK.EQ.1).AND.(BEST(1).NE.0))GO TO 110
0129 IF((IK.FQ.2).AND.(BEST(1).NE.0))GO TO 120
C131 GC TO 130
0132 110 WRITE(6,200)MM
0133 GC TO 130
0134 120 WRITE(6,300)MM
0135 200 FORMAT('D','*****MAX.DIST.VIOLATED BY ',1I2)
0136 300 FORMAT('D','*****ALL PROXEMICS VIOLATED BY USE ',1I2 )
C137 130 CONTINUE
C138 RETURN
C139 END
```

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,JO,NOXREF

```
0002      SUBROUTINE NXTBST(CNTR, KK, LL, J)
0003      INTEGER STORE, CNTR
0004      INTEGER CAP, PST, LOC
0005      COMMON BST(121), IBST(121), JBST(121), CAP(52,33,11), MAXDIS(6,6)
0006      1, MINDIS(6,6), LDC(460)
0006      COMMON NUMBER(6)
0007      COMMON ICOUNT(52,33)
0008      COMMON IPX(52,33)
0009      STORE=ICOUNT(1,1)
0010      DO 10 I=1,52
0011      DO 10 J=1,33
0012      IF(STORE.GE.ICOUNT(I,J))GO TO 10
0014      STORE=ICOUNT(I,J)
0015      K=I
0016      L=J
0017      10 CONTINUE
0018      KK=K
0019      LL=L
0020      RETURN
0021      END
```

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,1D,NOXREF

```
0002      SUBROUTINE CRDER(NN,MM,K,MAXA,MINA,ORD,MAXLEV,MINLEV,USES,  
0003      1A,MAP)  
0004      INTEGER USES,ACCEPT  
0005      INTEGER ORD(11,6)  
0006      INTEGER A  
0007      DIMENSION MAP(11,6)  
0008      DIMENSION MAXLEV(11,6),MINLEV(11,6)  
0009      K=ORD(NN,MM)  
0010      MAXA=MAXLEV(K,MM)  
0011      MINA=MINLEV(K,MM)  
0012      A=MAP(K,MM)  
0013      RETURN  
      END
```

```

COMPILER OPTIONS - NAME= MAIN,OPT=C2,LINECNT=60,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LCAD,MAP,NOEDIT,IO,NOXREF
0002 SUBROUTINE PXEVAL(MM,I,J,II,JJ,KK,LL,USES,IK,
1 IPLAN,JPLAN,USE,M1,IMAP,JMAP,NN)
0003 INTEGER USE(6)
0004 INTEGER USES
0005 INTEGER CAP,RST,LOC
0006 INTEGER A,B,C,CHECK
0007 INTEGER DEPTH
0008 DIMENSION IPLAN(460),JPLAN(460)
0009 COMMON BST(121),IBST(121),JBST(121),CAP(52,33,11),MAXDIS(6,6)
1,MINDIS(6,6),LOC(460)
0010 COMMON NUMBER(6)
0011 COMMON ICOUNT(52,33)
0012 COMMON IPX(52,33)
0013 N1=1
0014 N2=MM
0015 IF(MM.GT.1)N2=MM-1
0017 IF((NN.NE.MM).AND.(MINDIS(NN,MM).EQ.0))N1=NN+1
0019 II=0
0020 JJ=C
0021 DO 6 N=N1,N2
0022 IN=MAXDIS(N,MM)
0023 M=0
0024 IF(IN.EQ.0)GO TO 6
0026 1 CCNTINUE
0027 CALL REPET2(M,II,J1,IPLAN,JPLAN,&5,N,L)
0028 KL=(KK-II)**2+(LL-J1)**2+.5
0029 C=SQRT(FLOAT(KL))
0030 IF(C.LE.IN)GO TO 6
0032 GO TO 1
0033 5 CCNTINUE
0034 IPX(KK,LL)=1
0035 RETURN
0036 6 CCNTINUE
0037 II=I
0038 JJ=J
0039 RETURN
0040 END
    
```

COMPILER OPTIONS - NAME= MAIN,OPT=C2,LINECNT=60,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,IO,NOXREF

```

0002      SUBROUTINE CPFVAL(II,JJ,MM,CNTR,KK,LL,IMAP,JMAP,VAR,
          1ORD,USES,NN,SUM,MINLEV,MAXLEV,MAP)
0003      INTEGER SUM
0004      INTEGER ORD(11,6),USES,MINLEV(11,6)
0005      INTEGER MAXLEV(11,6)
0006      INTEGER A
0007      INTEGER CAP,RST,LOC
0008      INTEGER ACCEPT,CNTR,VAR
0009      DIMENSION MAP(11,6)
0010      COMMON BST(121),IBST(121),JBST(121),CAP(52,33,11),MAXDIS(6,6)
          1,MINDIS(6,6),LOC(460)
0011      COMMON NUMBER(6)
0012      COMMON ICOUNT(52,33)
0013      COMMON IPX(52,33)
0014      SUM=0
0015      N=1
0016      II=0
0017      JJ=0
0018      I=KK
0019      J=LL
0020      IF(CAP(I,J,1).GE.10)RETURN
0022      5      CONTINUE
0023      CALL ORDER(N,MM,K,MAXA,MINA,ORD,MAXLEV,MINLEV,USES,A,MAP)
0024      IF((CAP(I,J,K).GE.MINA).AND.(CAP(I,J,K).LE.MAXA))GO TO 10
0026      ICOUNT(I,J)=N
0027      GO TO 20
0028      10      N=N+1
0029      SUM=SUM+CAP(I,J,K)
0030      IF(N.EQ.(VAR+1))GO TO 15
0032      GO TO 5
0033      15      II=I
0034      JJ=J
0035      ICOUNT(I,J)=N
0036      20      CCNTINUE
0037      RETURN
0038      END

```

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,IO,NOXREF

```

0002 SUBROUTINE TCTDIS(VAR,MM,IHIGH,JHIGH,DIST,CELLS,
0003 1IRANK,JRANK,RADIUS,CRD,MAXLEV,MINLEV,USES,IMAP,JMAP,MAP)
0004 INTEGER A
0005 INTEGER USES
0006 INTEGER RADIUS, ACCEPT,OPD(11,6),LEVEL(11,6)
0007 DIMENSION IRANK(12),JRANK(12)
0008 INTEGER VAR,SUM,F,CELLS
0009 INTEGER DIST(CELLS),IHIGH(CELLS),JHIGH(CELLS)
0010 DIMENSION MAP(11,6)
0011 DIMENSION MINLEV(11,6),MAXLEV(11,6)
0012 DC 30 F=1,CELLS
1500 FORMAT('0','ORIGIN ',1I2,' IS ',1I2,',',1I2,
0013 1' DISTANCE IS ',1I3,/)
0014 M=VAR
0015 SUM=)
0016 DC 20 N=1,VAR
0017 CALL CRDR(N,MM,K,MAXA,MINA,ORD,MAXLEV,MINLEV,USES,A,MAP)
0018 I=IHIGH(F)
0019 J=JHIGH(F)
0020 CALL SERCH2(I,J,K,KK,LL,RADIUS,IMAP,JMAP,A)
0021 L=(KK-I)**2+(LL-J)**2
0022 ISUM=(SQRT(FLCAT(L))+.5)*M
0023 SUM=ISUM+SUM
0024 M=M-1
0025 IF(M.EQ.0)M=1
0026 20 CONTINUE
0027 DIST(F)=SUM
0028 WRITE(6,1500) F,I,J,SUM
0029 30 CONTINUE
0030 CALL RANKDR(DIST,IHIGH,JHIGH,CELLS,IRANK,JRANK)
0031 RETURN
0032 END

```

C
C

```
0002      SUBROUTINE RANKOR(DIST,IFIGH,JHIGH,CELLS  
0003      I,IRANK,JRANK)  
0004      INTEGER CELLS  
0005      DIMENSION IFIGH(12),JHIGH(12)  
0006      DIMENSION IRANK(12)  
0007      DIMENSION JRANK(12)  
0008      INTEGER DIST(12),A,STORE,F  
0009      INTEGER RANK(12),FF,STORE2(12)  
0010      DO 10 N=1,CELLS  
0011          STORE2(N)=DIST(N)  
0012      10    CONTINUE  
0013      DO 50 A=1,CELLS  
0014          STORE=STORE2(1)  
0015          FF=CELLS-1  
0016          DO 20 F=1,FF  
0017              KL=F+1  
0018              IF(STORE.GE.STORE2(KL))GO TO 20  
0019          20    STORE=STORE2(F+1)  
0020          20    CONTINUE  
0021          DO 30 N=1,CELLS  
0022              IF(STORE2(N).EQ.STORE)GO TO 40  
0023          30    CONTINUE  
0024          30    RANK(A)=STORE2(N)  
0025          40    IRANK(A)=IFIGH(N)  
0026          40    JRANK(A)=JHIGH(N)  
0027          40    STORE2(N)=0  
0028          40    STORE2(N)=0  
0029          50    CONTINUE  
0030      RETURN  
0031      END
```

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,LD,NOXREF

```

1 0002      SUBROUTINE BESTT(IMAP,JMAP,K,CELLS,IHIGH,JHIGH,
          1ICELLS,JCELLS,IRCW,JCOL,A)
1 0003      INTEGER CAP,BST,LOC
1 0004      INTEGER SUM,A,B,C,W,X,Y,Z,STORE
1 0005      INTEGER CELLS,BB,CC
1 0006      DIMENSION IRCW(12),JCOL(12),ISUM(15),JSUM(15)
1 0007      DIMENSION IHIGH(12),JHIGH(12),ITOTAL(15)
1 0008      DIMENSION JTOTAL(15)
1 0009      COMMON BST(121),IBST(121),JBST(121),CAP(52,33,11),MAXDIS(6,6)
          1,MINDIS(6,6),LOC(460)
          0010      COMMON NUMBER(6)
          0011      COMMON ICOUNT(52,33)
          0012      COMMON IPX(52,33)
          0013      5      CONTINUE
          0014      NSUM=C
          0015      10      DO 90 N=1,CELLS
          0016      B=1
          0017      X=IPX(N)
          0018      Y=IRCW(N)+IMAP/ICELLS
          0019      W=JCOL(N)
          0020      Z=JCOL(N)+JMAP/JCELLS
          0021      DO 70 I=X,Y
          0022      SUM=0
          0023      DO 40 J=W,Z
          0024      C=1
          0025      IF(CAP(1,J,K).EQ.A)GO TO 20
          0027      GO TO 40
          0028      20      SUM=SUM+1
          0029      NSUM=NSUM+1
          0030      40      CONTINUE
          0031      ISUM(B)=SUM
          0032      B=B+1
          0033      IF(B.EQ.(IMAP/ICELLS+2))GO TO 55
          0035      GO TO 70
          0036      55      CONTINUE
          0037      IF(NSUM.EQ.C)GO TO 220
          0039      C=1
          0040      BB=IMAP/ICELLS
          0041      DO 50 B=2,BB
          0042      ITOTAL(C)=ISUM(B)+ISUM(B-1)+ISUM(B+1)
          0043      C=C+1
          0044      50      CONTINUE
          0045      70      CONTINUE
          0046      C=1
          0047      STORE=ITOTAL(C)
          0048      CC=IMAP/ICELLS-2
          0049      DO 73 C=1,CC
          0050      IF(STORE.GE.ITOTAL(C+1))GO TO 72
          0052      STORE=ITOTAL(C+1)
          0053      72      CONTINUE
          0054      73      CONTINUE
          0055      CC=IMAP/ICELLS-1
          0056      DO 74 C=1,CC
          0057      IF(ITOTAL(C).EQ.STORE)GO TO 75
          0059      74      CONTINUE
          0060      75      IHIGH(N)=IRCW(N)+C

```

0061	80	CONTINUE
0062	90	CONTINUE
0063	120	CONTINUE
0064	125	CONTINUE
0065		NSUM=0
0066	130	DC 210 N=1,CELLS
0067		B=1
0068		W=JCOL(N)
0069		X=JCOL(N)+JMAP/JCELLS
0070		Y=1ROW(N)
0071		Z=1ROW(N)+IMAP/ICELLS
0072		DC 170 J=W,X
0073		SUM=0
0074		DO 160 I=Y,Z
0075		C=1
0076		IF(CAP(I,J,K).EQ.A)GO TO 140
0078		GO TO 160
0079	140	SUM=SUM+1
0080		NSUM=NSUM+1
0081	160	CONTINUE
0082		JSUM(B)=SUM
0083		B=B+1
0084		IF(B.EQ.(JMAP/JCELLS+2))GO TO 171
0086		GO TO 170
0087	171	CONTINUE
0088		IF(NSUM.EQ.C)GO TO 230
0090		C=1
0091		BB=JMAP/JCELLS
0092		DC 190 B=2,BB
0093		JTOTAL(C)=JSUM(B)+JSUM(B-1)+JSUM(B+1)
0094		C=C+1
0095	190	CONTINUE
0096	170	CONTINUE
0097		C=1
0098		STORE=JTOTAL(C)
0099		CC=JMAP/JCELLS-2
0100		DO 172 C=1,CC
0101		IF(STORE.GE.JTOTAL(C+1))GO TO 172
0103		STORE=JTOTAL(C+1)
0104	172	CONTINUE
0105		CC=JMAP/JCELLS-1
0106		DO 173 C=1,CC
0107		IF(JTOTAL(C).EQ.STORE)GO TO 175
0109	173	CONTINUE
0110	175	JHIGH(N)=JCOL(N)+C
0111	200	CONTINUE
0112	210	CONTINUE
0113		GO TO 240
0114	220	CONTINUE
0115		A=A-1
0116		GO TO 5
0117	230	CONTINUE
0118		A=A-1
0119		GO TO 125
0120	240	CONTINUE
0121		RETURN
0122		END

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
SOURCE,FBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOXREF

```
0002      SUBROUTINE PRT(USE,MM,KK,LL)
0003      COMMON BST(121),JBST(121),JBST(121),CAP(52,33,11),MAXDIS(6,6)
0004      COMMON MINDIS(6,6),LOC(460),NUMBER(6),ICOUNT(52,33)
0005      COMMON IPX(52,33)
0006      INTEGER USE(6),CNTR
0007      WRITE(6,1)USE(MM),KK,LL,ICOUNT(KK,LL)
0008      1  FORMAT('0','LAND USE ',I2,' LOCATED AT ',I2,',',I2,
0009      1  ' BUT FAILED TO PASS THROUGH ',I2)
0009      RETURN
0010      END
```

```

COMPILER OPTIONS - NAME= MAIN,OPT=C2,LINECNT=60,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LCAD,MAP,NOEDIT,LD,NOXREF
0002      SUBROUTINE SERCH2(I,J,K,KK,LL,RADIUS,IMAP,JMAP,A)
0003      INTEGER DEPTH
0004      INTEGER CAP,BST,LOC
0005      INTEGER A,RADIUS
0006      COMMON BST(121),IBST(121),JBST(121),CAP(52,33,11),MAXDIS(6,6)
1,MINDIS(6,6),LCC(460)
0007      COMMON NUMBER(6)
0008      COMMON ICOUNT(52,33)
0009      COMMON IPX(52,33)
0010      I1=1
0011      I2=20
0012      DO 50 DEPTH=I1,I2
0013      MINJ=J-DEPTH
0014      MAXJ=J+DEPTH
0015      MINI=I-DEPTH
0016      MAXI=I+DEPTH
0017      CALL TEST(MINI,MAXI,MINJ,MAXJ,IMAP,JMAP)
0018      DO 10 III=MINI,MAXI
0019      KK=III
0020      LL=MINJ
0021      5  IF(CAP(KK,LL,K).EQ.A)GO TO 100
0023      10  CONTINUE
0024      DO 20 III=MINI,MAXI
0025      KK=III
0026      LL=MAXJ
0027      15  IF(CAP(KK,LL,K).EQ.A)GO TO 100
0029      20  CONTINUE
0030      DO 30 JJJ=MINJ,MAXJ
0031      KK=MINI
0032      LL=JJJ
0033      25  IF(CAP(KK,LL,K).EQ.A)GO TO 100
0035      30  CONTINUE
0036      DO 40 JJJ=MINJ,MAXJ
0037      KK=MAXI
0038      LL=JJJ
0039      35  IF(CAP(KK,LL,K).EQ.A)GO TO 100
0041      40  CONTINUE
0042      50  CONTINUE
0043      100 CONTINUE
0044      RETURN
0045      END

```

```

COMPILER OPTIONS - NAME= MAIN,OPT=C2,LINECNT=60,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,IO,NOXREF
0002      SUBROUTINE EVAL(I,J,KK,LL,II,JJ,RADIUS,CNTR,MM,IMAP,JMAP,VAR,
1  ORD,USES,N,BEST,IBEST,JBEST,IC,ICNTR,IK,IPLAN,JPLAN,USE,
IMINLEV,MAXLEV,MAP,M1,NN)
0003      DIMENSION MAP(11,6)
0004      DIMENSION MINLEV(11,6),MAXLEV(11,6)
0005      INTEGER BST,CAP
0006      INTEGER SUM
0007      INTEGER RADIUS,CNTR,VAR,USES,ORD(11,6),LEVEL(11,6)
0008      INTEGER BEST(121),IBEST(121),JBEST(121)
0009      INTEGER USE(6)
0010      DIMENSION IPLAN(460),JPLAN(460)
0011      COMMON BST(121),IBST(121),JBST(121),CAP(52,33,11),MAXDIS(6,6)
1,MINDIS(6,6),LCC(460)
0012      COMMON NUMBER(6)
0013      COMMON ICGUNT(52,33)
0014      COMMON IPX(52,33)
0015      15  CCNTINUE
0016      IF((I1.EQ.2).OR.(IK.EQ.2))GO TO 16
0018      IF(MM.EQ.1)GO TO 16
0020      CALL PXEVAL(MM,I,J,II,JJ,KK,LL,USES,IK,
IPLAN,JPLAN,USE,M1,IMAP,JMAP,NN)
0021      IF((II.EQ.0).OR.(JJ.EQ.0))GO TO 10
0023      16  CONTINUE
0024      IC=IC+1
0025      CALL CPEVAL(II,JJ,MM,CNTR,KK,LL,IMAP,JMAP,VAR,
1ORD,USES,N,SUM,MINLEV,MAXLEV,MAP)
0026      IF((II.EQ.0).OR.(JJ.EQ.0))GO TO 10
0028      ICNTR=ICNTR+1
0029      BEST(ICNTR)=SUM
0030      IBEST(ICNTR)=KK
0031      JBEST(ICNTR)=LL
0032      10  CCNTINUE
0033      RETURN
0034      END

```

COMPILER OPTIONS - NAME= MAIN,OPT=C2,LINECNT=60,SIZE=0000K,
SOURCE,ERCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,IO,NOXREF

```
N 0002      SUBROUTINE TEST(MINI,MAXI,MINJ,MAXJ,IMAP,JMAP)  
N 0003      IF(MINJ.LT.1)MINJ=1  
N 0005      IF(MAXJ.GT.JMAP)MAXJ=JMAP  
N 0007      IF(MINI.LT.1)MINI=1  
N 0009      IF(MAXI.GT.IMAP)MAXI=IMAP  
N 0011      RETURN  
N 0012      END
```

COMPILER OPTIONS - NAME= MAIN,OPT=C2,LINFCNT=60,SIZE=0000K,
SOURCE,FBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID,NOXREF

```
N 0002      SUBROUTINE REPET3(NN,IPLAN,JPLAN,I,J,*,KKK,K)
N 0003      COMMON BST(121),IBST(121),JBST(121),CAP(52,33,11),MAXDIS(6,6),
          1MINDIS(6,6),LCC(460)
N 0004      COMMON NUMBER(6)
N 0005      COMMON ICCUNT(52,33)
N 0006      COMMON IPX(52,33)
N 0007      DIMENSION IPLAN(460),JPLAN(460)
N 0008      K=1+KKK
N 0009      IF(NN.EQ.1)GO TO 2
N 0011      IJ=NN-1
N 0012      DO 1 I=1,IJ
N 0013      K=K+NUMBER(L)
N 0014      1  CONTINUE
N 0015      2  CONTINUE
N 0016      IF(LCC(K).EQ.C)RETURN1
N 0018      I=IPLAN(K)
N 0019      J=JPLAN(K)
N 0020      RETURN
N 0021      END
```

COMPILER OPTIONS - NAME= MAIN,OPT=C2,LINECNT=60,SIZE=0000K,
SOURCE, EBCDIC, NOLIST, NODECK, LOAD, MAP, NOEDIT, ID, NOXREF

```
V 0002      SUBROUTINE REPET1(MM,MI,*,*)  
V 0003      COMMON BST(121),IBST(121),JBST(121),CAP(52,33,11),MAXDIS(6,6),  
          1MINDIS(6,6),LCC(460)  
V 0004      CCMCN NUMBER(6)  
V 0005      COMMON ICCUNT(52,33)  
V 0006      CCMCN IPX(52,33)  
V 0007      K=1  
V 0008      L=MI  
V 0009      MI=MI+1  
V 0010      DO 1 J=1,MM  
V 0011      K=NUMBER(J)+K  
V 0012      1  CCNTINUE  
V 0013      IF(K.EQ.L)RETURN1  
V 0015      RETURN2  
V 0016      END
```

COMPILER OPTIONS - NAME= MAIN,OPT=C2,LINECNT=60,SIZE=0000K,
 SOURCE,FRCDIC,NCLIST,NUDECK,LOAD,MAP,NOEDIT,ID,NOXREF

```

N 0002      SUBROUTINE REPET2(M,I,J,IPLAN,JPLAN,*,N,L)
N 0003      COMMON BST(121),IBST(121),JBST(121),CAP(52,33,11),MAXDIS(6,6),
          1MINDIS(6,6),LOC(460)
N 0004      COMMON NUMBER(6)
N 0005      COMMON ICCUNT(52,33)
N 0006      COMMON IPX(52,33)
N 0007      DIMENSION IPLAN(460),JPLAN(460)
N 0008      M=M+2
N 0009      GO TO (1,2,3,4,5,6),N
N 0010      1 K=NUMBER(1)+1
N 0011      L=M
          1+1
N 0012      IF(LOC(L).EQ.0)RETURN1
N 0014      IF(L.EQ.K)RETURN1
N 0016      I=IPLAN(L)
N 0017      J=JPLAN(L)
N 0018      RETURN
N 0019      2 K=NUMBER(1)+NUMBER(2)+1
N 0020      L=NUMBER(1)+M
          1+1
N 0021      IF(LOC(L).EQ.C)RETURN1
N 0023      IF(L.EQ.K)RETURN1
N 0025      I=IPLAN(L)
N 0026      J=JPLAN(L)
N 0027      RETURN
N 0028      3 K=NUMBER(1)+NUMBER(2)+NUMBER(3)+1
N 0029      L=NUMBER(1)+NUMBER(2)+M
          1+1
N 0030      IF(LOC(L).EQ.0)RETURN1
N 0032      IF(L.EQ.K)RETURN1
N 0034      I=IPLAN(L)
N 0035      J=JPLAN(L)
N 0036      RETURN
N 0037      4 K=NUMBER(1)+NUMBER(2)+NUMBER(3)+NUMBER(4)+1
N 0038      L=NUMBER(1)+NUMBER(2)+NUMBER(3)+M
          1+1
N 0039      IF(LOC(L).EQ.C)RETURN1
N 0041      IF(L.EQ.K)RETURN1
N 0043      I=IPLAN(L)
N 0044      J=JPLAN(L)
N 0045      RETURN
N 0046      5 K=NUMBER(1)+NUMBER(2)+NUMBER(3)+NUMBER(4)+NUMBER(5)+1
N 0047      L=NUMBER(1)+NUMBER(2)+NUMBER(3)+NUMBER(4)+M
          1+1
N 0048      IF(LOC(L).EQ.C)RETURN1
N 0050      IF(L.EQ.K)RETURN1
N 0052      I=IPLAN(L)
N 0053      J=JPLAN(L)
N 0054      RETURN
N 0055      6 K=NUMBER(1)+NUMBER(2)+NUMBER(3)+NUMBER(4)+NUMBER(5)+NUMBER(6)+1
N 0056      L=NUMBER(1)+NUMBER(2)+NUMBER(3)+NUMBER(4)+NUMBER(5)+M
          1+1
N 0057      IF(LOC(L).EQ.C)RETURN1
N 0059      IF(L.EQ.K)RETURN1
N 0061      I=IPLAN(L)
N 0062      J=JPLAN(L)
  
```