FOUNTAIN HILLS, ARIZONA

SCHOOL SITE STUDIES -- PROBLEMS AND PROPOSALS

by

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STATEMENT BY AUTHOR

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ABSTRACT

During the land planning of a new town, Fountain Hills, Arizona, the author was employed in the civil engineering firm responsible for formulation of land use plans for the developer, McCulloch Properties Inc. This paper reports an aspect of the planning, the selection of school sites. The history and arrangement of the community are reviewed and analyzed and the educational needs and facilities are considered in relation to the residential community as a whole. A master plan had been prepared specifying school sites, areas of zoning and major thoroughfares. The process and problems encountered in resolving residential boundaries for each elementary school are described. The history and philosophy of the neighborhood unit are discussed. Finally, a different method is suggested to achieve selection of a school site having the maximum social benefit and minimum social cost.
INTRODUCTION

In the last few decades the number of new communities in this country has been on the rise. Other countries have made progress in the construction of new towns, in the strict sense of self-contained, self-sufficient independent cities. However in terms of numbers of large-scale planned developments which may be identified more broadly as new communities, none can challenge the United States. New communities may be defined as those developments "constructed under single or unified management, following a fairly precise, inclusive plan and including different types of housing, commercial and cultural facilities, and amenities sufficient to serve the residents of the community." (ACIR, 1968). Although these developments may eventually achieve a considerable measure of self-sufficiency, most new communities in existence today are within commuting distance of established employment centers.

Due to the vast population increases in the western regions of the United States, developers are centering their efforts to market new communities in these areas. California has been the major area experiencing this new type of urban growth, whereas other western states remain in the initial stages.
Recently, Arizona has received the attention of investment-minded developers due to predictions of rapid population increases. Arizona communities which have arisen within the last decade include Sun City, Carefree, Lake Havasu City and Rio Rico.

The events and activities associated with another proposal, Fountain Hills, a development in the Phoenix metropolitan area, is one of the stimuli for this paper. This community was initiated by McCulloch Properties Inc. who were also responsible for Pueblo West, Colorado, Lake Havasu City, Arizona and Spring Creek, Nevada. The civil engineering firm, Trico International Inc., formulates the land use plans for development of all these McCulloch cities.

During the development of Fountain Hills, I was employed in the planning department of Trico and participated in projects ranging from initial site investigation through final site engineering. My chief projects included preparing master drainage studies, long range school site and district studies and site planning for housing, commercial, industrial and recreational areas. This paper is a detailed report of one project during this internship, the long-range school site study.

In focusing on the problems of school site planning, the experience of Fountain Hills is examined in this
paper. The arrangement of the community is reviewed and analyzed and the educational needs and facilities are considered in relation to the community as a whole. Prior to this study the master plan had been already prepared specifying school sites, areas of zoning and major thoroughfares. It became my task to resolve residential boundaries for each elementary school based on expected population densities.

In considering the process of school site selection for new communities, where a functional relationship between the school and the residential community as a whole is the desired outcome, it became essential to examine the history and philosophy of the neighborhood unit concept.

The report concludes with pragmatic recommendations for a method to achieve selection of a school site having the maximum social benefit and the minimum social cost. In order to identify areas intrinsically suitable for such land use, resource values, social values and physiographic criteria are identified and analyzed. The school is considered as a major public investment serving the social, cultural and recreational needs of the entire community. It is in relation to this expanded role that the location and design of the school are specified by this proposal.
FOUNTAIN HILLS - UNIFIED SUMMARY OF THE MASTER PLAN

The intent of this chapter is to review the development plan for the community of Fountain Hills, to explore its goals and to analyze its physical framework.

Formerly the land comprised a portion of the Tonto National Forest. In 1964 the United States Government exchanged it for acreage now included in the Point Reyes National Seashore in California. Federal ownership preserved the tract as a single unit (Fountain Hills, 1970).

The topography is highly varied, including medium to steep slopes, and stream bottoms. The flora is principally Saguaro, Mesquite, Palo Verde and desert shrubs (Figs. 1, 2). In the past this desert area had been utilized for cattle grazing purposes. The major considerations of McCulloch Properties Inc. in the choice of this area were availability of a sizeable tract of land under single ownership, and proximity to a major metropolitan center.

The Fountain Hills community site is located within the Phoenix metropolitan area and covers approximately nineteen square miles. It is bordered on the south by the Salt River Pima-Maricopa Indian Reservation; on the east by Fort McDowell Indian Reservation; on the north by the McDowell Mountain Regional Park; and on the west by
Figure 1. The flora in Fountain Hills is principally, Saguaro, Mesquite, Palo Verde and desert shrubs.

Figure 2. The topography in Fountain Hills is highly varied including medium to steep slopes.
the McDowell Mountains. The western boundary touches the city of Scottsdale at the crest of the McDowell Mountains. Commuting times to Mesa and Scottsdale are each twenty minutes from the townsite center using the two access highways, Shea Boulevard, running east to west, and State Highway 87, running northeast to southwest (Fig. 3).

Difficulties encountered in later stages of the development indicates that studies related to the political atmosphere in the Phoenix area and the topographical features of the land were not undertaken. Fountain Hills was initially to be developed as an irrigation district, as was Lake Havasu City. However public opposition forced the developers to find another vehicle for development. House Bill 145, the General Improvement District Act, more commonly known as the Model Cities Bill, was the result of this search. Since the bill had not been enacted and since it is more biased toward the developer than for the interest of the public, numerous attempts were made, predominantly by the League of Arizona Cities and Towns, to amend the bill or to prevent the developer from using it. Experts were called by the developers and representatives of the public interest to testify before both House and Senate committees. Subsequently the bill was amended and passed by the House (Gliege, 1970). However the bitterness and opposition to the development of Fountain Hills
Figure 3. General vicinity map of Fountain Hills, Maricopa County, Arizona (Fountain Hills, 1970).
was stronger than ever. Being delayed with this controversy, the developer, trying to overcome lost time, rushed into the first phase of construction on the site. This time the builders faced a different obstacle, because of weak predevelopment studies, the builders had to change the terrain more than they had anticipated. Drainage channels had to be diverted and filled in, hills had to be removed to provide passage to main roads and vegetation had to be uprooted to suit different land uses (Figs. 4, 5).

In 1969 Trico International Inc. formulated a land use plan for the community of Fountain Hills. This plan was based on several studies prepared by McCulloch Properties Inc. The studies included economic feasibility and financial reports, housing market investigations, public service requirements, and the relationship of Fountain Hills to other communities in the area. The plan was approved by the Maricopa County Planning and Zoning Commission and the Maricopa County Board of Supervisors. Subsequently the plan was publicized as the guide which would be followed in the development of Fountain Hills.

The goals and objectives as outlined in the report for the development of Fountain Hills are general and not specific. Their statements praise large scale communities as opposed to residential subdivisions. The report
Figure 4. Natural drainage channels are diverted and filled in.

Figure 5. Some washes are diverted and their courses are used for roads.
describes the plan as being one which preserves the natural beauty of the area (Figs. 6, 7), includes high and low density residential development, golf courses, commercial centers, parks, public school sites, and a major downtown commercial center near a 32-acre lake and fountain (Fountain Hills, 1970). The report outlines basic land use areas normally associated with a large scale community (ACIR, 1968), such as housing, commerce, industry, schools, community facilities and connecting roads. Unique to this plan is the 32-acre lake and the 500 foot-high fountain. One can surely say that the fountain is one objective well achieved since it is the tallest in the world (Figs. 8, 9).

A new development cannot be judged and analyzed only by the written report. A more useful and better vehicle for understanding is a map showing the plan and relating it to the area (Fig. 10, p. 13). The map shows six local commercial areas, twelve elementary schools, three junior high schools and two high schools. The northeastern one square mile area has a distinct neighborhood character. Major arterials border but do not cross through it. The elementary school is located in the center of this area, and the recreational space is combined with the school site. The shopping center is at a convenient distance from the homes and is located at the intersection of the main bordering thoroughfares.
Figure 6. Natural vegetation is removed to accommodate different land uses.

Figure 7. Small patch of vegetation which has not yet been removed.
Figure 8. Billboard advertising the community of Fountain Hills.

Figure 9. A hilltop view of fountain and man-made lake in the desert.
Figure 10 overlay. A circle of one-half mile radius was drawn around each elementary school.
Figure 10. Master Plan of Fountain Hills, Maricopa County, Arizona (Fountain Hills, 1970).
The area is well served by secondary collector roads connecting all residences to the school and shopping center. The population projection for this area (based on designated densities) constitutes approximately one elementary school area. With some exceptions, this one square mile area follows the neighborhood unit plan as seen by Clarence Perry and other planners (Perry, 1929). The validity and concept of such planning will be discussed in a later chapter, (The Neighborhood Unit Concept). The rest of the nineteen square mile area includes residential sites, roads, schools shopping centers and other elements of a community but the clear interrelation among them as seen in the northeastern one square mile is not evident.

One wonders why the neighborhood unit concept was applied only to one square mile and not carried throughout the community. A brief interview with the land use planners of Fountain Hills clarified this inconsistency. The first phase of the master plan preparation was to isolate several land use areas and present them in detail. These planned areas and consideration of topographical features and existing highways dictated the location of the future roads. An attempt to plan more neighborhood areas was made but the previously determined major arterials and other land uses made it impossible. According to the planners this process of planning was practiced to accommodate different land uses within the existing topographical
features, although the community center area was treated differently. The planners felt that the downtown area should be adjacent to the lake, despite the fact that this area was not suitable for such use. The whole area was leveled and the natural vegetation removed (Figs. 11, 12). Thus it seems that where terrain was an obstacle to what they wanted to achieve they changed the terrain. Consideration of the interrelationship among different land uses should have occurred at the first stage of the planning not only for one activity but for all activities associated with a self-sustained community.
Figure 11. Looking south across the downtown area of Fountain Hills.

Figure 12. The entire downtown area was leveled and the natural vegetation removed.
THE SCHOOL SITE STUDY OF FOUNTAIN HILLS

The Development Plan of Fountain Hills (1970) has only a few paragraphs related to the subject of education. From these paragraphs we learn that in March 1970 the developer had prepared and presented to Fountain Hills District Board of Trustees, subsidiary of McCulloch Properties Inc., a plan of educational needs based on projected population estimates. It provided for eleven elementary schools, three junior high schools, and two high schools. These schools would be situated on sites comprising a total of about 355 acres, over two percent of the development area. (Two percent is the minimum requirement set by the Planned Community Act.) The only map related to educational needs which was included in this report showed the geographical boundaries of school districts throughout Maricopa County (Fig. 13, p. 18). This map merely indicated the location of Fountain Hills School District 98 in relation to the school district boundaries of the whole county.

The report stated that a neighborhood elementary school would be within a half mile of most residential sites throughout Fountain Hills. Since a map (Fig. 16, p. 23) showing residential areas associated with their
Figure 13. Elementary and high school district boundaries, Maricopa County, Arizona (Fountain Hills, 1970).
respective schools was not included, this statement cannot be verified. The Master Plan (Fig. 10, p. 13) is the only map which indicates the future sites of the schools. Assuming that the elementary school pupils will attend the school nearest their residence, one still cannot say that most pupils live within one-half mile from a school. An overlay (Fig. 10, p. 13) of the Master Plan illustrates this very clearly. In fact, careful measurement shows that out of the 19 square mile area not more than ten square miles lies within one-half mile of a school. These ten square miles encompass approximately 55% of the total elementary school population.

Following the publication of the Development Plan of Fountain Hills (1970) I was asked to prepare a school site study for the community. The purpose of this study was to outline eleven residential areas. The location of the future school sites had been roughly indicated on the Master Plan. Some were located in residential areas surrounded by local streets. Others were bounded by major arterials, drainage channels, or commercial areas. The Master Plan had designated four categories of roads; major arterials, major collectors, secondary collectors, and local streets. Many of these roads, particularly the major arterials and major collectors, were already under construction (Figs. 14, 15).
Figure 14. Major arterials connected to Shea Blvd. were constructed early in the development stage of the community.

Figure 15. Major arterial leading to the fountain and downtown area.
In the first phase of my study arbitrary lines were chosen to separate eleven areas. At this time my main consideration in locating these lines was to define areas with centrally located elementary schools. An attempt was made not to include major arterials within the areas but to use them as boundaries between areas. Since the school sites had been specified, with no alternatives, it was not possible to include accessibility as a factor.

Within each area, separate residential densities were identified, and the size of school population was estimated. The estimated total school population was divided into three groups: elementary school population, junior high school population and high school population. A size for each elementary school site was recommended (Table 1, p. 22). Although the emphasis of this study was to estimate student population for the elementary school, the estimates for junior high and high school population derived from this study were later used to suggest rough partitioning into junior high and high schools.

Because the first attempt at defining school attendance areas used major roads as boundaries, it resulted in areas serving an unequal number of elementary school pupils; some were as low as 300, and others as high as 1100. Although 1100 pupils is normally not desirable for an elementary school there was generally no way to
Table 1. School population projection for area I, Fountain Hills, Arizona. June 2, 1970. (after Trico International Inc.)

<table>
<thead>
<tr>
<th>Area</th>
<th>Zone</th>
<th>Lots Per Acre</th>
<th>Factor</th>
<th>School Pop</th>
<th>Gross Acreage</th>
<th>Net Acreage</th>
<th>No. of Lots</th>
<th>Sch. Pop</th>
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</thead>
<tbody>
<tr>
<td>I-1</td>
<td>RI-8</td>
<td>3.8</td>
<td>1.08</td>
<td>500</td>
<td>335</td>
<td>1273</td>
<td>1374</td>
<td></td>
</tr>
<tr>
<td>I-2</td>
<td>R-3</td>
<td>2.0</td>
<td>1.80</td>
<td>16</td>
<td>11</td>
<td>22</td>
<td>40</td>
<td></td>
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<tr>
<td>I-3</td>
<td>RI-35</td>
<td>1.0</td>
<td>1.08</td>
<td>87</td>
<td>58</td>
<td>58</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td>I-4</td>
<td>RI-35</td>
<td>1.0</td>
<td>1.08</td>
<td>66</td>
<td>44</td>
<td>44</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>I-5</td>
<td>RI-10</td>
<td>2.2</td>
<td>1.08</td>
<td>57</td>
<td>38</td>
<td>83</td>
<td>89</td>
<td></td>
</tr>
<tr>
<td>I-6</td>
<td>RI-10</td>
<td>2.2</td>
<td>1.08</td>
<td>22</td>
<td>15</td>
<td>33</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>I-7</td>
<td>R-3</td>
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<td>1.80</td>
<td>11</td>
<td>7</td>
<td>14</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
<td>759</td>
<td>508</td>
<td>1527</td>
<td>1672</td>
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Elementary school population\(^3\) 920 pupils
Junior high school population\(^4\) 418 pupils
High school population\(^5\) 368 pupils
Elem. sch. site-size requirement\(^6\) 20 acres

1. R-3 Limited multiple family residential.
   RI-8 High density single family residential.
   RI-10 Medium density single family residential.
   RI-35 Low density single family residential.


3. Based on 55% of school population.

4. Based on 25% of school population.

5. Based on 22% of school population. (a total of 102% is used for safety factor)

6. Ten acres plus one acre per 100 pupils.
suggest additional school sites because the high population density areas caused this situation. An estimate of 1400 elementary school pupils for one area, due to a zoning change from low density residential dwellings to apartment dwellings, required the creation of a twelfth elementary school for Fountain Hills. The zoning change was applied to an area immediately north of the downtown area and approximately 250 acres in size. The projected elementary school population for this area was 700 pupils. The area is bordered by major arterials on all sides. The ideal location for the school would have been within the area. However, because the developers did not want to sacrifice land in the area designated for apartments, the elementary school site was situated across from one major arterial and within area A (Fig. 16, p. 25). The twelfth school, designated in figure 16 as school B, is on a site between two drainage channels. It is adjacent to a sewage treatment plant on one side and to a water retardation basin on the other side (for details of site B, see figure 21, page 31).

The importance of the distance relationship between the school site and the pupil residence and the location of the school in a safe environment seemed to me to be more important than having equal number of pupils per school. However the developer and associate personnel considered balanced distribution of pupils between adjacent areas to
be more critical than the factors mentioned above. I was therefore asked to shift the lines in such a manner as to create a more balanced distribution of pupils between areas. The character of the original areas were changed considerably. Areas of balanced pupil distribution were then achieved by bisecting the original areas not only by major collectors but also by major arterials. This also resulted in residential areas being serviced by an elementary school a mile or more distant (Fig. 16, p. 25). The overlay of figure 16 shows the areas which lie within one-half mile of their assigned schools. This area encompasses approximately 47% of the total elementary school population. The final proposal was accepted, although the distribution of the pupils remained far from balanced. Some areas included as few as 460 and some as many as 900 elementary school pupils. However since the purpose of the developer was to have not less than 450 nor more than 1000 pupils per school, and not to change the number of schools or their locations, the result was judged to be satisfactory.

A year later, in July 1971, a request for another study was made because some changes of residential densities, due to zoning adjustments, had created different population distributions. The same procedures as outlined for the first study were applied, first outlining areas, then estimating the school population (Table 2, page 26).
Figure 16 overlay. A circle of one-half mile radius was drawn around each elementary school within its own district.
Figure 16. Elementary school residential boundaries study for the community of Fountain Hills, Arizona, June 2, 1970. (after Trico International Inc.)
<table>
<thead>
<tr>
<th>Area</th>
<th>Zone *</th>
<th>Factor Lots Per acre</th>
<th>Factor (^{2}) School Pop.</th>
<th>Gross Acreage</th>
<th>Net Acreage</th>
<th>No. of Lots</th>
<th>Sch. Pop.</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-1</td>
<td>R-3</td>
<td>2.61</td>
<td>2.61</td>
<td>5</td>
<td>4</td>
<td>10</td>
<td>26</td>
</tr>
<tr>
<td>I-2</td>
<td>RI-35</td>
<td>1.31</td>
<td>1.08</td>
<td>180</td>
<td>137</td>
<td>180</td>
<td>194</td>
</tr>
<tr>
<td>I-3</td>
<td>RI-10</td>
<td>2.85</td>
<td>1.08</td>
<td>219</td>
<td>153</td>
<td>437</td>
<td>472</td>
</tr>
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<td>I-4</td>
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<td>2.61</td>
<td>2.61</td>
<td>43</td>
<td>31</td>
<td>82</td>
<td>213</td>
</tr>
<tr>
<td>I-5</td>
<td>RI-35</td>
<td>1.31</td>
<td>1.08</td>
<td>89</td>
<td>68</td>
<td>89</td>
<td>96</td>
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<tr>
<td>TOTAL AREA I</td>
<td></td>
<td>536</td>
<td>393</td>
<td>798</td>
<td>1001</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Elementary school population\(^{3}\) 550 pupils
Junior high school population\(^{4}\) 250 pupils
High school population\(^{5}\) 220 pupils
Elem. sch. site-size requirement\(^{6}\) 16 acres

1. R-3 Limited multiple family residential.
    RI-10 Medium density single family residential.
    RI-35 Low density single family residential.


3. Based on 55% of school population.
4. Based on 25% of school population.
5. Based on 22% of school population. (a total of 102% is used for safety factor)
6. Ten acres plus one acre per 100 pupils.
My objectives remained the same, delineating areas in such a way as to create safe and convenient areas for each school, however a relocation of several major arterials by the developer created further difficulties in achieving these objectives. Even though there was an increase of pupil-residence area more than one-half mile distant from assigned schools, the revised study was approved (Fig. 17 and overlay).

After final approval of the twelve school areas an attempt was made to show some relationship between each school and its surrounding residential areas. This was done in a detailed manner showing local streets, drainage areas and residential lots. One objective was to locate the school building on a somewhat higher elevation than the surrounding area. Another consideration was to provide school access roads away from main arterials. Wherever possible an attempt was made to orient the school to the areas from which the majority of the school population would be drawn (Fig. 18, p. 29). A general school-plant was outlined showing the relationship among buildings, recreational areas and incidental space. Each school was evaluated separately depending on the estimated number of pupils for the area. Due to topographical constraints and previous commitments of land for other purposes these objectives were achieved with only a few sites (Figs. 19, 20, 21).
Figure 17 overlay. A circle of one-half mile radius was drawn around each elementary school within its own district.
Figure 17. Revised study of the elementary school residential boundaries for the community of Fountain Hills, Arizona July 15, 1971. (after Trico International Inc.)
Figure 18. Desirable (above) and Undesirable (below) location for an elementary school.
Figure 19. Drainage channel near a school site.

Figure 20. View across the wash showing school site for residential area K (see figure 16, p. 25).
Figure 21. School site plan of area B. It is bounded on one side by a drainage channel, and on the opposite side by a major arterial and is bisected by a wash. (after Trico International Inc.)
Looking back at the two studies for school districts one has the feeling that the community is an already existing one which required some adjustment due to population shift. The developer spent time and money for these studies in an attempt to maximize social benefit. However, the safety of the children in this community is in question from the standpoint of school access or topographical insuitability. The poor environment of the school sites creates limitation of various educational opportunities. The relationship of the school site to residential areas and other public facilities tends to create poor participation by adults in activities offered in this institution. They failed to achieve the primary objective, which was to have a school as the central point of each neighborhood. This lack of proper land use relationships resulted from poor planning strategy. If systematic procedures of school site evaluation had been introduced in the first stages of the master plan preparation and revised as development progressed the developer could have achieved the goals outlined in the report for the development of Fountain Hills.
THE NEIGHBORHOOD UNIT CONCEPT

Contemporary land development is an enterprise conducted with the primary goal of economic benefits for the developers and much less effort is devoted to the study and appreciation of community life. The planning and development of land requires not only great skill and long experience, but the ability to adapt general methods to local conditions. This task is undertaken by many who, having no training or experience, are unable to do more than imitate what has been done before (ACIR, 1968).

In some cases, as in the case of Fountain Hills, a particular concept is used only for an advertising gimmick, usually outlined in the general plan of development, and applied in practice to only a small portion of the development area. The following statement is part of the Fountain Hills development plan: "The housing plan for Fountain Hills utilizes the neighborhood concept . . . McCulloch planners have divided the townsite into several areas, roughly equal in size, and have included a range of essential dwelling, commercial and recreational features within each area." (Fountain Hills, 1970). This statement is typical of almost any textbook dealing with the subject of neighborhood unit. As mentioned in a previous chapter,
the master plan of Fountain Hills does not demonstrate the physical characteristics of the neighborhood unit concept, with one exception, area 1, 750 acres in the northeast portion of the development. The report correctly uses this area as an illustration of neighborhood planning, however it omits the fact that this is the only area demonstrating neighborhood concept.

The main objective of this concept is the creation of a planned residential neighborhood where the physical frame of the area, its streets, open spaces, community center, and shopping districts are all placed in such a relation to the houses and to one another that they might significantly aid in the creation of a cooperative community life (Mumford, 1938).

The neighborhood unit concept in housing and city planning gained wide acceptance after the publication of Clarence A. Perry's The Neighborhood Unit, a Scheme of Arrangement for the Family-life Community (Perry, 1929). This scheme was put forward as the framework of a model community rather than as a detailed plan. Its actual realization depends on the ability of the planners to adapt such a model to the natural environment of the land in question. The underlying principal of the scheme is that an urban neighborhood should be regarded both as a unit of a larger whole and as a distinct entity within itself.
For government, fire and police protection, and for many other services, the neighborhood depends upon the municipality. But there are certain other facilities, functions or aspects which are strictly local and peculiar to a well-arranged residential community. They may be classified under four headings: 1. the elementary school, 2. small parks and playgrounds, 3. local shops, and 4. residential environment. The term "residential environment" includes the layout of streets, the lot design, and the relationship of dwelling places, shops and other commercial institutions. The attainment of these four main neighborhood functions, as well as the securing of safety for pedestrians and the laying of the structural foundation for quality in environment, depends upon the observance of the following neighborhood unit principles (Perry, 1939).

(1) Size. A residential unit development should provide housing for that population for which one elementary school is ordinarily required, its actual area depending upon population density.

(2) Boundaries. The unit should be bounded on all sides by arterial streets, sufficiently wide to facilitate by-passing traffic.

(3) Open Spaces. A system of small parks and recreational spaces planned to meet the needs of the particular neighborhood should be provided.
(4) Institution Sites. Sites for the school and other institutions having service spheres coinciding with the limits of the neighborhood unit should be suitably grouped about a central point.

(5) Local Shops. One or more shopping districts adequate to serve the population, should be laid out in the circumference of the unit, preferably at traffic junctions and adjacent to similar districts of adjoining neighborhoods.

(6) Internal Street System. The unit should be provided with a special street system, each highway being proportioned to its probable traffic load, and the street network as a whole being designed to facilitate circulation within the unit and to discourage its use by through traffic.

It is self-evident that the space to be occupied by a neighborhood unit should be just what is required for the working of its particular functions. Of the four major neighborhood functions three, school, playgrounds and shops, are services. The other, residential environment or character, is a quality that is dependent, at least partly, upon the fitness and the harmonious interplay of the first three functions. The neighborhood unit's most important element is the elementary school. Its central location and recommended size defines the physical extent of the neighborhood. The half-mile suggested maximum walking distance
for grade school children limits the size of the unit to less than one square mile. It is recommended that the school be planned for the use of both children and adults, for educational purposes, civic functions and indoor and outdoor recreational activities (Caudill, 1954). The second main element in the neighborhood unit is also significantly related to the needs of the school. That is the exclusion of through traffic from the residential area so that children are never required to cross a heavy traffic street on the way to school (Perry, 1939).

It is evident that the planners of Fountain Hills did not have a clear understanding of the neighborhood unit, as demonstrated by the fact that the school study was an isolated study. It was not coordinated with plans for the other three functions of the residential areas. All the elements usually associated with a community were included in the master plan for Fountain Hills. However, the integration of the various community elements was not achieved.

The criticism of the Fountain Hills developers is not of their failure in adopting the neighborhood unit as a scheme for their community, but of their failure in achieving the full potential of this new urban development as envisioned by its creators.
SUGGESTED CRITERIA FOR SCHOOL SITE LOCATION

New Towns, in some cases, are not built as part of regional growth demands. Rather, they are initiated by a developer who, for a variety of motives, is seeking to build a new community to satisfy his own idealistic view of a model town. His first step is to find a suitable piece of land to build this new development. Due to the obvious and universal profit motive he makes sure that his parcel of land is located in an area of growth and that it is accessible to the rest of the metropolitan area. Realizing that delay is money, the developer moves quickly, draws up plans, obtains necessary approvals, hires contractors and builds a model area for the purpose of selling lots as fast as possible. It is probably only after this point that the developer takes time to stand back and compare his original idealistic view to the reality which is occurring. To date, none of the new community developments have been a resounding success (ACIR, 1968).

The success of an urban development cannot be based solely on economic feasibility, as most developers seem to believe, but the suitability of the natural environment should be tested for human use to avoid the failures so far observed. According to Ian McHarg (1969), the author of
Design With Nature, the problem is to first apply ecological planning principles and then test them against the demands of metropolitan growth and the market mechanism. The basic proposition employed by McHarg is that any place is the sum of its historical, physical and biological processes, that these are dynamic, that they constitute social values, that each area has an intrinsic suitability for certain land uses and finally, that certain areas lend themselves to multiple coexisting land uses. To do this study all basic data—climate, historical geology, surface geology, physiography, hydrology, soils, plant ecology, wildlife habitats, and existing land uses—should be compiled and mapped. For each area of concern, the most important factors are identified. Every area of concern is then evaluated for different land uses. This process will identify areas intrinsically suitable for each of the land uses considered—recreation, conservation and both residential and industrial commercial aspects of urbanization (McHarg, 1969).

The result of such a study would be the first step toward realizing the type and size of possible future population centers. At this point the concept of a model community could be outlined. Once the scheme for the community is proposed each element within it should be evaluated and its relationship to other elements analyzed.
My objective here is to propose a systematic procedure for one element of a community, that of school site selection. This procedure is general and could be applied to a variety of community models. The method that has been traditionally used by planning agencies for future school facilities involves recommendations as to the general locations of the schools based on a limited unsystematic analysis (ASPO, 1963). The procedure I am proposing is based on certain basic areas of concern designed to identify ideal school sites in the communities being considered (Schneider and Wilsey, 1961). The objectives of this method concur with the ideals of McHarg and seek to incorporate resource values, social values and physiographical criteria. The primary goal of such a method is to reveal the school site location having the maximum social benefit and the minimum social cost. The school serves not only the educational needs, but the social, cultural and recreational needs of the whole community. Thus the school is considered as a major public investment which will affect the way of life, economy, health and visual experience of the entire population within its sphere of influence. It is in relation to this expanded role that the school should be located and designed (Sumption and Landes, 1957).

Categories to be considered for such a study might vary in detail from one community to another but the general
considerations will not change. The first group of factors includes the physical characteristics of the terrain. The degree of opportunity or limitation they afford is reflected directly in the cost of the school site development. The second category concerns danger to life and property. The remaining categories are evaluations of the natural and social processes including scenic values, recreational values, plant life values, and neighborhood values. It is recommended that the factors within each category be evaluated in a gradient of at least three values. The most unsuitable values are described as belonging to zone 1 and the most desirable values are placed in zone 3, with zone 2 an intermediate rank. The categories affecting school sites are given as follows, but not given necessarily in order of importance:

A. SLOPE

Zone 1 Areas with slopes in excess of 10%.
Zone 2 Areas with slopes less than 10% but in excess of 2%.
Zone 3 Areas with slopes less than 2%.

B. SURFACE DRAINAGE

Zone 1 Surface-water features such as streams, lakes and ponds.
Zone 2 Natural drainage channels and areas of constricted drainage.
Zone 3 Absence of surface water or pronounced drainage channels.
C. SOIL DRAINAGE

Zone 1 Salt marshes, brackish marshes, swamps, and other low-lying areas with poor drainage.

Zone 2 Areas with high water table.

Zone 3 Areas with good internal drainage.

D. BEDROCK FOUNDATION

Zone 1 Areas identified as marshlands are the most obstructive to the foundation of the building: they have an extremely low compressive strength.

Zone 2 The Cretaceous sediments: sands, clays, gravels.

Zone 3 The most suitable foundation conditions are available on crystalline rocks: serpentine and diabase.

E. SOIL FOUNDATION

Zone 1 Silts and clays have poor stability and low compressive strength.

Zone 2 Sandy loams and gravelly sandy to fine sandy loams.

Zone 3 Gravelly sand or silt loams and gravelly to stony sandy loams.

F. SUSCEPTIBILITY TO EROSION

Zone 1 All slopes in excess of 10° and gravelly sandy to fine sandy loam soils.

Zone 2 Gravelly sand or silt loam soils and areas with slopes in excess of 10° on gravelly to stony sandy loams.

Zone 3 Other soils with finer texture and flat topography.

G. FLOOD INUNDATION

Zone 1 Frequent flooding area based on previous records.
Zone 2  Susceptible areas to flooding based on projected data.
Zone 3  Areas above flood line.

H. SCENIC VALUE
Zone 1  Low scenic values.
Zone 2  Some scenic elements.
Zone 3  Scenic elements present.

I. RECREATION VALUE
Zone 1  Area with low recreational potential.
Zone 2  Some recreational potentials.
Zone 3  High recreational potentials with close relation to other institutions in the area.

J. PLANT LIFE VALUE
Zone 1  Requires removal of most natural vegetation.
Zone 2  Some difficulty in preserving natural vegetation.
Zone 3  Natural vegetation could be incorporated as part of the school-plant.

K. POLLUTION VALUE
Zone 1  Areas within close proximity of factories, trucks, airports, and heavy traffic.
Zone 2  Some effect from smoke, dirt or dust, odors, and smog.
Zone 3  Areas free from noise and air pollution.

L. TRAVEL SAFETY VALUE
Zone 1  Most pupils have to cross major arterials, railroads or other obstructions.
Zone 2 Many pupils cross or pass dangerous areas.

Zone 3 All pupils are free from crossing major traffic arterials.

M. TRAVEL DISTANCE VALUE

Zone 1 Over one mile away from most distant pupils.

Zone 2 Less than one mile away but more than one-half mile from most distant pupils.

Zone 3 One-half mile or less away from most distant pupils.

N. VISUAL VALUE

Zone 1 Physical and natural obstruction of light and view most of the days of the year.

Zone 2 Visual obstruction to light and view more than three months a year.

Zone 3 Clear view and free from light obstruction most of the days of the year.

A map is made for each category for the land area under consideration. Depending on which zone applies to the area, it is shaded in tones of grey, with zone 3 the lightest and zone 1 the darkest. The maps are made as transparent prints. The transparencies of the physiographic categories are superimposed upon one another and from this a summary map is produced that reveals the sum of physiographic factors influencing school site location. Each subsequent parameter is then superimposed upon the preceding ones until all parameters are overlaid. The darkest tone then represents the sum of social values and
physiographic obstructions to the school area. The lightest tone reveals the areas of highest social value representing the least direct cost for school construction. If the values are identified and ranked correctly, the composite map will reveal an area most suitable for this use.

Several general considerations are a must before applying such a method. The suggested alternative school sites or the general vicinity of the school site should be outlined and related to other functions of the residential area and the community as a whole. The area associated with the school should be identified and the number of pupils should be estimated. According to the needs and the number of pupils, the site size for the school area should be recommended (Caudill, 1954).

It is important to observe that at the beginning of the study the outcome is unknown. It is necessary to await the compilation of data, make the transparent maps, superimpose them over a light table and scrutinize them for the identification of the area. Several unpredicted results might occur. The area identified for the school site might not be in accord with the general scheme in the planner's mind. At this point it would be up to the planner to evaluate and analyze the situation and make the decision as to the changes to be made. A master plan, by nature should allow for alternative solutions leading to completion of
the task. To decide upon the best alternative, all studies should be completed before the implementation stage. Failure to do this was illustrated by the many difficulties encountered in the preparation of the school site study for Fountain Hills.

Regulatory techniques for the pre-development phase should be thought of as a bundle of legal tools to implement policies embodied in the approved plans for the large-scale development and on a broader scale, as devices to guide its development from site selection through construction. The plans per se are not regulatory devices, yet they can become the bases for land-use control, not just in theory, but in fact (ACIR, 1968).
LITERATURE CITED


