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Development Intensity Plan for the City of Tiffin, Iowa

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DEVELOPMENT INTENSITY PLAN FOR THE CITY OF TIFFIN, IOWA

Prepared by:

JAYAJIT CHAKRABORTY
MICHAEL SLAGLE

Submitted to:

Mike Hart, Tiffin City Engineer
Tiffin City Council
Glenn Potter, Mayor of Tiffin
May 6, 1993

102:215 Field Problems in Planning
Graduate Program in Urban and Regional Planning
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EXECUTIVE SUMMARY

In the fall of 1992, the East Central Iowa Council of Governments completed a land use plan for the City of Tiffin, Iowa. The technical portion of the land use plan was done without aid of computer analysis. In October of 1992, the opportunity arose to complement the land use plan with this report which uses computer analysis to identify areas of high, medium-high, medium and low development intensity based on a predetermined set of criteria.

It is hoped that this report will serve as a prototype for the East Central Iowa Council of Governments and other regional planning agencies for future land use and development planning studies. This development plan could represent an alternative approach to land use planning in the future. The rapidly emerging geographic information system technology is used in this study to provide solutions to development allocation questions. This plan is replicable in that the method used in this study can be applied to other communities with minimal or no refinement. If a planning agency were to combine the analyses of a city's population, income and housing characteristics (as the land use plan does) along with a more technical approach to land use and development planning (as this plan does), objectivity in making location decision recommendations could be enhanced.

This report identifies the areas of Tiffin that are best suited for high, medium-high, medium and low intensity development based on the site-situation relationships of the following criteria:

- Transportation links (situation);
- Slope characteristics (site);
- Soil characteristics (site); and
- Environmental constraints to development within the study region (site).
It is not the purpose of this report to establish actual land uses of certain areas. Instead, this report establishes the actual locations of appropriate development intensities within the planning area.

Specifically, this plan will be useful to the city of Tiffin for a variety of reasons.

- The plan can serve as a development strategy for the City. City leaders will have a variety of maps at their disposal which indicate the most suitable development areas for high, medium-high, medium and low intensity development.
- The plan indicates areas where higher intensity development will probably take place. This will enable the City Council to take proactive measures when planning for the future growth of the City.
- This plan can be an aid in solving locational and land use questions, and can be a basis, legal and otherwise, for land use regulation decisions the City Council may enact.
- This plan can serve as a preliminary step in environmental impact assessments.
DESCRIPTION OF THE PROBLEM

Background To The Report

In the fall of 1992, the East Central Iowa Council of Governments completed a land use plan for the City of Tiffin, Iowa. Included in this plan were analyses of Tiffin's population, income and housing characteristics, an inventory of current land use schemes, a commentary on current zoning and subdivision ordinances, and recommendations for future land use for the City.

The technical portion of the land use plan was done without aid of computer analysis. In October of 1992, the opportunity arose to complement the land use plan with this report which uses computer analysis to identify areas of high, medium-high, medium and low development intensity based on a predetermined set of criteria. This report does not attempt to supersede the land use plan's recommendations which were adopted by the Tiffin City Council in December of 1992. Rather, the land use plan and this study should be thought of as complementary. The land use plan focuses on the population, housing and income characteristics of Tiffin, while this development intensity allocation study is more technical in nature. Both plans attempt to address the planning issues raised by their respective conclusions.

This development plan could represent an alternative approach to land use planning in the future. If a planning agency were to combine the analyses of a city's population, income and housing characteristics (as the land use plan does) along with a more technical approach to land use and development planning (as this plan does), objectivity in making location decision recommendations could be enhanced.

It is hoped that this report will serve as a prototype for the East Central Iowa Council of Governments and other regional planning agencies for future land use and development planning studies. The report offers a relatively new way to look at an old problem. The rapidly emerging geographic information system technology is used in this study to provide solutions to
development allocation questions. This plan is replicable in that the method used in this study can be applied to other communities with minimal or no refinement.

A community needs to know the areas of appropriate development intensity for future possible uses of its current and surrounding land. By examining the site-situation characteristics of the land, determination of appropriate development intensities can be made. Site characteristics refer to the physical attributes of a particular location—in this study's case, the physical attributes of the least common geographical units. Situation characteristics refer to relative location. Situation places an area's attributes in a relational context with the surrounding areal attributes.

This report identifies the areas of Tiffin that are best suited for high, medium-high, medium and low intensity development based on the site-situation relationships of the following criteria:

- Transportation links (situation);
- Slope characteristics (site);
- Soil characteristics (site); and
- Environmental constraints to development within the study region (site).

It is not the purpose of this report to establish actual land uses of certain areas. Instead, this report establishes the actual locations of appropriate development intensities within the planning area. By overlaying and analyzing the four locational factors mentioned above, the areas that meet the criteria for the three development intensities readily become evident, and policy recommendations can be made in accordance with these areas.

It must be stressed that this plan is only to be used as an advisory tool for the East Central Iowa Council of Governments, the City Engineer, and the Tiffin City Council. Tiffin's City Council is under no obligation to adhere to the development boundaries present in this plan. However, this plan is based on a computer analysis of four locational factors, and the
development intensity boundaries contained within this plan are believed to be the locations of appropriate development intensities within the planning area.

Specifically, this plan will be useful to the city of Tiffin for a variety of reasons.

- The plan can serve as a development strategy for the City. City leaders will have a variety of maps at their disposal which indicate the most suitable development areas for high, medium-high, medium and low intensity development.
- The plan indicates areas where higher intensity development will probably take place. This will enable the City Council to take proactive measures when planning for the future growth of the City.
- This plan can be an aid in solving locational and land use questions, and can be a basis, legal and otherwise, for land use regulation decisions the City Council may enact.
- This plan can serve as a preliminary step in environmental impact assessments.

The Report's Study Area

The area that was studied for this report included all of Tiffin's current corporate limits, the area south of Tiffin to Interstate-80, the area east of Tiffin to Interstate-380, the area north of the City to the Ireland Avenue and Robert's Ferry fork, and the area to the west of Tiffin 1/4 mile past the electrical station. The total area of the study region is approximately 3075 acres. Map 1 shows the study area.
METHODOLOGY

Basic Methodology

The following methods were used to arrive at the conclusions contained in this report:

- Least common geographical unit approach for polygon overlay.
- Database query.
- A weighting mechanism.

A geographical information system (GIS) was used in this study. A GIS can best be thought of as a system for the "capture, storage, retrieval, analysis and display of spatial data" (Clarke, 1990, p. 11). A GIS consists of two parts—a graphics display device and an internal database. Together, these elements can produce digital overlays of spatially referenced information to help analyze and display the information present in the overlays.

The least common geographical unit approach (LCGU) for polygon overlay is a method of overlaying digital layers of information and re-entering the new polygons created by the overlay into another database. The LCGU method creates the largest possible areal unit of like characteristics for spatial analysis and query. This procedure is not a necessary step in some GIS packages, but the analysts in this study found it necessary to do so because the GIS software package used was limited in its overlay capabilities.

After the information from the LCGU step was completed and attributes for those new polygons were assigned, a database query was done to arrive at maps that show high, medium-high, medium, and low development intensities. A database query involves setting up various expressions using structured query language (SQL) to arrive at solutions to the various questions posed.
Not all of the four layers of digital information were treated equally. Weighting schemes were used to differentiate between those layers that were of greater importance than others. The values of the weights assigned to each layer will be discussed in the section Selection Criteria.

The hardware used in the project consisted of an IBM compatible computer with an Intel 486DX2 microprocessor chip operating at 50 mhz, a super VGA color monitor, and a laser printer. The software used was MapInfo, a geographic information system and analysis package.

**Base Map Sources**

Analog and digital maps for building the cartographic database for this project were from the following sources:

<table>
<thead>
<tr>
<th>Layer</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tiffin City Base Map</td>
<td>Johnson County Auditor AutoCAD files</td>
</tr>
<tr>
<td>Regional Soil and Slope Map</td>
<td>Johnson County General Soil Map</td>
</tr>
<tr>
<td>Environmental Hazard Map</td>
<td>FEMA Floodplain Map</td>
</tr>
<tr>
<td>Transportation Map</td>
<td>Johnson County Auditor AutoCAD files</td>
</tr>
</tbody>
</table>

The base map was checked for accuracy via ground measurements and comparison with other forms of digital information, and was found to be accurate for use in the project.

**Development Of Digital Maps From the Base Map Sources**

Each of the base maps used in this project were overlaid and queried based on a predetermined set of criteria to arrive at the four development intensities. (The justification of the selection criteria used can be found in the following section.) Prior to the generation of the four intensity maps, each digital layer had to be prepared for overlay. The transportation map, which came from the Johnson County Auditor AutoCAD files, was developed by creating a 300 meter buffer around the two major transportation links that serve the Tiffin area--U.S. Highway 6 and Interstate 80. The environmental hazard map was developed from the Federal Emergency
Management Act floodway maps. The floodplain for Clear Creek was identified and mapped accordingly. No other environmental hazards were identified. The soil and slope map was developed from the Johnson County General Soil Map. Each major soil class and slope characteristic was grouped together to create large areal units. These areal units were then digitized using MapInfo's interactive digitizing mode to produce the soil and slope digital layer.

After each digital layer was produced, an overlay of all the layers was created. This overlay, shown on Map 2, created the least common geographical unit polygons which formed the basis for the areal units used in this study. The other locational factor layers used in the study can be found in the appendix beginning on page 30.
SELECTION CRITERIA

Intensities Of Development

The objective of the study was to determine the capability of different areas on the map to support various types of development. The suitability of any area for a particular type of land use is indicated by its intensity of development. Each intensity in turn implies the presence or absence of a particular set of selection criteria. The land uses corresponding to the four categories of development intensities that were taken into consideration for the study area are listed in Table 1.

**TABLE 1: Classification Of Land-Uses By Intensity Of Future Development**

<table>
<thead>
<tr>
<th>High</th>
<th>Medium-High</th>
<th>Medium</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial</td>
<td>Office Park</td>
<td>Semi-public</td>
<td>Agricultural</td>
</tr>
<tr>
<td>Commercial</td>
<td>Warehousing</td>
<td>Neighborhood</td>
<td>Public</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>Residential:</td>
<td>commercial</td>
<td>Conservation</td>
</tr>
<tr>
<td>Research Park</td>
<td>DU&gt;6/acre</td>
<td>Residential:</td>
<td>Woodland</td>
</tr>
<tr>
<td>Residential:</td>
<td>Light Industrial</td>
<td>DU&lt;8/acre</td>
<td>Trails</td>
</tr>
<tr>
<td>DU&gt;8/acre</td>
<td>Light Commercial</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The basis for grouping the suggested land uses into four development intensities was that some areas in the study region are more capable than other areas of supporting different types of development intensities. Identification of such areas is based on the physical (site and situation) characteristics of the land. Land best suited for higher intensity uses, and identified by this study, was assigned more intense land uses. Land less suited for development was assigned lower intensity uses.

High intensity land-uses (commercial, industrial, etc.) not only require easy access to significant traffic ways, but also factors such as flat topography, room for expansion and necessary utilities. Areas with severe natural or physical limitations are not suitable for heavy or intense development, and are designated for low intensity development. Medium-high and medium development intensities are based on specific evaluation criteria (discussed later) and
include residential uses that are not as dense as high intensity, lighter forms of industrial and commercial development and public facilities. Though areas suitable for more intense development can adequately serve lower intensities, those designated for low intensity land uses cannot support high intensity development. This is illustrated in Table 2.

**TABLE 2: Interrelationships Of Various Intensities Of Development**

<table>
<thead>
<tr>
<th>Development Intensity</th>
<th>LOW</th>
<th>MEDIUM</th>
<th>MEDIUM-HIGH</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEDIUM</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEDIUM-HIGH</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>HIGH</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

x : indicates capability of meeting the demands of a particular intensity

**Identification Of Locational Factors And Their Effect On Intensity Of Development**

Locational factors such as ready access to transportation networks or natural limitations serve as indicators of potentials and limitations for a particular land-use. These were evaluated carefully for preparing an efficient and environmentally-sound future development plan. Four locational factors were identified for determining the areas of high, medium-high, medium and low intensity of development in the study area. The contribution of each factor to urban development in terms of potentials and limitations are as follows:

- **Environmental hazard zone:** Environmentally sensitive areas pose serious limitations to intensive development. As far as the city of Tiffin is concerned, the Clear Creek floodplain (south of the existing city) has flooded often in the past and is most likely to continue to flood periodically in the future. The city's recent floodplain management ordinance regulates and restricts new structures, improved structures, factory built homes, subdivisions, sanitary sewer systems, and other land use developments in the areas identified
as having flood hazard tendencies. The environmental hazard zone along the Creek is also classified as a wetlands area. The combination of all these factors rules out any possibility of intense development within this zone.

- **Transportation corridor:** The relationship between transportation networks and land-use intensity is well established. Intense land uses are generally located adjacent to traffic ways and, as the level of access increases, intensity increases. In the study area, the major highway (US. Highway 6) and interstate (Interstate 80) play an important role in determining locations of higher intensity development. A 150 meter (500 feet) transportation corridor along each side of these two transportation links was chosen as a positive locational criterion for high intensity development. This 150 meter service buffer was also recommended by the Iowa City Land Use Plan as a distance over which collector and local streets easily provide arterial system access for intense land uses. Areas located outside the transportation layer are less suited for intense land use in comparison with areas inside this corridor.

- **Soil quality:** Soil requirements vary for different land-uses and intense uses are more restricted by soil characteristics than others. Factors usually considered to be development hazards include bearing capacity, degree of wetness, shrink-swell potential, shear-strength, compressibility and the consolidating characteristics of the soil. The Johnson County General Soil Map has each soil group rated as to its potential for urban development, and mapped according these limitations - slight, moderate and severe - for general urban developability. For this model, soils falling in the "slight" or "moderate" category were considered to be adequate for intense development. Soils posing severe limitations were classified as poor. Dividing the soil quality attribute into two criteria was appropriate because further division of the variable did not alter the model's results.

- **Slope characteristics:** Slope is closely related to soil quality, and areas of steep slopes present limitations to urban development. Construction difficulties and erosion hazards are two potential problems associated with steeper slopes. In addition, roads built at grades of
over 10 percent pose hazardous driving conditions in winter months, and periodic flooding
is common. Moderately sloped land (less than 10 percent) is better suited for development
as it provides adequate drainage, causes fewer erosion hazards, and minimizes development
costs. The areas on the soil map with a slope of 10 percent or less were classified as
adequate for intense development. Steeper slopes (above 10 percent) that posed greater
limitations were classified as poor. Dividing the slope variable into two categories—poor
and adequate—was realistic for this study because the model was concerned about whether
or not a certain LCGU was suitable for development, not what the slope was of that
particular LCGU.

Based on the above description of the locational factors used in this model, two
possibilities or attributes for each factor exist. These can be summarized as:

<table>
<thead>
<tr>
<th>Factor</th>
<th>Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location with respect to environmental hazard zone</td>
<td>inside or outside</td>
</tr>
<tr>
<td>Location with respect to transportation corridor</td>
<td>inside or outside</td>
</tr>
<tr>
<td>Soil quality</td>
<td>adequate or poor</td>
</tr>
<tr>
<td>Slope characteristic</td>
<td>adequate or poor</td>
</tr>
</tbody>
</table>

**Intensity Evaluation Criteria**

**Assumptions**

After the identification of the locational factors, their contributions, attributes and
locations on the map, two important points were taken into consideration before the actual
overlay of the four map layers.

- The locational factors are interrelated and are present in combination at all locations on the
  map of our study area. The interrelationships of the locational factors must be recognized
  through an objective system before using them to indicate appropriate locations of land use
  intensities. There are sixteen possible combinations of these four variables and their
attributes. Table 3 lists all the different possibilities for any area on the map based on the attributes of the four variables.

TABLE 3--Possible Combinations Of The Evaluation Criteria

<table>
<thead>
<tr>
<th>Environmental Hazard Zone</th>
<th>Transportation Corridor</th>
<th>Soil Quality</th>
<th>Slope Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 outside</td>
<td>inside</td>
<td>adequate</td>
<td>adequate</td>
</tr>
<tr>
<td>2 outside</td>
<td>inside</td>
<td>adequate</td>
<td>poor</td>
</tr>
<tr>
<td>3 outside</td>
<td>inside</td>
<td>poor</td>
<td>adequate</td>
</tr>
<tr>
<td>4 outside</td>
<td>inside</td>
<td>poor</td>
<td>poor</td>
</tr>
<tr>
<td>5 outside</td>
<td>outside</td>
<td>adequate</td>
<td>adequate</td>
</tr>
<tr>
<td>6 outside</td>
<td>outside</td>
<td>adequate</td>
<td>poor</td>
</tr>
<tr>
<td>7 outside</td>
<td>outside</td>
<td>poor</td>
<td>adequate</td>
</tr>
<tr>
<td>8 outside</td>
<td>outside</td>
<td>poor</td>
<td>poor</td>
</tr>
<tr>
<td>9 inside</td>
<td>inside</td>
<td>adequate</td>
<td>adequate</td>
</tr>
<tr>
<td>10 inside</td>
<td>inside</td>
<td>adequate</td>
<td>poor</td>
</tr>
<tr>
<td>11 inside</td>
<td>inside</td>
<td>poor</td>
<td>adequate</td>
</tr>
<tr>
<td>12 inside</td>
<td>inside</td>
<td>poor</td>
<td>poor</td>
</tr>
<tr>
<td>13 inside</td>
<td>outside</td>
<td>adequate</td>
<td>poor</td>
</tr>
<tr>
<td>14 inside</td>
<td>outside</td>
<td>adequate</td>
<td>poor</td>
</tr>
<tr>
<td>15 inside</td>
<td>outside</td>
<td>poor</td>
<td>adequate</td>
</tr>
<tr>
<td>16 inside</td>
<td>outside</td>
<td>poor</td>
<td>poor</td>
</tr>
</tbody>
</table>

The four locational factors vary in the strength of their effects on development. For the study area in question, the environmental hazard zone is easily the most vital criterion for determining the intensity of development for any particular area and its importance equals the other factors taken together. Second in order importance is location relative to the transportation corridor which is almost as important as the two remaining factors - soil quality and slope, together. The significance of these two variables were assumed to be almost the same because there is not much variation between them. It should be noted that the model used here is a function of the characteristics of the area studied. The model would need to be altered in an area where slope or soil is a more severe development restraint.
Calculation of Intensity Scores

After identification of all the possible combinations for any area on the map and the relative significance of each locational variable, the final step was the computation of the intensity scores for every possible combination. The process consisted of four basic steps.

- Step 1: Weights were assigned to each of the four variables based on their relative importance discussed previously. They were as follows:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location with respect to environmental hazard zone</td>
<td>4</td>
</tr>
<tr>
<td>Location with respect to transportation corridor</td>
<td>2</td>
</tr>
<tr>
<td>Soil quality</td>
<td>1</td>
</tr>
<tr>
<td>Slope characteristic</td>
<td>1</td>
</tr>
</tbody>
</table>

- Step 2: Values were assigned to the variable attributes as either 0 (negative role) or 1 (positive role) based on their contribution to intense development.

- Step 3: Intensity scores for each possible combination were calculated by adding up the products of attribute value and variable weight. The scores for the various combinations are listed in the Decision Matrix Table which can be found in the appendix on page 23.

- Step 4—Determination of Development Intensity: The intensity score of any area on the map is a measure of its capability to support various intensities of land uses. Areas with a higher score can support higher intensity development. The division of the four categories of development intensities (based on scores) which were used to determine the intensities in the Decision Matrix are as follows:

<table>
<thead>
<tr>
<th>Score</th>
<th>Intensity Of Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>Low</td>
</tr>
<tr>
<td>5-6</td>
<td>Medium</td>
</tr>
<tr>
<td>7</td>
<td>Medium-high</td>
</tr>
<tr>
<td>8</td>
<td>High</td>
</tr>
</tbody>
</table>
FINDINGS

Based on the prescriptive and descriptive modelling approaches discussed above, four maps were created from the information contained within the GIS database. The four maps indicate the appropriate areas of high, medium-high, medium and low development intensity.

Low Intensity Areas

Seven areas, consisting of approximately 540 acres, best suited for low development intensity were identified in the Tiffin study region. This development intensity consisted of areas that were within the environmental hazard area or were outside the environmental hazard area and also were outside of the two 300-meter transportation buffers and had poor soil and slope quality for construction purposes.

The areas identified by the low intensity criteria are found:
- in the flood hazard area;
- in an area in the northeast corner of the study region; and
- in an area in the southeast portion of the study region.

Map 3 shows the areas of low development intensity. The following land uses are appropriate in areas of low intensity:
- Agricultural
- Public
- Conservation
- Woodland
- Trial
MAP 3 - TIFFIN, IOWA
Development Intensities

- Light intensity areas
- Outside light intensity areas

Scale: 1 in = 4768 ft
Medium Intensity Areas

Medium intensity areas were defined as those with the following characteristics:

outside the environmental hazard area AND EITHER

* outside the 300-meter transportation buffers with adequate slope and soil characteristics, OR

* any one of the three conditions: inside the transportation buffer, or adequate slope or soil characteristics.

Twenty least common geographical units were found to fit the above criteria. The locations of these areas, which cover approximately 1650 acres and are shown by Map 4, are:

* north of the U.S. Highway 6 300-meter buffer;

* south of the U.S. Highway 6 300-meter buffer area but north of the flood hazard area;

* south of the flood hazard area, but north of the Interstate 80 300-meter buffer.

The land uses best suited for medium intensity development include those listed in the low intensity category along with:

* Semi-public (e.g. libraries)

* Neighborhood commercial

* Residential uses of less than 8 dwelling units per acre
MAP 4 - TIFFIN, IOWA
Development Intensities

- Medium Intensity Areas
- Outside Medium Intensity Areas

Scale: 1 in = 4800 ft
Medium High Intensity Areas

Sixteen areas, representing approximately 500 acres, that are best suited for medium high development intensity were identified in the study area. Medium high intensity areas are outside the environmental hazard area, within the 300 meter transportation buffers, and have either adequate soil or slope for construction. These areas are located:

- west of the current core area of Tiffin and to the south of U.S. Highway 6;
- east of the current core area within the 300-meter transportation buffer of U.S. Highway 6;
- north of Interstate-80 and within its 300-meter buffer.

Map 5 indicates the appropriate areas of medium high development intensity. The land uses suitable for medium-high intensity use include those listed previously as low and medium intensity as well as the following:

- Office/Research Parks
- Warehousing
- Light industrial
- Light commercial
- Residential uses of greater than 8 dwelling units per acre
MAP 5 - TIFFIN, IOWA
Development Intensities

- Medium High Areas
- Outside Medium High Area

Scale: 1 in = 4768 ft
High Intensity Areas

Seventeen least common geographical units within the Tiffin study region were selected for high intensity development based on their characteristics. Areas identified as high intensity potential make up approximately 375 acres. These areas are located:
- near the current core area of Tiffin;
- to the north of U.S. Highway 6 and to the west of the current core area; and
- to the north of Interstate 80.

High intensity areas are within the 300 meter transportation buffer (created around Highway 6 and Interstate 80), have adequate soil and slope characteristics for construction, and are outside the environmental hazard area. Map 6 shows the appropriate areas of high intensity development.

The following land uses most appropriate in a high intensity area include all the land uses previously mentioned along with:
- Heavy Industrial
- Heavy Commercial
- Manufacturing
MAP 6 - TIFFIN, IOWA
Development Intensities

- High Intensity Areas
- Outside High Intensity Areas

Scale: 1 in = 4768 ft
Composite Map and Relationship of Development Intensities

Map 7 indicates the four development intensities in the Tiffin study region. Map 7 is a composite of maps 3, 4, 5 and 6.

The development intensity areas identified in this plan are based on four locational factors—transportation links, environmentally sensitive areas, soil and slope characteristics of the study area—and, as a result, are macro in nature. On a more micro level, the actual uses of the land within each intensity should be determined with a consideration of other factors such as the following:

- Proximity to existing infrastructure
- Proximity to the current core area of Tiffin
- Proximity to existing development and urban areas of Johnson County
- Proximity to the electrical station west of Tiffin.

Specifically, there are many examples of how the above variables can lend themselves to further development intensity identification. Development types that need to be close to infrastructure will probably be located closest to the existing infrastructure lines. The cost of development will be lower the fewer infrastructure improvements are needed. Development intensities should also be greater closer to the current core area of Tiffin to prevent "leap-frog" development. High intensity land uses which include commercial and manufacturing development could locate near the electrical station west of Tiffin, whereas high intensity residential development would be well-advised not to locate near there due to health and safety reasons.

The cartographic model designed for this plan did not use the above variables in the initial iteration of intensity identification. These variables were set aside to be used in a more micro-level analysis of specific development use of the varying intensities.
MAP 7 - TIFFIN, IOWA
Development Intensity

- High Intensity Areas
- Low Intensity Areas
- Medium Intensity Areas
- Medium High Intensity Areas

Scale: 1 in = 4768 ft
POLICY IMPLICATIONS

This development intensity plan has resulted in a number of policy implications for the City of Tiffin.

First, it is stressed that this plan is advisory in nature. The Tiffin City Council, City Engineer and the East Central Iowa Council of Governments are under no obligations to adhere to the development intensity boundaries identified in this plan. This plan is based, however, on an analytical approach to the problem of development intensity area identification, and the boundaries identified are believed to be the areas of the appropriate development intensity. Though the City Council is not under obligation to enforce the boundaries, it is recommended that the boundary area be taken into account when a development or zoning decision is to be made.

Second, it is recommended that the East Central Iowa Council of Governments and the Tiffin City Engineer assist the City of Tiffin in the future implementation of this plan. The development intensities are based on a specific point in time on factors that generally will not deviate too much in the future. If, however, some of the variables used in this plan do change (i.e. the major transportation links change), it is recommended that the East Central Iowa Council of Governments and the City Engineer be responsible for the continued updating and implementation of the plan.

Third, the actual boundary lines between the various intensities can be considered zones of transition. The lines are not to be, and should not be thought of as, lines of absolute certainty. The boundaries between various development intensities should be flexible to an extent. A narrow zone of change should be assumed to exist between areas of different intensity.

Fourth, in the section Selection Criteria, examples of land uses for each development intensity were discussed. One of the strengths of this plan is that it does not constrain the Tiffin City Council by assigning land uses to areas within the study region. Rather, this report identifies the appropriate development intensities for each area or least common geographical unit. The
actual zoning and land use for that area is flexible. In short, the actual land use for each identified
development intensity area is left open to market forces and City Council direction. This plan,
through its technical approach in identifying regions best suited for various development
intensities and through its flexible zoning aspects, seeks to clarify and guide Council direction.

Fifth, this plan can be of value to the City of Tiffin in a variety of ways. It is
recommended that the City use this plan for the following purposes.

• One, this plan along with the land use plan provides Tiffin with a sound development
strategy for the future. Areas best suited for commercial, residential, industrial and
manufacturing development have been identified and mapped through computer analysis.
The City can take proactive measures to aid in its development strategies. Roads can be
planned, land can be set aside for residential development and general infrastructure
improvements can be planned for with a greater degree of certainty about where
improvements will be needed. The development plan can be used as a decision tool for
locational and land use questions. The Tiffin City Council, as a result of this plan, will have
a source to aid with development decisions.

• Two, this plan will serve the Council with a basis for any zoning and land use decisions the
Council makes. With such a plan, the Council will be able to defend its regulatory decisions
against charges that its land use restrictions are unfair and without purpose.

• Three, the computer analysis process undertaken in this study provides a more sound and
rational basis of development intensity area identification than the land use plan did. This is
not to say that the land use plan's recommendations were inaccurate. A comparison of the
computer generated maps in this report and the future land use maps from the land use plan
shows that most of the intensity areas are consistent with land use recommended by the land
use plan. The analysis in this plan, however, is a bit more exact, and the appropriate
development intensity areas are more geographically accurate than the land use plan. This
project illustrates the usefulness of a GIS in a development planning context, and it is an
area Councils of Governments in Iowa should consider.
Sixth, this plan can also be of assistance to the City of Tiffin when analyzing environmental impacts of proposed development projects. An environmental impact statement (EIS) is a tool to ensure that a major project undergoes comprehensive review prior to construction or implementation. An underlying premise of the EIS is that substantive decision making will improve and a better balance will emerge between public agency and private interest goals and environmental concerns if a broad range of environmental attributes are examined before decisions are finalized (Greenberg, et al, 1978). The soil and slope map along with the environmental hazard and transportation buffer maps can aid in that process. Some of the ways the mapping done in this study can assist the EIS process are described below.

- **Soils:** Development can damage the soil. The soils must be described with the processes of erosion and sedimentation, mass wasting, and runoff in mind. The soil variables affecting these processes include texture, structure, permeability, bearing capacity, shrink-swell potential, depth to bedrock, rockiness, and depth to water table. With the soil boundaries already mapped in this study, the determination of soil suitability for various projects will be made easier.

- **Topography:** The general terrain and especially slope characteristics are essential in assessing possible soil erosion, mass wasting (landslides, soil creep, etc.), runoff from developed areas, and aesthetic considerations. The site should be categorized by the percentage of land falling within selected slope categories. Many states have established slope categories that effectively prohibit development by restricting the installation of sewer pipes. Because the slope boundaries have also been mapped, the determination of general slope characteristics can easily be determined for any areas sited for proposed development.

- **Surface Drainage:** Information on rivers, lakes, marshes, and other water bodies, and on the land areas that drain into them is essential to assess the impacts of development on water resources. The worst flood on record and the probability of floods of different magnitudes may also be included. The 100-year floodplain was mapped in the development intensity allocation study. This map, referred to as the environmentally hazardous area map, will be of value when doing an EIS.
As one can see, the mapping component of the many aspects of an EIS are either completed or begun as a result of this study. The digital layers of soil, slope and environmental constraints as identified in this study provide an analyst with a strong start toward the completion of an environmental impact statement.
REFERENCES


APPENDIX A - Procedure Of The Project

The following procedure was used to accomplish this study and is included here as a guide for local governments who may be interested in replicating the method for their own applications.

- Define user needs (i.e. meet with council, discuss project, etc.)
- Define software and hardware requirements
- Obtain access to appropriate software and hardware. This will be project dependent.
- Decide whether project is "do-able" with present and anticipated software and hardware resources.
- Obtain a digital file of the City under study for the base map.
- Inspect the base map for accuracy. Clean and build if the base map does not meet a predetermined level of accuracy. Most GIS packages have instructions on the procedures for the clean and build process.
- Decide on prescriptive and descriptive modelling criteria.
  
  This process will include:
  --determining the appropriate evaluation criteria
  --obtaining and researching the appropriate criteria information
  --consulting with engineers and other professionals to aid in selecting the appropriate evaluation criteria
  --defining high, medium-high, medium and low intensity development
- Obtain needed analog maps of the City under study and its surrounding area.
- Digitize each analog map as a separate layer of information.
- Overlay each layer to obtain a composite overlay of all layers. This will identify the least common geographical units of the study area.
- Print out a composite overlay.
- With the composite overlay analog map, manually create the database by assigning the appropriate attributes to each polygon.
- Check the manually created database against the source maps for accuracy.
• If the database and composite maps are 100 percent accurate based on the available information, proceed to step 15. If not, go back to step 9 and make the recommended corrections.
• Digitize the composite overlay map.
• Create computer database by assigning the appropriate attributes to each polygon.
• Check the database and the overlay digital file against the source maps for accuracy.
• If the database and overlay digital map are 100 percent accurate based on the available information, proceed to step 19. If not, go back to step 15 and make the recommended corrections.
• Based on the agreed upon modelling approach, query the database to determine the best locations for future areas of high, medium-high, medium and low intensity development.
• Create four final analog maps indicating the best future areas of low, medium and high intensity development.
• Once these areas have been identified, establish the need for future policy growth decisions to be made with consideration to these areas.
APPENDIX B - Decision Matrix Of Development Intensity

<table>
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<tr>
<th>Environmental Hazard Zone ($X_1$)</th>
<th>Transport Corridor ($X_2$)</th>
<th>Soil Quality ($X_3$)</th>
<th>Slope Characteristic ($X_4$)</th>
<th>Score*</th>
<th>Intensity Of Development</th>
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*Based on methodology explained in the chart, intensity scores for any combination is equal to:

$$(4 \times X_1) + (2 \times X_2) + (1 \times X_3) + (1 \times X_4).$$
MAP 8 - TIFFIN, IOWA
Transportation Layer

Scale: 1 in = 4768 ft
MAP 9 - TIFFIN, IOWA
Environmental Hazard Area

Scale: 1 in = 4768 ft
MAP 10 - TIFFIN, IOWA
Soil and Slope Boundary

Scale: 1 in = 4768 ft