CHAPTER V

Land Capability

5.1 Land Capability

In this study, the land capability for industry and sanitary landfill waste disposal sites were analysed. The land capability rating is chosen for final evaluation for each option based on the suitability of various parameters of environmental geology.

Mc Harg (1969) suggested a graphic procedure for integrating various relatedfactorsto identify the area as proposed. Hopkins(1977) applied scoring and weight factor instead of graphic procedure as land capability rating system. The steps of land capability rating include : (i) dividing of the study area into 1 square kilometer grid cell for application of weight rating values. The factors which are chosen for assessing the suitability of land for industrial development and sanitary landfill waste disposal site are selected; (ii) the concerned factors of environmental geology would be categorized into 4 suitable levels which give a rating value of 1 for the low capability and rating 4 for high capability or most suitable. Each parameter is given different weight scale, such as from 1 to 10. The weight and rating value of each factor varies according to the different option of development. Then,in single gridcell will be assigned weight rating by multiplying weight and rating value and the score range from 1 to 40. The sumation of each gridcell in various factor are calculated. For each option of development potential, the weight rating is classified into 4 classes of capability rating,namely, most suitable, second most suitable, third most suitable and least suitable; (iii); all of those cells that are considered to be social and political restriction are identified and mapped such as the primary national forest.(iv) the thematic maps representing different parameters will be overlaid to identify critical areas. Those cells that found to have social and political restrictions are eliminated from the analysis and the remaining cells are mapped according to their degree of suitability for land application (Howard and Remson,1978 , Evans and Myers,1990).

Caroll (1975) suggested 14 generally basic location factors for industrial plant site selection. These factors include :

1. The location of production materials
2. Labor
3. Sites
4. Fuel sources
5. Transportation net
6. Distribution facilities
7. The Market
8. Availability of water
9. Availability of power
10. Availability of housing, communities
11. Prestige of location and services
12. Favourable climate
13. Laws and regulatory agencies
14. Tax structures

The location should have minimal damage from natural phenomena such as flood.

Busakorn Singkaratana (1990) concluded the essential industrial location selection factors in the descending order as follows:

1. Raw material
2. Transportation net and public ultilities facility
3. The Market
4. Labor
5. Land
6. Prestige of location and services
7. Availability of power
8. Proximity to the cluster of same industry
9. The capital fund

Sunya Sarapirome (1982) identified the physical factors for land capability assessment for heavy industry land-use potential in the Eastern Seaboards of Thailand as follows :

1. Availability of power (electricity and natural gas)

2. Availability of water

3. Transportation net (access road and highway, railway and sea port in respective priority of importance)

4. Existing land use and land cover

5. Marine geological condition, potential source for fresh water pollution, wind , and hazard (flood) in respective priority of

importance.

6. Slope

7. Foundation

8. Construction Material

The industrial development can improve people living standard by creating more job apportunity and higher value added, resulting in stable regional growth. The industrialization,however, may cause serious conflicts against agricultural based society, such as land use and environment.

Therefore, the limitation of the area such as limitation by legal restriction eg. the primary forest preserved in national park. The restriction due to the forest in Saraburi has decreased from about 493,066 rais or 22.06 percents of Changwat area to about 114,611 rais or 5.1 percents of Changwat area (Forest Department,1989). The remaining forests are entirely on the preserved national forest such as Khao Pong, Nam Tok Jed Sao Noi, Khao Yai and Khao Sam Lan National Park. The destroyed forest were planned to use as agro-forest area and to use as land for settlement of the local people living there.

The manipulation of the map overlay technique as described above yields the results as summarized in Table 5.1

Table 5.1 Weighted Capability Values of Environmental Factors for Industrial Land-use Potential.

Environmental factor	subclass	weight	capability value	weight Capability
I. Infrastructure				
a: access road and highways	within 1 kms	10	5	50
	between 1-3 kms		4	40
	between 3-5 kms		3	30
	more than 5 kms		2	14
b: railways	within 1 kms	10	5	50
	between 1-3 kms		4	40
	between 3-5 kms		3	30
	between 5 kms		2	20
II. water supply nearness to mainstreams	within 1 kms	7	5	35
	between 1-2 kms		4	28
	between 2-3 kms		3	21
	more than 3 kms		2	14
III. Slope	0- 5 %	5	5	25
	5-10 %		4	20
	10-20 %		3	15
	> 20 %		2	10

Table 5.1 (cont.)

Environmental factor	subclass	weight	capability value	weight Capability
IV. Risk hazard				
a. Flood inundated	Fan	4	5	20
	Valley Plain		4	16
	Delta		3	12
	Back Marsh		2	8
b. Soil Erosion	more than 3 kms	4	5	20
	between 2-3 kms		4	16
	between 1-2 kms		3	12
	less than 1 kms		2	·8
V. Community	more than 15 kms	4	5	20
	between 10-15 kms		4	16
	between 5-10 kms		3	12
	less than 5 kms		2	8

The map of land capability rating for industrial development potential is shown in figure 5.1. It should be noted that raw materials is the important factor for land capability rating for industrial development. These raw materials include carbonate potential and raw materials of agricultural produce for agricultural base. The development of every kind of industry will cause industrial pollution. For instance, the cement industry can air and

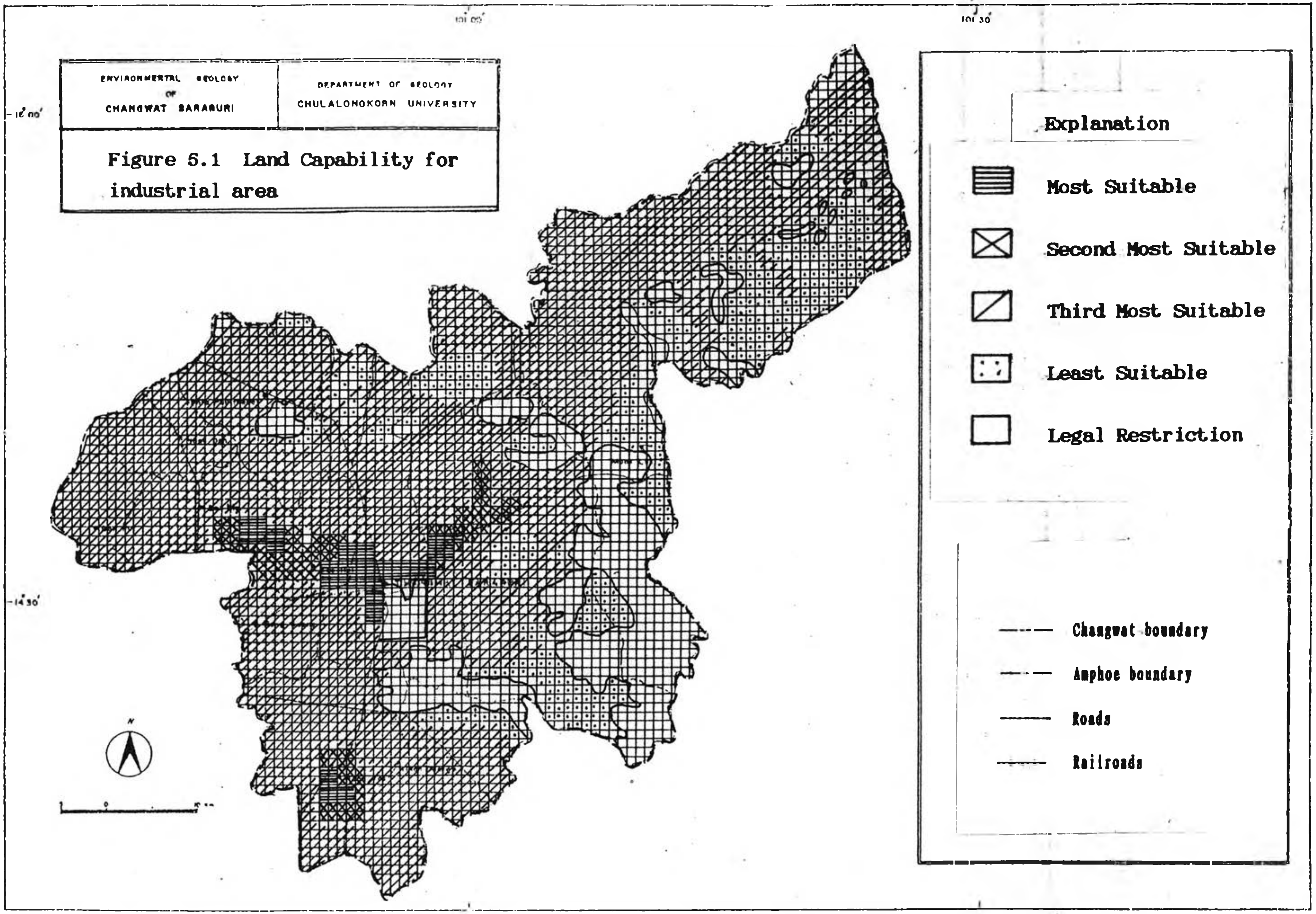

Figure 5.1 Land Capability for industrial area

noise pollution during the raw material extraction, mining, crushing, hauling and production. The agricultural base industry such as swine and chicken feeding can cause surface water contamination during rainy season.

Wastes can result from any stage of development. Industrial wastes should be minimized by more efficient use or by waste recycling before disposal. The waste disposal by the open method has little pollution control measures. The wastes may be left untouched or they may be incinerated. The open dump waste is a source of pollution,heath hazards, and environmental degradation. It is undesirable and should be avoided. The preferred method of solid wastes disposal is sanitary-landfill which is a method of disposing off refuse on land by confining it to the smallest practical area and covering it with a layer of earth each day. The sanitary landfill cancreate solidpollution, liquid pollution, gaspollution, biological pollution and visual pollution (Howard and Remson, 1976).

For sanitary landfill waste disposal site, the pollution potentialfrom municipal waste of high moisture content waste must be cosidered (JICA, 1990). The most significant possible hazard from a sanitary landfill is groundwater or surface water contamination (Keller, 1979).

The factors controlling the feasible site of sanitary landfill include topographic relief, location of groundwater table, amount of precipitation, type of soil and rock and the location of the disposal zone in the surface-water and ground water flow system.

The most desirable site in a humid climate should be buried well above the groundwater table in relatively impermeable clay and silt. Any leachate produced will remain in the vicinity of the silt and be degraded by natural filtering action and base exchange of some ions between the clay and the leachate. The ideal site is above the water table which is underly by impermeable rocks (Keller,1979)

The criteria to be considered for sanitary landfill waste disal site selection include : (i) avoidance of the permeable material such as limestone highly fractured rock and gravel and sand pits; (ii) avoidance of the swampy area, unless properly drained to prevent disposal into standing water; (iii) the clay pits,if kept dry, may provide satisfactory sites; (iv) flat upland are favorable sites provided that an adequate layer of impermeable materials is available; (v) flood plains likely to be inundated by surface water should not be considered as acceptable sites except the flood protection dike is provided. (vi) the pemeable material with high water table is considered as unfavorable site (Keller,1979).

The factors considered byHoward and Remson (1978) are accessibility to trucks for all weather conditions, the ecological condition such as the existing valuable botanical and fauna preserved, and avoid the area susceptible to ersion and flooding.

Valdiya (1987) suggested that the sanitary landfill sites should be located on flat terrain with the slope of less than 10 percents and free from flooding and the ground water level must be well below the base of landfill.

Chaiyan Hintong (1992) suggested that the favorable area for waste disposal site should be above the known highest recorded flooding level and consisting mainly of sandy clay and clayey sand with occasionally gravel sand beds of sufficient thickness.

Seibenhuner and Silitonga (1992) suggested that the suitable area for waste disposal should avoid the best agricultural area, military area, flood prone area, national parks, deposit of mineral resources and tourist attraction area. The hauling distance to disposal sites,depthto ground water table and the thickness of the underlying rock are also the criteria for disposal site selection. The ground water table in the site must be deeper than 2 m. and the impounding bedrock must be at least 20 m. thick.

In the present study, the factors considered for land capability for sanitary landfill waste disposal site include site geology especially the unit of Nong Pong and Sub Bon Formation which consist mainly of shale and slaty shale and minor interbedded siltstoneandsandstone (Chaiyan Hintong,1981 and Vivat Paijitprapapornet al.,1983).In addition, depth to static water level flood inundated area, hauling distant, water supply, soil erosion, and slope are also the factors in consideration. More over, the legal restricted areas are not considered for selection.

After weighted rating land capability , the capability maps of of each option are prepared and presented(Figure 5.1 and 5.2)

Table 5.2 Weighted Capability Values of Environmental Factors for Sanitary Landfill Waste Disposal Landuse Potential.

Environmental factor	subclass	weight	capability value	weight Capability
I. Geology	slate,slaty shale (P_n and P_s)	10	5	50
	volcanic rocks		4	40
	Quaternary deposits		3	30
	limestone,thin bedded		2	10
II. Ground water (depth to static water level)	more than 10 m.	8	5	40
	between 6-10 m.		4	32
	between 2-6 m.		3	24
	less than 2 m.		2	16
III. Flood inundated	Fan	6	5	30
	Valley plain		4	24
	Delta		3	18
	Back marsh		2	12
IV. Hauling distant (from major community)	less than 10 kms	5	5	25
	between 10-20 kms		4	20
	between 20-30 kms		3	15
	more than 30 kms		2	10

Table 5.2 (cont.)

Environmental factor	subclass	weight	capability value	weight Capability
V. Water supply (nearness to main stream)	more than 3 kms	3	5	15
	between 2-3 kms		4	12
	between 1-2 kms		3	9
	less than 1 km		2	6
VI. Soil erosion	more than 3 kms	2	5	10
	between 2-3 kms		4	8
	between 1-2 kms		3	6
	less than 1 km		2	4
VII.Slope	0 - 5 %	2	5	10
	5 - 10 %		4	8
	10-20 %		3	6
	> 20 %		2	4

Figure 5.2 shows the map of land capability rating for sanitary waste disposal area. The area in most suitable categories are recommended for future detailed study for waste disposal site.

In this study, the information is presented in the small scale map, therefore, unmappable unit is not illustrated in the map.

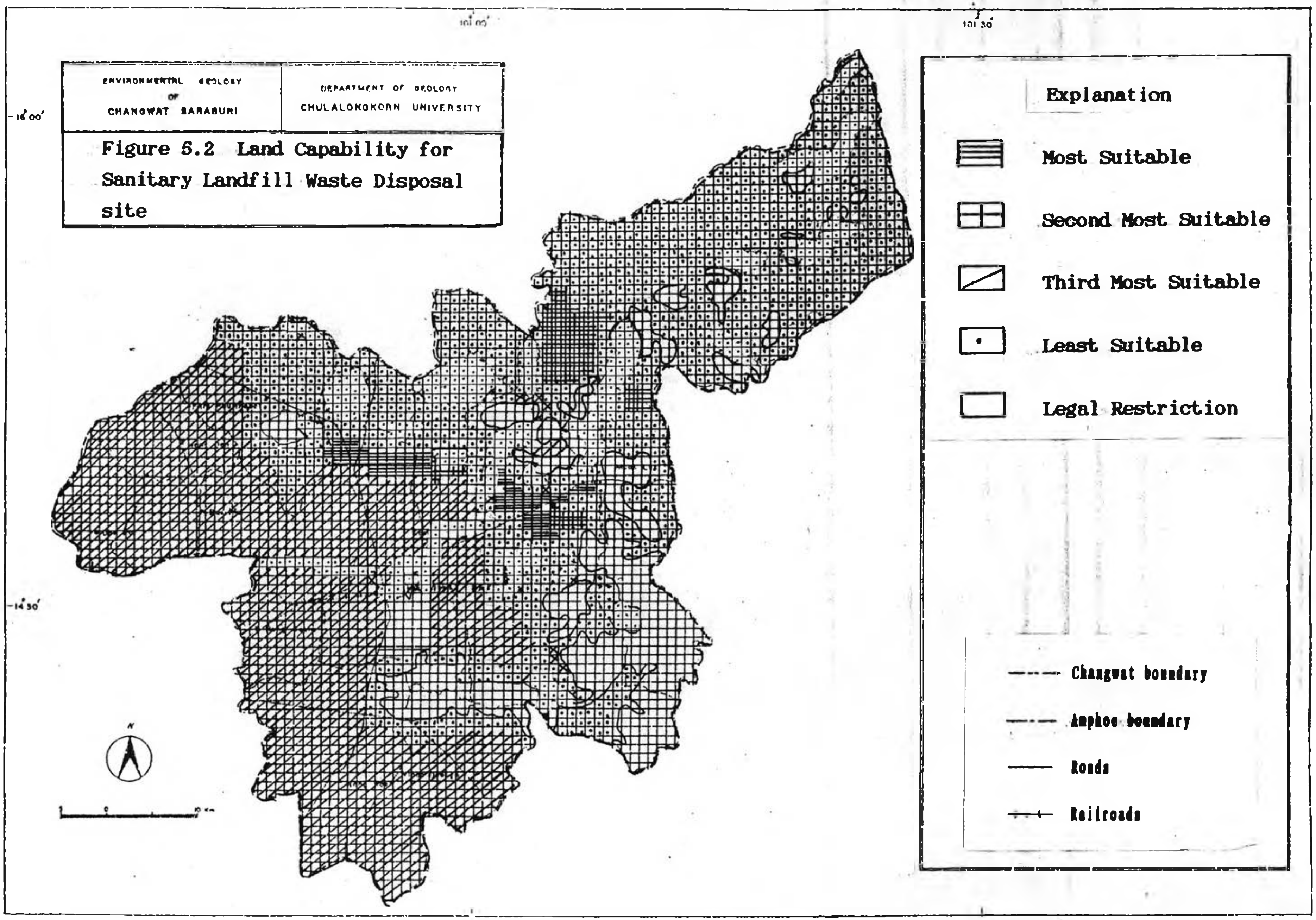

Figure 5.2 Land Capability for Sanitary Landfill Waste Disposal site