General Disclaimer

One or more of the Following Statements may affect this Document

- This document has been reproduced from the best copy furnished by the organizational source. It is being released in the interest of making available as much information as possible.

- This document may contain data, which exceeds the sheet parameters. It was furnished in this condition by the organizational source and is the best copy available.

- This document may contain tone-on-tone or color graphs, charts and/or pictures, which have been reproduced in black and white.

- This document is paginated as submitted by the original source.

- Portions of this document are not fully legible due to the historical nature of some of the material. However, it is the best reproduction available from the original submission.

FINAL REPORT FOR LAND USE SURVEY AND MAPPING AND WATER RESOURCES INVESTIGATION IN KOREA

31 AUGUST 1978

(E79-10003) LAND USE SURVEY AND MAPPING AND WATER RESOURCES INVESTIGATION IN KOREA Final Report (Ministry of Construction) 34 p HC A03/MF A01 CSCL 08B

N79-13425

Unclas
G3/43 00003

NATIONAL GEOGRAPHIC INSTITUTE
MINISTRY OF CONSTRUCTION
REPUBLIC OF KOREA

Final Report

for

Land use survey and mapping and water resources investigation in Korea
(NASA's Investigation #0001495)

Submitted by : Jae Hwa CHOI
Principal Investigator

Agency : The National Geographic Institute
Ministry of Construction
#43-1, Hwikyeong-dong, Dondaemun-ku,
Seoul 131, Korea

Type of Report : Final Report

Date : 31 August 1978

CONTENTS

Land use survey and mapping and water resources investigation in Korea

By Jae-Hwa CHOI (Principal Investigator)
Won-Ik KIM (Land use survey and mapping,
Dae-Sung SON (Water resources investigation)
The National Geographic Institute,
Ministry of Construction,
Republic of Korea

Significant Results

Utilizing LANDSAT multispectral imagery dated on from 1973 to 1975, a pilot project of a land use mapping over the AHSAN bay regions of Korea was schemed in order to extract a certain possibility which may make an application to land use classification for map revision and a small scale mapping.

The AHSAN bay regions selected as a tested area in this pilot project are located at mid-western part of the Korean peninsula where involve a various land use pattern and there is situated a part of metropolitan district and there also runs HAN river westwards. The HAN river is the largest one in Korea at it's run way distance and catchment area.

The methodology taken in the project was that:

1. The results of land use classification from the LANDSAT imagery were represented on 1:250,000 scale map base.

2. Afterward this land use map 1:250,000 scale was compared to a existing land use map at a same scale which was derived by photographical reduction from 1:25,000 land use mapping on-going.

3. Image interpretation was mainly done by conventional method (Visual interpretation).

In evaluating the results of land use classification analyzed from MSS imagery, 6 categories of LEVEL I of land use classification can be recognizable and those may nearly be matchable on the 7 categories of LEVEL I of land use map at scale of 1:250,000 which was derived from 1:25,000 land use map of which LEVEL I has 8 categories.

LEVEL II categories of land use classification was almost impossible by visual interpretation unless either an image resolution is enhenced or an interpretation method is upgraded.

To assess an accuracy of an acrage of the map at scale of 1:250,000 the 3 major categories of LEVEL I classification are chosen and each area of boundary has been calculated on both LANDSAT imagery made map and existing derived map respectively.

The varience of the acrage of that was more or less than 1% in total while in each category had a larger discrepancy of area portion as shown in table(2).

As for decision-making for a revision of land use mapping and a small scale mapping less than 1:250,000, it can be

concluded that LANDSAT imagery is useful and beneficial as follow:

1. Land use imagery is applicable to land use classification for samll scale land use mapping less than 1:250,000.
2. The repetitive coverage of LANDSAT can provide the opportunity to constantly update land use inventory for map revision, while at the same time noting the type and direction of land use change.
3. LANDSAT images use is more efficient than using conventional aerial photographs for small scale mapping, for instance 1:250,000, derived from large scale map.
4. The accuracy of LANDSAT mapping has been proved at a 1:250,000 scale level in satisfaction.
5. LANDSAT imagery is cost-effective.
   By the most conservative estimates, land use mapping by satellite is cheaper by more than an order of magnitude over land use mapping from conventional medium-altitude aerial photography.

For water resources investigation, hydro-geomorphological study was carried out on the Han river basin.

The studied area of the hydro-geomorphological aspects is the same as the land use investigation. The water resources investigation is chiefly carried out by the LANDSAT imagery interpretation.

The evaluation of the interpretation is summarized by following aspects.

1. The studied area is shown to be typical boundary each other on the MSS Imagery. Especially band 7 is very useful for the recognition of the soil and the weathering part of the bed rock.
2. The morphological change of the main river is recognized accurately. The drainage system in the studied area is classified easily because of the more or less simple rock type.
3. Geological and geomorphological structural characteristics which have great influence on the hydrological aspect are also interpretated easily.
4. Hydro morphological unit gives an useful information to the land use.
5. Although the direct hydrological characteristics are not taken from the MSS imagery, the indirect information, such as permeability of the soil and the vegetation cover etc., is helpful to interpretate the hydrological aspects.

Part I. Land use survey and mapping

By Won Ik, Kim
Co-Investigator

1. Introduction

From 1972, the Republic of Korea started land use mapping 1:25,000 scale to cover the entire country for the national land use planning and inventory preparation.

However, being executed the project, the progress of the mapping has remarkably been slow as shown in the table 1 while the change of land cover is considerably being rapid.

Table 1.

1:25,000 land use mapping program

Unit: $1,000

FY		'72		'73		'74		'75		'76	
Total	Cost	Map Sheet	Cost	M.S	C	M.S	C	M.S	C	M.S	C
762	843	150	107	146	92	60	45	40	30	22	25

'77		'78		'79-'81	
M.S	C	M.S	C	M.S	C
21	24	56	77	267	443

* C : Cost
M.S : Map sheet

Thus very often, land use maps are several years old and do not correspond any longer to the existing situation.

It is therefore necessary that the existing land use maps should periodically be revised and be updated in accordance with the progress of the land use planning.

It is also of great importance to enhence reliability of the maps.

Furthermore, for the comprehensive land use planning purpose, there also needs the smaller scale land use map than 1:25,000 scale: ie. 1:250,000 scale preferable to.

In summing-up, there mainly are two items of problems of the land use mapping under-taken:

1. Periodical map revision.
2. Small scale mapping.

With use of conventional aerial photographs, map revision and small scale map compilation by deriving from larger scale map are somewhat expensive on view point of time and cost.

Taking the advantage of LANDSAT imageries for it's wide ground coverage, repetitious coverage and multispectral bands, a pilot project was schemed on the western region of the Korean peninsula in order to prove possibility for the space craft imagery to incorporate into the on-going 1:25,000 land use mapping project.

For this purpose, an addition to LANDSAT imagery interpretation existing 1:25,000 land use maps in the area were photographed with normal 35mm camera and made a mosaic to scale 1:250,000.

Another trial was computer derived map. It was scanned by Computer Eye 101 and displayed by NOVA computer.

The results were enhanced on the section paper with scale 1:250,000. But those instruments were not belonged to the Institute so only one imagery was tested (band 5, 8 Oct. '73)

2. Description of area

The tested area was on the western part of Korean peninsula with boundaries as follow.

North : 38° -00'

East : 127° -30'

South : 37° -00

West : 126° -00'

In this area, there locates metropolitan district involving the Seoul, the capital city of Republic of Korea, and a big river named HAN River (514 Km long). Western part of this region is well developed agricultural land and industrial area and under-construction area around Seoul. Eastern part is mostly forest area.

3. Interretation

The LANDSAT imageries used in this study were the four bands exposured on 16 Feb. '73 and 30 Nov. '75 (ID NO. 1208-01455, 2312-01314). All the bands were of good quality.

The four bands were studied on the Multispectral viewer (I^2S). With this instrument, it is possible to combine the four images of 70mm transparencies and project them to about 3.36 times enlarged onto glassplate the scale of image then becomes approximately 1:1,000,000. The illumination of each image can be regulated individually and by placing a green, red and blue filters in front of a particular band, it is possible to add colour to it.

In this study the best combination for interpretation of the images was band 5 with a blue filter, band 6 with a green filter and band 7 with a red filter. And band 4 was not very useful for the interpretation because of it's poor resolution.

Addition to this, each band was enlarged to scale 1:250,000 and colour composites were tested with same scale using SEG V Rectifier which we have.

Interpretation was done mainly on the transparent paper placed on enlarged (1:250,000) black and white paper prints of band 5 and the other bands, the colour image of Multispectral Viewer and the enlarged images from Rectifier were used to edit the result.

By the visual interpretation (Fig. 3), this area was distinguished with 6 categories as follow.

Land use classifications of LANDSAT imagery

1 Forest area

2 Agricultural area

3 Built up area

4 Water bodies

5 Salt field

6 Others (Tidal flat, Granular materials)

In the computer analysis, we took 7 levels(Fig.4). In the case of more than 7 steps(Fig.5), the result on the line printer was too much complicated.

Steps of computer analysis

0- 30	M
31- 60	#
61- 90	Z
91-120	N
121-150	0
151-180	.
181-255	Blank

In this map, each characters represent 16 pixcels and final map on the line printer is 125 columns and 120 lines. This map is delineated to regular rectangular shape on the section paper with the scale 1:250,000 and delineated boundaries.

Existing 1:25,000 land use map had two kind of categories as follow.

Classification of 1:25,000 land use map

LEVEL I	LEVEL II
Paddy field	Fully irrigated paddy field Partially irrigated paddy field Adjusted paddy field
Crop land	General crop Special crop Vegetable Seedling
Perennial crop land	Orchard Mulberry Bamtoo
Pasture	Pasture
Forest	Dense forest Open forest Cut-over land Unproductive land
Settlement	City Village
Industrial area	Industrial area
Others	Cemetry Reclaimed land Miscellaneous

When this map was reduced to scale 1:250,000 the classification was simplified and generalized.

The scale 1:250,000 derived map (Fig.6) from existing 1:25,000 land use map had 7 categories as follow.

Categories of derived land use map

1. Forest area
2. Agricultural area
3. Built up area
4. Water bodies
5. Orchard
6. Salt field
7. Others (Air field, High way)

4. Discussions

1. The visual interpretation of LANDSAT imagery is somewhat difficult techniques to land use classification due to it's scale and poor resolution.
2. The distinction among agriculture area, big city and forest area was very clear in color composite.
3. The boundary of large city was distinguished in band 5.
4. Highways and air fields were poorly visible in the images.
5. Industrial area and built-up area were also distinguishable but it was too difficult to delineate exact boundaries of them.
6. Small patches surrounded by another category were not distinguishable in any images.

7. The detection of periodical changes was almost impossible between two images '73 and '75 because that the changes were too small to detect.

II. To determine the agreement between LANDSAT interpretation map and existing land use map, several categories in the same area were measured with millimeter paper and calculated to ground area multiplied by scale factor.

Table 2

Areas of land use type

Type	Existing land use map		Landsat map		Variance
	area in Km^2	%	area in Km^2	%	%
Built-up area	310	7.5	250	6.1	-18.0
Forest	1,930	46.9	1,850	45.4	-3.2
Agricultural area	1,880	45.6	1,980	48.5	+6.3
Total	4,120		4,080		-1

In the figure, the reason why built-up area and forest area are appeared smaller in LANDSAT map than existing map is that the scattered small forest area in the agricultural area was considered as agricultural area and under-construction area mixed with agricultural area on the outskirts of big cities was also interpretated as agricultural area because of it's scale and poor resolution.

Anyhow the figure shown in the table indicates that there does not make so much differences between two maps. It means that Landsat map is sometimes quite useful to get a rough statistical data and to observe overall changes of land use phenomena.

Part II. Hydrogeomorphology of Han River Basin

By Dae-Sung, SON
Co-Investigator

1. Introduction

The Han river which is located in the middle part of Korean peninsula is the largest river in Korea. Especially this river flows through the capital Seoul, therefore the evaluation of this river is very important.

This chapter is on the purpose of the evaluation of Landsat imagery interpretation empasized on the hydrogeomoraphological aspects. The studied area is selected by the following aspects: easily inundated area by the flood, hydromorphological aspects of the basin and the geology of the catchment area. The Han River Basin is composed of all kind of rock units: igneous, sedimentary and metamorphic rock.

For the purpose of the investigation 1:250,000 Landsat imagery interpretation is carried out together with the land use map (1:25,000) made by the National Geographic Institute, Korea. The general geological information of the studied area is taken from the existing geological map scaled 1:250,000 prepared by the Korea Research Institute of Geoscience and Mineral Resources.

The hydrogeomorphological unit of the map is classified by the geological and geomorphological characteristics of the river basin. (Fig. 7).

2. General Geology and Geomorphology

The studied area is composed chiefly of Precambrian gneiss and shist called Gyeonggi metamo.phic complex. In the middle part of the area, Seoul, Jurassic granite occurs as intrusive body or gradation type. The boundary between the granite and the metamorphic rocks shows a sharp contact. Near the estuary of the Han river the sedimentary formation which is composed of conglomerate, sandstone, black and coal shale is developed. In the northern part of Seoul the ring dike is intruded. Along the stream Quarternary sediments are deposited, partly a flood plain deposit.

The large fault lines are interpretated in the northern part of Seoul and along the North Han river.

Geomorphologically speaking the studied area can be indicated as an old age in geomorphic cycle. The land system is classified into two units according to their slope steepness.: steep slope zone is located in the eastern part of the area, gentle slope zone or hill in the western part. The relief is classified according to slope steepness (3 classes) with the additional geology of the basin.

3. Characteristics of Hydrogeomorphology

3-1. Drainage system

The drainage pattern of the studied area is shown to be typical dendritic, which means the area consists of the

homogeneous rock. In somepart the stream is developed along the fault and structural line. In the paddy plain which is the largest one of the Gyeonggi province the drainage pattern is shown to be a fine dendritic pattern.

The valley of the mountainous area shows the typical v-shape, and near the main river the valley changes u-shape occupied with the cultivated area.

3-2. Precipitation of the Han River Basin

Table 3. shows the average monthly precipitation measured by existing rain gauging station. The distribution of the annual rainfall is ranging from 832.7 mm to 1,497.0 mm (Fig. 1). Most of the precipitation is concentrated in July and August according to the table 1.

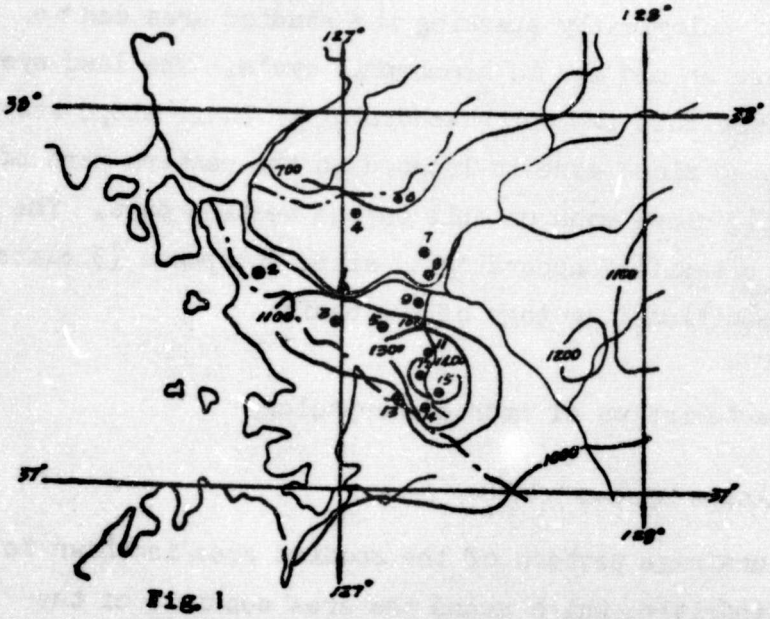


Fig. 1
Distribution of Annual Rainfall('76)

Table 3. Average Monthly Rainfall ('72 - '76)

Station / Month	1 Seoul	2 Gimpo	3 Nam-myeon	4 Eui-jeongbu	5 Nag-seang	6 Naeri	7 Geumgog	8 Goan	9 Namhan-san	G
1	34.5	40.7	35.2	26.1	7.7	14.6	28.6	36.2	44.7	
2	13.8	16.8	17.4	6.1	13.0	3.0	11.4	16.6	26.3	
3	33.1	35.6	34.8	9.0	27.9	12.3	51.7	39.3	29.3	
4	92.7	90.7	109.8	92.7	108.1	102.3	114.2	77.1	104.1	
5	92.2	130.3	111.4	98.2	163.0	83.2	113.6	81.1	145.3	
6	59.9	55.0	68.8	51.4	76.3	56.5	74.3	54.7	77.7	
7	269.1	229.4	301.9	276.1	191.8	233.6	341.3	287.1	253.4	
8	326.0	120.9	340.5	375.5	171.5	116.1	202.6	132.4	359.2	
9	116.6	96.4	129.4	83.6	114.4	134.0	115.3	148.2	125.1	
10	35.1	32.4	37.5	29.1	35.5	26.4	36.9	48.5	20.5	
11	33.7	41.1	45.8	18.9	29.9	19.7	16.4	53.5	47.4	
12	11.3	15.5	17.5	3.6	17.0	31.0	16.4	8.0	11.4	
Total	1,118.0	904.8	1,250.0	1,070.3	956.1	832.7	1,122.7	982.7	1,244.4	1,

. Average Monthly Rainfall ('72 - '76) in the Basin

mm

5 ag-eang	6 Naeri	7 Geumgog	8 Goan	9 Namhan-san	10 Gwangju	11 Mohyeon	12 Pogog	13 Yongin	14 Unhag	15 Yangji
.7	14.6	28.6	36.2	44.7	33.7	87.6	51.8	41.4	36.6	20.5
.0	3.0	11.4	16.6	26.3	36.6	45.2	19.3	31.4	20.1	10.1
.9	12.3	51.7	39.3	29.3	46.3	53.9	43.7	55.9	52.0	43.3
.1	102.3	[illegible]	[illegible]	104.1	103.5	72.6	97.8	103.6	129.4	20.6
.0	83.2	113.6	81.1	145.3	121.5	104.5	168.3	131.0	122.9	62.2
.3	56.5	74.3	54.7	77.7	58.0	62.5	80.2	77.9	63.5	54.7
.8	233.6	341.3	287.1	253.4	277.3	541.4	314.2	265.3	288.7	149.8
.5	116.1	202.6	132.4	359.2	346.0	292.4	290.2	306.3	369.3	308.6
.4	134.0	115.3	148.2	125.1	90.9	109.5	136.7	127.7	121.5	101.8
.5	26.4	36.9	48.5	20.5	34.1	24.4	61.0	48.2	41.8	50.3
.9	19.7	16.4	53.5	47.4	47.2	31.2	52.7	51.1	41.2	35.1
.0	31.0	16.4	8.0	11.4	16.6	71.8	16.5	14.6	11.6	12.9
.1	832.7	1,122.7	982.7	1,244.4	1,211.7	1,497.0	1,332.4	1,254.4	1,298.6	869.9

3-3. Surface runoff distribution

Surface runoff distribution is divided into two characteristics: the influenced by the lithology in mountainous area and by the land use in the hill and alluvium area.

-The influenced by the lithology

Generally speaking, the studied area is not so much influenced by the lithology. Each catchment area is also composed of more or less simple lithology such as gneiss and granite. However in the Precambrian gneiss are the feldspatic gneiss is easily weathered by water. The granite area around Seoul is also homogeneous and is difficult to be weathered.

- The influenced by the land use zone

In the studied area land use is almost same distribution of alluvial deposit along the stream, and the weathered zone of the bed rock is mainly used as a cropland.

The land use zone and the weathered zone make the velocity of surface runoff decreased. In seasonal flood duration such difference of the surface runoff velocity make the sediments transported to the main river.

3-4. Flood Aspects

The Quarternary deposit which is developed along the main river is chiefly originated from the seasonal flood of the river. According to the distribution of the rainfall and the

hydromorphological characteristics in the basin, the potential flood area is concentrated on the lower part of the basin near Seoul.

Although the permeability of the basin is basically depended on the geological property, it is also varied with the seasonal rainfall. The Landsat imagery shows the phenomena clearly, which indicates the potential flood demage area of the basin. The potential flood demage area is almost same boundary of Quarternary deposits and the weathered zone indicated by the more or less gentle slope zone on the map.

The flood demage of the Han river is decreased by the dam construction in the upper part of the river. The Landsat imagery of the studied area shows the change of the river morphology due to the dam construction. (Fig. 2)

Basically the flood of the river is characterized by the overflow over the natural bank and the ground water flow into the artificial bank along the river.

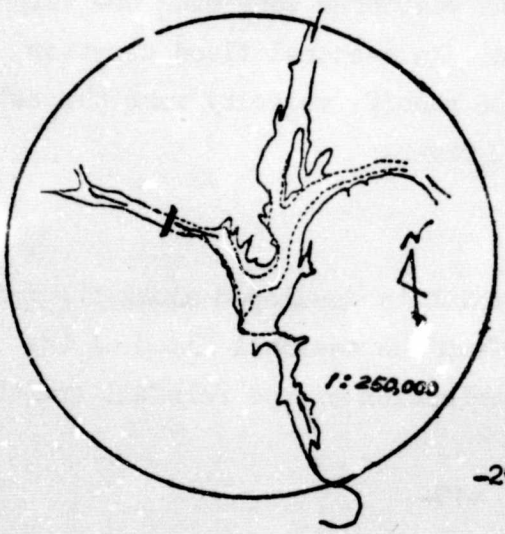


Fig. 2
Morphology Change of the Han River due to the Dam Construction
····· before the dam construction
—— after the dam construction

4. Discussions

4-1. Evaluation of the Landsat imagery interpretation emphasized on the Hydrogeomorphological aspects.

Landsat imagery interpretation is very useful for the hydromorphological characteristics of the large area. For example, the lineament of the morphology, the drainage system, the lithology and the land use are distinguishable on the imagery.

However, for the hydrological problem itself there are some requirements followed:

1. more accurate field data
2. Landsat imagery showing the monthly and annual variation
3. the laboratory work for the analysis of the soil deposit and the base rock
4. hydrological data of the catchment area

4-2. The Relationship between the Hydromorphological aspect and the Land use

Generally the hydromorphological characteristics are close relation to the land use unit. Most of paddy plain is cultivated in the Quarternary deposits and the cropland area is almost same boundary of the weathered zone of the bed rock. The sandy gravel area of the Quarternary deposits is not used for the cultivated area. The permeability of the Quarternary deposits is helpful to classify the cropland from the paddy plain.

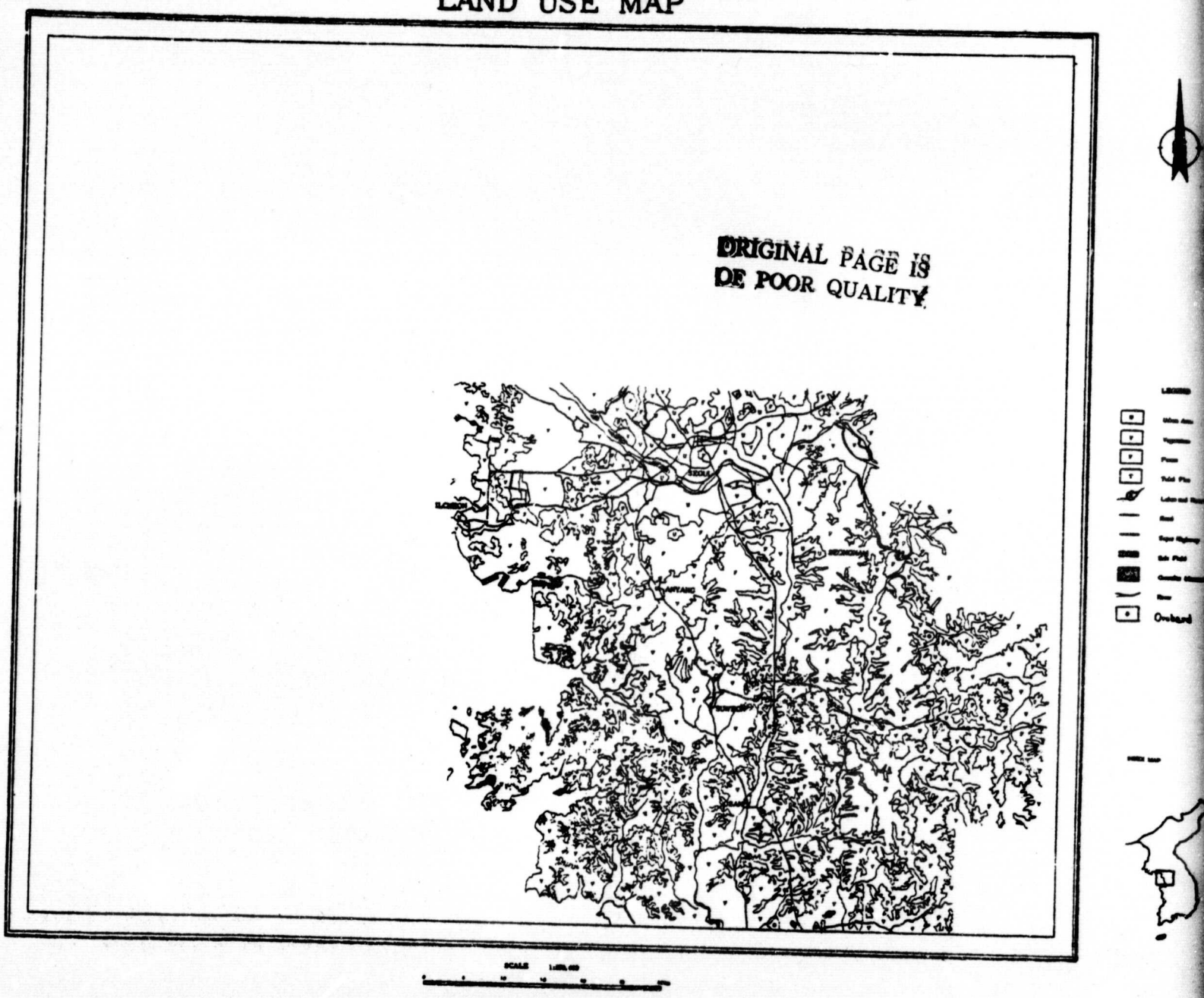


Fig.4 Land use map derived from existing 1:25,000 scale land use map

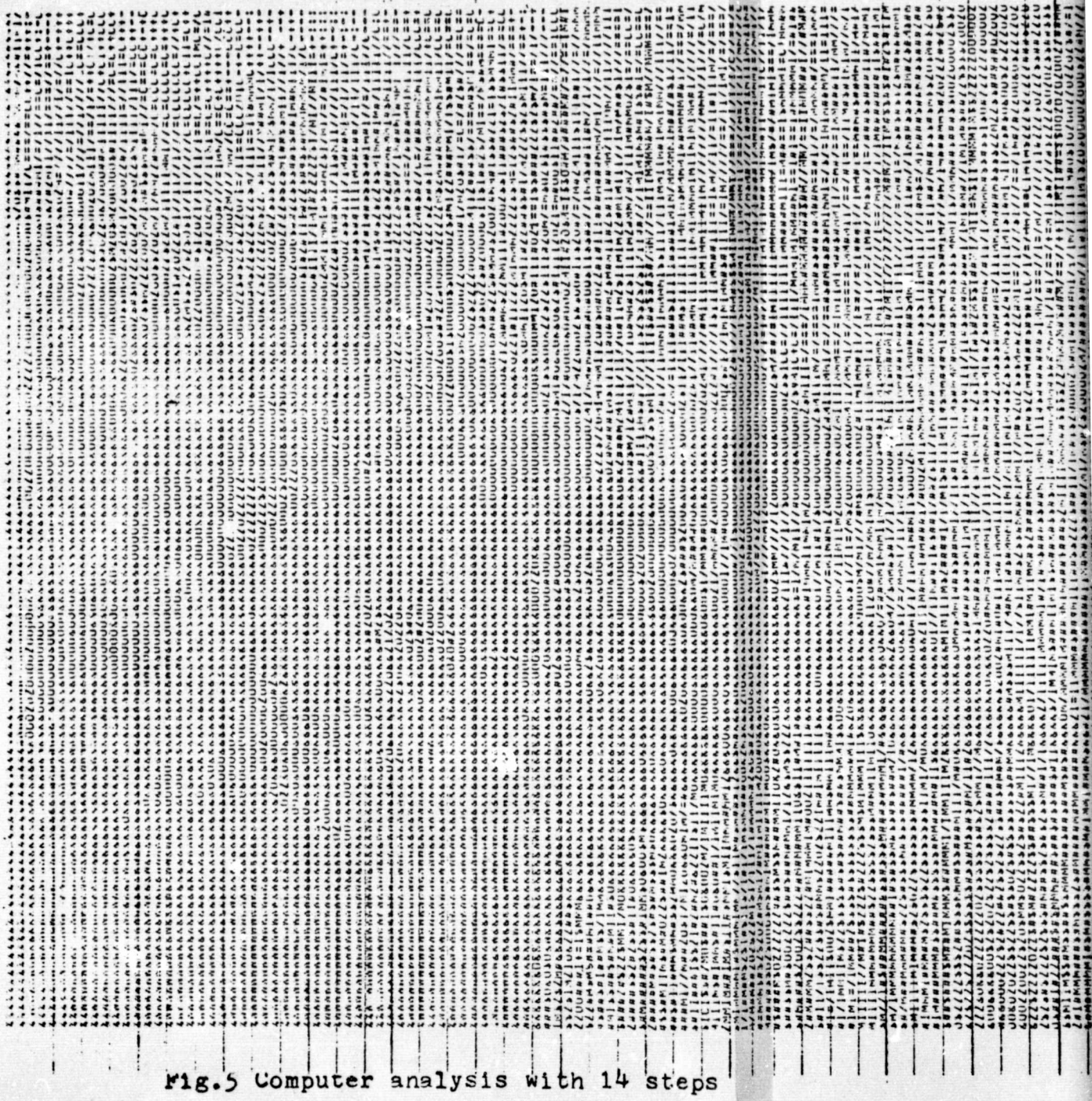
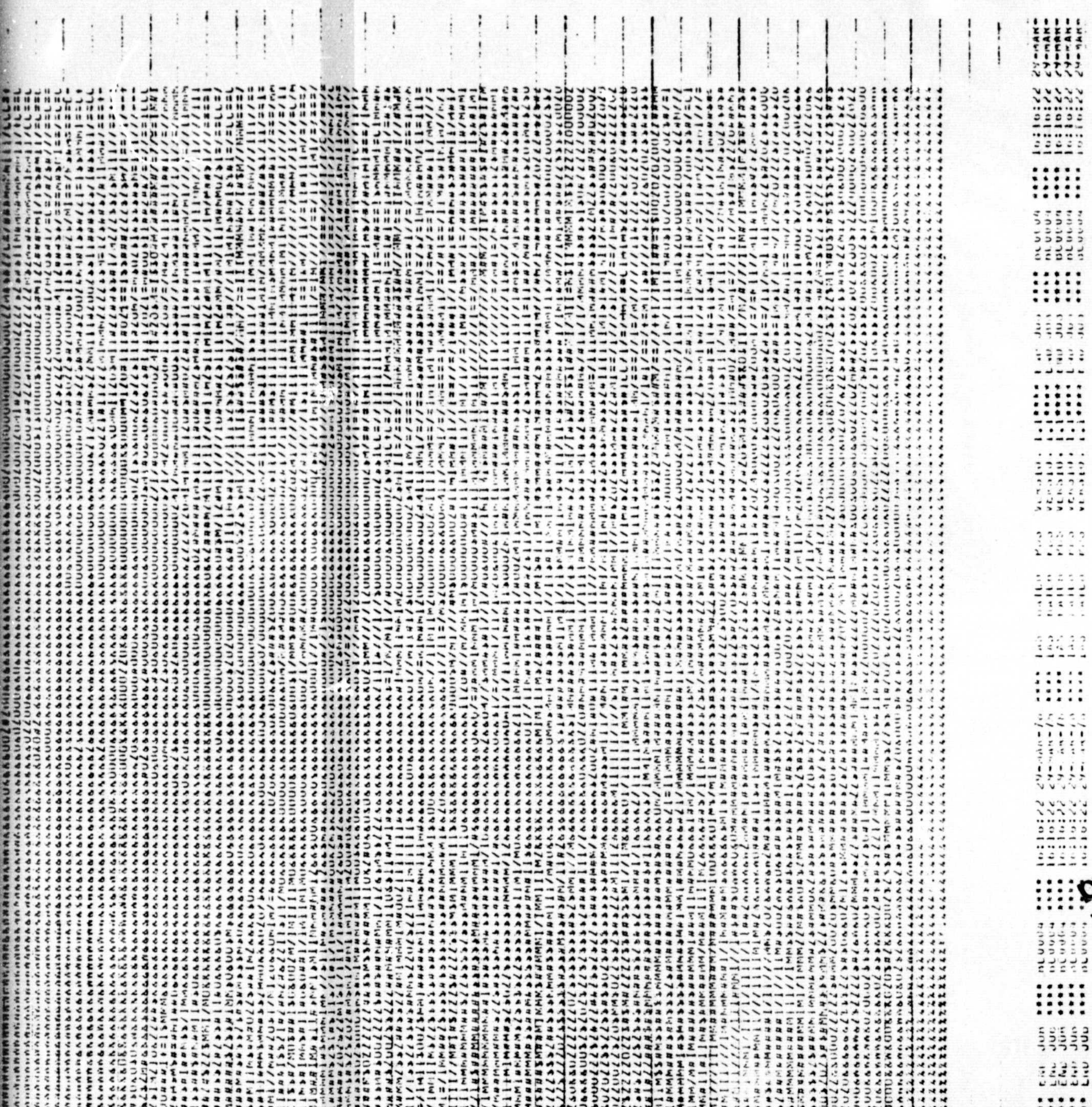


Fig.5 Computer analysis with 14 steps

HT FRAME



alysis with 14 steps

ORIGINAL PAGE IS OF POOR QUALITY

2 FOLDOUT FRAME

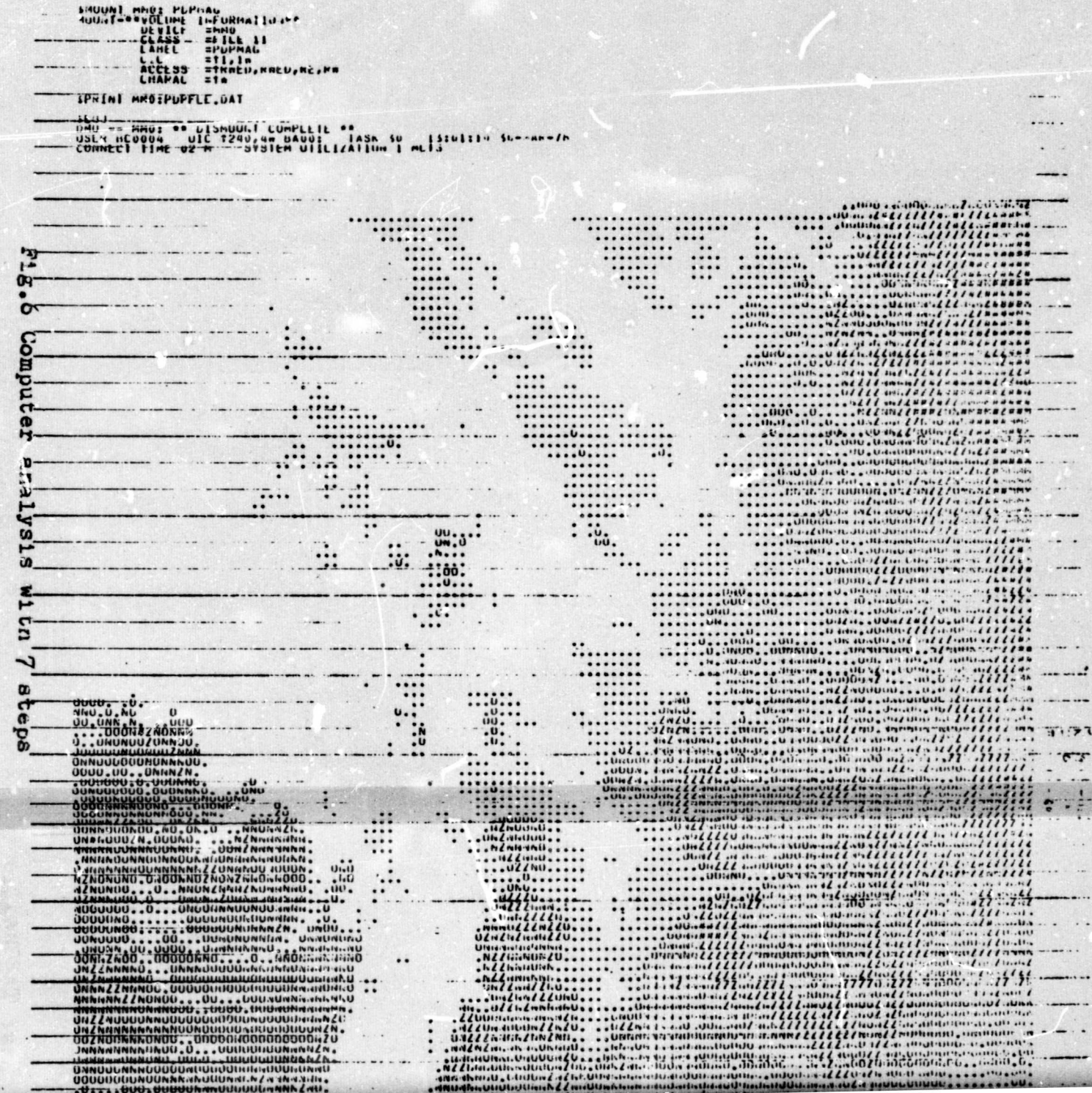
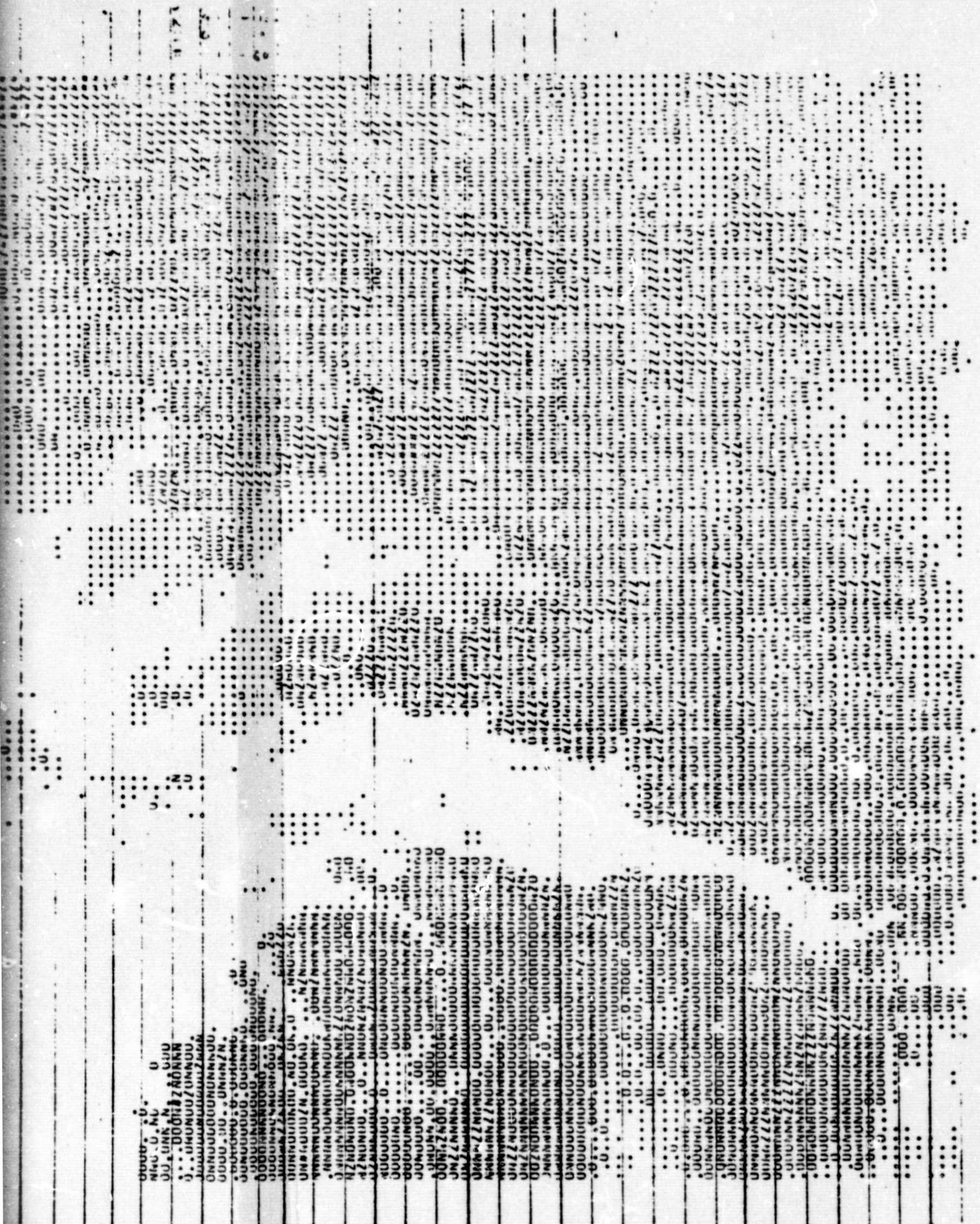


Fig.6 Computer analysis with 7 steps

LOGOUT FRAME

LOGOUT FRAME



with 7 steps

2 FOLDOUT FRAME

HYDROMORPHOLOGY MAP OF THE HAN RIVER BASIN

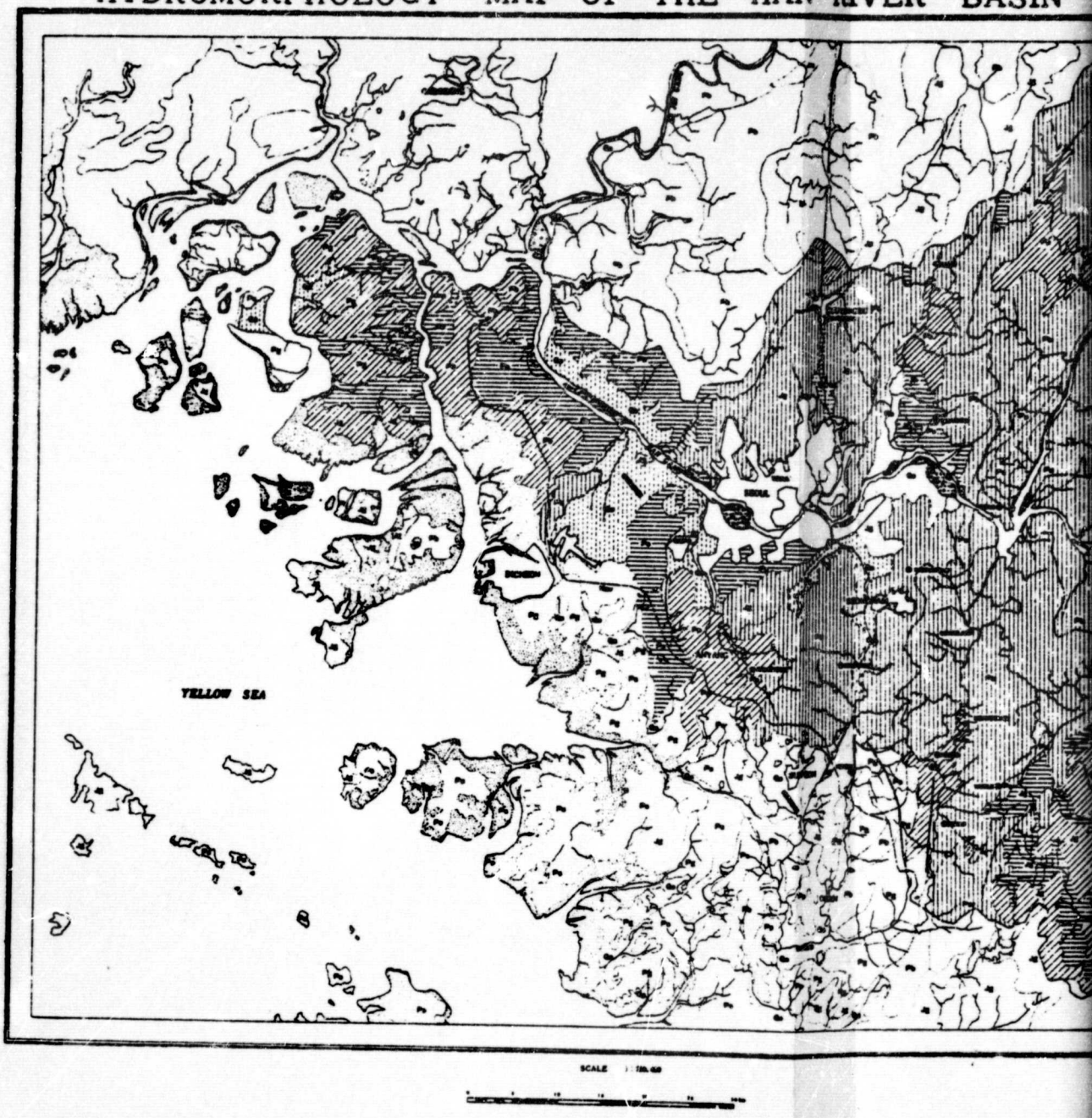
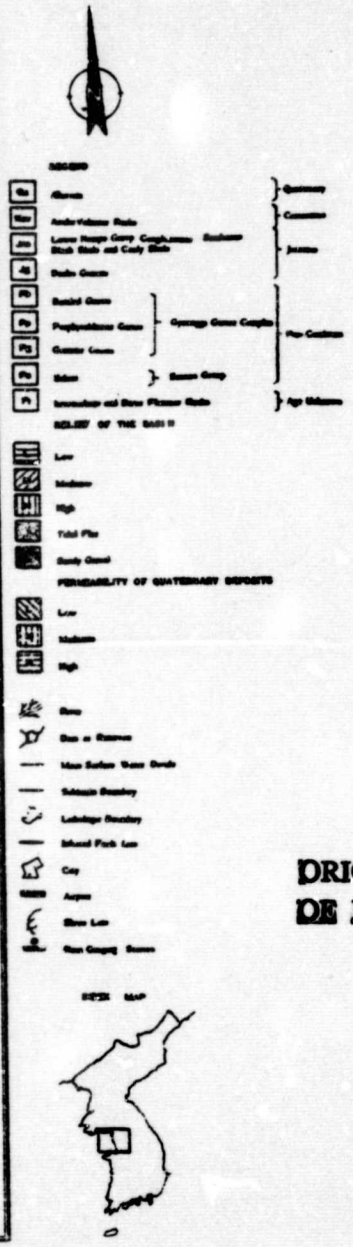


Fig.7 Hydromorphology map by visual interpretation of LANDSAT im

FOLDOUT FRAME

OF THE HAN RIVER BASIN



ORIGINAL PAGE IS
OF POOR QUALITY

sual interpretation of LANDSAT imagery

1 FOLDOUT FRAME

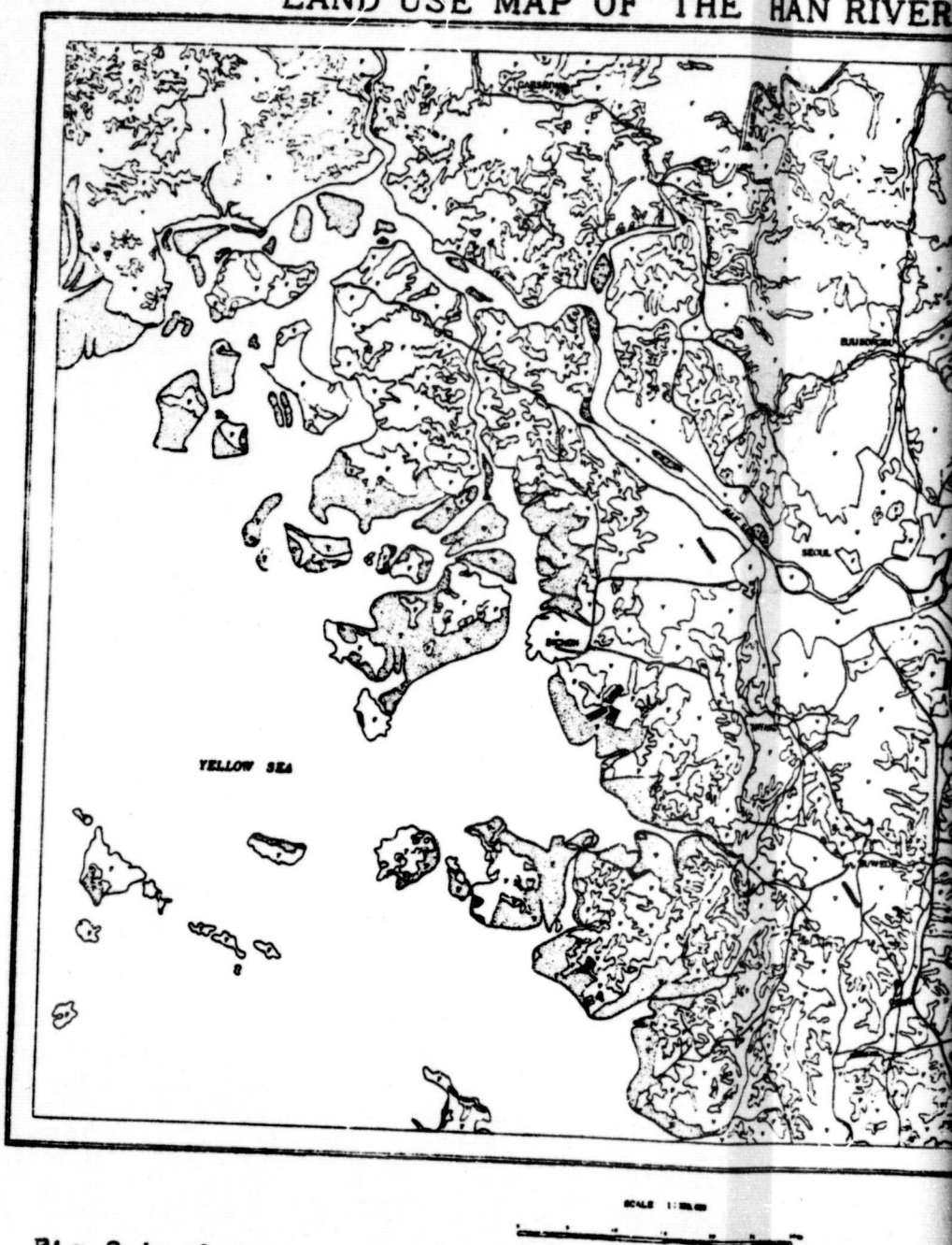
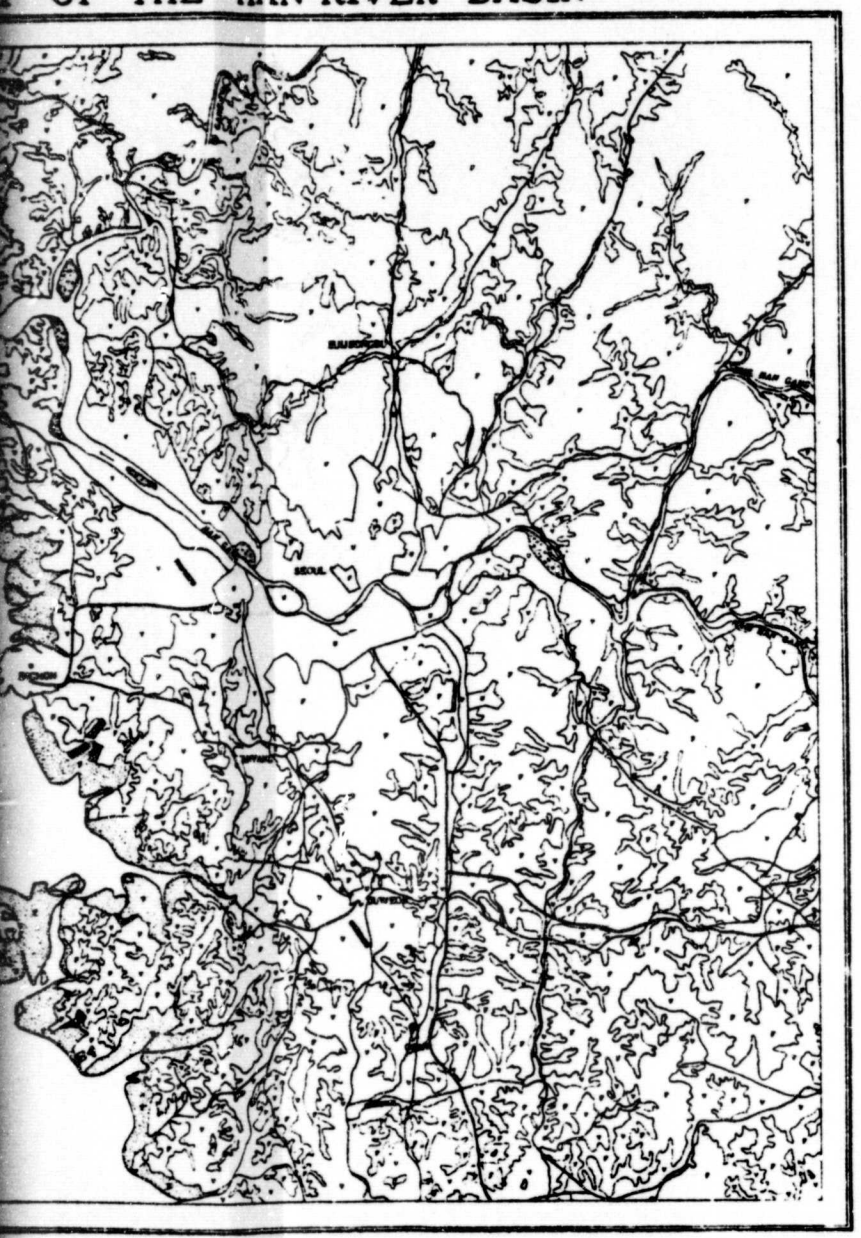
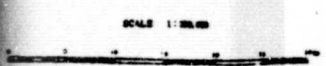


Fig.3 Land use map by visual interpretation of LANDS

P OF THE HAN RIVER BASIN





l interpretation of LANDSAT imagery

2 FOLDOUT FRAME