
**Special Flood Hazard
Evaluation Report**

Big Sister Creek

Village of Angola, Erie County, New York

Prepared for the
New York State Department of Environmental Conservation

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**US Army Corps
of Engineers
Buffalo District**

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**SPECIAL FLOOD HAZARD EVALUATION REPORT
BIG SISTER CREEK
VILLAGE OF ANGOLA, ERIE COUNTY, NEW YORK**

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Flood Profile, Big Sister Creek (1 sheet)

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**SPECIAL FLOOD HAZARD EVALUATION REPORT
BIG SISTER CREEK
VILLAGE OF ANGOLA, ERIE COUNTY, NY**

INTRODUCTION

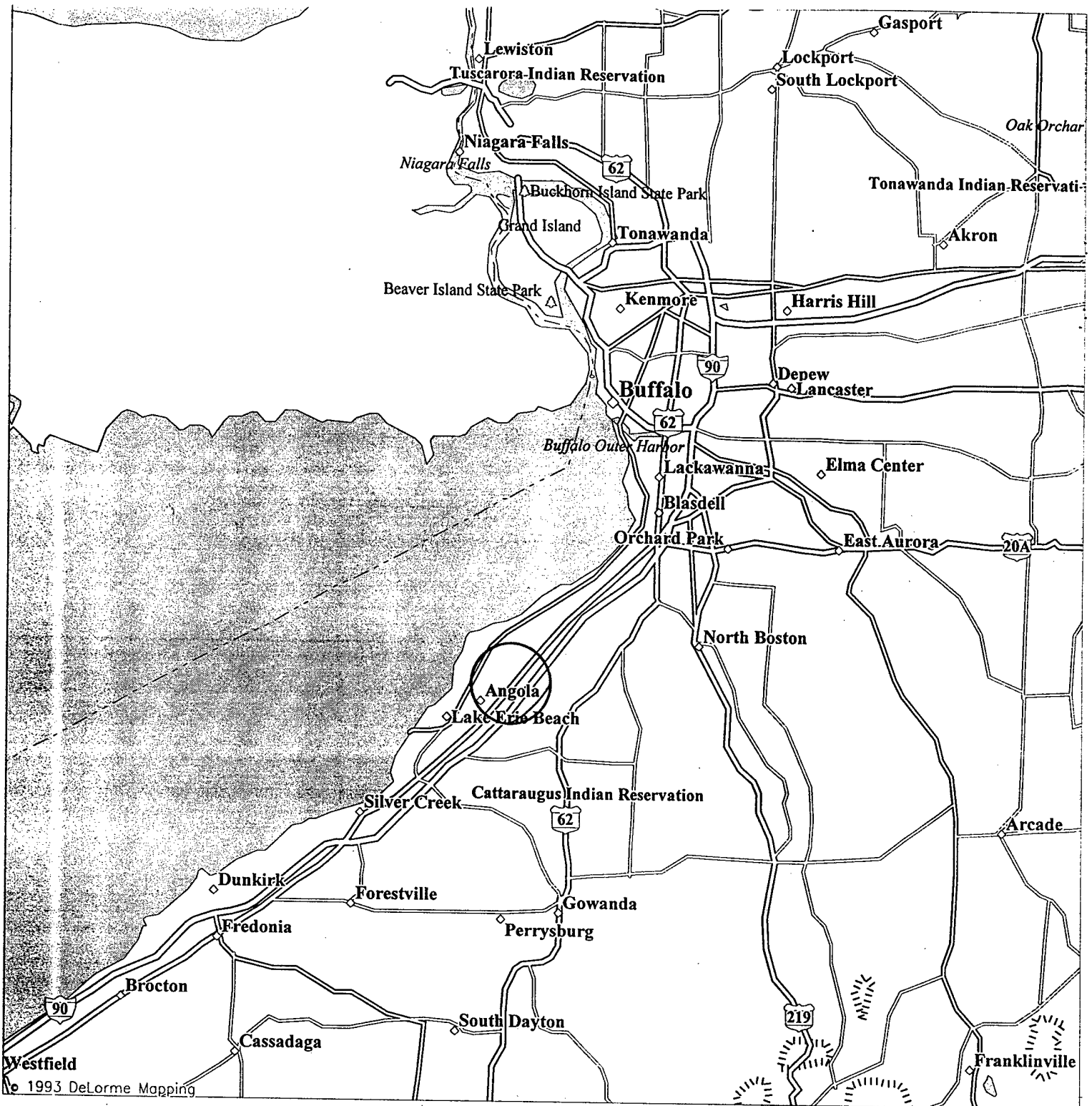
This Special Flood Hazard Evaluation Report documents the results of an investigation to determine the potential flood situation along Big Sister Creek within the Village of Angola, Erie County, New York. This study was conducted at the request of the New York State Department of Environmental Conservation under the authority of Section 206 of the 1960 Flood Control Act, as amended. The study reach includes Big Sister Creek from the downstream corporate boundary of Angola/Town of Evans to the upstream corporate boundary.

The Village of Angola is located in southwestern Erie County entirely within the Town of Evans, approximately 30 miles southwest of Buffalo. The town is bordered on the north by the Town of Hamburg, on the east by the Town of Eden, on the south by the Town of Brant and on the west by Lake Erie. The Angola population is 2,231 according to the 1990 census (Reference 1). Big Sister Creek originates in the town of Brant and flows in a northwesterly direction through the Village of Angola to Lake Erie.

Knowledge of potential floods and flood hazards is important in land use planning. This report identifies the 100-year and 500-year flood plains for the reaches studied.

Information developed for this study will be used by local officials to manage future flood plain development. While the report does not provide solutions to flood problems, it does furnish a suitable basis for the adoption of land use controls to guide flood plain development, thereby preventing intensification of the flood loss problem. It will also aid in the development of other flood damage reduction techniques to modify flooding and reduce flood damages which might be embodied in an overall Flood Plain Management (FPM) program. Other types of studies, such as those of environmental attributes and the current and future land use roles of the flood plain as part of its surroundings, would also profit from this information.

Although Flood Insurance Rate Maps have been developed for the community, no detailed analyses was used to study the stream reaches analyzed in this study because the area was thought to have a low development potential at the time the maps were prepared. However, the area is now experiencing residential development pressure, and local officials requested detailed flood plain information to assist them in managing development.



LEGEND

- Population Center
- ◇ Town, Small City
- ◇ Large City
- △ Park
- Interstate, Turnpike
- US Highway
- - - National Boundary
- Major Street/Road
- State Route
- Interstate Highway
- US Highway
- Land Mass
- Open Water

VILLAGE OF ANGOLA, NY
 Erie County
SPECIAL FLOOD HAZARD EVALUATION
BIG SISTER CREEK

VICINITY MAP

 U. S. Army Engineer District, Buffalo

Additional copies of this report can be obtained from the New York State Department of Environmental Conservation until its supply is exhausted, and the National Technical Information Service of the U.S. Department of Commerce, Springfield, Virginia 22161, at the cost of reproducing the report. The Buffalo District Corps of Engineers will provide technical assistance and guidance to planning agencies in the interpretation and use of the hydrologic data obtained for this study.

PRINCIPAL FLOOD PROBLEMS

Although flooding may occur during any season, the principal flood problems have occurred during winter and spring months and are usually the result of spring rains and or snowmelt.

Flood Magnitudes and Their Frequencies

Floods are classified on the basis of their frequency or recurrence interval. A 100-year flood is an event with a magnitude that can be expected to be equaled or exceeded once on the average during any 100-year period. It has a 1.0 percent chance of occurring in any given year. It is important to note that, while on a long-term basis, the exceedence averages out to once per 100 years, floods of this magnitude can occur in any given year or even in consecutive years and within any given time interval. For example, there is a greater than 50 percent probability that a 100-year event will occur during a 70-year lifetime. Additionally, a house which is built within the 100-year flood level has about a one-in-four chance of being flooded in a 30-year mortgage life.

Hazards and Damages of Large Floods

The extent of damage caused by any flood depends on the topography of the flooded area, the depth and duration of flooding, the velocity of flow, the rate of rise in water surface elevation, and development of the flood plain. Deep water flowing at a high velocity and carrying floating debris would create conditions hazardous to persons and vehicles which attempt to cross the flood plain. Generally, water 3 or more feet deep which flows at a velocity of 3 or more feet per second could easily sweep an adult off his feet and create definite danger of injury or drowning. Rapidly rising and swiftly flowing floodwater may trap persons in homes that are ultimately destroyed or in vehicles that are ultimately submerged or floated. Since water lines can be ruptured by deposits of debris and by the force of flood waters, there is the possibility of contaminated domestic water supplies. Damaged sanitary sewer lines and sewage treatment plants could result in the pollution of floodwaters and could create health hazards. Isolation of

areas by floodwater could create hazards in terms of medical, fire, or law enforcement emergencies.

HYDROLOGIC ANALYSES

Discharges for the 100-year and 500-year floods were obtained from the existing Flood Insurance Study for the Town of Evans, New York (Reference 2). The 100-year and 500-year discharges were 8,400 cfs and 10,400 cfs, respectively, at the downstream limit of the study at the town/village corporate limit. Those discharges were reduced to 6,800 cfs and 8,300 cfs, respectively, because a tributary enters Big Sister Creek within the study area, approximately 24,100 feet upstream of the mouth.

HYDRAULIC ANALYSES

Analyses of the hydraulic characteristics of flooding from sources studied were carried out to provide estimates of the elevations of floods for the 100-year and 500-year recurrence intervals.

Cross-section data for the backwater analyses of Big Sister Creek were obtained from field surveys performed by Buffalo District personnel. Additional data were obtained from topographic maps (Reference 3) and from data obtained for the Town of Evans Flood Insurance Study previously referenced. All bridges and culverts were surveyed to determine elevation data and structural geometry. Spot elevations were obtained in the overbank areas in order to accurately delineate the flood plain boundaries.

Water surface elevations of the 100-year and 500-year recurrence interval flood events were computed using the COE HEC-2 step-backwater computer program (Reference 4). Starting water surface elevations for Big Sister Creek were taken from the Town of Evans study.

Locations of the selected cross-sections used in the hydraulic analyses are shown on the Flood Profile (Plate 1) and on the Flooded Areas Map which accompany this report.

Channel and overbank roughness factors (Manning's "n") used in the hydraulic computations were selected using engineering judgement and were based on field observations of the stream and flood plain areas. The values for Manning's "n" and the contraction and expansion coefficients are shown in Table 1.

Flood profiles were drawn showing the computed water surface elevations for the selected recurrence intervals. The flood plain boundaries were delineated using

the flood elevations determined at each cross section, Between cross sections, the boundaries were interpolated using the topographic maps and spot elevations obtained during the field surveys. Small areas within the flood plain boundaries may be above the flood elevations, but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

**TABLE 1
MANNING'S "N" AND CONTRACTION & EXPANSION COEFFICIENTS**

<u>Flooding Source</u>	<u>Channel</u>	<u>Overbank</u>	<u>Contraction</u>	<u>Expansion</u>
Big Sister Creek	0.04	0.08	0.1 - 0.3	0.3 - 0.5

No floodway encroachment was made for Big Sister Creek in the Village of Angola because the 100-year flood plain boundary is contained within the banks of the creek; therefore, no floodway was determined nor delineated on the flooded area maps.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profile are considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Descriptions of the marks are presented in Table 2.

**TABLE 2
ELEVATION REFERENCE MARKS**

<u>Reference Mark</u>	<u>Elevation</u>	<u>Description</u>
RM-1	688.84	A standard USGS disk stamped "Angola (1934)" located at the east end of Lake Street on the east side of North Main Street at Angola, in the west wall of the building, 2.5 feet north of the southwest corner of the building, and about 4.5 feet above the sidewalk.
RM-2	672.04	A standard USGS disk stamped "E471 (1983)" in Angola, in the northeast angle of the junction of North Main and Maple Streets, on the property of the Niagara Mohawk Power Company, 72 feet east of the centerline of North Main Street, 28 feet north of the center of Maple Street, 33 feet east-southeast of the southwest corner of the Niagara Mohawk building, 6.6 feet south of the south face of the building, 4.5 feet east of the flagpole.

UNIFIED FLOOD PLAIN MANAGEMENT

Historically, the alleviation of flood damage has been accomplished almost exclusively by the construction of protective works such as reservoirs, channel improvements, and floodwalls and levees. However, in spite of the billions of dollars that have already been spent for construction of well-designed and efficient flood control works, annual flood damages continue to increase because the number of persons and structures occupying floodprone lands is increasing faster than protective works can be provided.

Recognition of this trend has forced a reassessment of the flood control concept and resulted in the broadened concept of unified flood plain management programs. Legislative and administrative policies frequently cite two approaches: structural and nonstructural, for adjusting to the flood hazard. In this context, "structural" is usually intended to mean adjustments that modify the behavior of floodwaters through the use of measures such as dams and channel work. "Nonstructural" is usually intended to include all other adjustments in the way society acts when occupying or modifying a flood plain (e.g., regulations, floodproofing, insurance, etc.). Both structural and nonstructural tools are used for achieving desired future flood plain conditions. There are three basic strategies which may be applied individually or in combination: (1) modifying the susceptibility to flood damage and disruption, (2) modifying the floods themselves, and (3) modifying (reducing) the adverse impacts of floods on the individual and the community.

Modify Susceptibility to Flood Damage and Disruption

The strategy to modify susceptibility to flood damage and disruption consists of actions to avoid dangerous, economically undesirable, or unwise use of the flood plain. Responsibility for implementing such actions rests largely with the non-Federal sector and primarily at the local level of government.

These actions include restrictions in the mode and the time of occupancy; in the ways and means of access; in the pattern, density, and elevation of structures and in the character of their materials (structural strength, adsorptiveness, solubility, corrodibility); in the shape and type of buildings and in their contents; and in the appurtenant facilities and landscaping of the grounds. The strategy may also necessitate changes in the interdependencies between flood plains and surrounding areas not subject to flooding, especially interdependencies regarding utilities and commerce. Implementing mechanisms for these actions include land use regulations, development and redevelopment policies, floodproofing, disaster preparedness and response plans, and flood forecasting and warning systems.

Different tools may be more suitable for developed or underdeveloped flood plain or for urban or rural areas. The information contained in this report is particularly useful for the preparation of flood plain regulations.

a. Flood Plain Regulations.

Flood plain regulations apply to the full range of ordinances and other means designed to control land use and construction within floodprone areas. The term encompasses zoning ordinances, subdivision regulations, building and housing codes, encroachment line statutes, open area regulations, and other similar methods of management which affect the use and development of floodprone areas.

Flood plain land use management does not prohibit use of floodprone areas; to the contrary, flood plain land use management seeks the best use of flood plain lands. The flooded area maps and the water surface profiles contained in this report can be used to guide development in the flood plain. The elevations shown on the profile should be used to determine flood heights because they are more accurate than the outlines of flooded areas. It is recommended that development in areas susceptible to frequent flooding adhere to the principles expressed in Executive Order 11988 - Flood Plain Management, whose objective is to "... avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of flood plains ... whenever there is a practicable alternative." Accordingly, development in areas susceptible to frequent flooding should consist of construction which has a low damage potential such as parking areas, parks, and golf courses. High value construction such as buildings, should be located outside the flood plain to the fullest extent possible. In instances where no practicable alternative exists, the land should be elevated to minimize damages. If it is uneconomical to elevate the land in these areas, means of floodproofing the structure should be given careful consideration.

b. Development Zones.

A flood plain consists of two zones. The first zone is the designated "floodway" or that cross sectional area required for carrying or discharging the anticipated flood waters with a maximum 1-foot increase in flood level (New York State Department of Environmental Conservation standard). Velocities are the greatest and most damaging in the floodway. Regulations essentially maintain the flow-conveying capability of the floodway to minimize inundation of additional adjacent areas. Uses which are acceptable for floodways include parks, parking areas, open spaces, etc.

The second zone of the flood plain is termed the "floodway fringe" or restrictive zone, in which inundation might occur but where depths and velocities are generally low. Although not recommended if practicable alternatives exist, such areas can be developed provided structures are placed high enough or floodproofed to be reasonably free from flood damage during the 100-year flood. Typical relationships between the floodway and floodway fringe are shown in Figure 2.

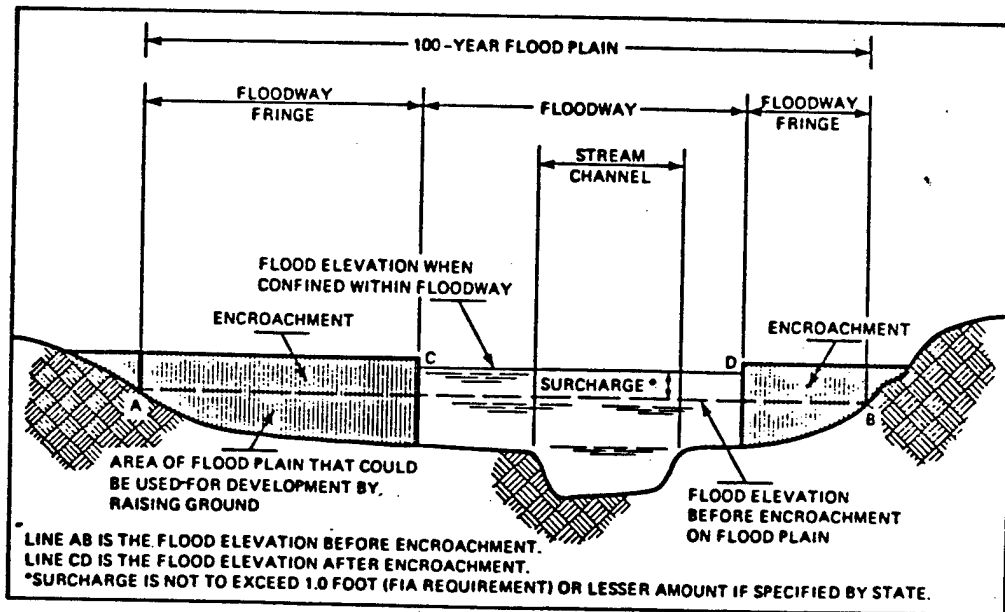


Figure 2 - Floodway Schematic

c. Formulation of Flood Plain Regulations.

Formulation of flood plain regulations in a simplified sense involves selecting the type and degree of control to be exercised for each specific flood plain. In principle, the form of the regulations is not as important as a maintained adequacy of control. The degree of control normally varies with the flood hazard as measured by depth of inundation, velocity of flow, frequency of flooding, and the need for available land. Considerable planning and research is required for the proper formulation of flood plain regulations. Formulation of flood plain regulations may require a lengthy period of time during which development is likely to occur. In such cases, temporary regulations should be adopted and amended later as necessary.

Modify Flooding

The traditional strategy of modifying floods through the construction of dams, dikes, levees and floodwalls, channel alterations, high flow diversions and

spillways, and land treatment measures has repeatedly demonstrated its effectiveness for protecting property and saving lives, and it will continue to be a strategy of flood plain management. However, in the future, reliance solely upon a flood modification strategy is neither possible nor desirable. Although the large capital investment required by flood modifying tools has been provided largely by the Federal government, sufficient funds from Federal sources have not been and are not likely to be available to meet all situations for which flood modifying measures would be both effective and economically feasible. Another consideration is that the cost of maintaining and operating flood control structures falls upon local governments.

Flood modifications acting alone leave a residual flood loss potential and can encourage an unwarranted sense of security leading to inappropriate use of lands in the areas that are directly protected or in adjacent areas. For this reason, measures to modify possible floods should usually be accompanied by measures to modify the susceptibility to flood damage, particularly by land use regulations.

Modify the Impact of Flooding on Individuals and the Community

A third strategy for mitigating flood losses consists of actions designed to assist individuals and communities in their preparatory, survival, and recovery responses to floods. Tools include information dissemination and education, arrangements for spreading the costs of the loss over time, purposeful transfer of some of the individual's loss to the community by reducing taxes in flood prone areas, and the purchase of Federally subsidized flood insurance.

The distinction between a reasonable and unreasonable transfer of costs from the individual to the community can also be regulated and is a key to effective flood plain management.

CONCLUSION

This report presents local flood hazard information for Big Sister Creek in the Village of Angola, New York. The U.S. Army Corps of Engineers, Buffalo District, will provide interpretation in the application of the data contained in this report, particularly as to its use in developing effective flood plain regulations. Requests should be coordinated with the New York State Department of Environmental Conservation.

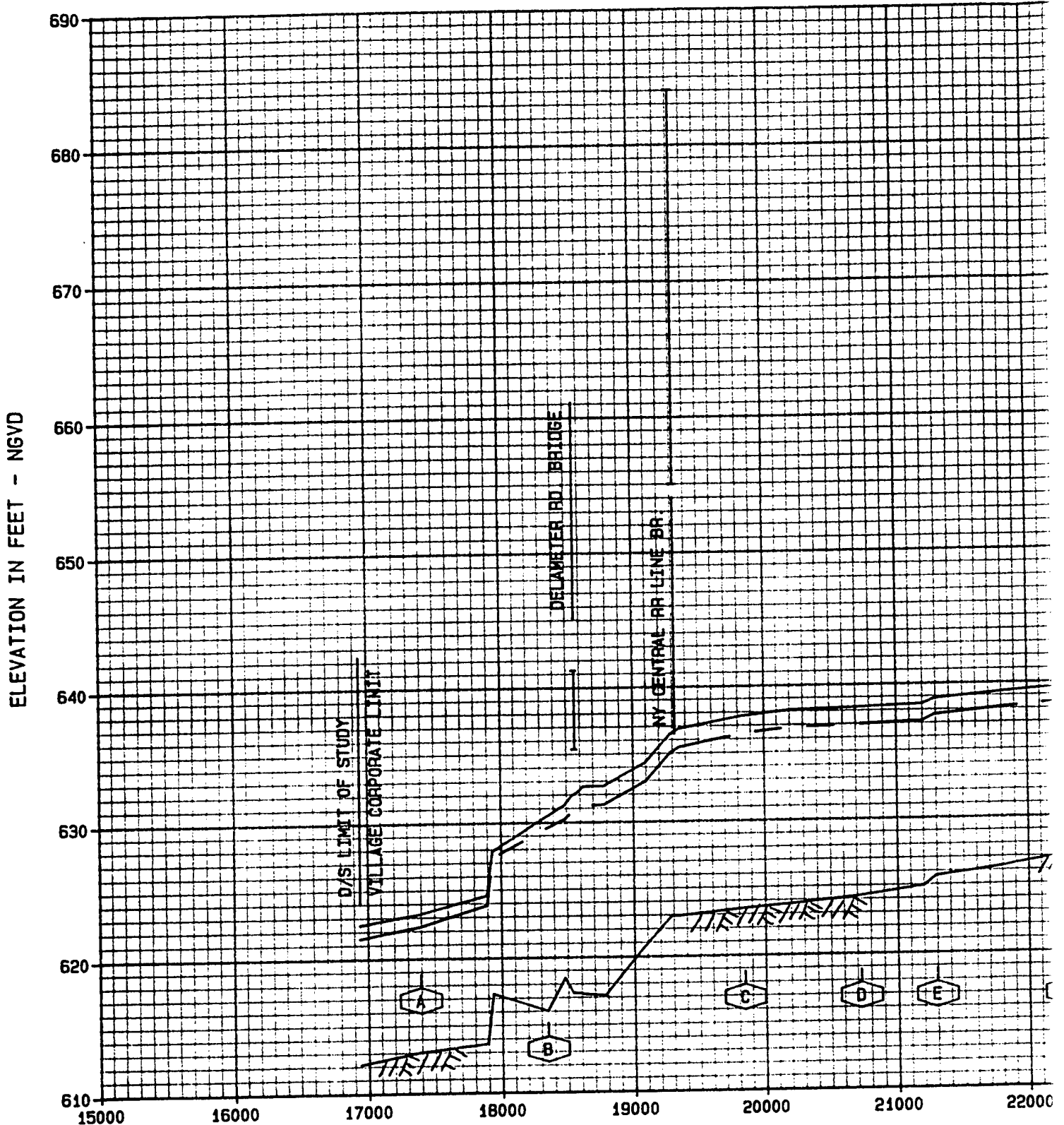
GLOSSARY

BACKWATER EFFECT	The resulting rise in water surface in a given stream due to a downstream obstruction or high stages in an intersecting stream.
BASE FLOOD	A flood which has an average return interval in the order of once in 100 years, although the flood may occur in any year. It is based on statistical analysis of streamflow records available for the watershed and analysis of rainfall and runoff characteristics in the general region of the watershed. It is commonly referred to as the "100-year flood."
DISCHARGE	The quantity of flow in a stream at any given time, usually measured in cubic feet per second (cfs).
FLOOD	<p>An overflow of lands not normally covered by water. Floods have two essential characteristics: the inundation of land is temporary and the lands are adjacent to and inundated by overflow from a river, stream, ocean, lake, or other body of standing water.</p> <p>Normally a "flood" is considered as any temporary rise in streamflow or stage, but not the ponding of surface water, that results in significant adverse effects in the vicinity. Adverse effects may include damages from overflow of land areas, temporary backwater effects in sewers and local drainage channels, creation of unsanitary conditions or other unfavorable situations by deposition of materials in stream channels during flood recessions, and rise of groundwater coincident with increased streamflow.</p>
FLOOD CREST	The maximum stage or elevation reached by floodwaters at a given location.
FLOOD FREQUENCY	A statistical expression of the percent chance of exceeding a discharge of a given magnitude in any given year. For example, a <u>100-year flood</u> has a magnitude expected to be exceeded on the average of once every hundred years. Such a <u>flood</u> has a 1 percent chance of being exceeded in any given year. Often used interchangeably with <u>RECURRENCE INTERVAL</u> .
FLOOD PLAIN	The areas adjoining a river, stream, watercourse, ocean, lake, or other body of standing water that have been or may be covered by floodwater.

FLOOD PROFILE	A graph showing the relationship of water surface elevation to location; the latter generally expressed as distance upstream from a known point along the approximate centerline of a stream of water that flows in an open channel. It is generally drawn to show surface elevation for the rest of a specific flood, but may be prepared for conditions at a given time or stage.
FLOOD STAGE	The stage or elevation at which overflow of the natural banks of a stream or body of water begins in the reach or area in which the elevation is measured.
FLOODWAY	The channel of a watercourse and those portions of the adjoining flood plain required to provide for the passage of the selected flood (normally the 100-year flood) with an insignificant increase in the flood levels above that of natural conditions. As used in the National Flood Insurance Program, floodways must be large enough to pass the 100-year flood without causing an increase in elevation of more than a specified amount (1 foot in most areas).
RECURRENCE INTERVAL	A statistical expression of the average time between floods exceeding a given magnitude (see FLOOD FREQUENCY).

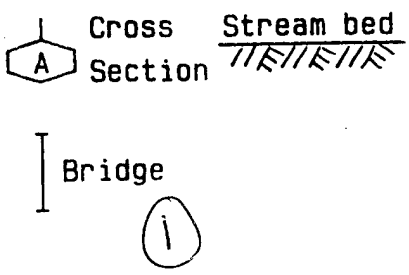
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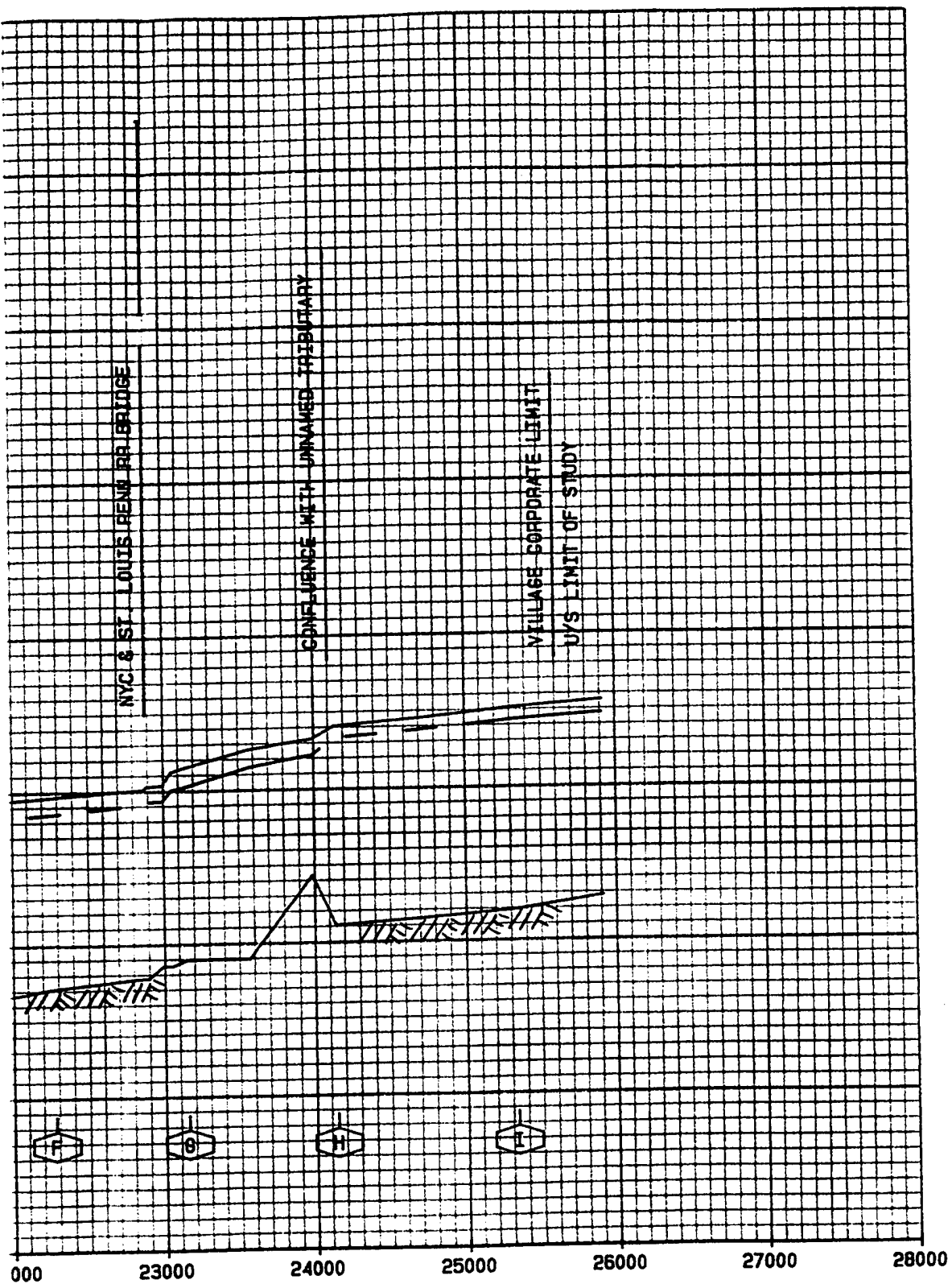
1. U.S. Department of Commerce, Bureau of the Census, 1990 Census of the Population and Housing, Washington, D.C.
2. Federal Emergency Management Agency, Flood Insurance Study, Town of Evans, New York, Erie County, March 1982.
3. U.S. Department of the Interior, Geological Survey, 7.5 Minute Series (Topographic) Map, Scale 1:24,000, Contour Interval 20 feet: Angola, NY (1960).
4. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles Generalized Computer Program, Davis, California, 1987.



DISTANCE IN FEET ABOVE CONFLUENCE

Legend:
 100-YR. FLOOD ————
 500-YR. FLOOD ————





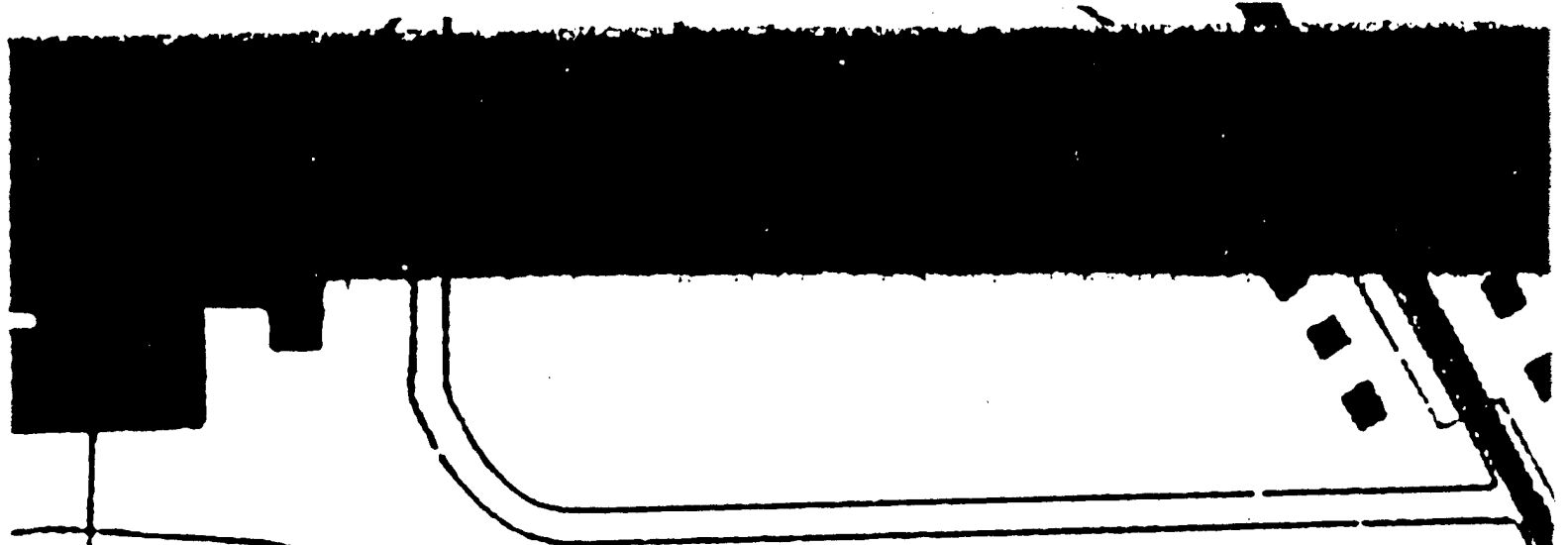
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BIG SISTER CREEK
 VILLAGE OF ANGOLA, NY
 ERIE COUNTY
 WATER SURFACE PROFILES
 Plate 1 OF 1

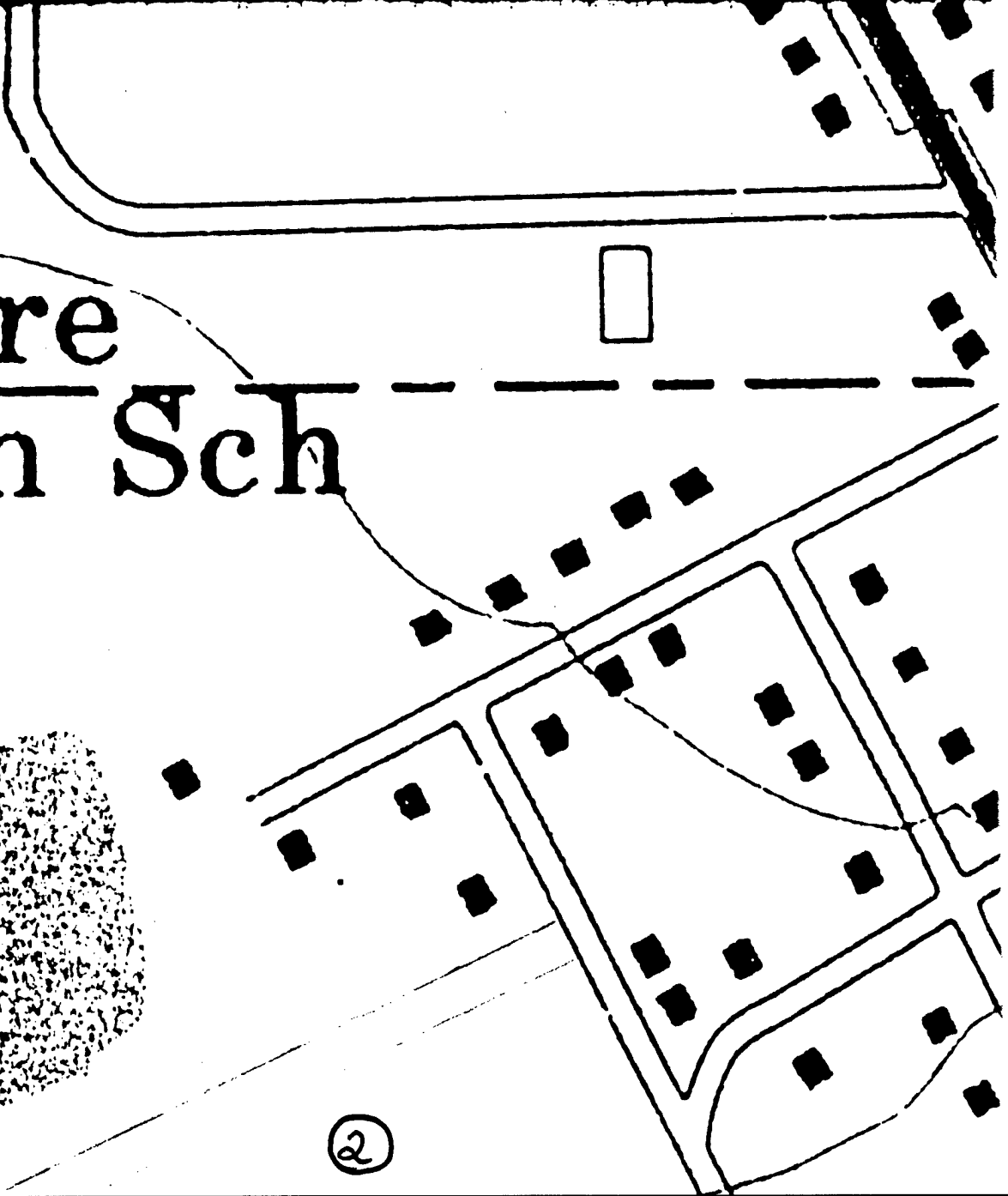
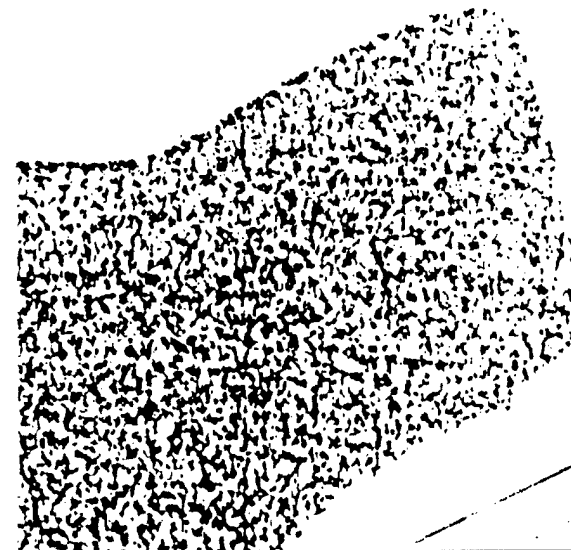


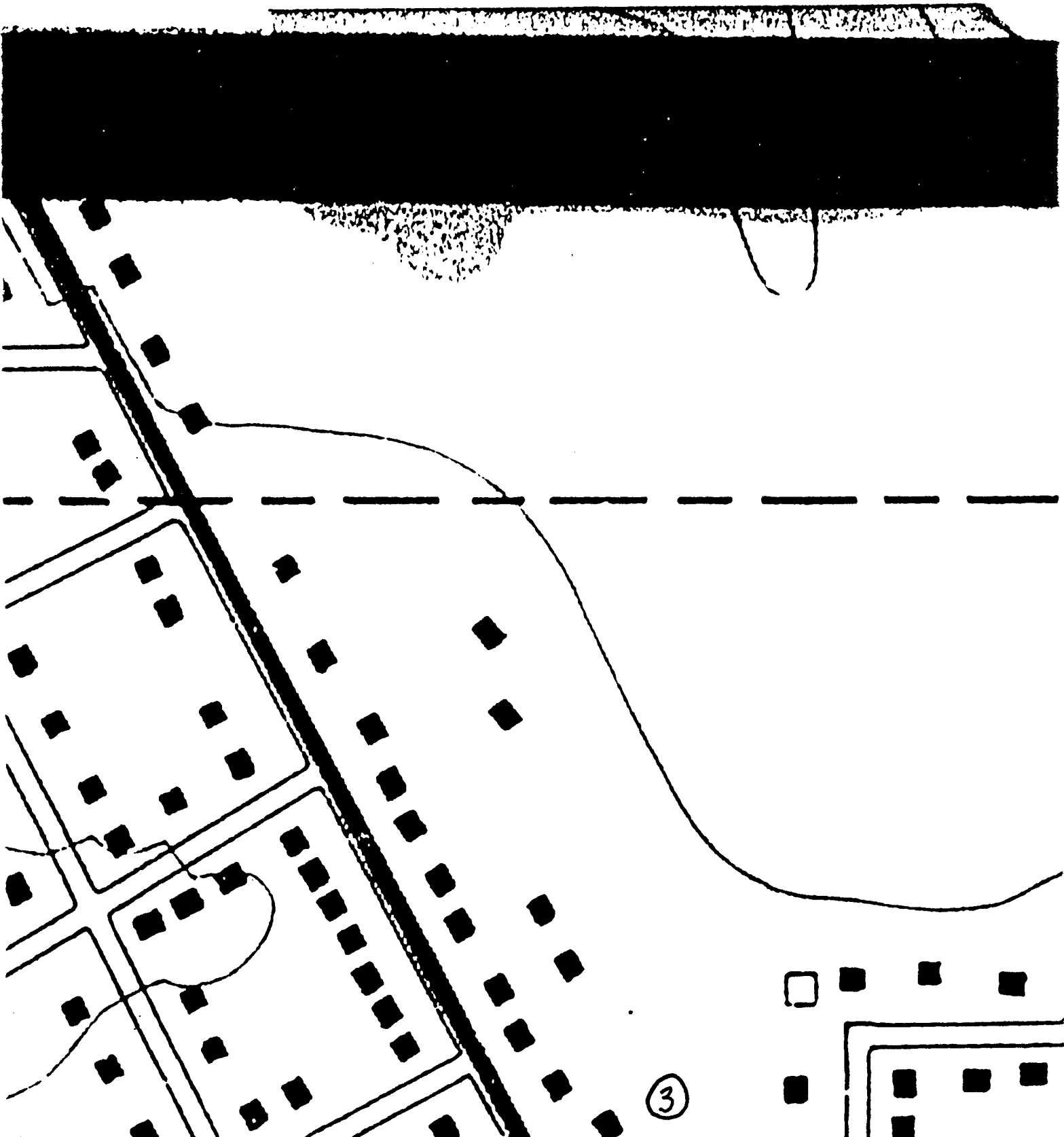
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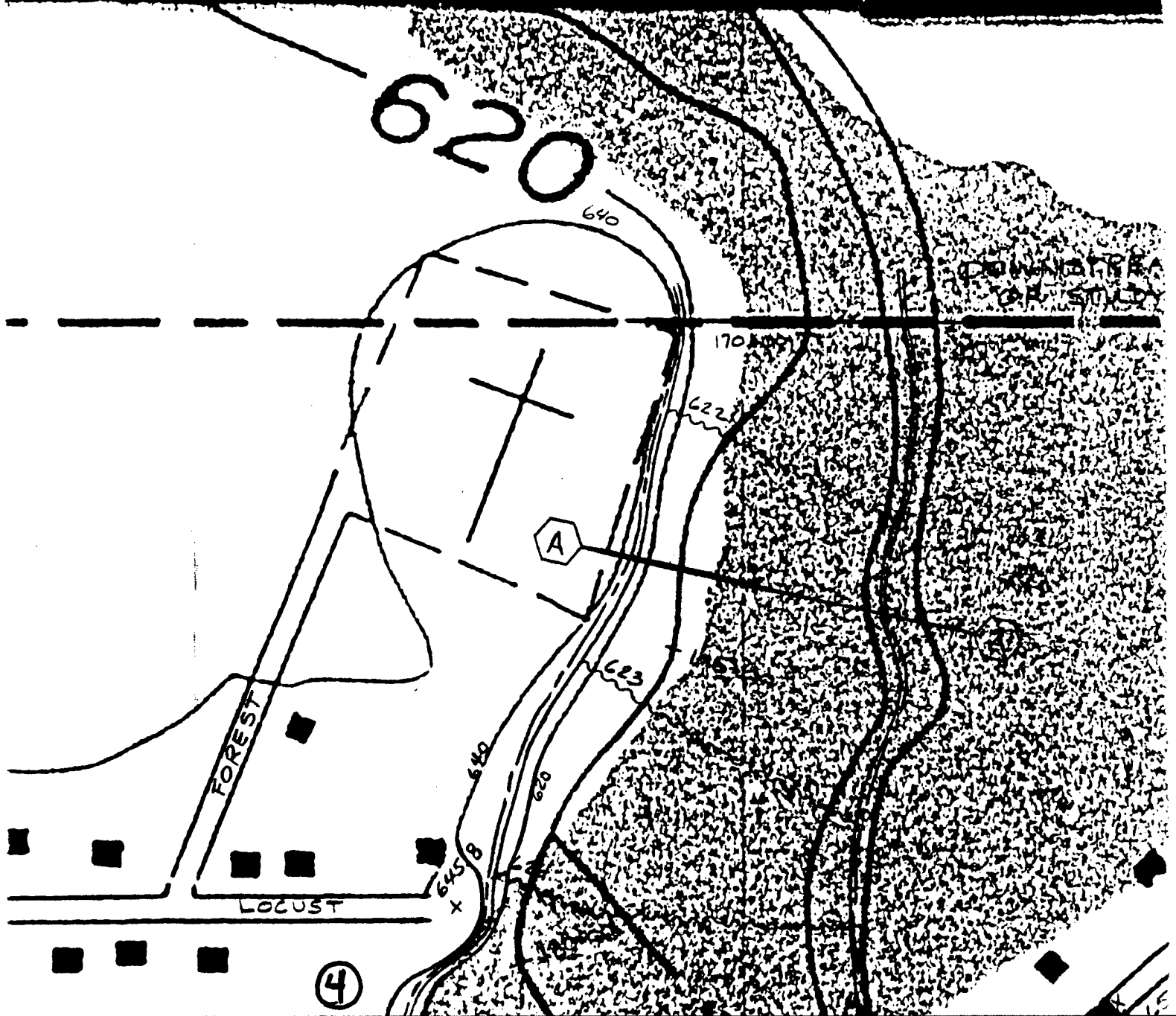
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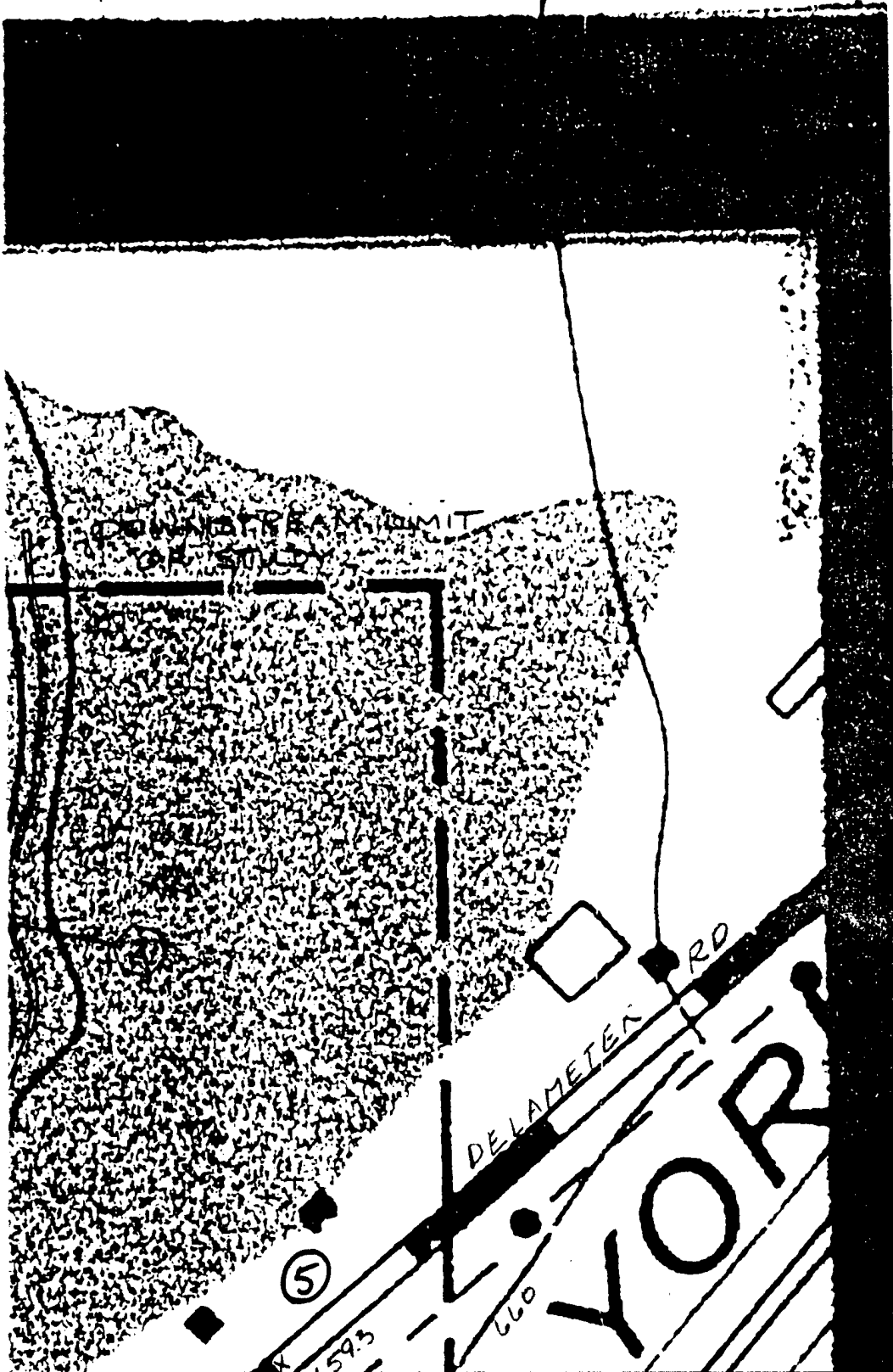


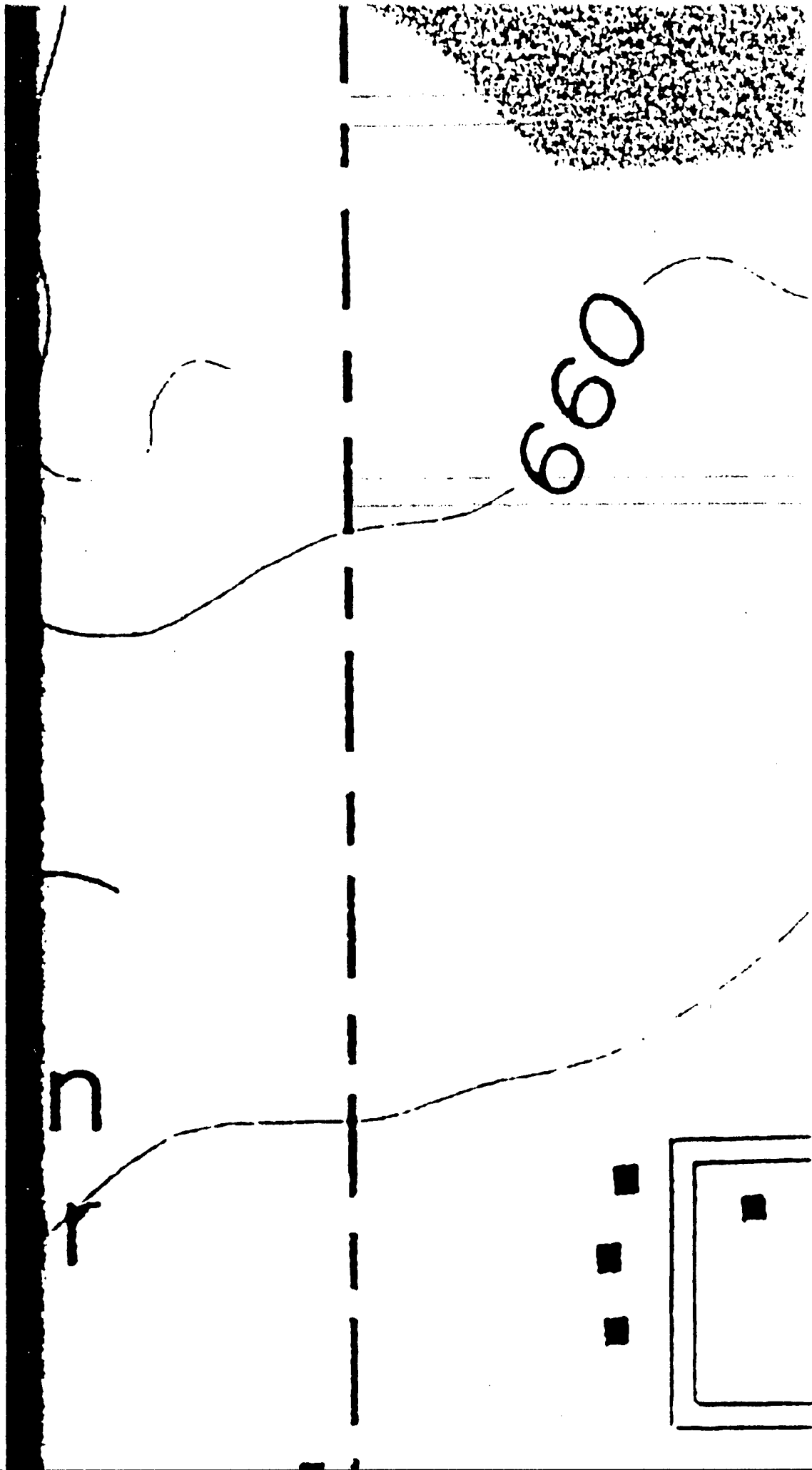
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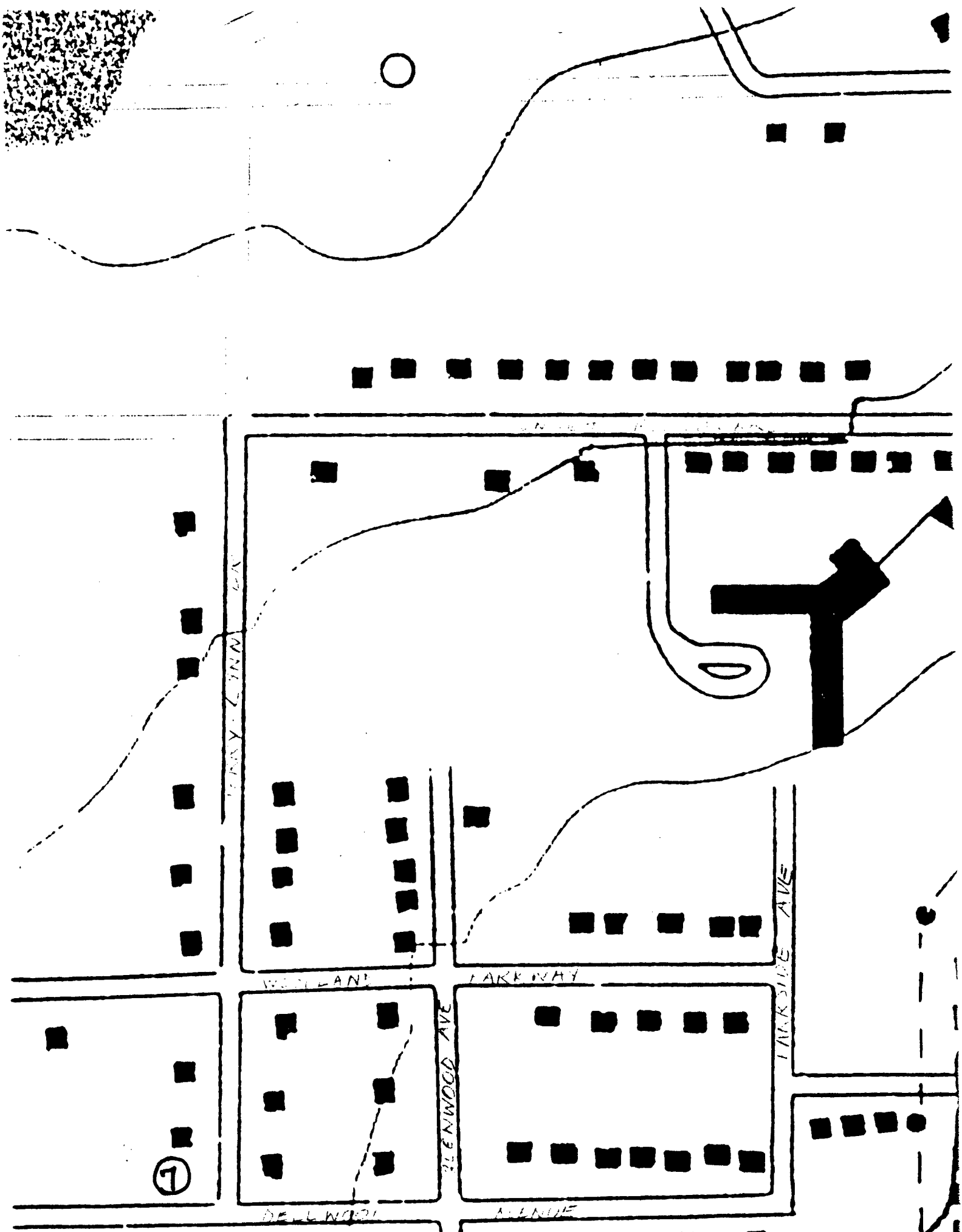












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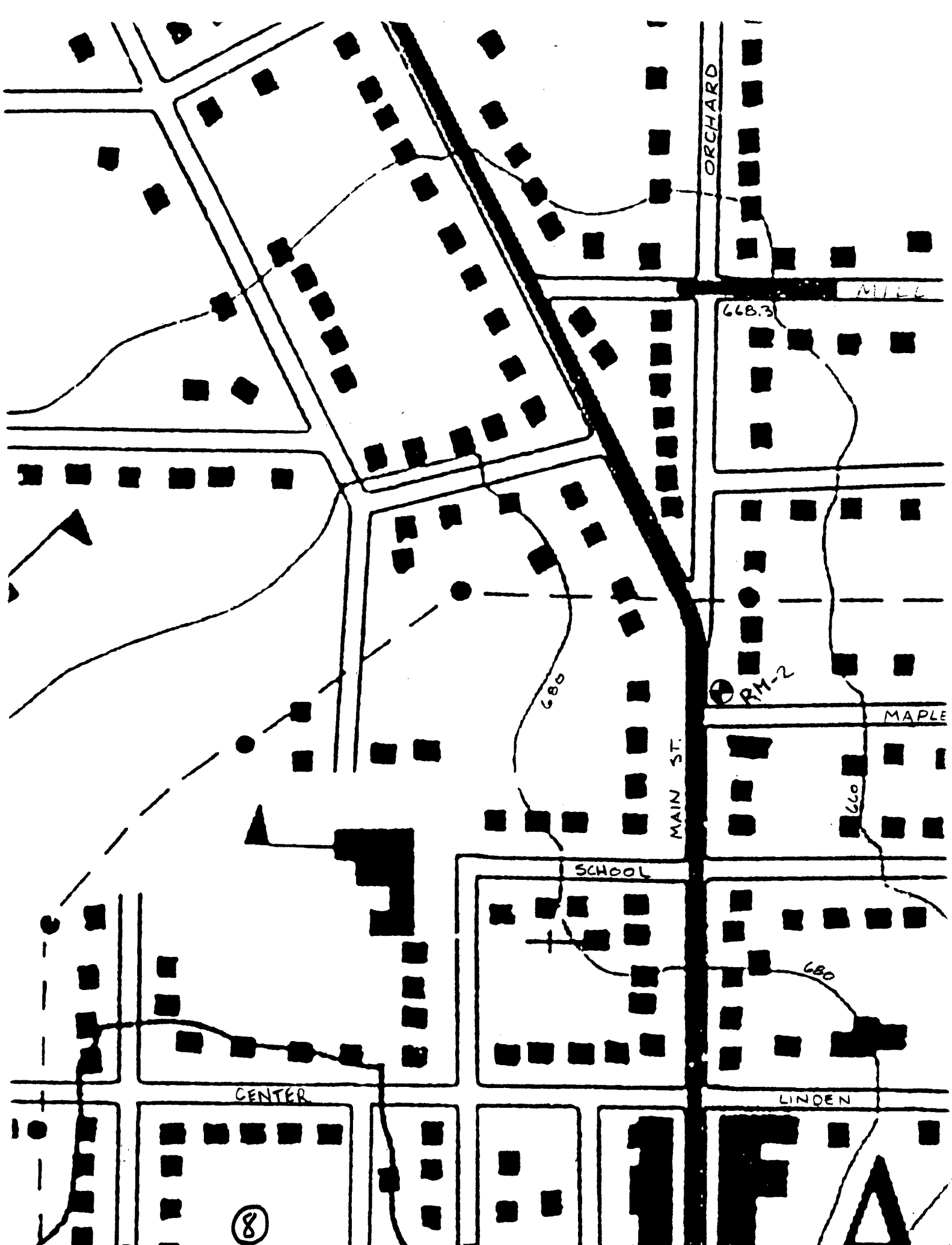
PARKWAY

BLENWOOD AVE

LAKEVIEW AVE

DELLWOOD

ALLENUE



ORCHARD

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MAPLE

MAIN ST.

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SCHOOL

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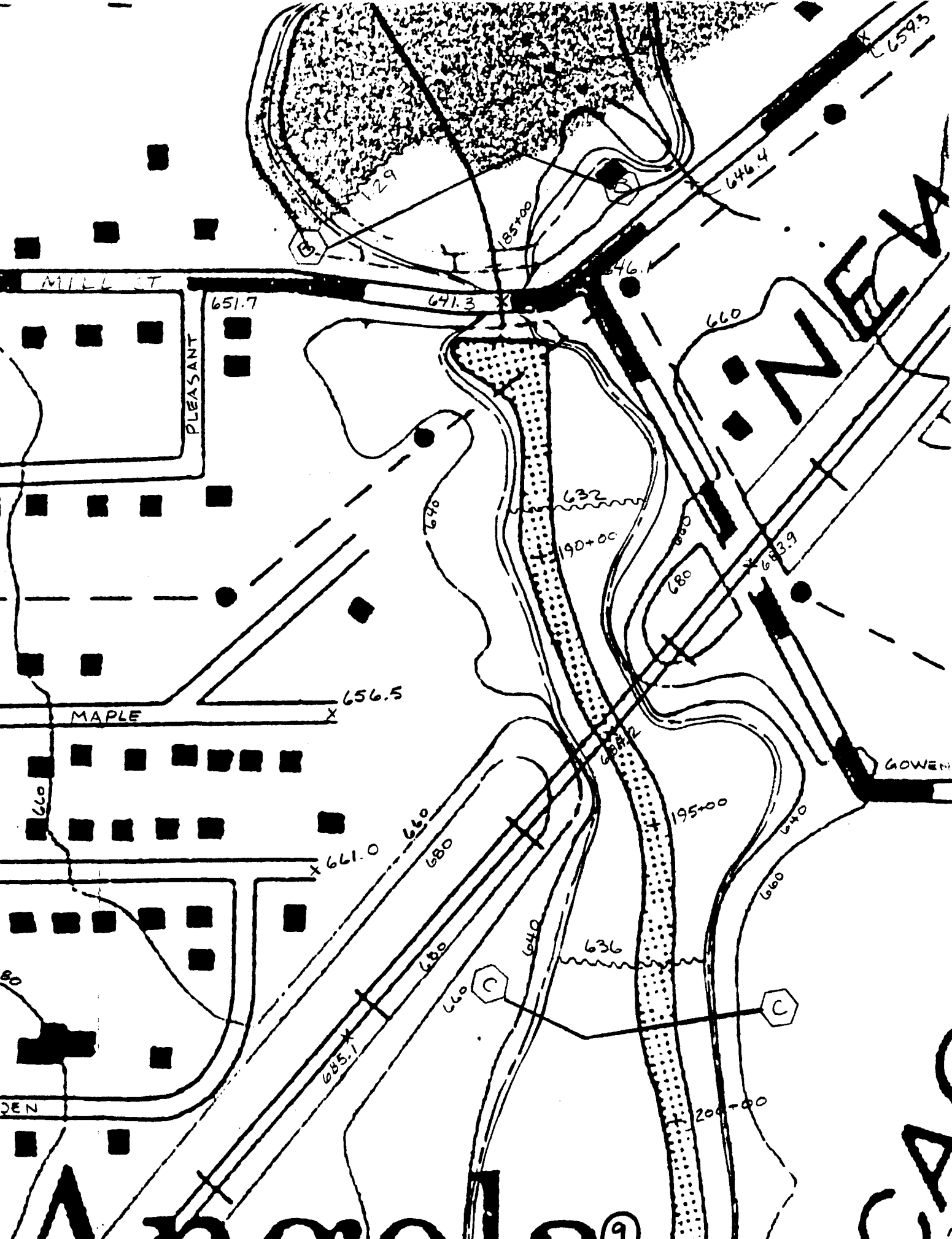
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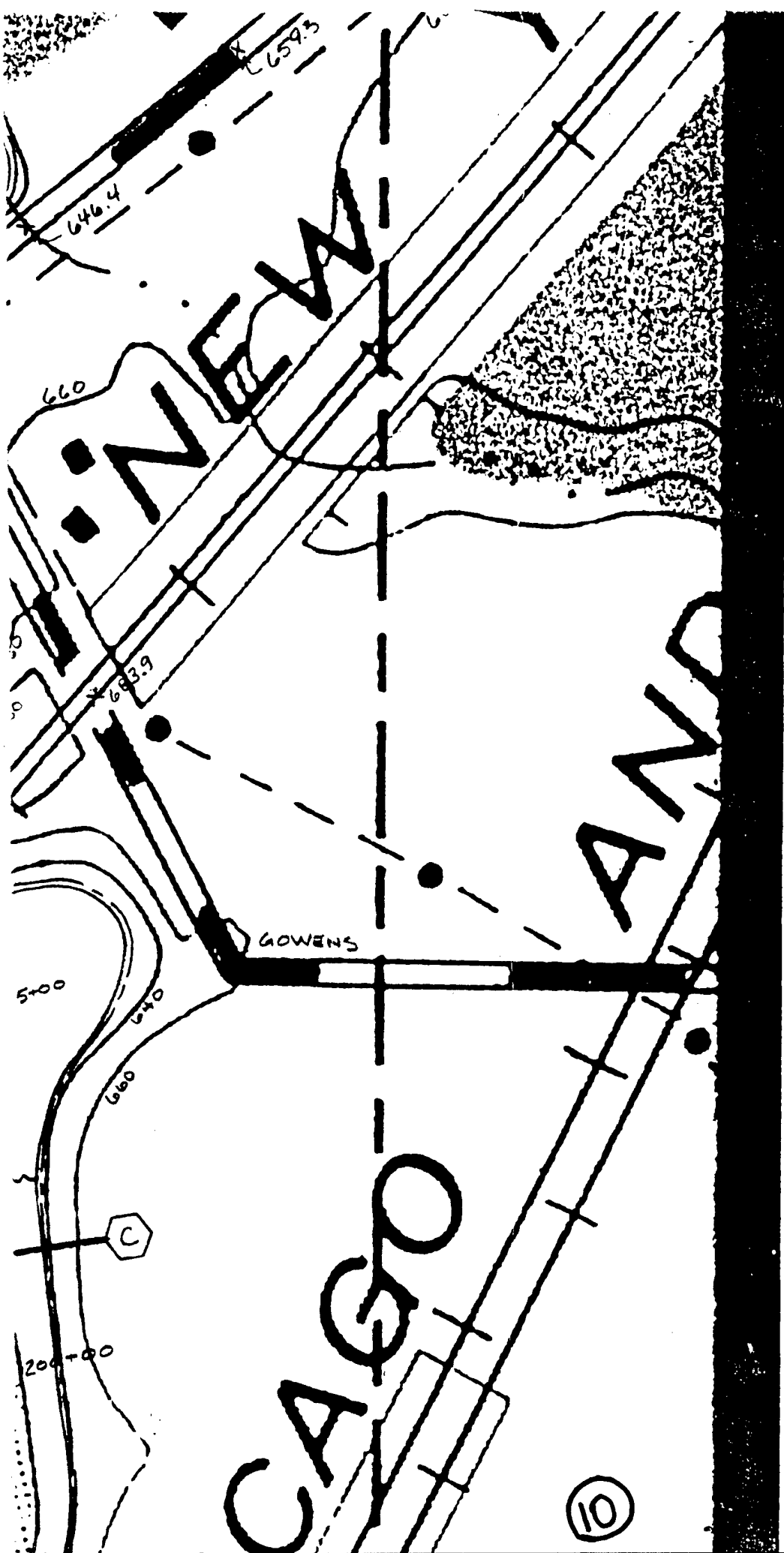
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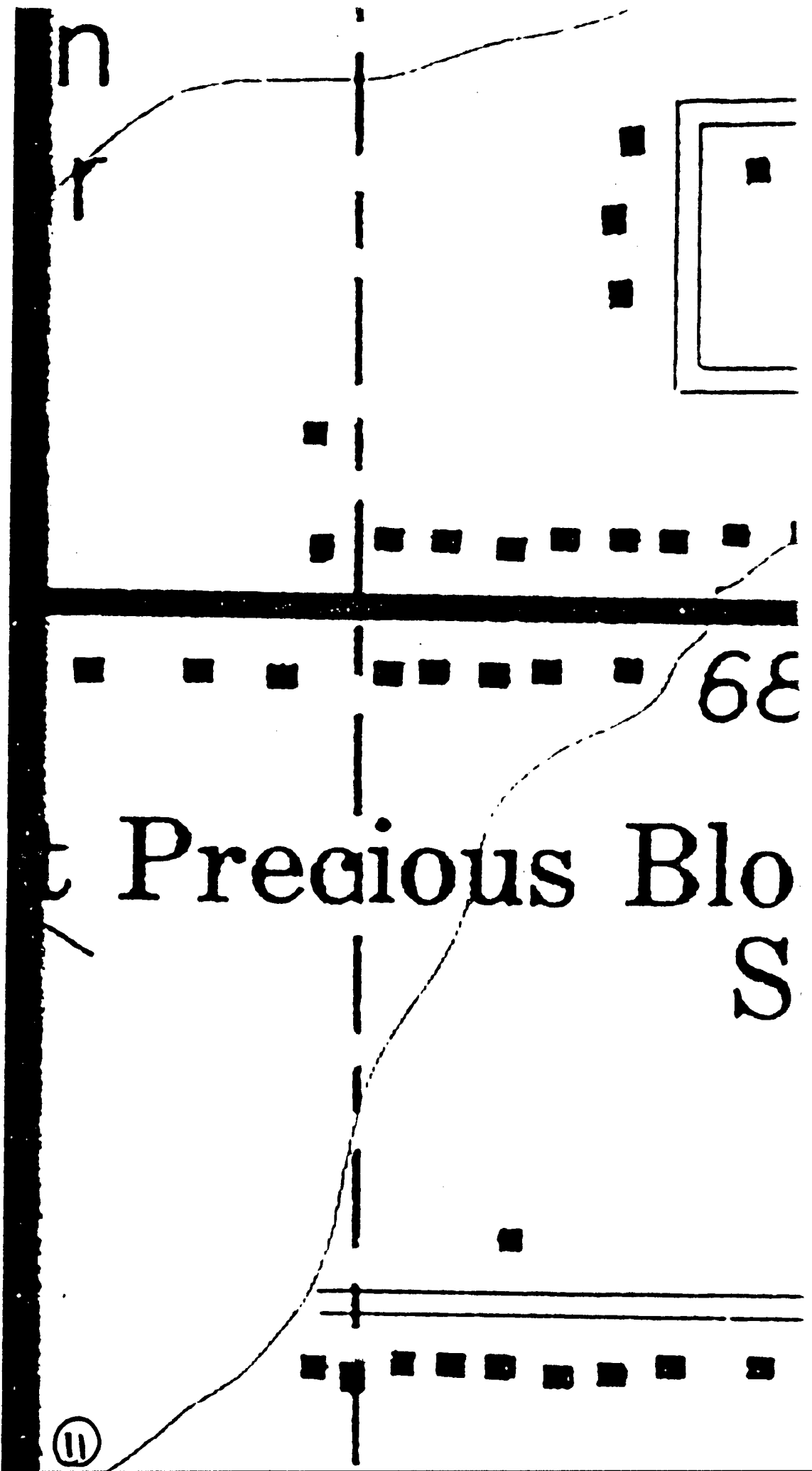
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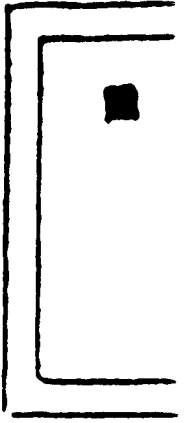






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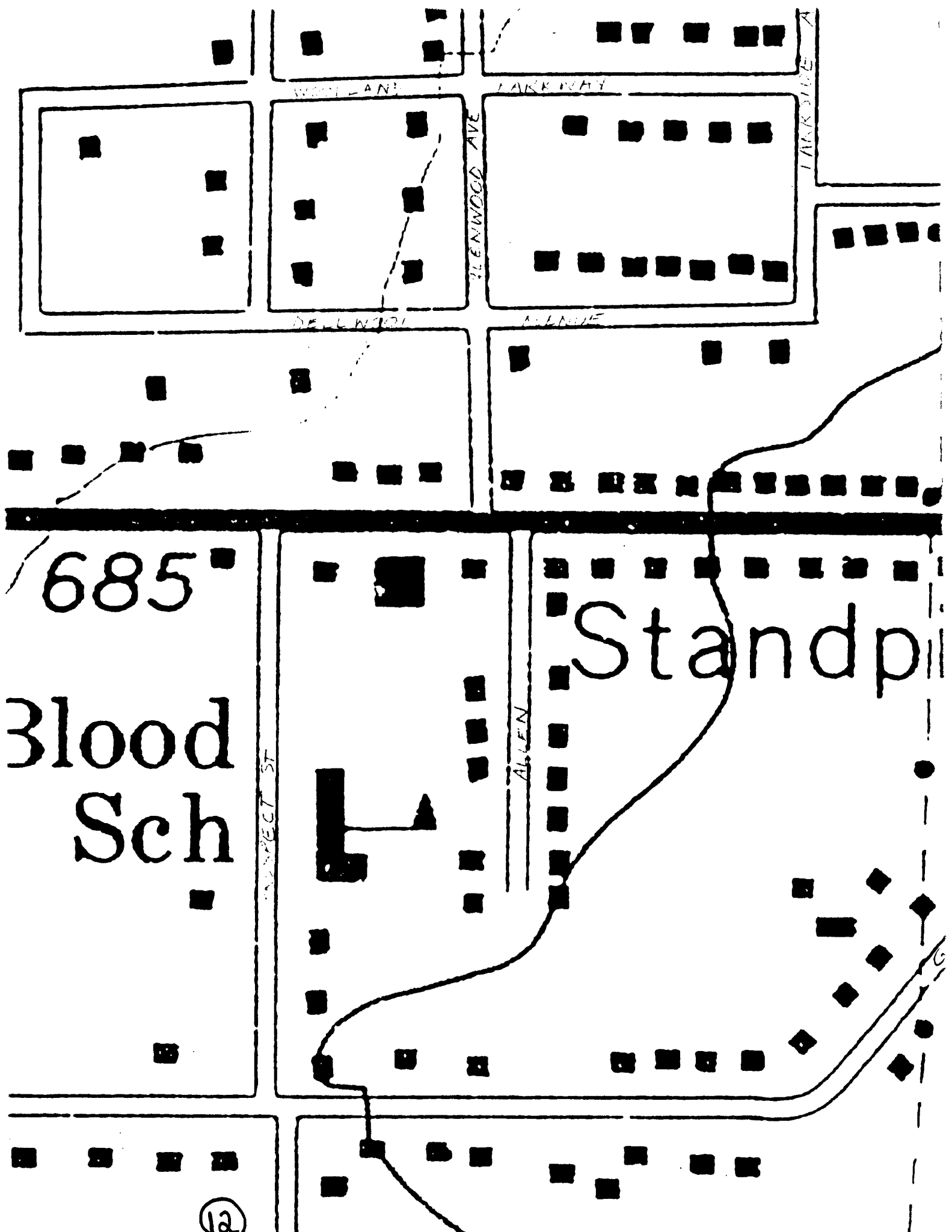
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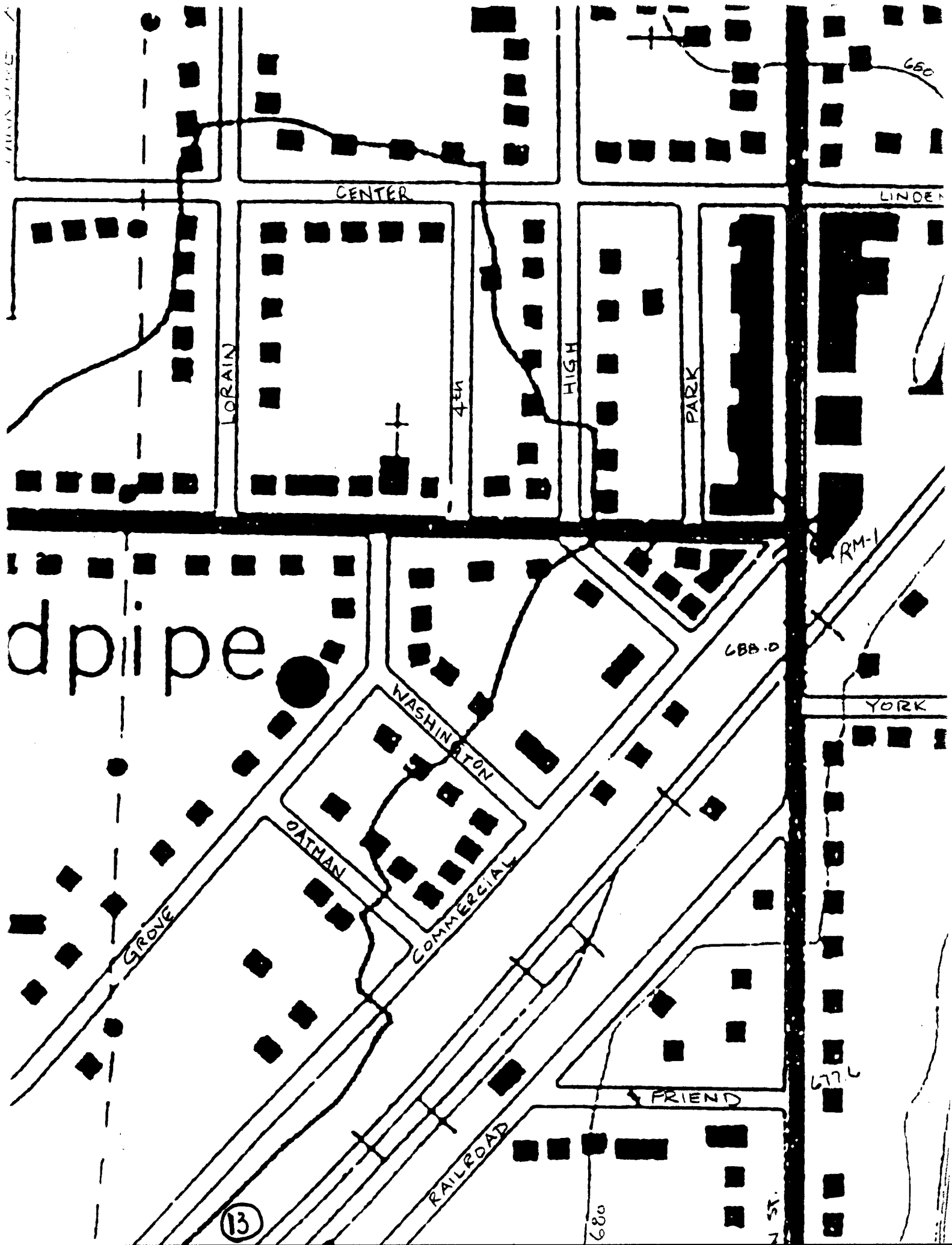
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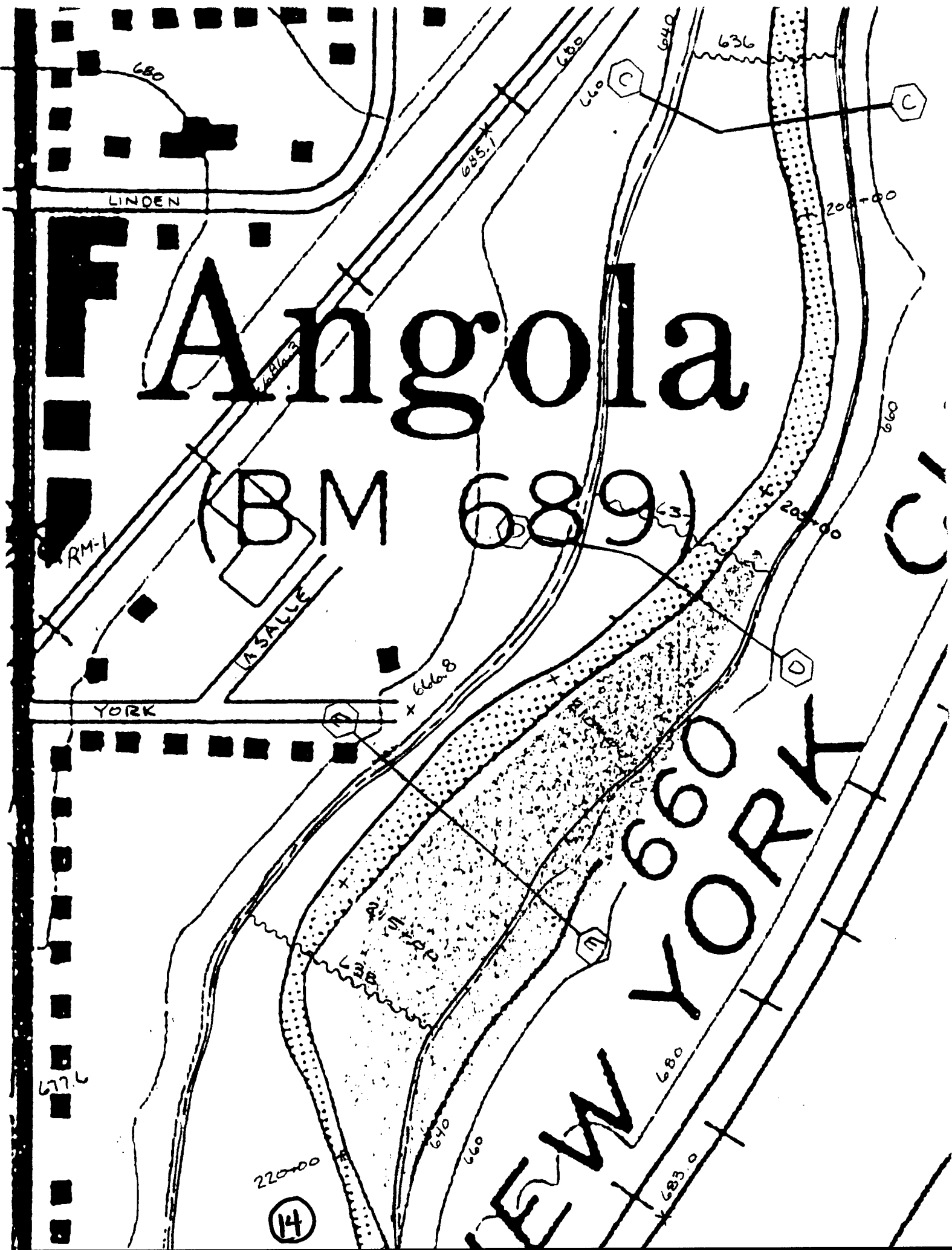
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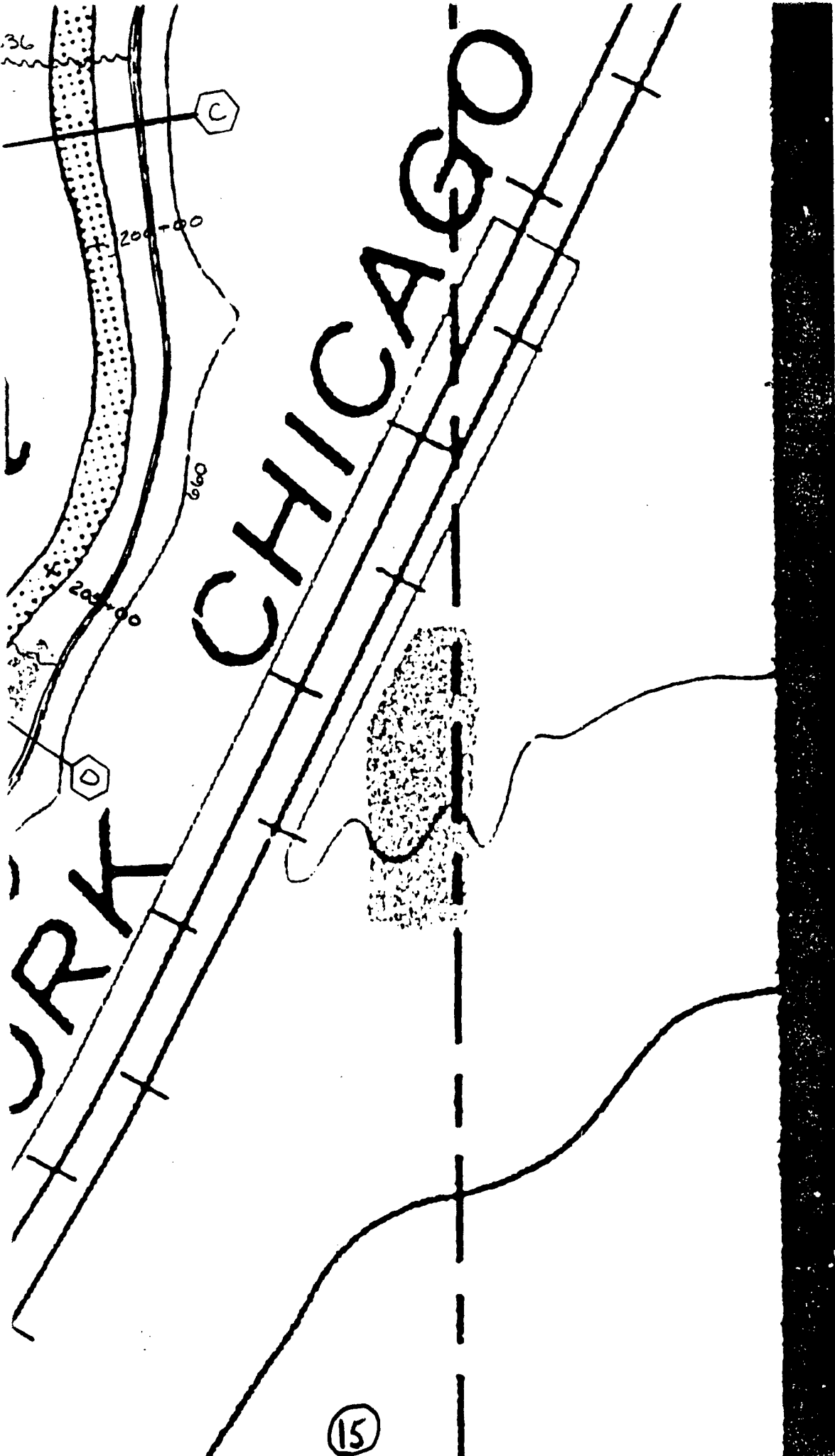
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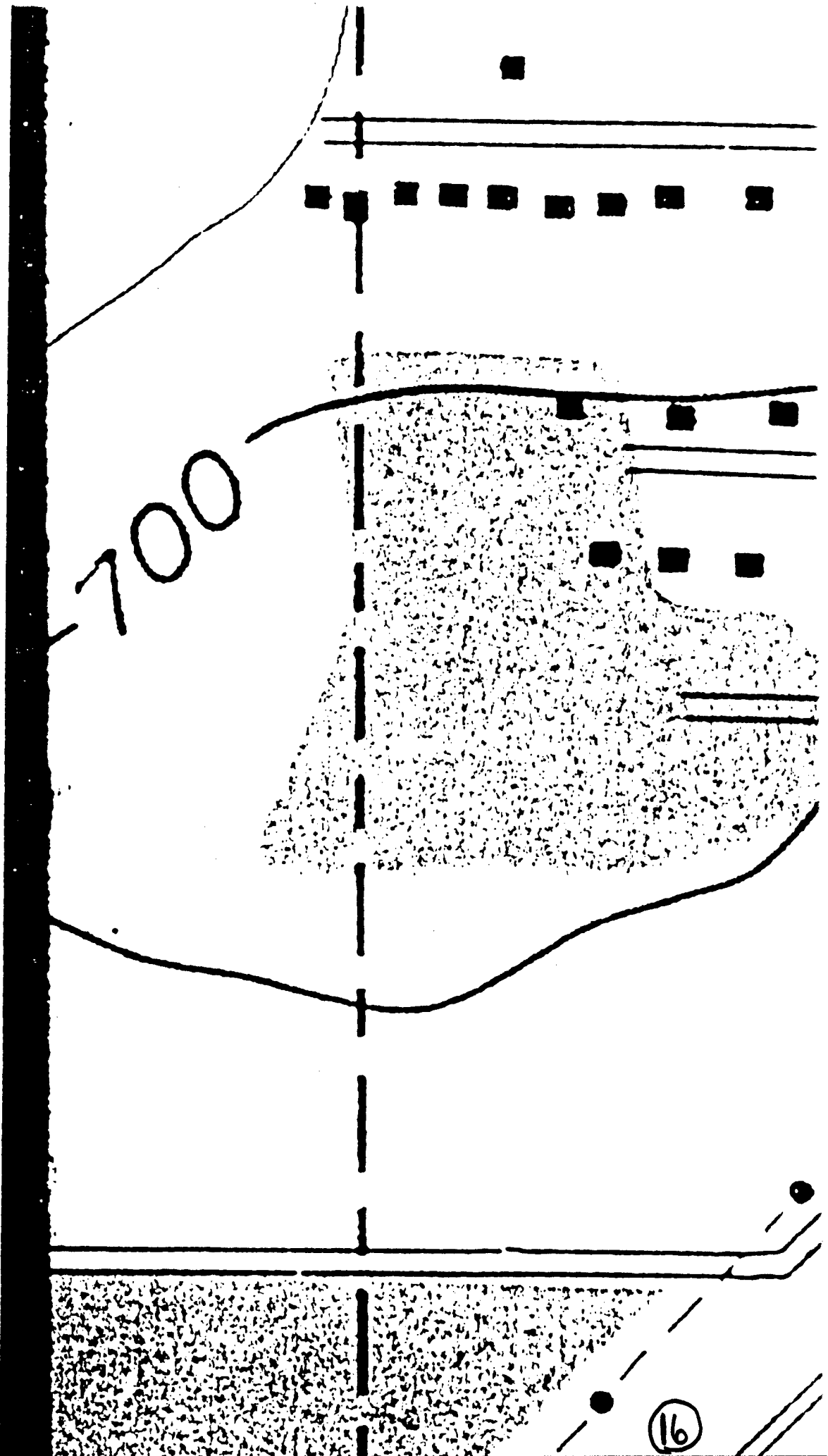
LASALLE

NEW YORK

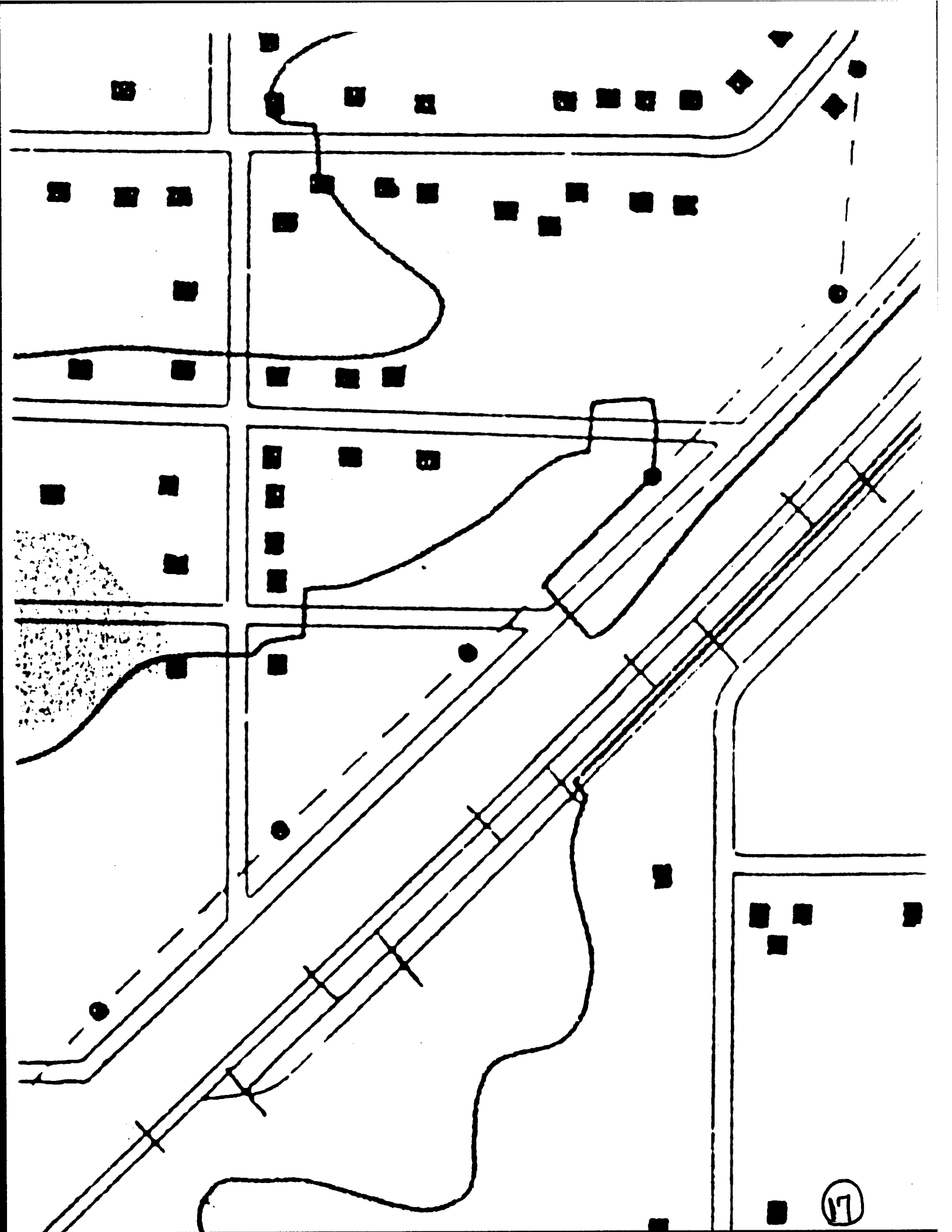
14

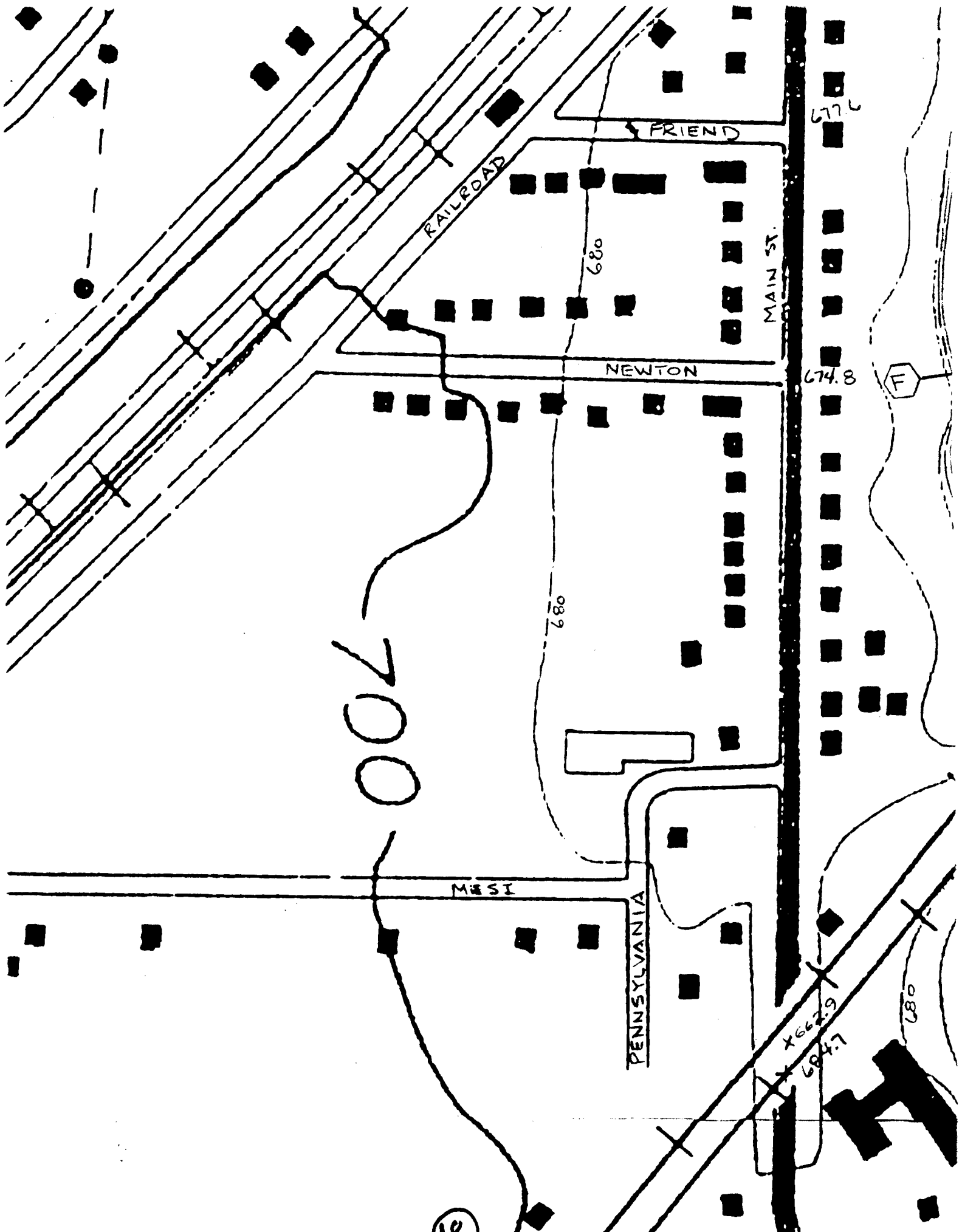






700





700

RAILROAD

FRIEND

NEWTON

MAIN ST.

WEST

PENNSYLVANIA

680

682

677.6

674.8

662.9
684.7

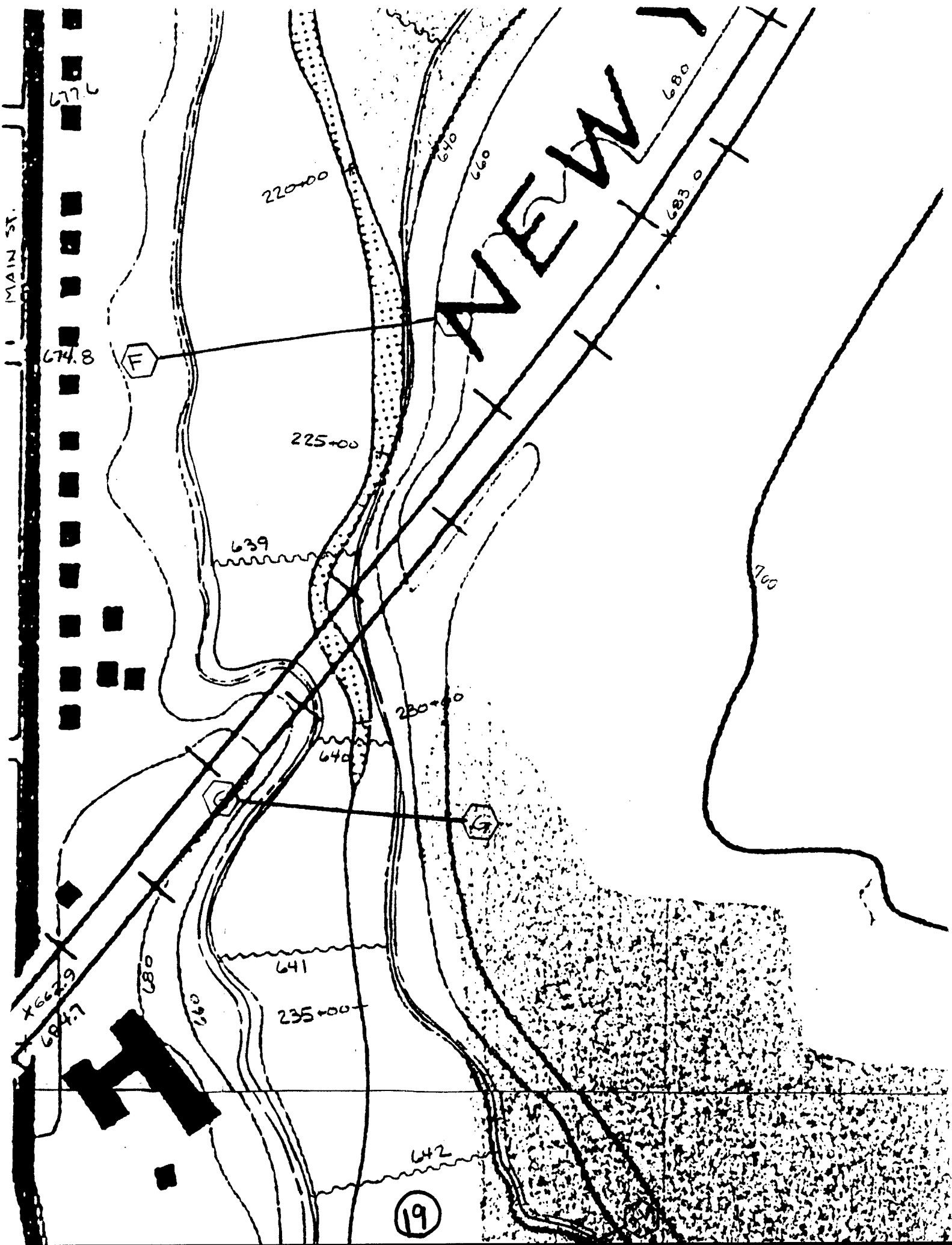
687

18

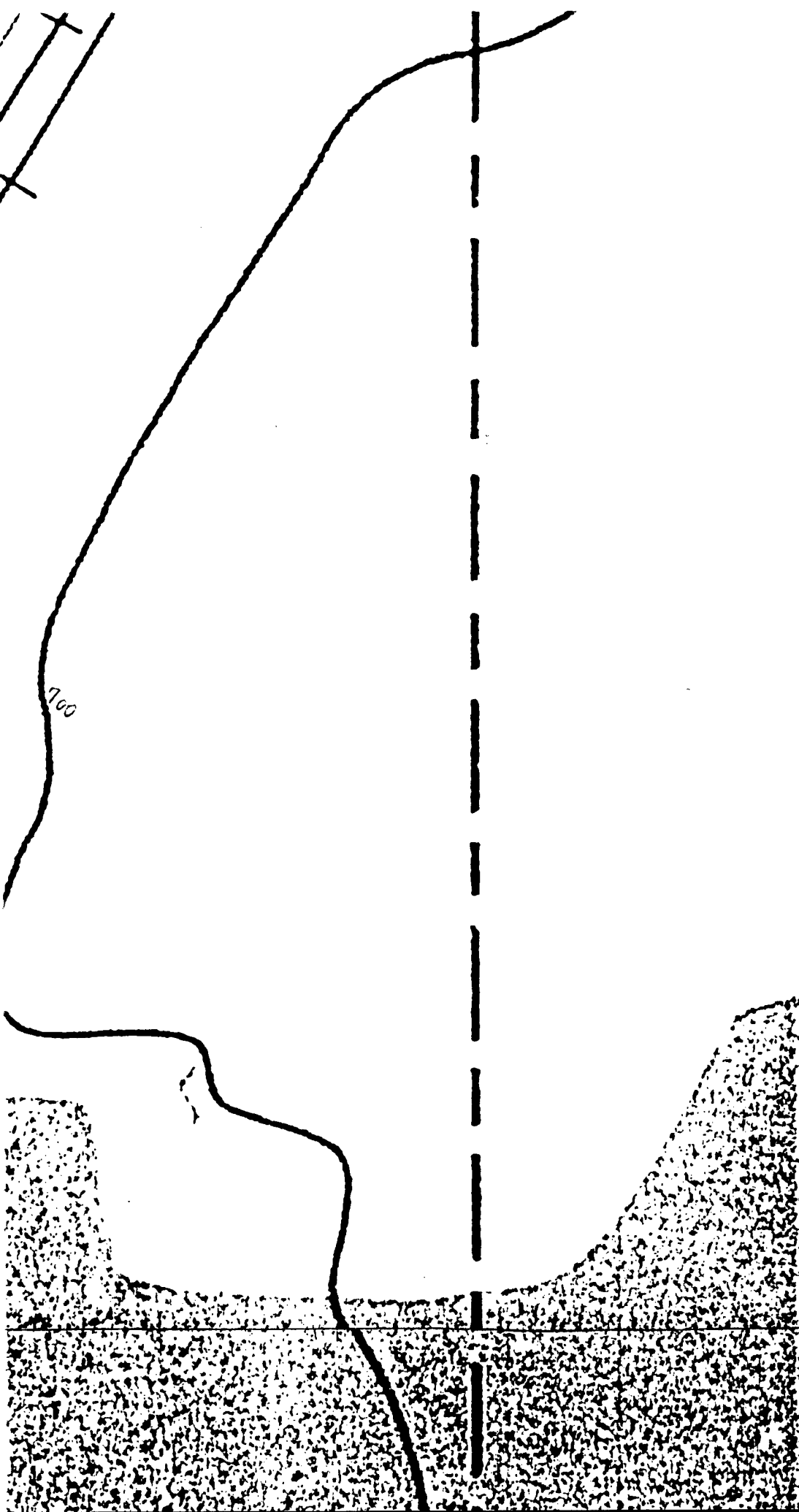
F

MAIN ST.

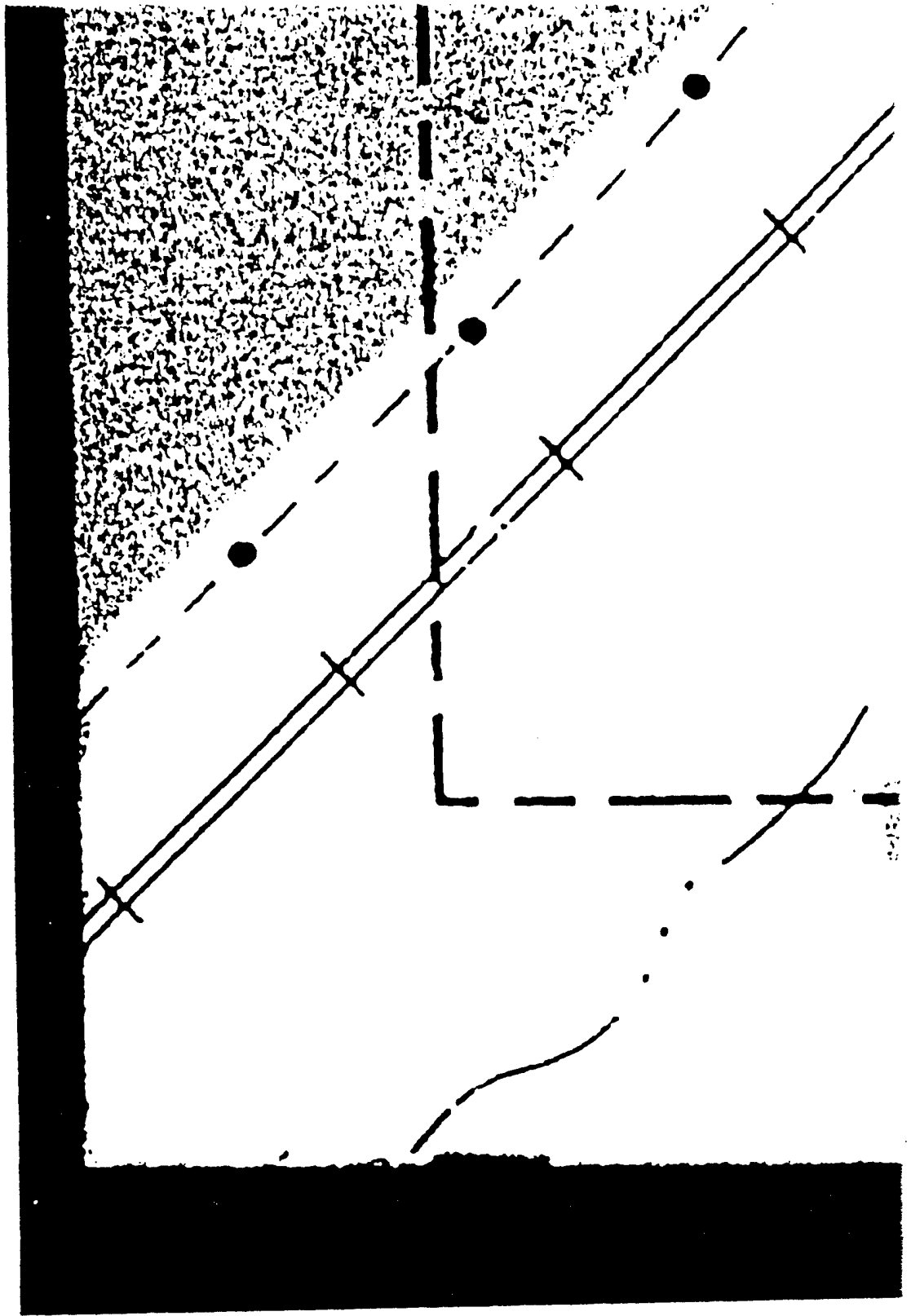
AVENUE



19

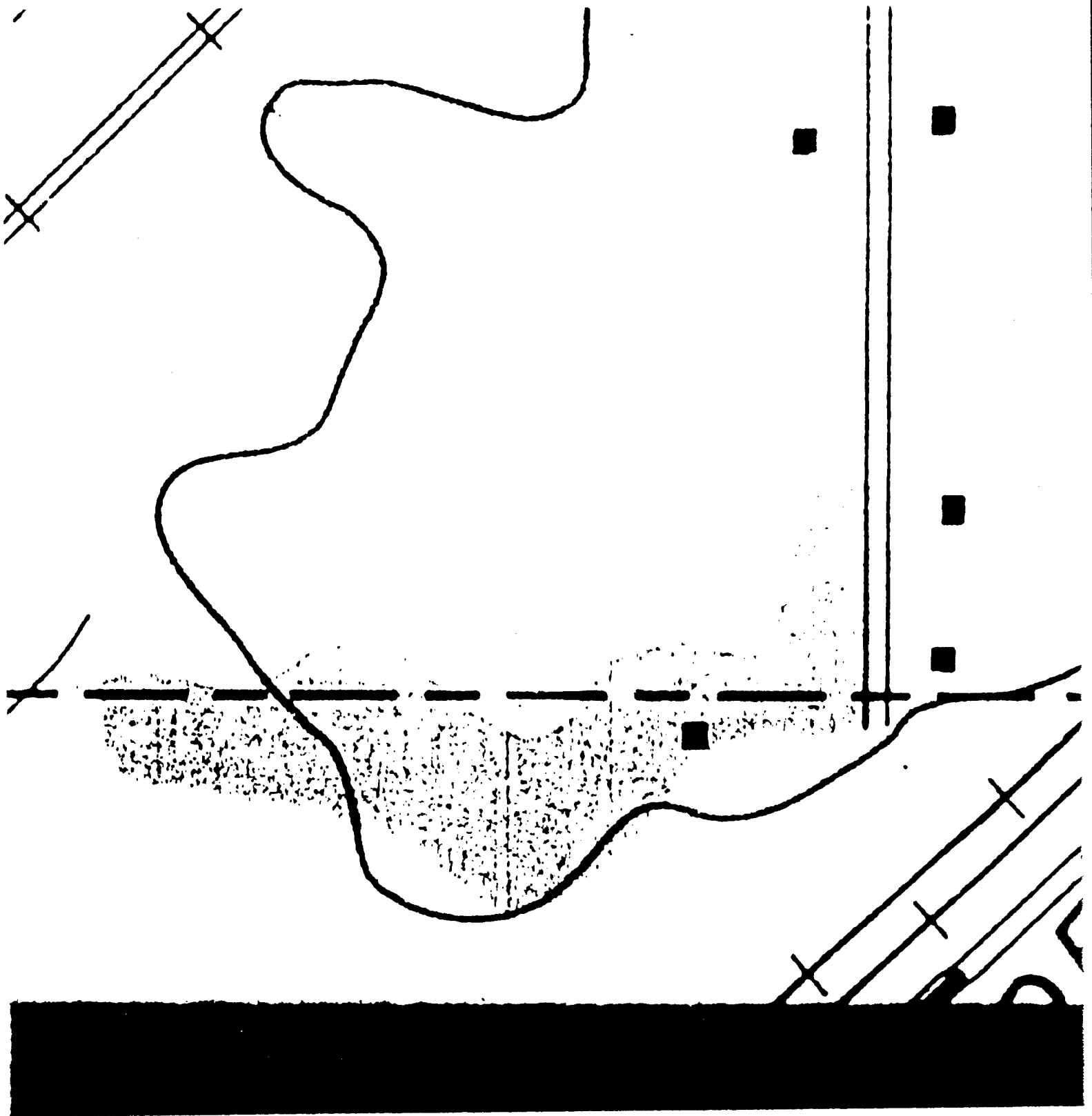


700



-
-
- ⊙ A —
- R
- ~
- 210

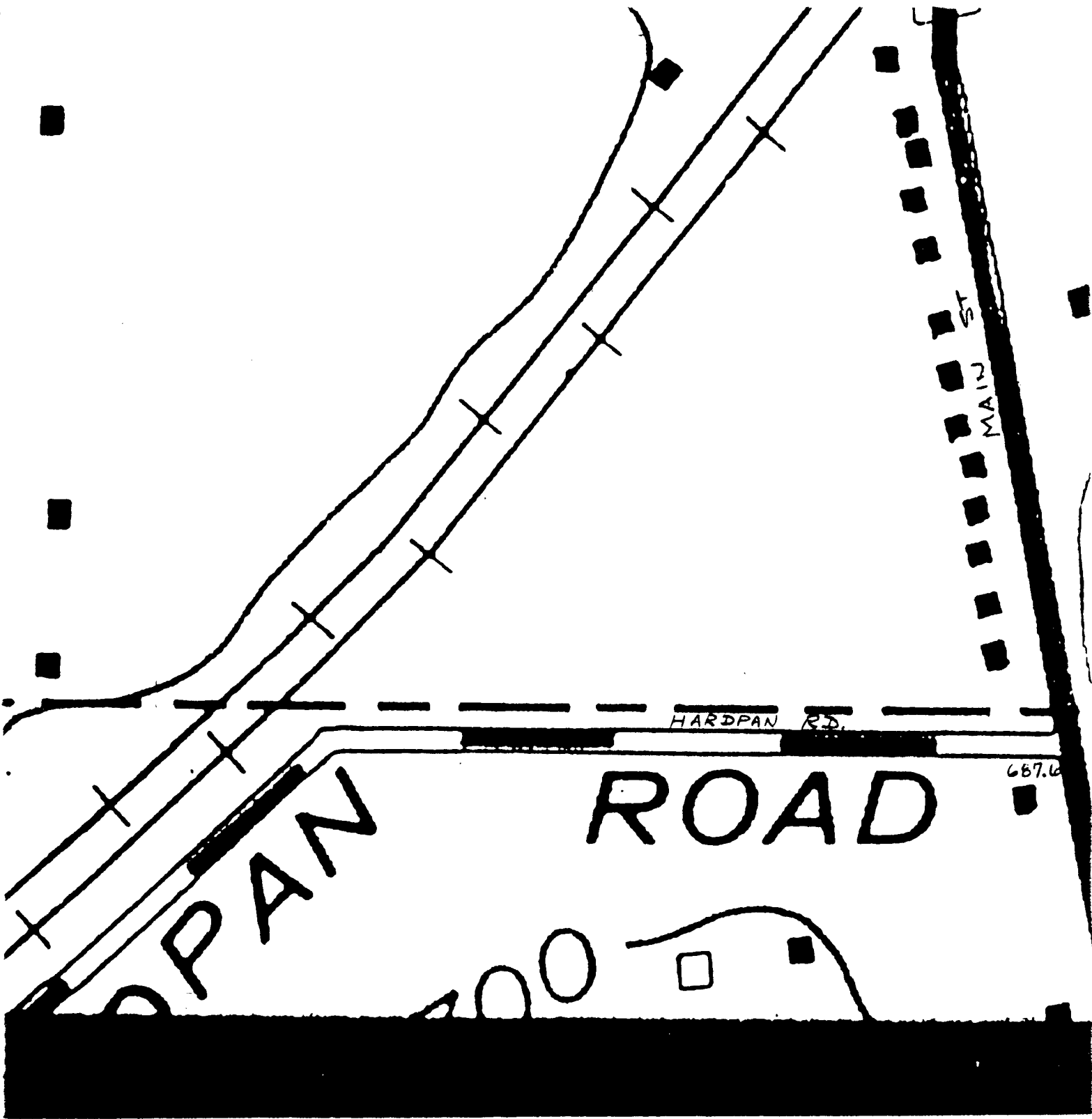
(21)



LEGEND

- 100 YR FLOOD BOUNDARY
- - - - - 500 YR FLOOD BOUNDARY
- Ⓐ ——— Ⓐ CROSS SECTION LOCATION
- RM 1 ELEVATION REFERENCE MARK
- ~~~~~ BASE FLOOD ELEVATION
- 210+00 STREAM DISTANCE MEASURED FROM MOUTH

22



SCALE
1" = 200'

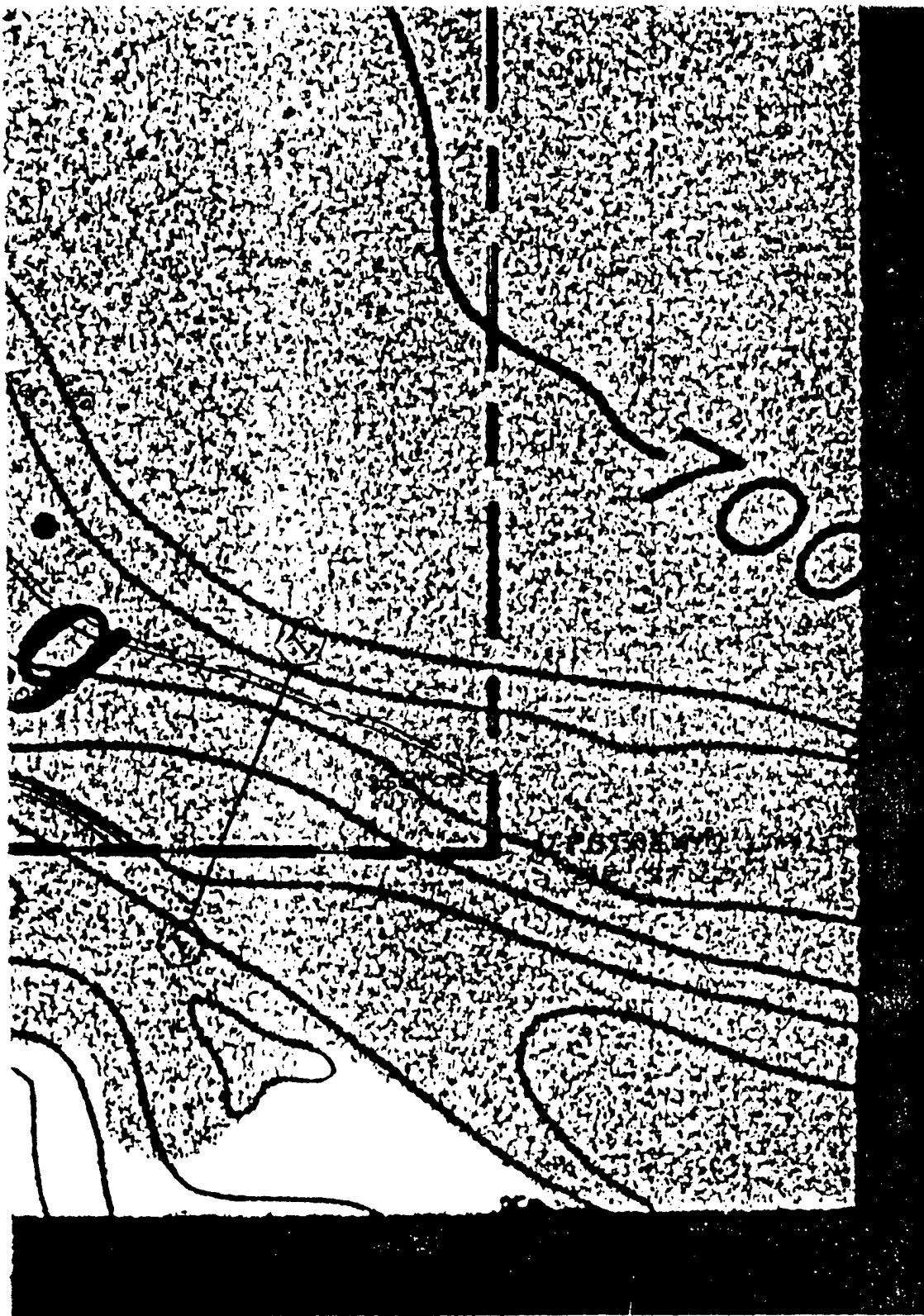


NOTE: BOTH 10
500-YR. F
CONTAIN
THE BANK
FLOODWAY
BANK TO



116. Both 100-YR. & 500-YR. FLOODS ARE CONTAINED WITHIN THE BANKS. THEREFORE, FLOODWAY IS CONSIDERED BANK TO BANK.

U.S.A.E.D. , BUFFALO
 SPECIAL FLOOD HAZARD EVALUATION
 VILLAGE OF ANGOLA, NEW YORK
 BIG SISTER CREEK
 SHEET 1 OF 1



EVALUATION
/ YORK

(25)