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**Special Flood Hazard  
Evaluation Report**

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**Wolf Creek and Drennan Ditch**  
Village of Holland, Lucas County, Ohio

Prepared for the  
Ohio Department of Natural Resources

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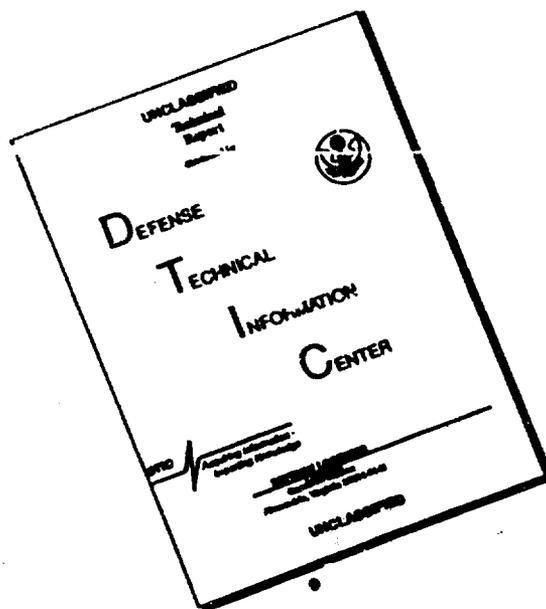
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SPECIAL FLOOD HAZARD EVALUATION REPORT  
DRENNAN DITCH AND WOLF CREEK  
VILLAGE OF HOLLAND  
LUCAS COUNTY, OHIO

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SPECIAL FLOOD HAZARD EVALUATION REPORT  
DRENNAN DITCH AND WOLF CREEK  
VILLAGE OF HOLLAND  
LUCAS COUNTY, OHIO

INTRODUCTION

This Special Flood Hazard Evaluation Report documents the results of an investigation to determine the potential flood situation along Drennan Ditch and Wolf Creek within the village of Holland, Ohio. This study was conducted at the request of the Ohio Department of Natural Resources under the authority of Section 206 of the 1960 Flood Control Act, as amended. The study reaches include the entire length of streams, 1.0 mile for Drennan Ditch and .33 mile for Wolf Creek, within the corporate boundaries of the village.

The village of Holland is located in northwestern Ohio, about 3 miles west of Toledo. It is bordered on all sides by the unincorporated areas of Lucas County (See Figure 1). The village is served by the Ohio Turnpike, U.S. Route 23, and Conrail. The 1990 population of Holland was reported to be 1210 (Reference 1).

The climate of Holland is continental, characterized by moderate differences in temperature and precipitation. The average annual precipitation is 31.51. The maximum recorded temperature at the nearest climatological data station was 101 degrees Fahrenheit (°F), recorded in July 1977; a minimum of -17°F was recorded in January 1972. The maximum 24-hour rainfall was 4.39 inches, recorded in July 1969, and the maximum 24-hour snowfall was 13.9 inches, recorded in December 1974 (Reference 2).

Drennan Ditch originates in Spencer Township and flows in a southeasterly direction to the village of Holland, where it joins Wolf Creek. Wolf Creek originates in the township of Springfield and flows in an easterly direction to its confluence with Swan Creek, which drains into the Maumee River. Neither stream is gaged. The topography of the watershed is generally flat with a gentle downward slope from west to east.

Knowledge of potential floods and flood hazards is important in land use planning. This report identifies the 100-year flood plain and 100-year floodway for Drennan Ditch and Wolf Creek.

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

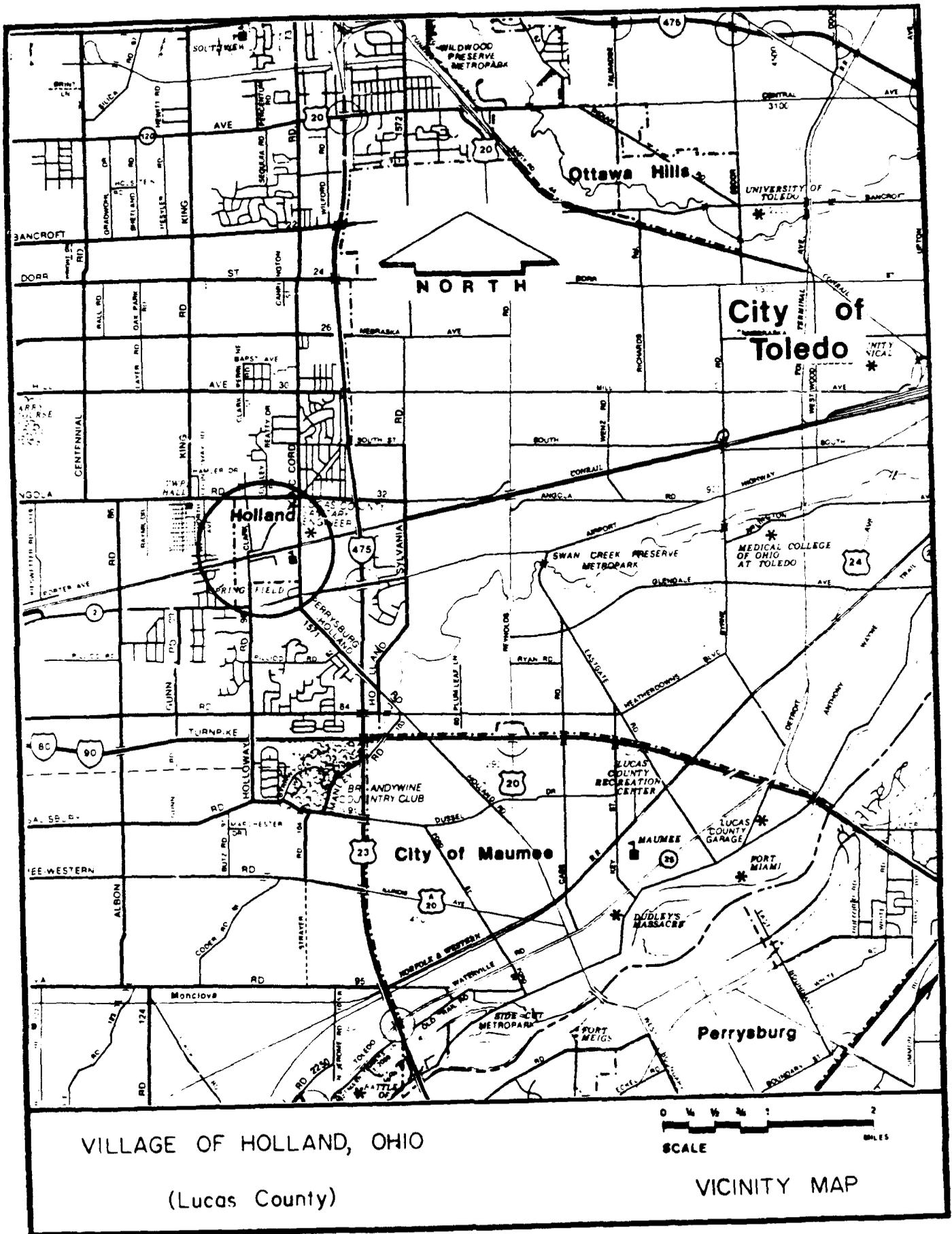


FIGURE 1

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, approximate analyses were used to delineate approximate flood plains within the village of Holland. The area was thought to have low development potential at the time the maps were prepared. However, the area now is experiencing residential development pressure and more detailed flood plain information is required by local officials to manage this development.

Additional copies of this report can be obtained from the Ohio Department of Natural Resources 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

Most flooding in Ohio is caused by rainfall of unusual intensity and duration. General flooding occurs most frequently during January to March and occasionally during August to October.

Principal flood problems in Holland have been in areas where urbanization has occurred in the flood plain. Undersized bridges and culverts lead to stream flow backups, and these conditions extend long distances upstream due to the small stream gradients. However, as the streams are ungaged, there are no stream flow records and no accurate record of flood within the village of Holland.

#### 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. As indicated in Table 2, flow velocities of the streams studied exceed 3 feet per second at some locations. 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

Hydrologic analyses for Drennan Ditch and Wolf Creek were carried out to determine the 100-year peak discharges. For this analyses, the peak discharge for Drennan Ditch was calculated at a point just upstream of the confluence with Wolf Creek and used for the entire reach of the stream within the village corporate boundaries. Two reaches were delineated for Wolf Creek. Reach 1 extends from the downstream corporate boundary, upstream to the confluence of Drennan ditch. Reach 2 extends from Drennan Ditch, upstream to the western corporate limit. The discharge for Reach 1 was calculated at a point just downstream of the confluence with Drennan Ditch; and for Reach 2, the discharge was calculated at a point just upstream of Drennan Ditch (see Plate 3).

Two ditches, Prairie and Wireglass, cross Drennan Ditch and carry some water north from Drennan ditch to Tenmile Creek during heavy flows. These outflows were considered and found to have an insignificant impact on the village of Holland.

The method used to calculate the peak discharges is described in Water Resources Investigation Report 89-426 "Techniques for Estimating Flood-Peak Discharges of Rural, Unregulated Streams in Ohio" (Reference 3). The equation considers contributing drainage area, slope, and storage for each reach.

Watershed characteristics were determined through use of USGS 7.5-minute topographic maps (Reference 4) and the guidelines in the National Handbook of Recommended Methods for Water Data Acquisition (Reference 5). The values for the drainage areas and 100-year peak discharges are shown in Table 1.

Table 1 - Summary of Discharges

<u>Location</u>	<u>Drainage Area</u> (sq. mi.)	<u>100-Year Peak Discharge</u> (cfs)
Drennan Ditch	12.29	1120
Wolf Creek		
Reach 1	23.09	1510
Reach 2	10.80	720

#### HYDRAULIC ANALYSES

Analyses of the hydraulic characteristics of flooding from Drennan Ditch and Wolf Creek were carried out to provide estimates of the elevations of floods for the 100-year flooding event.

Cross-section data for the streams were obtained from a field survey performed in 1990. Additional elevation data were obtained from USGS topographic maps (Reference 4). All bridges and culverts were surveyed to determine elevation data and structural geometry.

Water surface elevations for Drennan Ditch and Wolf Creek were developed using the COE HEC-2 step-backwater computer program (Reference 6). The starting water surface elevation for Wolf Creek was established using the slope-area method. For Drennan Ditch, the 100 year flood stage at the confluence with Wolf Creek was used as the starting water surface elevation.

Locations of the selected cross-sections used in the hydraulic analyses are shown on the Flood Profiles (Plates 1 and 2) and on the Flooded Area Map (Plate 3).

Channel and overbank roughness factors (Manning's "n") used in the hydraulic computations were selected using engineering judgment and were based on field observations of the stream and flood plain areas. The "n" values ranged from 0.015 to 0.04 in the channel and 0.04 to 0.10 in the overbank. Contraction coefficients were 0.1 to 0.3 and expansion coefficients ranged from 0.3 to 0.8.

The computed 100-year water surface profiles for Drennan Ditch and Wolf Creek are shown on Plates 1 and 2. The flood plain boundaries are shown on Plate 3. These boundaries were delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using USGS 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.

An encroachment floodway was determined for Wolf Creek based on equal conveyance reduction from each side of the flood plain, with adjustments as necessary to account for the effects of existing development and to provide functional and manageable floodways. The floodway for Drennan Ditch was computed by first determining the reduction of equal conveyance. Next, additional encroachment of the floodplain was achieved by setting specific floodway widths upstream of approximate station 8+50 in order to provide the maximum benefit to the community. At the request of the Ohio Department of Natural Resources, the maximum increase in stage due to encroachment was limited to 1 foot, provided that hazardous velocities were not produced. Floodway widths were computed at cross sections and varied from 33 to 199 feet. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections and are shown in Table 2. The computed floodway is also shown on the Flooded Area Map, Plate 3. In cases where the floodway and the 100-year flood plain boundaries are either close together or collinear, only the floodway boundary is shown.

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 3.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY	INCREASE
WOLF CREEK								
A	10,890 17	199	311	3.1	616.6	616.6	616.7	0.1
B	11,880 17	31	299	6.3	616.8	616.8	617.2	0.4
C	12,157 17	36	229	2.9	619.3	619.3	620.0	0.6
BRENNAN DITCH								
D	589 27	32	386	2.9	629.6	629.6	629.6	0.0
E	1,015 27	30	608	1.7	633.8	633.8	633.8	0.0
F	1,663 27	29	599	3.7	633.8	633.8	633.9	0.1
G	2,187 27	25	283	3.9	633.8	633.8	634.0	0.2
H	2,939 27	27	267	3.7	633.8	633.8	634.0	0.2

1/ Measured in feet above Toledo corporate limit.

2/ Measured in feet above confluence with Wolf Creek.

TABLE 12

FLOODWAY DATA

VILLAGE OF HOLLAND, OHIO  
LUCAS COUNTY

WOLF CREEK AND BRENNAN DITCH

Table 3 - Elevation Reference Marks

<u>Reference Mark</u>	<u>Elevation</u> (feet NGVD)	<u>Description of Location</u>
RM1	622.80	Lucas County Benchmark No. 365. Brass plate in south end of west guard wall of Holloway Road bridge over Wolf Creek.
RM2	638.69	Chisel "X" in west bonnet bolt of fire hydrant located at the intersection of Holloway Road and Front Street. Hydrant is located on the north side of Front Street at the end of Holloway Road.
RM3	635.48	Chisel "X" in south bonnet bolt of fire hydrant on west side of Clark Street. Hydrant is located across from residence 1111 Clark Street.
RM4	640.64	Chisel "X" in west bonnet bolt of fire hydrant on south side of Dunn Drive. Hydrant is located across from residence 7258 Dunn Drive.

#### 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, absorptiveness, 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 plains 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 map and the water surface profile 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 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 (Ohio Department of Natural Resources 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. The floodway for Drennan Ditch and Wolf Creek has been plotted on the Flooded Area Map, Plate 3.

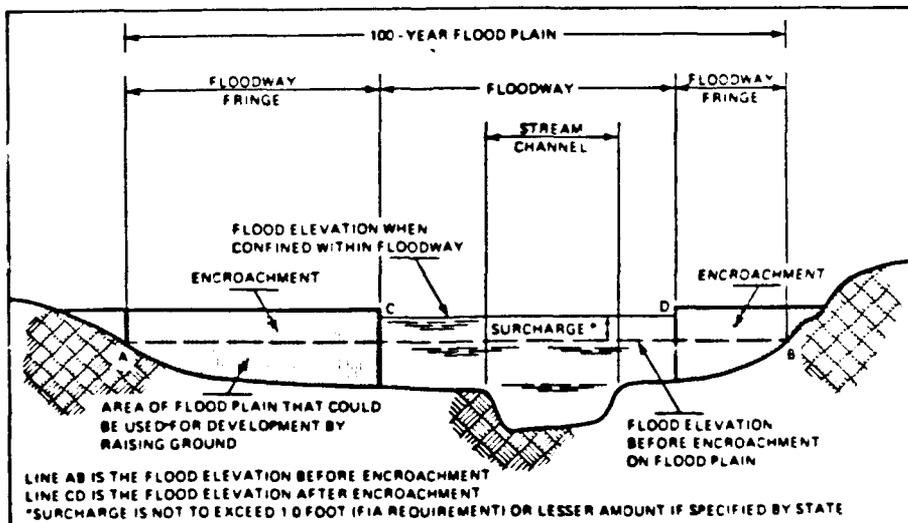


Figure 2 - Floodway Schematic

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 Drennan Ditch and Wolf Creek in the village of Holland, Ohio. 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 Ohio Department of Natural Resources.

## GLOSSARY

- BACKWATER** The resulting high 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** 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.
- 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.
- 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 100-year flood has a magnitude expected to be exceeded on the average of once every hundred years. Such a flood has a 1 percent chance of being exceeded in any given year. Often used interchangeably with RECURRENCE INTERVAL.

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 crest 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).

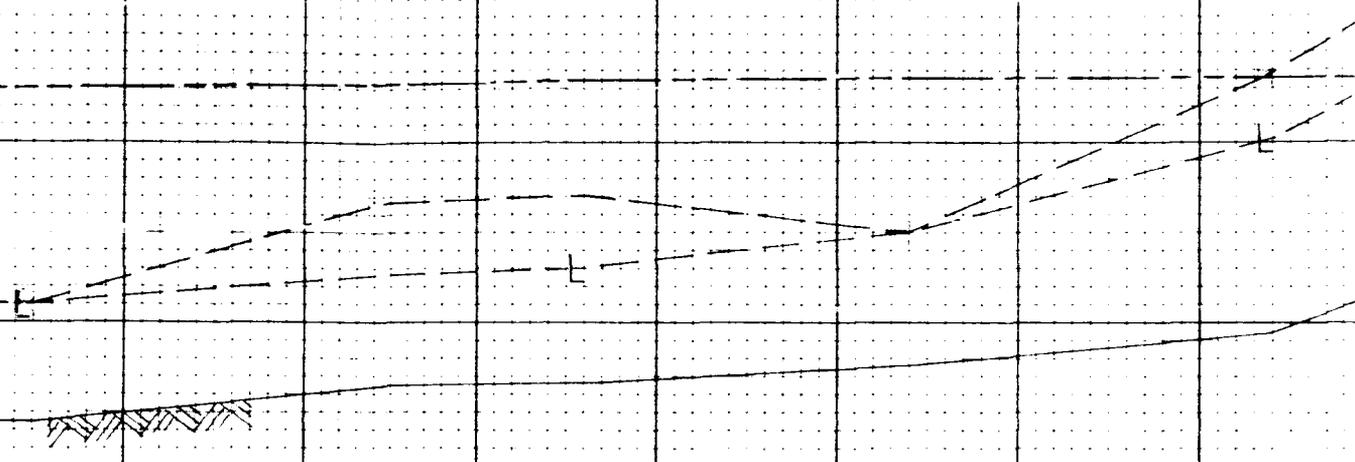
RECURRENCE INTERVAL A statistical expression of the average time between floods exceeding a given magnitude (see FLOOD FREQUENCY).

## REFERENCES

1. U.S. Department of Commerce, Bureau of the Census, 1990 Census of the Population and Housing, Washington, DC.
2. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Climates of the States, 1974.
3. U.S. Geological Survey, Water Resources Investigation Report 89-4126, Techniques for Estimating Flood-Peak Discharges of Rural, Unregulated Streams in Ohio, March 1990.
4. U.S. Department of the Interior, Geologic survey, 7.5 Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 5 feet, Assumption, photo revised 1971. Berkey, 1966; Sylvania, 1965; Miami, photo revised 1979; Whitehouse, 1964. and Maumee, photorevised 1979.
5. U.S. Geological Survey, National Handbook of Recommended Methods for Water Data Acquisition, 1977.
6. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles Generalized Computer Program, Davis, California, 1974.



DOWNSTREAM  
CORPORATE LIMIT



A

B

NOTE: DISTANCE IS MEASURED IN FEET.  
ABOVE TOLEDO CORPORATE LIMIT.

100-YEAR FLOOD

CHANNEL BOTTOM

CROSS SECTION LOCATION

BRIDGE

LEFT / RIGHT TOP OF BANK

DOWNSTREAM  
CORPORATE LIMIT

UPSTREAM  
CORPORATE LIMIT

HOLLOWAY ROAD

CONFLUENCE WITH DRENNAN DITCH

DISTANCE IS MEASURED IN FEET  
FROM TOLEDO CORPORATE LIMIT

B

C

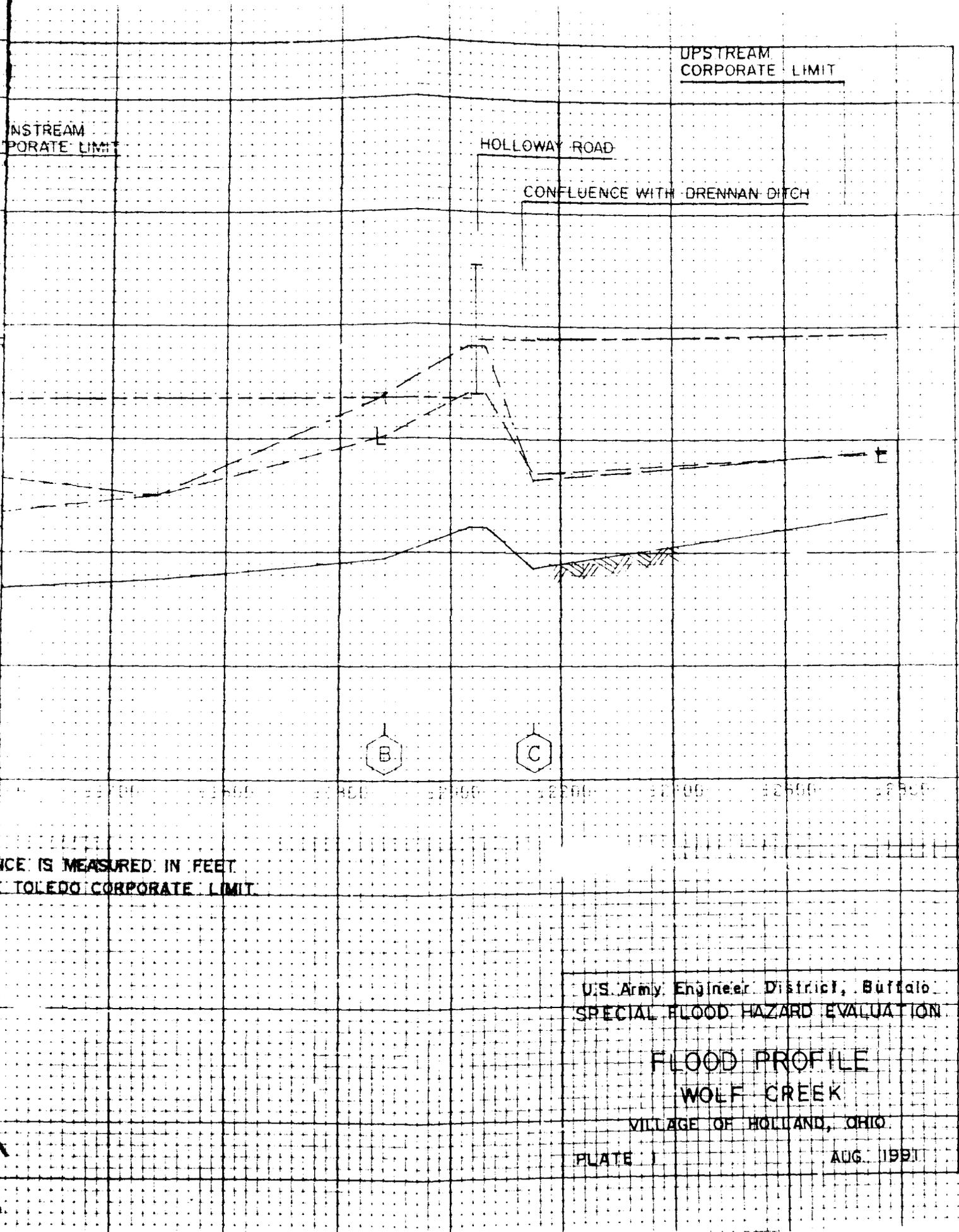
U.S. Army Engineer District, Buffalo  
SPECIAL FLOOD HAZARD EVALUATION

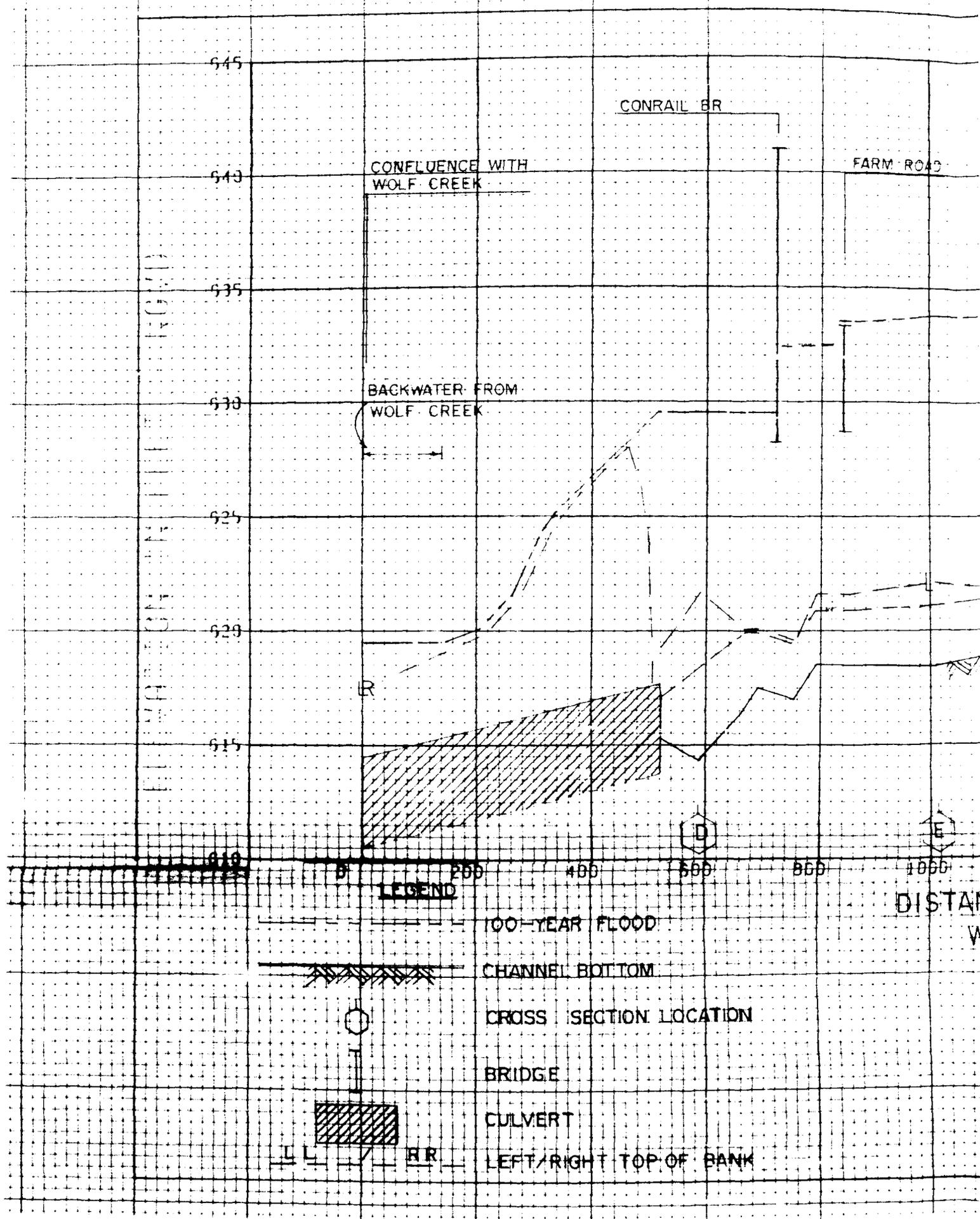
# FLOOD PROFILE WOLF CREEK

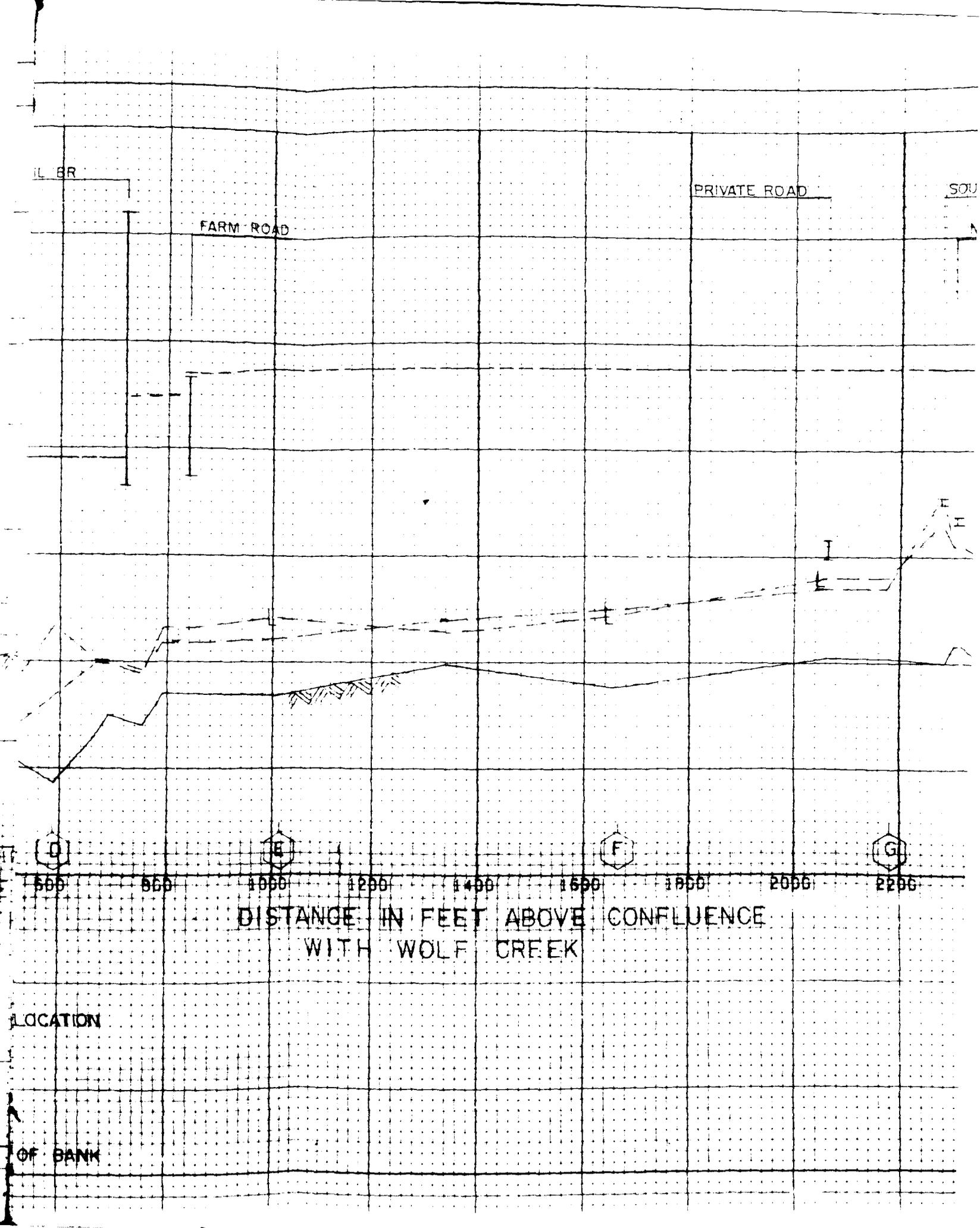
VILLAGE OF HOLLAND, OHIO

PLATE 1

AUG. 1991







IL BR

FARM ROAD

PRIVATE ROAD

SOU

D

E

F

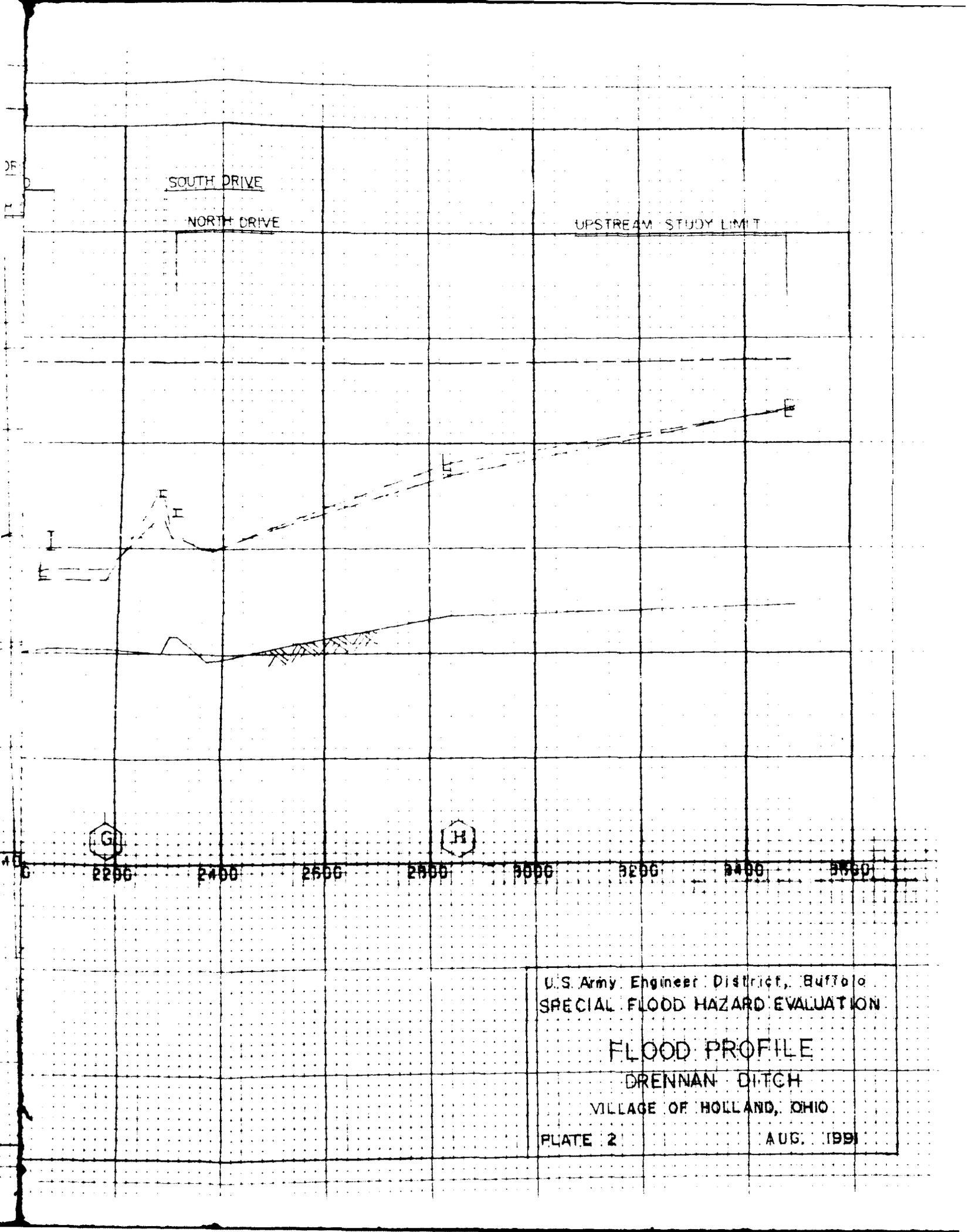
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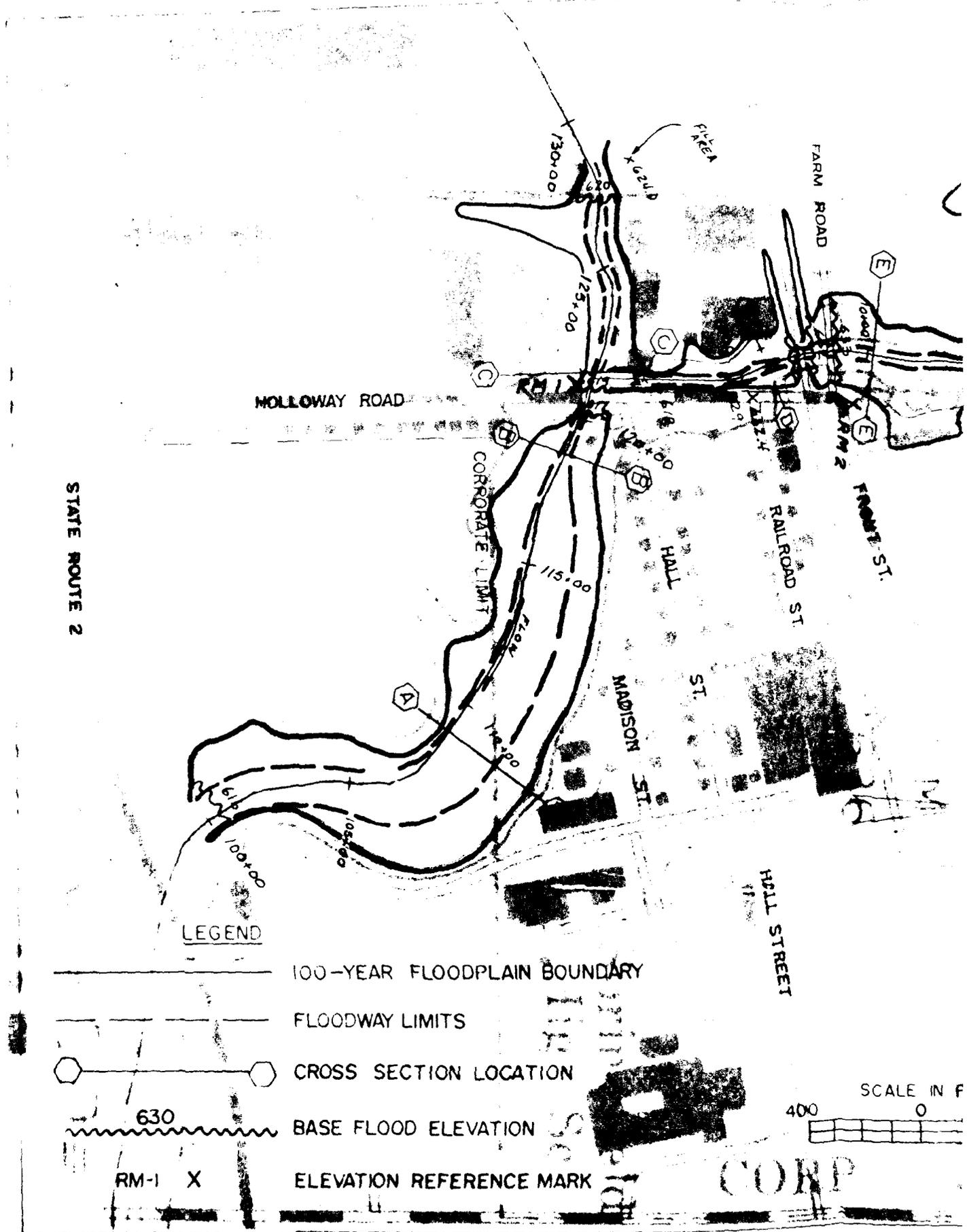
500 800 1000 1200 1400 1600 1800 2000 2200

DISTANCE IN FEET ABOVE CONFLUENCE  
WITH WOLF CREEK

LOCATION

OF BANK





STATE ROUTE 2

MOLLOWAY ROAD

FARM ROAD

FRONT ST.

RAILROAD ST.

HILL ST.

MADISON ST.

HILL STREET

LEGEND

100-YEAR FLOODPLAIN BOUNDARY

FLOODWAY LIMITS

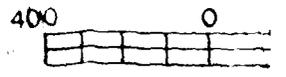
CROSS SECTION LOCATION

630  
BASE FLOOD ELEVATION

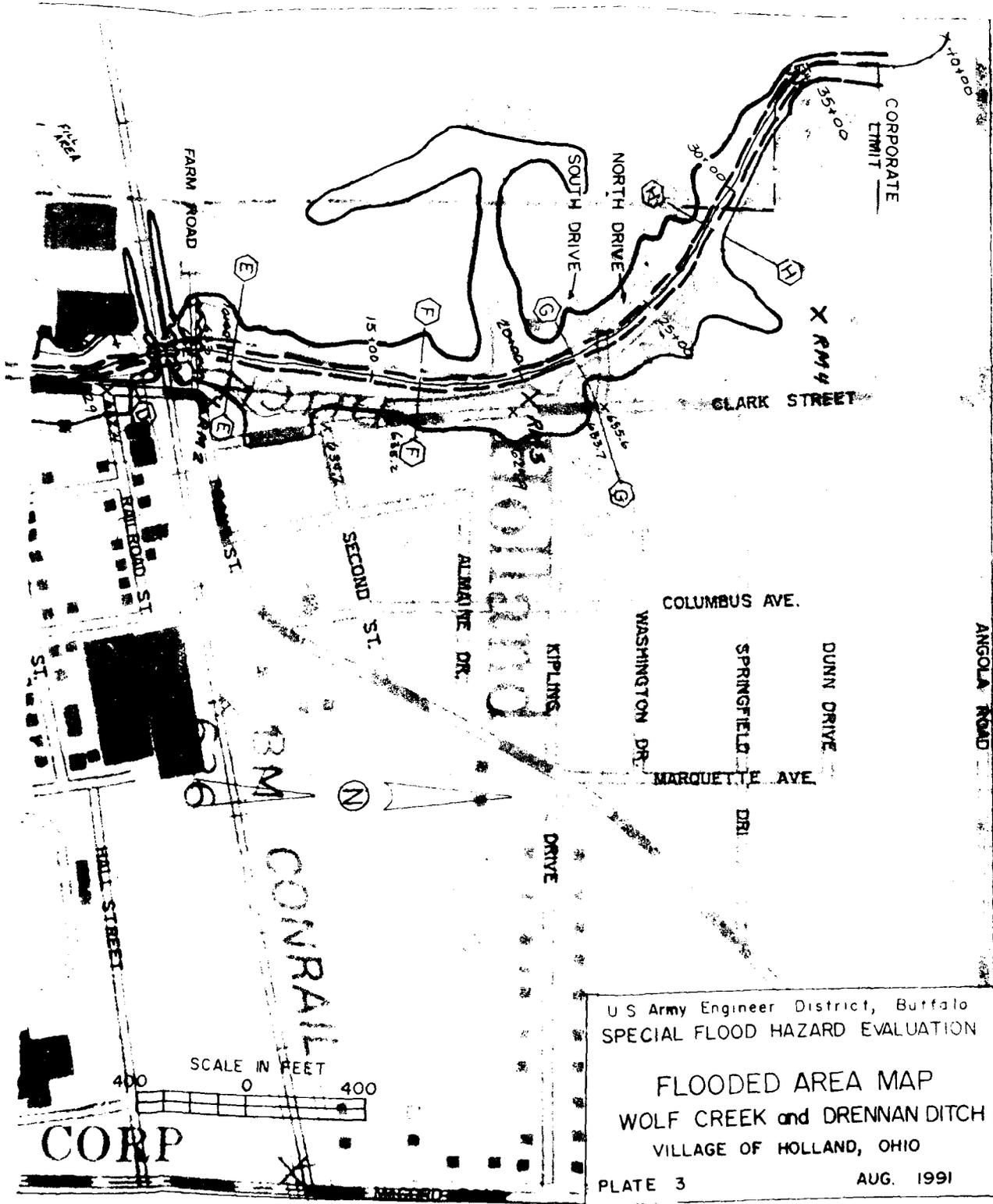
RM-1 X

ELEVATION REFERENCE MARK

SCALE IN F



CORP



U S Army Engineer District, Buffalo  
 SPECIAL FLOOD HAZARD EVALUATION

**FLOODED AREA MAP**  
**WOLF CREEK and DRENNAN DITCH**  
 VILLAGE OF HOLLAND, OHIO

PLATE 3

AUG. 1991

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