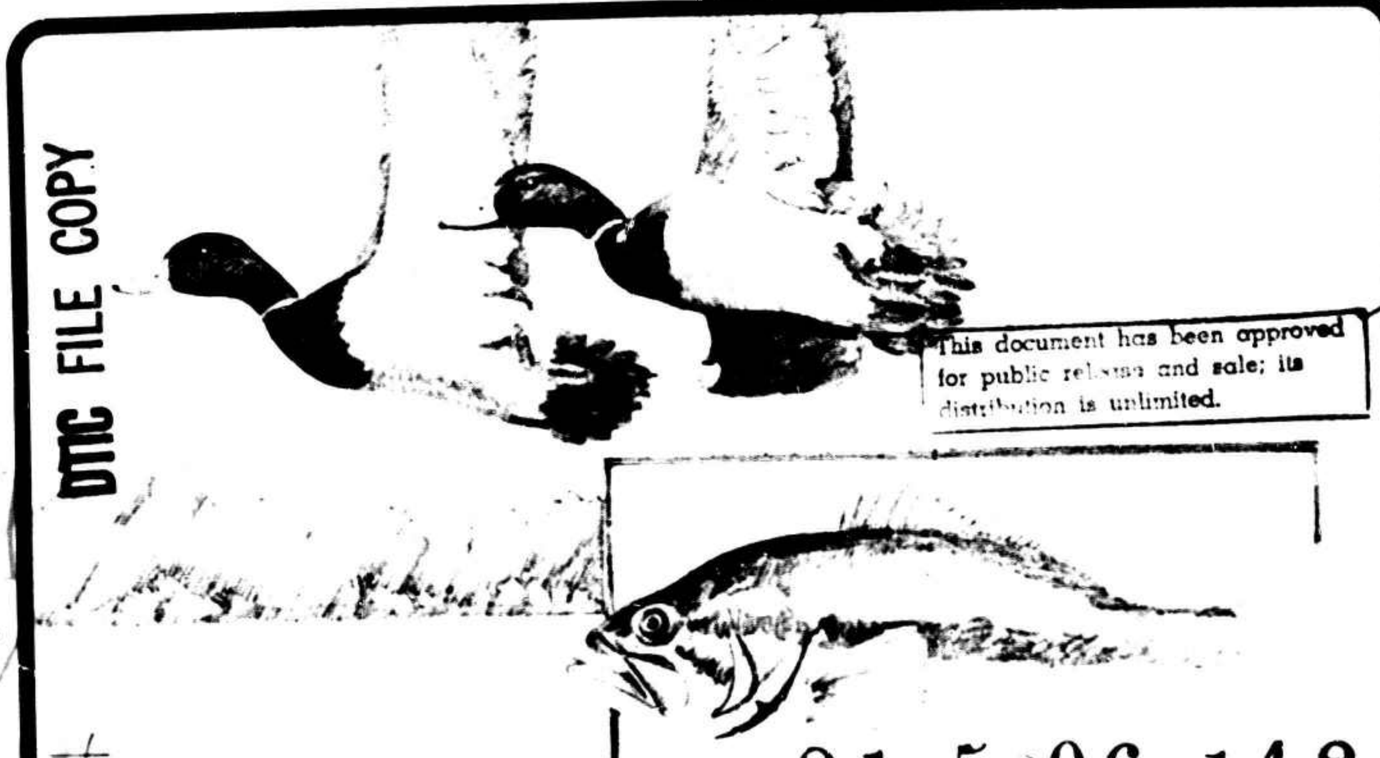
LEVEL II

Side Channel Work Group Appendix

FINAL
DECEMBER
1980

GREAT II

Upper Mississippi River
(Guttenberg, Iowa to Saverton, Missouri)



Great River Environmental Action Team

SIDE CHANNEL

WORK GROUP APPENDIX

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GREAT RIVER ENVIRONMENTAL ACTION TEAM

GREAT II

UPPER MISSISSIPPI RIVER

(Guttenberg, Iowa to Saverton, Missouri)

DECEMBER 1980

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I. INTRODUCTION

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The Mississippi River is the greatest river in North America, gathering run-off from 31 states and two Canadian provinces, draining 1.5 million square miles. It is the third largest watershed in the world flowing 2,500 miles to the Gulf of Mexico. Millions of people live on its banks and draw life from its waters. Over five hundred kinds of animals live among the diverse plant communities that thrive in and along the river.

Man, in his progress, has put the river to many varied and sometimes conflicting uses. The pressures of man's use of the river are feared to be degrading the environmental qualities of the river. More information is needed on the complex interactions of the river's resources and these resource reactions to man's activities on the river. When this information is obtained, it can then be used to determine where problems exist and the alternatives available to man to solve these problems and coordinate river uses to minimize conflicts.

I. A. Study Authorization and Development

In response to increasing public concern for the environmental quality of the river, the Great River Study was authorized by Congress in the Water Resources Development Act of 1976 (PL 94-587). This legislation authorizes the U.S. Army Corps of Engineers.... "to investigate and study, in cooperation with interested states and Federal agencies, through the Upper Mississippi River Basin Commission, the development of a river system management plan...".

The total study program includes three Great River Environmental Action Teams (GREAT), which have the responsibility for the river reaches from St. Paul/Minneapolis to Guttenberg, Iowa (GREAT I); Guttenberg to Saverton, Missouri (GREAT II); and Saverton to the confluence of the Ohio (GREAT III).

The study programs and recommendations of the three GREAT Teams will be brought together into a river management strategy for the entire Upper Mississippi River. The goal of the study is to present to Congress and the people a river resource management plan that is, above all, realistic - a plan that is technically and economically sound, socially and environmentally acceptable, and capable of being put into action within a reasonable period of time.

I. B. Study Purpose and Scope

The purpose of the GREAT II Studies is to identify and resolve conflicts resulting from separate legislative actions of Congress which mandated that the Upper Mississippi River be managed in the national interest for commercial navigation and as a fish and wildlife refuge.

The concept of the study originated from a need to coordinate the maintenance activities of a nine foot navigation channel by the U.S. Corps of Engineers from Guttenberg, Iowa to Saverton, Missouri with other river uses. GREAT II was founded because of increasing concern by conservationists and the general public over the lack of information available about the impacts of U.S. Corps of Engineers channel maintenance activities on many key resources of the river.

The scope of the GREAT II Study is directed toward developing a river system management plan incorporating total river resource requirements. GREAT II was organized early in fiscal 1977 (October 1976 through September 1977) and is studying the river from Guttenberg, Iowa, to Saverton, Missouri.

I. C. Study Participation and Organization

The GREAT II Team is composed of representatives from the following Upper Mississippi Basin States and the Federal River Resource-oriented agencies:

- State of Illinois
- State of Iowa
- State of Missouri
- State of Wisconsin
- U.S. Department of the Interior-Fish and Wildlife Service
- U.S. Department of Agriculture-Soil Conservation Service
- U.S. Department of Defense-Department of the Army-Corps of Engineers
- U.S. Department of Transportation-U.S. Coast Guard
- U.S. Environmental Protection Agency
- Upper Mississippi River Conservation Committee (ex officio)

GREAT II is organized into 12 functional work groups and the Plan Formulation Work Group. Each work group is to accomplish the study objectives as they relate to the work group's functional area and as directed by the team. Work groups are composed of persons having expertise and interest in the work groups area of study.

This report summarizes the concerns, objectives, activities, conclusions and recommendations of the Side Channel Work Group as they relate to the GREAT II Study area.

I. D. Work Group Organization

Participation - The Work Group membership has been open to any and all federal and state agencies having an express interest in the management of side channels and backwater lakes, sloughs and islands for any purpose. Since off-channel areas are primarily maintained and managed for the production and preservation of fish and wildlife resources, work group composition is a reflection of resource agency participation. The following agencies maintained an active role in the work group throughout its existence:

U.S. Fish and Wildlife Service
U.S. Army Corps of Engineers
Illinois Department of Conservation
Iowa Conservation Commission
Missouri Department of Conservation
Wisconsin Department of Natural Resources

The public was represented through the Coordinator of the Public Participation and Information Work Group. Other agencies and entities which occasionally participated in work group activities include:

Missouri Cooperative Fisheries Unit
Upper Mississippi River Basin Commission
U.S. Environmental Protection Agency
Illinois Division of Water Resources
University of Iowa
Loras College, Dubuque, Iowa
River Studies Center, LaCrosse, Wisconsin

For the most part, the Side Channel Work Group, is a sub-unit of the Fish and Wildlife Management Work Group and the two share many of the same problems and concerns. Consequently, the participating agencies have a joint membership on both work groups. While the Side Channel Work Group concentrates on problems associated with off-channel habitat, the Fish and Wildlife Management Work Group considers the problems of fish and wildlife as a whole on the river. This has resulted in some overlap of objectives, consideration and treatment of problems and in the conclusions and recommendations independently reached.

Meetings and Procedures - The Side Channel Work Group was one of the first organized. Even before GREAT II was officially kicked off, there was an interest among the resource agencies regarding the impact of dredging and disposal on side channels and backwaters. These agencies met with the Corps of Engineers to discuss their concerns and to identify potential sites for reclamation. This evolved into a work group which held its first official meeting on March 26, 1975. Meetings were generally held bi-monthly with an occasional joint meeting with the Fish and Wildlife Management Work Group. Meeting minutes were prepared by the chairman and distributed to work group members.

Voting Procedures - Prior to May 25, 1979, work group voting procedures were informal and consisted of a consensus of the individuals present at the meeting regardless of agency affiliation. Although no problems were experienced using this procedure, the work group adopted more formal voting procedures in an effort to forestall any potential problems when considering work group recommendations. The elements of this procedure are as follows:

Voting representation is limited to the six active agencies listed above.

Each agency shall have one vote.

The chairman will vote for the U.S. Fish and Wildlife Service after considering the concerns of all divisions of that agency.

Questions will be decided by a simple majority of voting representatives present. Members must be present to vote.

A tie vote shall be considered as a vote to pass the question.

All other agencies and individuals may participate in the meetings and discussions but may not vote.

Division of Responsibility - The Work Group is chaired by the U.S. Fish and Wildlife Service. The chairman handles administrative duties including scheduling meetings and the preparation of minutes, reports and correspondence. The chairman represents the work group on the Plan Formulation Work Group, on the On-Site Inspection Team, the Disposal Site Selection Task Force, and the Post Disposal Evaluation Task Force. Work Group members provide input into the planning process and provide specific products on an as-needed basis.

II. PROBLEM IDENTIFICATION

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II. A. Process

Once the twelve functional work groups and their overall objectives were formulated, the work group members began to identify public concerns, use conflicts and other problems related to their overall objective and area of study. A work groups' list of problems was composed of those problems identified in any of the following ways:

the problem was identified in GREAT I and was applicable to the GREAT II area

the particular work group recognized an existing problem based on future projections of existing conditions

the particular work group recognized a potential problem based on future projections of existing conditions and trends

other work groups identified concerns relating to the particular work groups' area of study

the public expressed concerns and problems directly to the particular work group

the public expressed concerns and problem to a particular work group through the public participation and information work group (i.e. town meetings; houseboat trips; etc.).

These problems were compiled into a list to be evaluated by the particular work group for their relevancy to the study; the urgency or certainty of the problem; and the potential for resolving the problem within the time-frame of the study. Certain problems were eliminated from further study based on criteria guidelines developed by the Upper Mississippi River Basin Commission in 1974. Priorities were then placed on the remaining problems by the work group. (See Plan Formulation Work Group Appendix for the listing of these problems.)

The results of this screening process were put into tables and displayed in the Preliminary Feasibility Report.

Once the work groups had developed a set of problems and needs, they formulated a list of objectives designed to address and, at a minimum, partially resolve their problems. These objectives were then used to identify tasks and/or studies which the work group needed to accomplish in order to identify the possible alternative solutions to their respective problems. The problems, objectives and tasks therefore represent the plans-of-action each work group used to derive their final conclusions and recommendations.

The conditions, both existing and future, which were used to identify a work groups problems are discussed in the following sections. The year 1979 was chosen as a base point for existing conditions, and a project life of fifty years was used to predict future conditions.

II. B. 1979 Base Conditions

II. B. 1. Evolution and Characteristics of Side Channels and Backwaters

Many sections of the Upper Mississippi River exhibit a braided character with respect to river morphology. Typically, the river's flow is divided and subdivided by numerous islands into a main channel and one or more side channels. Occasionally, these existing side channels rival the main channel for dominance and account for a significant portion of the total flow. Given the proper hydrologic conditions, the river may change its course into a side channel, abandoning the old main channel to a fate of isolation, stagnation and ultimate conversion to lowland forest.

Within the islands themselves, secondary side channels can often be found which may connect other morphological features to the main water body such as lakes, ponds, sloughs, wetlands, swamps, or bogs. These "backwaters", as they are collectively called, form an infinite variety of characteristics including depth, current velocity, discharge, sediment size, sediment nutrients, water chemistry and water level fluctuations.

Nord (1967) described the various types of aquatic habitat in the Upper Mississippi. The classifications of interest to the Side Channel Work Group are described as follows:

> <u>Side Channels</u> - These include all departures from the main channel and main channel border, in which there is current during normal river stage. The graduations in this category are widespread, ranging from fast flowing watercourses with high banks to sluggish streams winding through marshy areas. Unless they are former main channels (a situation occurring in a few places on the Mississippi), the banks are usually protected or stabilized by riparian vegetation.
>
> Undercut or eroded banks are common along side channels near their departure from the main channel. This occurs mainly in the upper sections of the pools where banks are highest and the current is swifter. Closing or diversion dams are usually present where the side channel leaves the main channel or main channel border, and infrequently at other locations. In the impounded section of the river, these are mostly submerged.

The bottom type usually varies from sand in the upper reaches to silt in the lower. In the swifter current, there is no rooted aquatic vegetation, but vegetation is common in the shallower areas having silty bottoms and moderate to slight current.

Other terms that have been used for this habitat are sloughs, running sloughs, chutes, cuts, guts, cut offs, and canals.

River Lakes and Ponds - River lakes and ponds may have some connection with the river at normal water stages or be completely isolated depressions on the interior of islands. They may or may not have a slight current depending on their location. Bottom types consist mostly of mud or silt two or more feet thick. They may exhibit an abundance of rooted aquatic vegetation and/or be surrounded by marshlands.

The term "river lake" has also been applied to the large expanse of open water created by and found immediately upstream of the navigation dams (McDonald and Konefes, 1977). However, this does not represent a "backwater" as such although pre-impoundment islands and backwaters may now be flooded. These areas are not included in the definition and discussions herein.

Sloughs - Sloughs often border on the lake or pond category on the one side and on the side channel category on the other. They may be former side channels that have been cut off, or that have only intermittent flows in them. They may be relatively narrow branches or off-shoots of other bodies of water. They are characterized by having no current at normal water stages, muck bottoms, and an abundance of submerged and emergent aquatic vegetation. These sloughs and some of the ponds and smaller lakes are most often representative of the ecological succession taking place in the river bottoms, from aquatic to marsh habitat.

Simons, et al. (1975a), reports that side channels and islands are formed in three basic ways in a natural, alluvial river. First of all, it is apparent that islands are larger and more numerous at the mouths of tributaries. These tributaries carry sediment which is deposited in delta-like sandbars at their mouths providing a triggering mechanism for the formation of an island. (Figure 1.) During the next high water period, most of these islands are eroded away, However, should the island persist long enough to establish pioneer woody vegetation, it may withstand subsequent floods and continue to grow. Floodwaters may erode the upstream end of the island but this is compensated for by deposition at the lower end. The net result of this process is that the island migrates downstream and may be succeeded by a new one where it began.

Occasionally, an obstruction such as a timber snag or a sunken barge can trigger the formation of an island. In any event, growth may be rapid with encroachment occurring into the side channel from both the island and the mainland. Ultimately, the side channel becomes a slough with very little or no flow and the island will be joined to the mainland. Or, given a different set of hydrologic conditions, the island may be eroded out of existence.

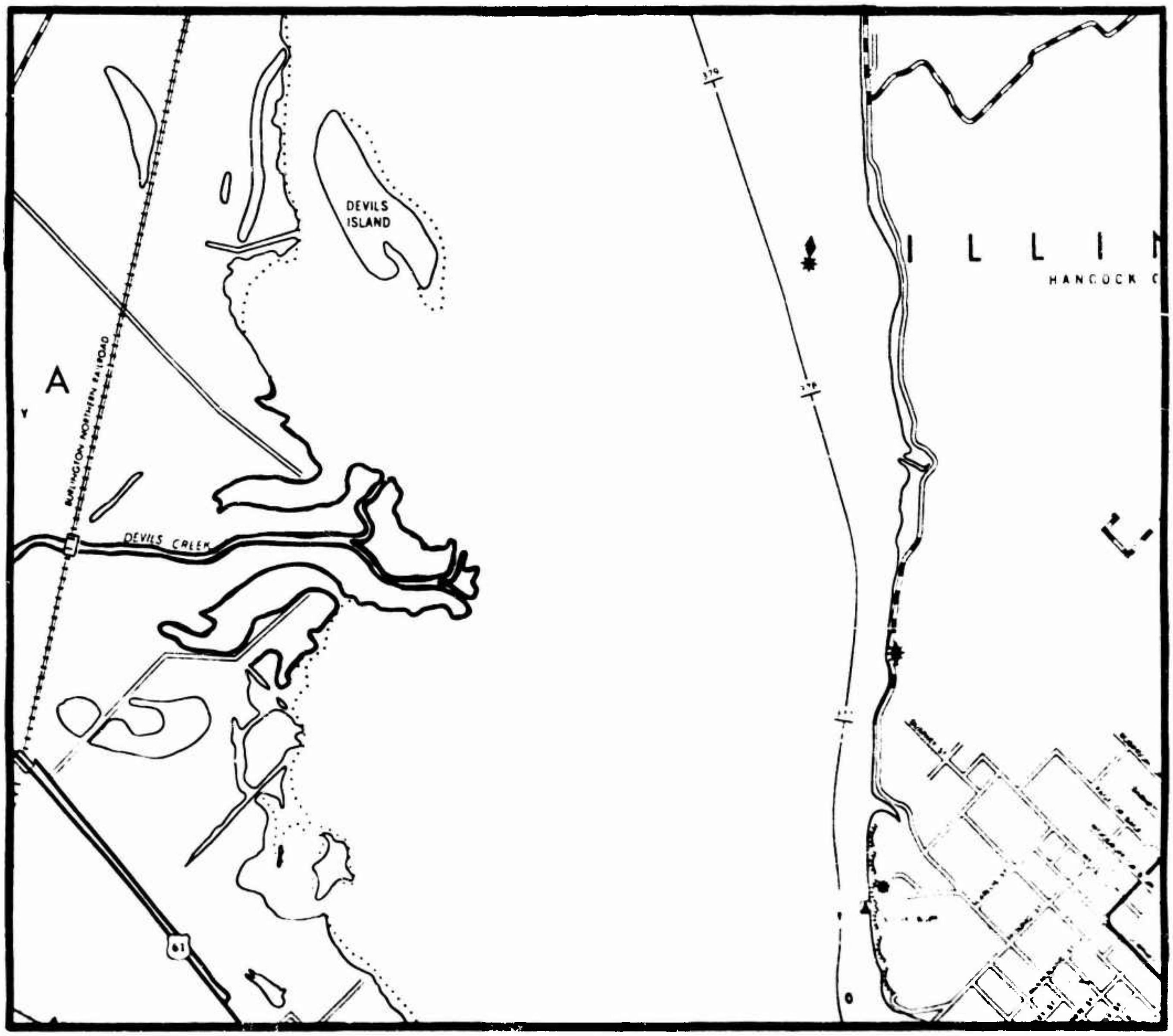

Figure 1. Tributary delta formation as a mechanism in backwater formation, Creek, River Mile 378, Pool 19, Iowa.

During the highwater period, when the river carries its heaviest load of suspended sediment, islands grow by aggradation. As the water passes through the vegetation it slows, dropping some of its sediment load. The coursest material drops out first forming a U-shaped levee around the perimeter of the island with its base pointing upstream. The finer material deposits in the interior of the island often forming a low swale or boggy condition. This process produces the characteristic "crab claw" shaped island. (See Figure 2).

A second means of island and side channel formation occurs when one or both sides of the river bank are composed of clay or erosion resistant rock. A projecting bank condition is found which creates an "energy shadow" downstream. This causes deposition of sediment to form islands which, through erosion and accretion, slowly migrate downstream. The result may be a series of islands which regularly "drip off" of the projecting river bank.

Thirdly, a meandering river attempts to short-circuit or cut off a meander loop during the highwater period resulting in a channel/island/chute configuration. Ultimately, the river may isolate the old meander loop from the main river forming an "oxbow" lake or slough. (Figure 3).

In its natural state, an alluvial river can be said to be in a dynamic state of equilibrium. Simons describes this phenomenon as follows: "... an alluvial river divides itself into two or more channels by the process of either erosion or deposition. The side channels so formed can grow in size and capture most of the discharge and becomes the main channel; they can deteriorate in size and become part of the floodplain; they can grow to the size of the main channel and maintain that size. In the natural state, those side channels which are obliterated by deposition are replaced by new side channels caused by floods and/or river migrations."

The characteristics of side channels and backwaters of the Upper Mississippi River must be discussed in the context of man-induced changes designed to control the river and make it navigable. Such changes include the construction of locks and dams, wing and closure dikes, bank revetments, water level control, dredging and disposal. In addition, non-navigation changes, such as levee and drainage activities, agriculture, urban development, municipal and industrial waste disposal, and recreation all contribute to the quality and quantity of off-channel habitat on the river. In the following paragraphs will be a brief discussion of the pre-impoundment river and the changes that the above mentioned activities have induced on side channels and backwaters.

Green (1960) described pre-impoundment bottomlands as consisting mainly of wooded islands and deep sloughs with hundreds of lakes and ponds scattered throughout. Marsh development was limited to the shores of lakes and guts leading to sloughs. These marshes often dried up completely by the end of the summer as well as did many of the lakes and ponds.

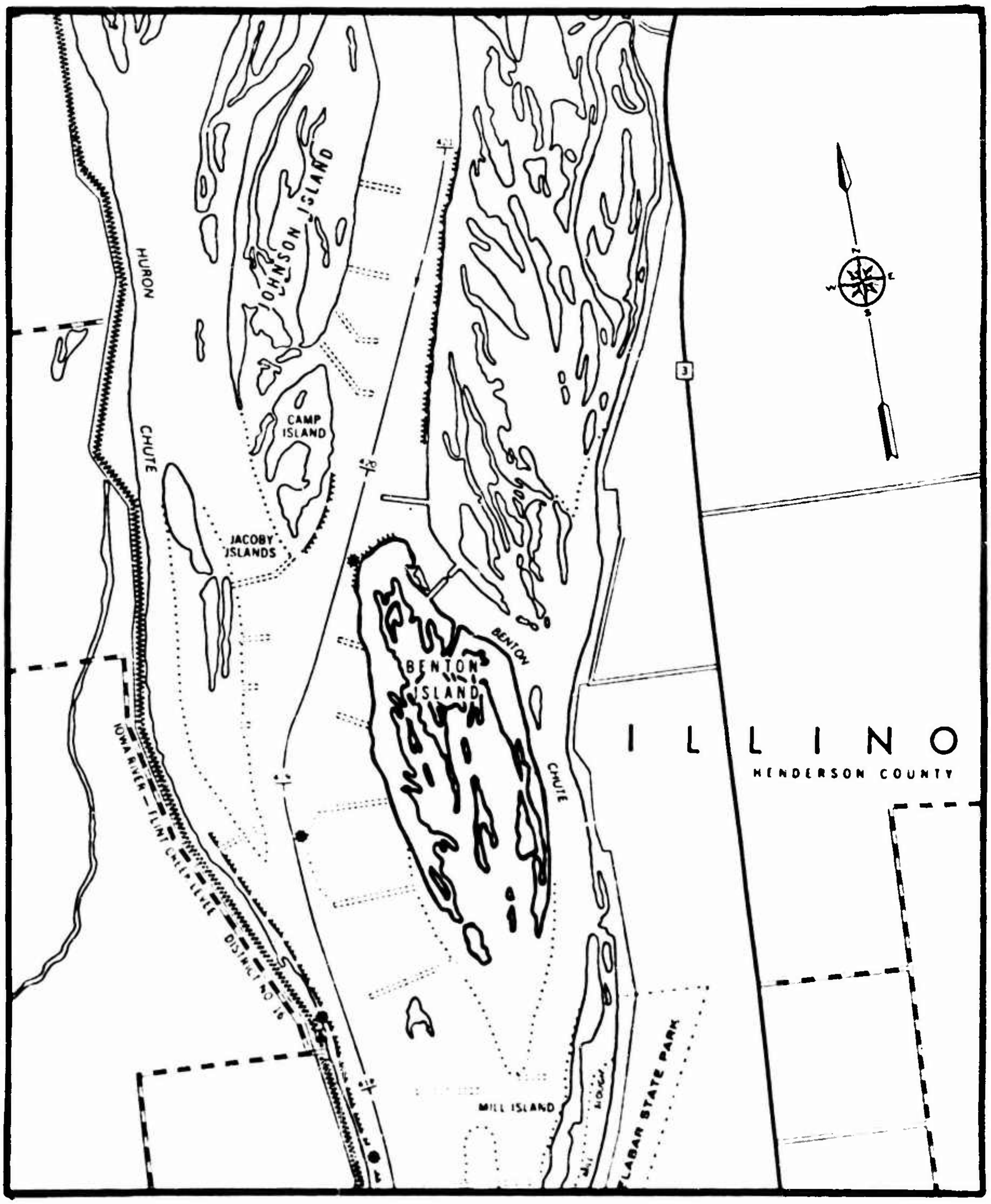

Figure 2. Typical "crab-claw" island shape, Benton Island, River Mile 419, Pool 18, Illinois.

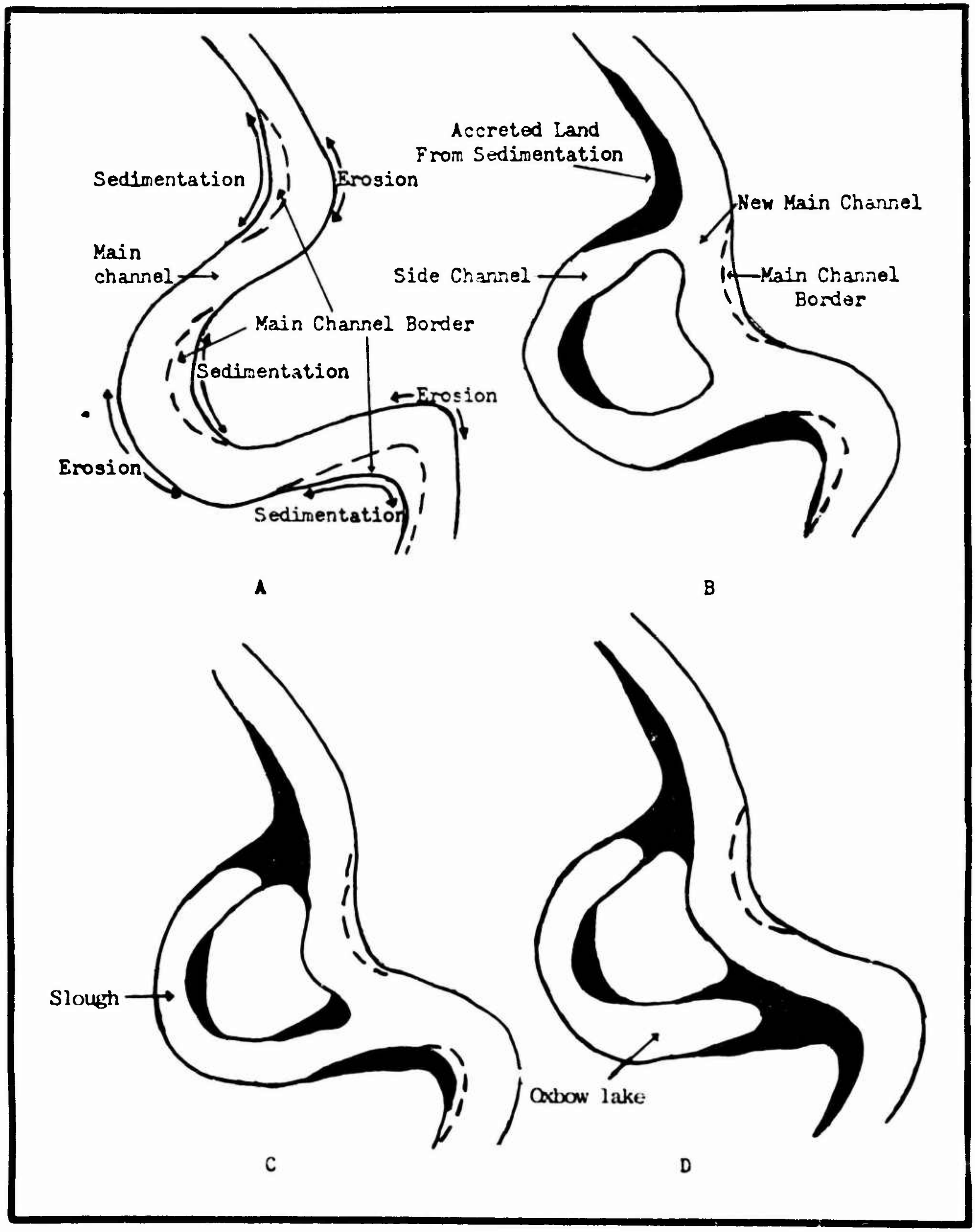

Figure 3. The geomorphic evolution of a meander loop to an oxbow lake as a mechanism in backwater formation.

In 1930, Culler noted three major problems affecting the aquatic life of the pre-impoundment river: (1) pollution, (2) erosion, and (3) fluctuating water levels. Erosion of sands and silts, he observed, caused sedimentation in the river which affected fish spawning. Backwaters in the spring were "muddy and unsuitable for spawning". Silt buried eggs, separated young from the main river, buried mussel beds, and in some places, materially changed plant and animal life of the river. He also noted a reduction in the commercial fish harvest.

Culler was hopeful for the proposed impoundments as the Corps made plans for the 9-foot navigation project. He saw a benefit to erosion conditions"... as the slackened water will not carry as great a quantity of silt as before but will deposit it at the head of each pool." He hoped that the impoundments would "... clear the water in the sloughs by depositing the silt load before it reaches the backwaters...". Green expected siltation to create conditions more suitable for marsh development.

Fluctuating water levels as encountered in an uncontrolled river, were seen as particularly harmful to fish and wildlife by (1) preventing marsh development, (2) interfering with fish spawning, and (3) trapping fish in backwater lakes and ponds, necessitating large scale fish rescue work. Some early investigators, notably Bailey (1930) and Uhler (ca. 1929), saw fluctuating water levels as particularly devastating to marsh development and suggested the construction of dams to retain the water in lakes and ponds. Culler anticipated the 9-foot navigation project to stabilize water level fluctuations particularly if fixed dams were used but questioned the value of the overall changes that would be experienced.

Ellis (1931) studied Lake Keokuk (Pool 19) which had been impounded since 1913, prior to the construction of the other locks and dams. His studies predicted the changes which could be expected to take place when the other 26 locks and dams were constructed. He found that the initial flooding of lateral areas produced extensive tracts of shallow backwaters which supplied large quantities of plankton and other fish food and provided a spawning ground and refuge areas for young fish. This condition existed as long as these backwaters were maintained. However, reclamation of backwaters for agricultural purposes as well as the deposition of fine sediment eventually reduced and degraded this habitat until such rough fish as carp, buffalo and catfish were the dominant species. Game fish as well as food fish numbers were severely reduced.

When the Corps of Engineers impounded the river with 26 locks and dams in the 1930's abrupt changes occurred in the bottomlands. Fluctuating water levels were stabilized and drying of backwater lakes and ponds ceased to occur. Fish rescue work became a thing of the past. Wooded islands became shallow water and conditions were favorable for excellent marsh development. Waterfowl food became abundant.

Green (1960) recognized three distinct zones develop within a pool. The upper end was essentially a normal riverine condition with deep sloughs and limited marsh development. The middle pool saw water backed up over islands and hay meadows, spreading out over large areas. The best marsh development occurred here. Above each dam was a lake-like pool, too deep for marsh development but with some aquatic plant growth.

McDonald and Konefes (1977) compared pre-impoundment (1927) and 1975 aerial photographs and quantified the changes in habitat types that occurred in pools 11-22. They noted a general increase in total aquatic habitat and a decrease in terrestrial habitat in all pools except 15, 19, and 20. Pools 15 and 20 are small and the dams did not create large river lakes. Pool 19 was in existence prior to the 9-foot navigation project and changes during the 48 year period were not as pronounced.

Changes in side channel acreage showed no consistent pattern from pool to pool although there was an overall loss of 3,466 acres in the study area. The largest factor in this conversion was due to the river lakes behind the dams. Sloughs showed a consistent increase where flooding created new areas with connections to the main channel or enlarged existing slough areas. River lakes and ponds showed the largest overall increase in the aquatic category, 40,299 acres. However, this category includes the large pool areas immediately above the navigation dams and the contribution of smaller lakes and ponds to the backwaters was actually much less. A majority of the pools gained in marsh habitat due to the flooding of low areas. In total, 5,328 acres of marshlands became established. Forested lands showed an overall decrease of 10,297 acres as a result of flooding. In addition, 41,211 acres of agricultural lands were converted to other habitat types. And finally, these investigators found that developed lands increased 18,375 acres primarily due to urban (residential) development. While not a direct effect of the navigation project, it certainly results indirectly from stimulation of the economy, creation of jobs and population increases.

In addition to these habitat changes, navigation dams have reduced the current and therefore the sediment carrying capacity of the river during non-flood flows. Typically, scouring, or degradation, takes place in the upper pool. During periods of increased flow, when the river stage is high enough to overtop the islands, sediment laden water is carried into the backwaters where it slows down the drops some of its sediments load. This sedimentation process results in the evolution or succession of open water to terrestrial habitat.

By impounding the river, more cross-section or "conveyance" was created than the flow characteristics can support. Simply put, the river is too wide for the amount of water passing through it. The river, therefore, is attempting to restore pre-impoundment conditions by reducing its cross-section, i.e. filling in the backwaters. Many factors influence sedimentation rates and patterns including the hydrologic cycle, land use, navigation dams, regulating structures, tow and small boat traffic. In addition the morphology of the river and its discharge and velocity greatly influence sedimentation. A high flow river acts entirely different from a low flow river.

The Side Channel Inventory conducted by the work group identified those areas receiving enough sediment to support aquatic, marsh and pioneer woody vegetation (see Section III.C.). The results indicate that approximately 9,000 acres of off-channel water surface area has been converted to various types of vegetation since dam construction. Clearly, sedimentation is the number one problem facing the productive life of the backwaters of the river.

Regulatory structures such as wing and closing dikes divert water away from side channels and into the main channel. While this may reduce the flow of freshwater into backwater areas and can cause stagnant conditions during certain stages, they also limit the amount of sediment ultimately entering the backwaters. However, because of the reduced velocity through side channels and, therefore, the reduced sediment carrying capacity of the water, sedimentation may actually increase in side channels with closing structures (U.S. Army Corps of Engineers, 1974). Bank stabilization (revetments), levees and floodwalls have reduced to a minor extent the amount of sediment entering the water through erosion.

Maintenance of the navigation project necessitates dredging and spoil disposal. In the past, some spoil disposal has resulted in direct or secondary movement of material into side channels and backwaters. The Side Channel Inventory (Section III.C.5.) has identified known instances of when Corps' spoiling has impacted side channels and backwaters. It has been estimated that approximately 1,800 acres of backwater habitat has been impacted by spoil disposal between 1956 and 1975 or about 90 acres per year assuming a linear relationship. It is assumed, however, that this impact has been less severe during the last 20 years than during the first two decades since lock and dam construction. This is primarily due to decreased amounts of dredging and greater environmental concern in spoil placement.

Due to the slower current and greater water surface area above the dams, winter ice cover has increased. However, other factors such as thermal discharges from power plants and industries and barge traffic encourage ice movement downstream. The effects of this phenomenon are varied and undocumented (Ecology Consultants, Inc., 1979).

Obviously, the 9-foot navigation project creates and stimulates commercial navigation which in turn affects the river environment. Karaki and Van Hoften (1975) discuss the resuspension of bottom sediments due to barge traffic and the effects of wave generated erosion. These effects are particularly significant at low flows and are proportional to barge frequency. The resuspended sediment can find its way into side channels and backwaters aggravating the already serious problem of sedimentation. Johnson (1976) found that lateral movements of sediment resuspended by barge tows and transported to shoreward areas does occur during normal pool conditions. Link and Williamson (1976) also found that turbidity levels following barge and tow passage can increase in side channel areas. The effect is particularly noticeable when barge clearance with the bottom of the channel is minimal and when a side channel is located on the outside of a bend. In a few cases, such as Beaver Slough (Pool 14, Clinton, Iowa), commercial barge traffic actually takes place within a side channel.

Additionally, the river has witnessed an increase in pleasure boating, particularly by larger, deeper draft boats. Although other factors are responsible for this increase such as more leisure time and a higher standard of living, the navigation project certainly is a contributor by providing a deep channel and an abundance of beaches. Karaki and Van Hoften noted that small, fast moving pleasure boats can create as large a wave as a slow moving barge. Recreational use of the river including hunting, fishing, pleasure boating, picnicing, swimming, and sunbathing all contribute incrementally to reduced water quality, loss of habitat, reduced utilization by wildlife and fish, and erosion and sedimentation.

Farming practices have taken their toll on backwaters also. Many hundreds of acres of floodplain have been diked, drained and cleared for agriculture. In some cases these areas have been returned to fish and wildlife management since lock and dam construction or portions of a drainage district may be farmed and managed for wildlife both. In addition to outright bottomland loss, changing agricultural practices and lack of proper soil conservation measures contribute to the overall silt-load of the river.

LePage, et al. (1979) identified farmlands as the primary source of fine sediment in the river today and found that the river environment is deteriorating rapidly as a result. They conclude that the only solution is to prevent its production (erosion) at the source. On the other hand, Nakato (1980) compared total stream sediment in the GREAT II reach with regional erosion rates and found that only about seven percent of material eroded from the upland is actually delivered to the streams. This fact demonstrates that even a minor portion surface erosion can be a major source of stream sediment.

Evans and Schnepper (1977), attributed 44 percent of silt and clay sediment in the Spoon River (Illinois) to streambank erosion. Similarly, Bowie, et al. (1975) found streambank erosion to account for 40 percent of the average annual yield in one of the two watersheds they examined and Anderson (1975) estimated that 54 percent of suspended sediment in the Willamette River (Oregon) to be due to streambank erosion.

Water level fluctuations, whether a natural phenomenon or man-induced to accommodate hydropower production or commercial navigation, further exacerbates the resuspension/deposition of fine sediment in the river. As the flow and current velocity is reduced, the sediment carrying capacity of the river is also reduced and the fine sediment settles out. As flow and current velocity increases, the river resuspends sediment, particularly along the shoreline, and carries it downstream.

Urban development and its attendant problems impact side channels and backwaters. Bluffs and riverbanks have been cleared adjacent to a side channel to provide the residential home owner a better view. Loss of soil holding vegetation allows erosion of the steep banks and ultimately threatens the residence. Some of this eroded soil contributes to backwater sedimentation. Municipal and industrial wastes are dumped into the river or leach from septic systems. The additional nutrient load stimulates aquatic plant production (particularly algae and phytoplankton). These "blooms" accelerate the filling of backwaters by hastening the natural ageing process called eutrophication.

In summary it can be seen that the characteristics of side channels and backwaters have been shaped by many varied influences. The 9-foot navigation project has resulted in enhancement as well as degradation of fish and wildlife resources. Most non-navigational activities, with the exception of management of bottomlands for fish and wildlife purposes, have incrementally contributed to an overall decline in fish and wildlife values. Ultimately, "...all natural side channels except major chutes, may disappear from the river scene. There will be no natural replacement of side channels" (Simons, et al., 1975a).

II. B. 2. Existing Side Channels and Backwaters

The Side Channel Work Group characterized and quantified the off-channel habitat of the river in their Side Channel Inventory (Section III. C.). It included an analysis of other's work (Hagen, Werth and Meyer, 1977) as well as observation of many areas in the field. Changes which have occurred in riverine habitat since 1956 were noted by a comparison of aerial photographs.

In the following descriptions of the existing side channel and backwater resources of each pool, acreage percentages are based on off-channel acreages only and do not include the main channel or main channel border. Major side channels are listed as well as major rivers, creeks and diversions that enter each pool. Where side channels are not named on Corps of Engineers Navigation Charts, they were named for the predominant island which separated them from the main channel.

And finally, Tables 1 and 2 summarize the acreage of various habitat types as well as changes which have taken place in them since 1956.

POOL 11

Base Conditions - 1979

Pool 11 contains relatively extensive backwaters as the general trend is for backwater habitat to decrease as one progresses downstream from the headwaters. Approximately 9920 acres (43.8%) of the backwaters are open water and woodlands occupy 6993 acres (30.9%). Aquatic and moist soil vegetation comprises 10.0% (2287 acres) and significant amounts of submerged aquatic vegetation (1855 acres, 8.2%). Agricultural lands (506 acres), developed property (446 acres), herbaceous plants (471 acres) and bare ground (159 acres) account for only 7% of the total off-channel habitat.

Changes Since 1956

In the period between 1956 and 1975, 636 acres of open water have been lost to sedimentation, spoil disposal or filling. Nearly 500 acres of this loss is due to sedimentation. While only 126 acres have been directly lost due to spoil disposal, the work group estimates that as much as 400 acres of backwaters have been impacted by spoiling through side channel blockages and redeposition of material. Other significant changes include the conversion of 204 acres of woodlands to agricultural uses, a 67% increase.

Listing of Side Channels

Snyder Slough	- RM 595.3 - 598.0 L
Hurricane Chute	- RM 596.9 - 599.1 L
Bertom Lake/McCartney Lake	- RM 598.0 - 602.5 L
Bunker Chute	- RM 600.6 - 603.0 R
Jack Oak Slough	- RM 603.3 - 606.0 L
Cassville Slough	- RM 608.5 - 615.0 L
Bluff Slough	- RM 609.0 - 611.0 R

Major Rivers, Creeks and Diversions

Little Maquoketa River	- RM 586.5 R
Platte River	- RM 588.5 L
Grant River	- RM 593.0 L
Turkey River	- RM 608.0 R

POOL 12

Base Condition - 1979

Side channel and backwater habitat is restricted to the left (Illinois) bank throughout most of the pool. Three quarters of the off-channel habitat is more or less equally divided between open water (5473 acres) and woodlands (5185 acres). Aquatic and moist soil vegetation occupies 1916 acres (13.3%) while submerged aquatics (506 acres), herbaceous vegetation (308 acres) and unvegetated lands (41.7 acres) account for 6% of the total. Agriculture and development occupy 7% of the off-channel areas covering 160 acres and 849 acres respectively.

Changes Since 1956

In terms of surface acreage, the conversion of open water habitat has been the greatest change. Sedimentation (427 acres) spoil disposal (28.5 acres) and filling (35.6 acres) have resulted in a loss of 7.2% of backwater and side channels. Spoil and redeposition of this material has impacted 130 acres of backwater habitat. Although agriculture and developed lands still account for approximately 7% of the total off-channel area, the proportions have changed. There has been a 30% decrease in agricultural lands and a 35% increase in developed lands.

Listing of Side Channels

Crooked Slough	- RM 557.0 - 561.0 L
Bellevue Slough	- RM 559.5 - 562.0 R
Younkers Lake	- RM 559.0 - 560.5 L
Wise Lake	- RM 560.5 - 562.5 L
Stone Slough	- RM 562.0 - 565.0 L
Harris Slough/Galena River	- RM 563.5 - 565.0 L
Deadman's Slough	- RM 566.2 - 569.6 L
Menominee Slough	- RM 568.8 - 572.3 L
Molo Slough	- RM 572.4 - 573.2 R
Shawon Dasse Slough	- RM 572.8 - 574.3 R
Frentress Lake Slough	- RM 574.4 - 575.7 L
Mother House Slough	- RM 577.0 - 577.5 L
Lake Peosta Channel	- RM 580.5 - 582.0 R

Major Rivers, Creeks and Diversions

Galena River	- RM 564.8 L
Tete DuMort Creek	- RM 567.1 R
Sinsinawa River	- RM 568.8 L
Little Menominee River	- RM 570.5 L
Menominee River	- RM 574.5 L
Catfish Creek	- RM 577.5 R

POOL 13

Base Conditions - 1979

Pool 13 contains the largest acreage of off-channel habitat of all pools in the Rock Island District, almost 32,000 acres. Open water comprises 37.5% (11,993 acres) of this acreage. Although woodlands are the most common cover in this pool (9455 acres, 29.6%), they are not as predominant as in most other pools. Aquatic and moist soil plants cover 4871 acres (15.2%), the largest percentage of all the pools. Submerged aquatic plants comprise 3.5% (506 acres) of the total and herbaceous cover comprises 2.1% (308 acres). Agriculture is practiced on 2507 acres (7.8%) and 564 acres (1.8%) of off-channel lands have been developed. These figures do not include an additional 6500 acres of off-channel habitat which are controlled by the Savanna Proving Grounds.

Changes Since 1956

The major change in this pool has been the filling and blocking of side channels and backwaters by sedimentation (1178 acres) and spoil disposal (79.5 acres) resulting in a 9.4% loss of open water surface area. In addition, it is estimated that spoil disposal and redeposition of this material has impacted 250 acres of aquatic habitat. Development has converted 86.4 acres of woodlands, agricultural lands and other lands to higher intensity uses.

Listing of Side Channels

Elk River Slough	- RM 526.8 - 532.0 R
Big Slough	- RM 529.0 - 532.5 L
Dark Slough	- RM 531.5 - 533.2 R
Savanna Slough	- RM 533.0 - 537.0 L
Running Slough	- RM 536.0 - 540.4 R
Savanna Bay	- RM 539.0 - 543.0 L
Lainsville Slough	- RM 541.4 - 545.5 R
Crooked Slough	- RM 550.2 - 555.7 L

Major Rivers, Creeks and Diversions

Heldt Ditch	- RM 526.7 R
Elk River	- RM 528.5 R
Plum River	- RM 537.0 L
Apple River	- RM 545.2 L
Maquoketa River	- RM 548.5 R

POOL 14

Base Conditions - 1979

The distribution of cover types is similar to that of other pools with open water and woodlands comprising the majority (22.8% and 49.1% respectively). Developed lands occupy nearly 12% of off-channel habitat (1711 acres), second only to Pool 15. Approximately 7.6% (1095 acres) of these areas are farmlands, while herbaceous plants (587 acres), aquatic and moist soil plants (562 acres), submerged aquatics (11.9 acres) and unvegetated cover types (79.5 acres) combine to occupy less than 9% of the total.

Changes Since 1956

The most significant change which has taken place in this pool is the conversion of 639 acres of farmlands tc higher intensity land uses representing a 37% increase. A 10% loss of open water habitat is due primarily to sedimentation (187 acres), spoil disposal (57.7 acres) and filling (114 acres). Spoil disposal and redeposition of material has impacted an estimated 140 acres of side channels and backwaters.

Listing of Side Channels

LeClaire Canal	- RM 493.0 - 496.3 R
Steamboat Slough	- RM 503.3 - 506.0 R
Grant Slough	- RM 503.2 - 506.4 R
Hanson Slough	- RM 507.0 - 509.5 R
Rock Creek/Schricker Slough	- RM 506.0 - 510.0 R
Swan Slough	- RM 510.2 - 511.3 R
Marais D'Osier Slough	- RM 510.0 - 512.2 L
Beaver Slough	- RM 512.8 - 517.5 R
Cattail/Sunfish Slough	- RM 516.0 - 518.0 L
Joyce Slough	- RM 518.7 - 519.9 R
Little Rock Island Side Channel	- RM 517.5 - 518.7 L

Major Rivers, Creeks and Diversions

Wapsipinicon River	- RM 506.7 R
Mill Creek	- RM 513.5 R
Otter Creek	- RM 521.3 L
Rock Creek	- RM 509.4 R
Bud Creek	- RM 501.2 R
Johnson Creek Diversion	- RM 522.0 L

POOL 15

Base Conditions - 1979

This pool is by far the smallest in the Rock Island District and most of the adjacent shoreline is incorporated into the Quad Cities urban areas. Consequently, very little side channel and backwater acreage exists (3694 acres). Of this total, 922 acres (25%) is open water and 445 acres (12%) is in agriculture. The greatest proportion (51%) has been developed to higher intensity land use, more than any other pool in either percentage or total acreage. Other cover types account for about 12% of the total off-channel habitat.

Changes Since 1956

Changes have been relatively insignificant in the two decade study period primarily due to the developed nature of the pool. However, 23.9 acres of open water were filled for development purposes and 244 acres of agricultural and wooded lands were converted to higher intensity land use. This represents a change of 7% of off-channel lands and waters.

Listing of Side Channels

Campbell's Island Slough - RM 489.8 - 491.3 L
Sylvan Slough (partial) - RM 484.3 - 486.0 L

Major Rivers, Creeks and Diversions

Duck Creek - RM 487.8 R
Crow Creek - RM 490.5 R

POOL 16

Base Conditions - 1979

Off-channel habitat in this pool is divided roughly in thirds, open water comprising 32% (4894 acres), woodland 36% (5577 acres) and all others 32%. Submerged aquatic vegetation is extremely limited (2.0 acres). Much of the backwater habitat is found in Andalusia Island, a ten-mile long complex of islands and sloughs.

Changes Since 1956

Pool 16 ranks first in conversion of open water to vegetated habitats due to sedimentation (885 acres) amounting to a 15% loss. Numerous backwater areas are choked with vegetation and several side channels have been completely blocked. It is estimated that dredge spoil has impacted 25 acres of backwaters. There has been an 18% increase in developed lands primarily at the loss of 266 acres of agricultural lands.

Listing of Side Channels

Wyoming Slough	- RM 458.0 - 462.0 R
Drury Slough	- RM 460.0 - 461.5 L
Scisco Chute	- RM 462.8 - 465.5 L
Andalusia Slough	- RM 464.0 - 475.5 L
Velie Chute	- RM 466.3 - 468.5 L
Davenport Harbor	- RM 478.5 - 480.5 R
Sylvan Slough (partial)	- RM 482.5 - 484.3 L

Major Rivers, Creeks and Diversions

Rock River	- RM 479.0 L
South Slough	- RM 477.7 L
Lake George Outlet	- RM 467.0 L
Pine Creek	- RM 465.7 R

POOL 17

Base Conditions - 1979

Off-channel areas are spread throughout the length of the pool with a great deal of interspersion of the various cover types. As with other pools, open water and woodlands combined form the majority of cover types. Open water covers 3942 acres (29.2%) while woodlands comprise 7488 acres (55.3%). Of the minor cover types, herbaceous plants are the most common (822 acres, 6.1%) while submerged aquatic vegetation is apparently non-existent. Aquatic and moist soil plants (355 acres), agricultural land (422 acres), unvegetated soils (271 acres) and developed areas (225 acres) combine to account for 9.4% of off-channel acreage.

Changes Since 1956

Changes which have taken place in the pool since 1956 have not been outstanding. The largest change is the sedimentation of 333 acres of backwaters and side channels. Spoil disposal filled 38 acres of open water and probably impacted a total of 140 acres. One change not recorded in any other pool is the flooding of approximately 16 acres of leveed land, possibly due to levee failure.

Listing of Side Channels

Turkey Chute	- RM 437.2 - 439.2 R
Swift Chute	- RM 437.3 - 438.0 R
Hail Chute	- RM 439.0 - 440.4 L
Bogus Chute	- RM 440.5 - 444.5 L
Coleman Chute	- RM 441.8 - 443.5 L
Barkis Island Chute	- RM 444.5 - 446.4 L
Kilpeck Island Side Channel	- RM 446.0 - 447.8 R
Blanchard Island Chute	- RM 448.0 - 452.2 L
Muscatine Island Side Channel	- RM 453.2 - 455.0 L

Major Rivers, Creeks and Diversions

Michael Creek	- RM 441.1 R
Muscatine Slough	- RM 441.2 R
Copperas Creek Diversion	- RM 451.0 L
Mad Creek	- RM 455.9 R

POOL 18

Base Conditions - 1979

Of the total backwater habitat in this pool, 4396 acres (31.4%) are open water, 7781 acres (55.6%) are woodlands, and 812 acres (5.8%) are aquatic and moist soil plants. Other natural cover includes 213 acres of herbaceous plants, 416 acres in agriculture, 7.0 acres of submerged aquatics, and 220 acres unvegetated, to form 6.1% of the total.

Changes Since 1956

Sedimentation has converted 231 acres of open water to other cover types. Spoil disposal has impacted 170 acres of backwaters directly or indirectly through blockage of flow or redeposition. Other changes are insignificant.

Listing of Side Channels

Benton Chute	- RM 418.0 - 419.8 L
Huron Chute	- RM 418.6 - 425.5 R
Campbell Chute	- RM 420.8 - 423.3 L
Mapes Chute	- RM 425.0 - 426.2 L
Blackhawk Chute	- RM 426.2 - 429.2 R
Keg Island Side Channel	- RM 435.2 - 436.5 R

Major Rivers, Creeks and Diversions

Hawkeye - Dolbee Diversion	- RM 422.0 R
Pope Creek	- RM 427.7 L
Edwards River	- RM 431.3 L
Iowa River	- RM 434.0 R

POOL 19

Base Conditions - 1979

Pool 19, by far the largest pool in the study area, contains approximately 30,676 acres of off-channel habitat. The lower 26 miles of the pool are virtually devoid of backwater and island habitat although much of this area is shallow and supports aquatic vegetation (1207 acres, 3.9%). Above RM 390, the river narrows and backwater development greatly increases. The 6348 acres of open, backwater and side channel habitat represents 20.7% of the total. A total of 12,709 acres of the terrestrial habitat is wooded (39.4%) while agricultural lands comprise 6092 acres (19.8%). Other types of development occupy 1784 acres (5.8%). Note: the Green Bay Levee and Drainage District was included in the UMR Habitat Inventory but was excluded for the purposes of this discussion.

Changes Since 1956

Pool-wide, there has been a 9.3% decrease in open water surface area which has been restricted almost entirely to the backwaters of the upper ½ of the pool. Six hundred eighty-one acres of exposed sedimentation has accumulated and nearly 100 acres of backwaters and side channels have been impacted by dredge spoil. This soil aggradation has been partially offset by the erosion of 155 acres of land although much of this material has undoubtedly contributed to sedimentation downstream.

A significant change in this mostly privately owned pool has been the conversion of 391 acres of woodlands to agriculture and 161 acres of agricultural land to other types of development. In total, 552 acres (7.3%) of off-channel habitat has been changed to a higher intensity land use representing a 45% increase in two decades.

Listing of Side Channels

Lead Island Chute	- RM 386.3 - 387.0 R
Grape Island Chute	- RM 390.8 - 394.2 R
Shokokon Slough	- RM 395.0 - 402.3 L
Turkey Chute	- RM 394.5 - 396.5 L
Rush Chute	- RM 405.5 - 407.0 R
O'Connel Slough	- RM 404.5 - 407.5 R
Otter Slough	- RM 406.5 - 409.5 R

Major Rivers, Creeks and Diversions

Skunk River	- RM 396.0 R
Flint River	- RM 405.4 R

Yellow Spring Creek Diversion	- RM 410.5 R
Henderson Creek Diversion	- RM 410 L
Devil's Creek	- RM 377.2 L

POOL 20

Base Conditions - 1979

Pool 20 contains 8516 acres of off-channel habitat. The most extensive side channel development in the lower 2/3 of the pool is along the right bank while in the upper 1/3, it is found along the left bank. Open water comprises 19.4% (1655 acres) of the area. Terrestrial areas are mostly wooded (41.6%, 3543 acres) or in agriculture (30.4%, 2591 acres). Four per cent (339 acres) of the off-channel has been converted to other land uses by development. The remaining area is covered by herbaceous plants (231 acres) aquatic and moist soil plants (37 acres) or is unvegetated (120 acres).

Changes Since 1956

Fourty-four acres of backwater and side channel habitat have been lost to sediment deposition and another 161 acres have been impacted by spoil disposal. Several side channels have been blocked. In addition, 40 acres of land has eroded thus increasing the sediment load. A significant conversion of woodland to agricultural uses (82 acres) has occurred in this pool which is mostly privately owned.

Listing of Side Channels

Missouri Chute	- RM 344.5 - 346.7 R
Huff Island Side Channel	- RM 347.0 - 349.0 L
Buzzard Chute	- RM 349.2 - 351.0 R
Taylor Chute	- RM 351.5 - 353.0 L
Hackley Chute	- RM 352.5 - 355.0 L
Grey Chute	- RM 354.8 - 358.3 R
Mud Slough	- RM 360.8 - 363.0 L

Major Rivers, Creeks and Diversions

Fox River	- RM 353.5 R
Des Moines River	- RM 360.3 R

POOL 21

Base Conditions - 1979

A total of 11,684 acres other than main channel and main channel border is recorded for Pool 21. The upper 2/3 of the side channel area is dominated by several large islands. Woodlands cover 61.2% (7146 acres) and open water comprises 24.6% (2878 acres) of this acreage. Agriculture and developed lands occupy 1024 acres (8.8%) and 361 acres (3.1%) respectively. The combined area covered by aquatic and moist soil plants (7.1 acres), herbaceous plants (1.4 acres) and bare soils (0.8 acres) account for only 2.3% of the off-channel habitat. No areas of submerged aquatics were reported.

Changes Since 1956

Approximately 87 acres of open water has been lost to sedimentation in backwaters and side channels while the loss of another 36 acres can be attributed to filling by man. However, the greatest impacts seen in this pool are due to dredge spoiling which has affected 214 acres of backwater and side channel habitat by direct and indirect means. In addition, the erosion of 68.7 acres of woodland and dredge material and the excavation of 24.0 acres has undoubtedly increased the sediment load downstream.

Another significant change in this period has been an increase of agricultural lands by 16.6%. This has been accomplished by the conversion of 153 acres of wetlands and woodlands. Runoff from these farmed lands undoubtedly serves to increase sedimentation in backwaters.

Listing of Side Channels

Canton / Smoot's Chutes	- RM 331.3 - 324.0 L
LaGrange Island Side Channel	- RM 334.8 - 337.0 L
Cottonwood Island Side Channel	- RM 328.5 - 330.7 R
Quincy Bay	- RM 327.3 - 330.5 L

Major Rivers, Creeks and Diversions

Bear Creek	- RM 341.0 L
Corner Slough	- RM 338.5 L
Wyaconda River	- RM 337.2 R
Rock & Ursa Creek Diversion	- RM 336.5 L
Durgan's Creek Diversion	- RM 331.5 R

POOL 22

Base Conditions - 1979

A total of 9528 acres of habitat other than main channel and main channel border is listed in this pool. Of this acreage, 7058 acres (74.1%) is wooded and 1670 acres (17.5%) is water. Agricultural lands comprise 398 acres (4.2%) and 195 acres (2.0%) have been developed for other uses. The following habitat types comprise only 2.2% of the total: unvegetated (67.2 acres), aquatic and moist soil plants (67.2 acres), and herbaceous cover (114 acres). No areas of submerged aquatics were reported.

The majority of the backwater areas follow the left (east) bank; the right bank consisting mainly of agricultural lands separated from the main channel by a levee and narrow strip of woodland.

Changes Since 1956

The most prevalent change in these two decades has been loss of backwater areas due to soil aggradation and an increase in terrestrial vegetation. Approximately 102 acres of open water has been lost, due to sedimentation while 98 acres have been impacted by spoil disposal. Thirty-two acres of woodlands and dredged material have been eroded, much of it being redeposited in side channel areas. Ten acres of land has been converted (developed) to other uses and 130 acres of barren ground (sand or dredged material) has been stabilized by vegetation in this interval.

Listing of Side Channels

Texas Chute	- RM 321.0 - 321.8 L
Fabius Island Side Channel	- RM 321.0 - 323.7 R
Goose Island Side Channel	- RM 318.5 - 320.5 L
Beebe Island Side Channel	- RM 316.5 - 317.5 L
Whitney Island Side Channel	- RM 314.3 - 316.5 R
Armstrong Island Side Channel	- RM 312.0 - 314.0 L
Stilwell Chute	- RM 310.5 - 311.8 R
Zeigler Island Side Channel	- RM 310.5 - 311.7 R
Shucks, Glasscox & Kings Island Side Channel	- RM 306.9 - 309.0 L

Major Rivers, Creeks and Diversions

Fabius River Diversion	- RM 323.3 R
North River	- RM 321.0 R
South River	- RM 320.7 R
Mill Creek	- RM 318.3 L
The Sny	- RM 313.8 L
Bear Creek	- RM 308.7 R

Table 1 Side Channel Habitat Summary (Acres)

Habitat Type		11	12	13	14	15	16	Pool 17	18	19	20	21	22	Total
Open Water	(A)	9,920	5,473	11,993	3,277	922	4,894	3,942	4,396	6,348	1,655	2,878	1,670	57,373
	(%)	43.8	37.9	37.5	22.8	24.9	31.8	29.2	31.4	20.7	19.4	24.6	17.5	30.1
Unvegetated	(A)	159	42	237	80	20	41	271	220	318	120	98	62	1,673
	(%)	0.7	0.3	0.7	0.5	0.5	0.3	2.0	1.6	1.0	1.4	0.8	0.7	0.9
Submerged Aquatic Vegetation	(A)	1,856	506	1,332	12	8	2	0	7	1,207	0	0	0	4,929
	(%)	8.2	3.5	4.2	0.1	0.1	0.1	0	0.1	3.9	0	0	0	2.6
Aquatic & Moist Soil Vegetation	(A)	2,287	1,916	4,871	562	18	1,011	355	812	2,130	37	7	26	14,032
	(%)	10.1	13.3	15.2	3.9	0.5	6.6	2.6	5.8	6.9	0.4	0.1	0.3	7.4
Herbaceous Vegetation	(A)	471	308	986	587	82	546	822	213	718	231	170	114	5,248
	(%)	2.1	2.1	3.1	4.1	2.2	3.5	6.1	1.5	2.3	2.7	1.4	1.2	2.7
Woodland Vegetation	(A)	6,993	5,185	4,055	7,058	317	5,577	7,488	7,781	12,079	3,453	7,146	7,058	79,680
	(%)	30.9	35.9	29.6	49.1	8.6	36.3	55.3	55.6	39.4	41.6	61.2	74.1	41.8
Agriculture	(A)	506	160	2,507	1,095	445	1,694	422	416	6,092	2,591	1,024	398	17,350
	(%)	2.2	1.1	7.8	7.6	12.0	11.0	3.1	3.0	19.8	30.4	8.8	4.2	9.1
Developed	(A)	446	849	564	1,711	1,882	1,606	225	152	1,784	339	361	195	10,114
	(%)	2.0	5.9	1.8	11.9	50.9	10.4	1.7	1.1	5.8	4.0	3.1	2.0	5.3
Totals		22,637	14,439	31,945*	14,381	3,694	15,371	13,530	13,997	30,676	8,516	11,684	9,528	190,399
Stump Fields		6,677	346	9,390	85	-	1,150	74	1,334	-	-	77	-	-

* Does not include approximately 6,500 acres of off-channel habitat controlled by the Savanna Proving Grounds. This acreage was not inventoried by Hagen, Werth and Meyer (1977).

TABLE 2 CHANGES IN OFF-CHANNEL HABITAT SINCE 1956 (ACRES)

	Pool												
CHANGE TYPE*	11	12	13	14	15	16	17	18	19	20	21	22	TOTAL
11	495	427	1178	187	3	885	333	231	681	44	87	102	4653
12	126	28	79	58	0	52	38	197	99	131	48	37	894
13	153	36	0	114	24	25	0	0	23	1	36	0	283
TOTAL	634	491	1257	359	27	972	371	428	803	176	171	139	5830
21	72	11	2	2	0	0	7	5	87	4	2	9	203
22	0	0	0	0	0	0	2	0	3	35	66	23	129
23	0	55	2	35	0	104	0	0	66	19	24	0	305
TOTAL	72	66	4	37	0	104	9	5	156	58	92	32	637
31	204	2	20	0	0	29	6	0	18	82	153	0	514
32	0	0	0	0	30	18	28	28	40	16	7	0	168
33	12	69	42	639	220	266	8	0	391	0	0	0	1648
34	7	151	24	41	24	19	18	0	161	9	16	10	480
35	19	14	0	15	0	0	0	15	7	68	31	130	299
36	0	0	0	0	0	0	16	0	0	0	0	0	16
TOTAL	242	236	86	695	274	332	76	43	617	175	207	140	3125
POOL TOTAL	967	798	1348	1092	301	1408	457	477	1575	418	475	311	9627

*CHANGE TYPE CODE KEY

10. AGGRADATION/FILL
    11. NATURAL SEDIMENTATION - CHARACTERIZED BY A TRANSITION FROM OPEN WATER TO MUD OR SUBMERGED VEGETATION OR MARSH VEGETATION OR WOODED
    12. SPOIL DISPOSAL - TRANSITION OF OPEN WATER TO BARE OR VEGETATED SAND
    13. FILL - FROM UPLAND SOURCES FOR PURPOSES OF DEVELOPMENT

20. EROSION/EXCAVATION
    21. WOODED - LOSS OF FORESTED AREAS
    22. DREDGED SPOIL - SECONDARY MOVEMENT OF SPOIL
    23. EXCAVATION/BORROW FOR FILL

30. OTHER CHANGES
    31. CLEARING OF WOODLANDS FOR AGRICULTURE
    32. ABANDONED AGRICULTURAL LANDS
    33. DEVELOPMENT OF AGRICULTURAL LANDS
    34. DEVELOPMENT OF OTHER HABITATS
    35. VEGETATION OF DREDGED SPOIL
    36. DREDGED MATERIAL PLACED IN WOODLANDS
    37. FLOODED TERRESTRIAL LANDS (POSSIBLY DUE TO LEVEE BREAKS)

II. B. 3. Importance/Value of Side Channels and Backwaters to Fish and Wildlife

Prior to lock and dam construction, early investigators noted that the river contained a nucleus of diverse plant and animal species but that none were found in great abundance. One factor attributing to the great diversity was the overlapping of eastern and western species and subspecies.

Today, however, that diversity is diminished somewhat. While a few species have benefited from the navigation project, many have suffered from the loss or alteration of their habitat. Some have been extirpated altogether. It is an ecological principle that a diverse ecosystem, with respect to habitat types and the species living within them, is more stable than one containing only a few species. In the diverse system, impacting one element will not cause changes in the other elements to any large degree. However, in a less diverse situation, changing one element could cause the entire ecosystem to change. We must take care that our future actions do not further upset this delicate balance and render the system even more fragile and less resistant to adversity.

For the most part, it is the backwaters and side channels that are responsible for the quantity and quality of fish and wildlife found on the river today. In their study of the importance of backwater chutes to the riverine fishery, for instance, Schramm and Lewis (1974) found that "... extra channel areas provide the most favorable conditions of existence for the river fishes..." and that "... it can be said that the loss of extra channel areas will be detrimental to the survival of adult and young fishes."

Ellis (1978) studied three side channels with varying degrees of current. He found that a greater percentage of game fish species (largemouth bass, bluegills, crappies) preferred the lake-like side channel (slough) with the least current while carp and gizzard shad accounted for more than 50 percent of the catch in the riverine and "in between" side channels. However, because of the shallow, currentless nature of sloughs and backwaters,dissolved oxygen occasionally drops below life substaining levels in the summertime.

Bertrand and Miller sampled several types of habitat in 1973 and found the best results to be from sloughs. Bertrand and Allen (1973) concluded that "in general, the side channels would appear to be the best areas to try (fishing)..."

At present, the river probably supports a standing crop of fish in excess of 300 pounds per acre (U.S. Army Corps of Engineers, 1978). Christenson and Smith (1965) studied fish populations in Mississippi backwaters and found that production exceeded that of most waters of the north central states. He found an adjusted average of 285 pounds of fish per acre of water surface. Growth rates of fish were also faster in Mississippi backwaters than for the same species in almost all waters of the north central states. In a backwater lake of the Illinois River, Starrett and Fritz (1965) found a standing crop of 500 pounds per acre of water surface.

Just about any fish species in the river can be found at some time in off-channel areas. With the exception of but a few, all fish species depend upon the backwaters for some part of their life cycle. It may be spawning, feeding, escaping from predators, or overwintering, but the varied habitats found in the backwaters offer the proper combination of physical factors suited to the purpose.

Fuller (1978) noted that backwaters offer prime nursery and breeding ground for unionid mussels and their host fishes and thus provide a reservoir of larvae, some of which contribute to populations farther afield. Destruction of a backwater population is not only a loss in itself, but also a loss of mussel resource to surrounding waters.

Schramm and Lewis (1974) found that the abundance of phytoplankton, zooplankton and benthos is greatest in the slack-current backwater areas. These organisms represent the base of the aquatic food web and the supply of plankton is a good index of the productivity of a water body. An increase in the biomass at a lower level will affect an increase in biomass at the next higher level of the food web.

The composition of bottom fauna has changed in the Upper Mississippi since lock and dam construction from those favoring flowing water (lotic) to those favoring slow-moving, lake-like conditions (lentic). Productivity has remained approximately the same, however with the exception of the mayfly genus Hexagenia. Phenomenal increases in Hexagenia populations have been experienced primarily as this genus prefers the more lake-like conditions created by the dams. This organism serves as a primary food source for many bottom feeding fishes.

As stated earlier, Green noted a paucity of moist soil and aquatic vegetation prior to lock and dam construction and that water level fluctuations prevented their development. Following lock and dam construction, McDonald and Konefes (1977) found an increase of over 5,000 acres of marshland, approximately twice what it was in 1927. This increase in marshland created a phenomenal increase in waterfowl utilization and a shift from diving species (predominantly scaup) to puddle ducks (mallard, wood duck). The birds stayed in the area much longer during their migrations and hunting increased markedly.

The navigation project has produced mixed responses in other species of wildlife. Formerly there were high populations of badgers, skunks, foxes and rabbits. These have been reduced in numbers because flooding has reduced or eliminated suitable habitat. Beavers were nearly extirpated but were restocked and their numbers are increasing. Otters, minks, raccoons and deer have become more plentiful. Muskrats were always plentiful but they have shown a shift from bank dwelling to house building behavior as marshes became more plentiful. Prairie chickens were once found in the bottomlands but are no more (Green, 1960).

Great blue herons, great egrets, double crested cormorants and black-crowned night herons have shown decreases in population which is attributed to such factors as turbidity which reduces feeding efficiency, land development, human persecution, natural calamities and toxic chemicals. Forster's tern is invading the marshlands created since lock and dam construction and is increasing in numbers (Thompson and Landin, 1978).

In general, colonially nesting birds require relatively undisturbed, quiet backwater areas in close proximity to shallow lakes and ponds for feeding. Great blue herons and great egrets seem to prefer the upper one-third of a navigation pool which is that portion most unchanged by dam construction. No colonies have been found on islands that are completely surrounded by navigable water (ibid).

The productivity found in the backwaters of the Upper Mississippi is primarily due to the chemical fertility of the water which is in turn a product of the geology of the area and the nutrients which enter the water from the surrounding farmlands. However, with the nutrients comes a tremendous load of sediment, which through turbidity and deposition, is probably the dominant influence on the quantity and quality of fish, wildlife and their habitat on the river today.

In their literature review on the effects of turbidity and siltation, Hollis, et al., (1968) found that fish production seems to vary inversely with turbidity. Silt and turbidity may interfere with reproduction, destroy spawning beds, smother eggs and young and even affect adults. Silt may alter habitat by filling holes, kill or conceal food, or decrease light penetration to photosynthetic plants. Fish exhibit an avoidance reaction to silt, even the tolerant carp. Turbidity also decreases fishing success.

Ellis (1931) found an increase in rough fish in Lake Keokuk (Pool 19). He felt this was due to a change in bottom fauna to those organisms capable of withstanding the low oxygen levels associated with an organic/silty sediment type. The resultant fishery composition (carp, buffalo, catfish) is dominated by those species capable of utilizing such a food source. Furthermore, silt deposits are found practically to water's edge in most parts of the lake. Consequently, only a very narrow shore zone is kept silt-free by wave action and is thus available for the spawning of game and food fish species.

Stern and Stickle (1978) found that the group of aquatic organisms most frequently affected by siltation are the filter feeding invertebrates (mussels, benthos). Silt interacts with dissolved oxygen and temperature in a complex manner, clogging gill membranes and interfering with the gaseous exchange of respiration. Overall, benthos and plankton have decreased in diversity, resulting in a less stable, less resilient ecosystem. (Solomon, et al., 1975).

Siltation also traps organic matter on the bottom and creates an oxygen demand which may result in the release of toxic gases and objectionable anaerobic conditions. Turbidity delays the self purification of water and allows the distant transport of organic wastes. Silt flocculates planktonic algae and carries it to the bottom to die. It absorbs oil and precipitates, remaining a potential source of pollution when these sediments are resuspended (Hollis, et al., ibid).

It has been shown that agricultural and streambank erosion are the primary source of fine sediment in the Upper Mississippi. With the wholesale use of artificial fertilizers and pesticides, farming practices have changed to allow more bare ground exposed to fall and spring rains. Many fields are plowed to the very edges of streams and fence rows have been eliminated to get more land into production. The loss of these natural buffers allows top soil to runoff, unchecked, into the water. With the soil particles go the nutrients from the fertilizers and toxins from the pesticides. Removal of riparian vegetation and greater runoff rates also increase streambank erosion, all contributing to the sediment load reaching the river.

II. B. 4. Public Concerns

Throughout the GREAT program the public has been consulted for their input through the Public Participation and Information Work Group. At several river tours and public meetings the public was asked to indicate their concerns with the river. Many comments were made regarding the loss or alteration of backwater habitat. Primarily this involved loss due to sedimentation. Hunters and fishermen find that they are continually being denied access to their traditional recreation areas because the side channels and backwaters are filling in with sediment.

Each of the public comments have been taken into consideration by the work group in the problem identification process and each will be answered in some way. These problems are enumerated in Section II.D. of this Appendix.

II. B. 5. Comment

The backwaters can be said, therefore, to be of critical importance to the maintenance and propagation of abundant and diverse fish and wildlife populations. Several investigators have made attempts to place a dollar value on an acre of backwater habitat. Starrett (1957), for example, estimated the value of the sport and commercial fishery alone of a reflooded bottomland lake on the Illinois River to be $29 per acre. As this was in 1954 dollars, a 10 percent per year inflation rate would realize a value of $78 per acre. Mitsch, et al. (1977) valued a Cache River (Illinois) floodplain cypress swamp at $246 per acre when considering its floodwater retention and nutrient filtration functions.

Odum, et al. (1975) recycled treated sewage through a Florida cypress swamp and found it could remove nitrogen and phosphorus at one-seventh the cost that man could with all his sophisticated technology. Mitsch (1979) most recently assessed the value of the Momence Wetlands of the Kankakee River (Illinois) in two ways. He estimated the wetlands replacement cost for fish production, flood control, drought prevention, sediment control and water quality enhancement to be $494 per acre. In a comparison of the energy flow through the wetland to the amount of fossil fuel it would take to produce the same amount of energy, the value derived was $289 per acre. And, finally, Wharton (1970) assessed the education, public use, groundwater recharge, water quality, sediment control and productivity value of a Georgia swamp on the Alcovy River to be $3126 per acre.

Throughout such attempts to put a dollar value on a wetland it becomes apparent that to do so is extremely difficult because of the many interrelated and often subtle functions that a wetland provides in maintaining environmental quality. Historically, wetlands have been looked upon as a wasteland, something of little value, to be drained, filled, "reclaimed" for the benefit of man. Science has just scratched the surface in its realization of the value of these "wastelands".

Congress, as well as the Office of the President, has recognized the value of wetlands. The National Environmental Policy Act, Executive Orders 11988 and 11990, the Federal Water Pollution Control Act (Clear Water Act) as well as regulations for the Corps of Engineers permit program all emphasize the importance of wetlands and directs that they be protected unless overriding public interest dictates otherwise.

River biologists believe that the fish and wildlife resources of the Upper Mississippi are molded by the physical characteristics of the system and the external influences on them. Man's activities greatly influence the quality and quantity of our natural resources. It therefore follows that it is man's responsibility to check his activities if he is to insure an environment which he and his progeny can enjoy in years to come.

In the next section, the work group has projected what it feels the next 50 years will reveal for fish and wildlife on the river if current trends continue.

II. C. Projected Conditions - 2025

II. C. 1. Projected Backwater Characteristics

In order to project the future condition of backwaters and side channels and their biotic components, it is necessary to make several assumptions regarding the future of certain controlling factors on the river.

The river will continue to be utilized and maintained for commercial navigation and that utilization will increase according to projections of the Commercial Transportation Work Group (5% per year). Pressures will continue to be exerted to build facilities to accommodate the increase traffic. The prospect for a year-round or extended navigation season appears dim at this time.

The river will continue to be utilized by recreationists and that utilization will increase according to projections of the Recreation Work Group (21% over the next 45 years). Demand will be high to maintain and create additional beach sites, campsites and parks. Recreational boat traffic and hunting and fishing use will increase accordingly.

Soil erosion will increase in severity as more land in put into production to meet world food needs and as the production of energy is supplemented by grain alcohols. Marginal lands more prone to soil erosion will be put into production and removal of fencerows, buffer strips and riparian vegetation will contribute to the problem.

Side channels and backwaters will continue to experience sedimentation as the river seeks to reduce its cross-section to what it was prior to lock and dam construction.

Pressures will continue to be exerted on backwaters to convert them to other uses such as agriculture (levee and drainage) residential and industrial development.

Given the above, we can make some generalizations about the biotic and abiotic composition of the backwaters in the next 50 years. We will also note the changes that have occurred in other river systems of the midwest that could be said to be advanced stages of the Upper Mississippi.

In their literature review, Ecology Consultants, Inc. (1979) noted that because of the continuous input of sediment and reduced overall transport capability, accumulation of sediment in the pools will continue to occur. Training works eliminate the creation of new backwaters to replace those lost to sedimentation. Thus, backwaters will slowly fill in until the river reaches an equilibrium between its sediment load and sediment carrying capacity.

The Corps of Engineers (1974) agree with this projection, stating that "sedimentation will fill many marshes, sloughs and other secondary watercourses...until the channel cross-section is reduced to the original capacity before dam construction."

Eckblad studied sedimentation rates in Pool 9 (1977) and projected the life expectancy of a floodplain lake at between 43 and 61 years. And, in the Middle Mississippi, Emge, et al. (1974) studied 23 side channels and projected that a majority of them are in danger of closing off due to sedimentation and vegetation.

In their appendix to the GREAT I Final Report, the Sediment and Erosion Work Group (LePage, 1979) determined sedimentation rates in several backwater sites using different methods of measurement. Their data revealed that sedimentation in Pools 4-10 is occuring at a rate of 2.5-5.0 centimeters per year. This translates into 4-8 feet in 50 years and since most backwaters are less than eight feet in depth, their future is obvious.

The Illinois Natural History Survey has studied the Illinois River many years and notes that the single greatest physical effect of sedimentation is the filling of backwaters (Bellrose, et al., 1977; Bellrose, et al., 1979; and Sparks, et al., 1979 unpublished). They found that turbidity and sedimentation has all but eliminated aquatic and marsh vegetation. Lake Chautauqua has lost 34.5 percent of its storage capacity in 51 years and its projected life expectancy is less than 100 years. Lake DePue has lost 72.6 percent of its storage capacity in 72 years. Overall, they found that between 1933 and 1976, 4.2 percent of total lake acreage in bottomland lakes below Spring Valley has been lost to sedimentation.

To the contrary, Simons, et al. (1975b) utilized a mathematical model to predict the next 50 years of Pools 24, 25, and 26. They found that natural levees along the river bank will continue to grow but that deposition in the floodplain will be minimal (approximately 1.0 inch). They predict that the river will look essentially as it does today. Their predictions assume that yields of silt and clay will remain low in the next 50 years. Sparks, et al. (1979 unpublished) refutes Simons' conclusions however. They note that Simons studied only the movement of sands and studied sedimentation only in main channels. Filling of backwaters is caused by fine sediment and is increasing in rate. "Succession has been increased to such an extent that changes that would normally take thousands of years are being completed in less than 150 years" (Ibid).

It should be pointed out here that in all of the above estimates or projections of life expectancy of a backwater area, an assumption is made of a linear relationship between observed sedimentation and the projected rate. This assumption is not valid but it simplifies the process for the purposes of discussion. For example, if 10 inches of sediment has accumulated in 10 years, the observed rate is one inch/year. Thus, projecting for the next 50 years, results in an additional 50 inches of sediment. In truth, the rate is not constant and is highly dependent on the hydrologic cycle as well as other factors. Furthermore, the more shallow an area becomes, the less the rate of accumulation results.

II. C. 2. Projected Side Channels and Backwaters

Predicting what the future river will look like is extremely difficult primarily because we do not have good empirical data regarding the changes that have taken place in the past and because of a multitude of factors which influence river morphometry. Calculating past sedimentation is difficult because the changes are often subtle and take place underwater where they are not readily observed. In the Side Channel Inventory (see Section III. C.), as in the GREAT I Sediment and Erosion Work Groups' study (LePage, et al., 1979), measuring changes in surface area of water lost to sedimentation belies the actual loss in water volume which goes unseen. Where loss of surface area may be 25 percent, the actual loss in volume of a backwater or lake may be much more.

As noted in the previous Section, GREAT I found a sedimentation rate in backwater areas of 2.5 - 5.0 centimeters (1-2 inches) per year and that approximately 25 percent of open water in these areas has been converted to non-water habitat in a 34 year period. The GREAT II Side Channel Inventory measured a loss of 8.1 percent of open water in a 20 year period by comparing aerial photography, or about 16 percent in total since lock and dam construction assuming a linear relationship. However, the Side Channel Work Group further estimates that the loss of open water habitat may approach a figure of 31 percent since the navigation dams were closed if one assumes that all aquatic and marsh type vegetation currently found in the river is indicative of areas of sedimentation. While it can be argued that many areas were suitable for the establishment of aquatic and marsh vegetation at the time of dam closure (and indeed there were), it has been the experience of river biologists that those original marshes have since been succeeded by bottomland hardwood forest and that existing marshland has sprung up on areas made shallow by fine sediment. Hence, even if the truth lies in between these two estimates, we see that losses of open water to sedimentation in the GREAT II study area compare favorably with GREAT I estimates and tend to support their conclusions regarding the nature and severity of this problem.

Extrapolating from these data, we can make various estimates of sedimentation over the next 50 years, all of which can be criticized or discredited for a multitude of reasons. They do, however, provide a range of estimates for the reader's consideration.

Estimate A - Given the sedimentation rate of 1-2 inches per year estimated by GREAT I, we calculate a 50-year accumulation of 4-8 feet of sediment in most backwater areas. It is the experience of the work group that most backwater areas are less than 8 feet deep. Thus, their fate is obvious and a near total loss would be anticipated.

Estimate B - Given the measured loss of 8 percent of backwater surface area in 20 years (0.4 percent per year), we calculate an additional loss of 20 percent of the original surface area in 50 years or 22 percent of the existing water surface area (12,600 acres).

Estimate C - Given the prediction that only main side channels and chutes will remain intact once the river has reduced its cross-section compatible with its flow characteristics (Simons et al., 1975a), we calculate the loss of 34 percent (19,000 acres) of the existing water surface area. These figures were estimated from the Habitat Inventory Maps considering present trends and patterns of sedimentation in backwater areas and the likliehood that individual side channels will remain open and flowing. (This estimate is essentially the same as "A")

Estimate D - Given the GREAT I estimated loss of 25 percent of backwater surface area in 34 years (0.74 percent per year) we calculate an additional loss of 37 percent of the original acreage or 49 percent of the existing acreage (28,000 acres).

Estimates B, C and D are summarized by pool in Table 3.

The conclusion which has been reached, therefore, is that the next 50 years will see a significant demise in backwater habitat. Certainly, within the century, all but the largest side channels will become incorporated into a monotypic bottomland hardwood forest with an attendant decline in fish and wildlife numbers and diversity unless man acts to correct this situation.

II. C. 3. Value of Side Channels and Backwaters to Future Fish and Wildlife Resources

Biological responses to these physical changes will be varied. On the one hand, those species dependent upon the terrestrial portions of off-channel habitat will either remain stable in population or increase. Squirrels will increase as mast-producing timber ages. Raccoons will remain abundant. Deer will remain common as will fox, rabbit and other small mammals.

TABLE 3. ESTIMATED LOSSES OF BACKWATER HABITAT DUE TO SEDIMENTATION AND VEGETATION OVER THE NEXT 50 YEARS. (SEE PAGE II-36 FOR DISCUSSION OF METHODS)

POOL	EXISTING BACKWATER ACREAGE*	FUTURE LOSSES ESTIMATE "B" ACRES	%	FUTURE LOSSES ESTIMATE "C" ACRES	%	FUTURE LOSSES ESTIMATE "D" ACRES	%
11	9920	2182	22	2689	27	4861	49
12	5473	1204	22	2507	46	2682	49
13	11993	2638	22	4817	40	5877	49
14	3277	721	22	1763	54	1606	49
15	922	203	22	0	0	452	49
16	4894	1077	22	1266	26	2398	49
17	3942	867	22	1266	32	1932	49
18	4396	967	22	1480	34	2154	49
19	6348	1397	22	1295	20	3111	49
20	1655	364	22	536	32	811	49
21	2878	633	22	1250	43	1410	49
22	1620	356	22	605	36	794	49
TOTAL	57373	12622	22	19474	34	28113	49

*ACREAGE CALCULATED FROM THE HABITAT INVENTORY MAPS BY HAGEN, WERTH, AND MEYER (1977).

Any organism directly tied to aquatic or moist-soil habitats, however, will experience a different fate. Many species will undoubtedly be reduced in numbers and range. Muskrats will remain abundant until marsh vegetation is converted to terrestrial. They will then shift to a low density, bankdwelling population. Beaver will continue at present levels and may increase as long as pioneer woody vegetation (willow) remains abundant. They could, however, begin to experience population losses near the end of the projection period.

Colonially nesting birds will continue to experience population reductions as backwater habitat continues to be lost. The Forster's tern, like the muskrat, is dependent upon the marshes so will continue its trend of increased numbers until the marshes are gone. Increased human disturbance and utilization of the river will be a factor in reducing the numbers and range of these birds.

Waterfowl production will remain high as long as the off-channel wetlands exist. As this habitat ultimately decreases due to encroachment of terrestrial vegetation, waterfowl numbers and composition will return to pre-impoundment levels.

Fish will probably be impacted the most over the next 50 years. Funk's and Robinson's studies (1974) of the lower Missouri River blamed the decline of an immense fishery resource on habitat changes, particularly a reduction in the number and quality of chutes and backwaters. The fish population became less varied and diverse, dominated by a few species adapted to survival in a swift, turbid stream (catfish and carp).

Jackson and Starrett (1959) described the changes in the fishery of Lake Chautauqua (Illinois River) as a result of sedimentation. Yellow perch and largemouth bass numbers decreased. Carp became a contributing factor in the lake's turbidity as they stirred up the bottom sediments through their feeding behavior. In another backwater lake of the Illinois River, Patterson Bay, it was reported that siltation completely eliminated the fish population (Anon., 1965).

It therefore appears highly probable that the fishery which will remain in 50 years will be much like that of the present river below Saint Louis, Missouri, where most side channels, lakes and sloughs have been eliminated. With the loss of habitat diversity, fish diversity decreases. Largemouth bass, crappie, northern pike, bluegill, rock bass, warmouth,paddlefish, bullheads and others will be much reduced in numbers or gone entirely. Commercial catches of buffalo and freshwater drum will decline. Freshwater mussels will be severely reduced in numbers, not only because of loss of habitat but because the host fish species on which their larval stages depend are greatly reduced in numbers and diversity.

The question might be raised that if the river is attempting to reach a so-called state of equilibrium by returning to pre-impoundment conditions, why would not the biota also reflect pre-impoundment conditions? It would not primarily because of man's attempt to control the river with dams, wing and closure dikes, riprap and revetments, all of which prevent the creation of backwaters to replace those that will be lost. The river may approximate a pre-impoundment cross-section, but it can never again approximate a natural, free-flowing condition. Man's actions may have temporarily improved conditions for many species, but will ultimately result in even less abundance and diversity of fish and wildlife populations than were experienced by pre-impoundment investigators.

II. C. 4. Impact of State and Federal Legislation on Future Side Channels and Backwaters

Several pieces of legislation have the potential for directly influencing the quality and quantity of backwater habitat on the Upper Mississippi particularly as it relates to the number one problem being experienced in these areas - sedimentation.

The Rural Development Act of 1972 provides the Soil Conservation Service through the Secretary of Agriculture, the mechanisms for soil conservation with provisions for considering and protecting fish and wildlife. Erosion control and flood prevention, water conservation and land use planning are primary purposes. The Act provides coordination with Federal, State and local agencies and private interests.

The Water Bank Act, also administered by the Soil Conservation Service, provides monetary incentives to farmers to preserve, restore and improve wetlands and reduce water runoff and soil erosion. It requires a conservation agreement in order to transfer funds and also provides for consultation with the Department ot the Interior to insure harmony of programs. This program is currently inactive due to funding impoundment.

The Soil and Water Resources Conservation Act of 1977 (P.L. 95-192) provides that the conduct of programs administered by the Department of Agriculture for the conservation of such resources shall be responsive to the long term needs of the nation, that the Secretary of Agriculture develop a national soil and water conservation program to be used as a guide for the SCS in assisting private landowners and land users, and declares that existing mechanisms be used to the fullest extent practicable to achieve the purposes of the Act.

The Water Resources Planning Act of 1965 establishes the Water Resources Council and provides a policy to encourage the conservation, development and use of water and related land resources on a comprehensive and coordinated basis. Objectives are to enhance regional and national economic development, quality of the environment and well-being of the people. It establishes the mechanisms for developing the priniciples, standards and procedures for preparation of regional and river basin plans.

The Clean Water Act Amendments of 1977 (P.L. 95-217), provides policies, goals, regulations and funding for Federal, State and local cooperation in improving and maintaining the quality of the nation's water resources. In particular, Section 208 provides for the development and implementation of areawide waste water treatment plans that would include "a process to (i) identify, if appropriate, agriculturally and silviculturally related non-point sources of pollution, including the return flows from irrigated agriculture, and their cumulative effects, runoff from manure disposal ares, and from land used for livestock and crop production, and (ii) set forth procedures and methods (including land use requirements) to control to the extent feasible such sources". This Act is the responsibility of States and the Environmental Protection Agency.

The Fish and Wildlife Coordination Act requires that water development planning and permitting agencies coordinate with the U.S. Fish and Wildlife Service (Department of the Interior) to insure that fish and wildlife resources will receive equal consideration with other project purposes.

All the above acts have one thing in common, they provide for proper land use and land use planning. In order to have a significant impact on sedimentation in the backwaters of the river, it is necessary to attack the problem at the source and on a large scale. Even if all of the above programs were implemented to their fullest extent and concentrated on the problem of suspended sediment, however, we could not completely eliminate the problem. GREAT I Sediment and Erosion Work Group estimates that if existing land treatment measures were <u>fully</u> implemented, erosion would be reduced by only one-half to one-third. Clearly, new and innovative measures need to be adopted to conserve our natural resources.

II. C. 5. The Relationship of Land Management Practices to Side Channel Characteristics

<u>Corps-owned Lands</u>

Prior to and during construction of the 9-foot channel project, the United States Government acquired fee title to approximately 94,000 acres of river lands as part of the navigation project (U.S. Army, Corps of Engineers, 1969). Essentially, these lands encompass all areas between levees or railroad embankments in all pools except 15, 19 and 20. River lands in Pools 19 and 20 are privately owned by the Union Electric Power Company. Lock and Dam 19 was constructed at Keokuk in 1913. Pool 15 is small by comparison and contains very little land that is not within the corporate city limits of the Quad Cities urban area.

According to Section 7 of the 1954 agreement between the Bureau of Sport Fisheries and Wildlife (precursor of the U.S. Fish and Wildlife Service) and the U.S. Army, Corps of Engineers, a General Plan for fish and wildlife management shall be developed jointly by the Corps, Bureau, and appropriate state agency for all project lands and water where management for fish and wildlife purposes is proposed. The administrative details for implementing the General Plan are a part of the Cooperative Agreement made between the Department of the Interior and Department of the Army in 1963. Under this agreement, the Department of the Army has made available to the Bureau (Service) 83,712 acres of land and water areas for the conservation, maintenance and management of wildlife resources.

Of this 83,712 acres, the U.S. Fish and Wildlife Service actively manages 47,253 acres as part of the Upper Mississippi River Wild Life and Fish Refuge (UMR) in Pools 11-14 and 10,597 acres as part of the Mark Twain National Wildlife Refuge in Pools 17, 18 and 21. The management goals of the UMR are to (a) maintain the lands and waters as a refuge and breeding place for migratory birds; (b) to maintain the lands and waters as a refuge and breeding place for other wild birds, fur bearers, other wildlife, and conservation of wildflowers and aquatic plants; and (c) to maintain lands and waters as a refuge and breeding place for fish and other aquatic life. Similarly, the management objectives of the Mark Twain NWR are (a) to provide migrating waterfowl with food, water and protection during the fall and spring months; (b) to improve and maintain existing habitat for the production of wood ducks; (c) to provide food, water and protection for wintering waterfowl; (d) to maintain balanced populations of all resident wildlife species; (e) to maintain portions of the refuge river bottom habitat in its natural, virgin state; and (f) to provide limited day-use recreation where and when such activities are compatible with primary objectives. Various federal laws and treaties provide the authority for the Fish and Wildlife Service to manage refuges including the following:

- Flood Control Act of 1944
- Fish and Wildlife Coordination Act (as amended)
- Fish and Wildlife Act of 1956 (as amended)
- Migratory Bird Conservation Act (as amended)
- Migratory Bird Treaty Act of 1918 (as amended)
- National Wildlife Refuge System Administration Act of 1966 (as amended)
- Executive Order 7524

None of these provide specific authority to perform alterations to backwaters, although mandates and guidelines for refuge management include provisions for improvement of habitat using such techniques. Neither do these acts and laws preclude the necessity of obtaining the necessary state and federal permits and certificates nor do they preclude compliance with the National Environmental Policy Act of 1969, Executive Order 11988 (Floodplain Management) or Executive Order 11990 (Wetland Management).

The Service will continue to consider backwater alterations in meeting their management objectives. However, funding remains to be a problem and such projects that have been proposed are relegated a low priority.

In addition to the above, the State of Illinois (Department of Conservation) manages 14,712 acres of Cooperative Agreement lands in Pools 16, 17, 18, 21 and 22. The Department's management objectives are to provide a refuge for fish and wildlife and to provide access and enhance opportunities for outdoor recreation including camping, hiking, boating, hunting, fishing, trapping and wildlife observation. The agency has authority to conduct alterations to backwaters for the benefit of fish and wildlife through the Agreement with the Corps and Fish and Wildlife Service. As with Service managed lands, the necessary permits, certificates and reviews must be obtained. The agency does not anticipate future projects of this nature primarily due to a lack of funding although it cooperated in the opening of the Burnt Pocket backwater (see Section III. B.).

The State of Missouri (Department of Conservation) manages 2536 acres of Cooperative Agreement lands in Pools 21 and 22. Their management objectives include the control, restoration, conservation and regulation of bird, fish, game, forestry and all wildlife and is subject to the same limitations as the State of Illinois. The Department assisted in the attempted opening of the Orton-Fabius side channel (see Section III. A.) but does not anticipate future projects of this nature primarily due to lack of funding.

The State of Iowa (Iowa Conservation Commission) manages approximately 9962 acres of leveed "backwaters" in Pools 13, 14, 16, 17 and 18. Their management objectives include promoting waterfowl production and duck hunter use. Their authority to conduct backwater alterations is vested in the Cooperative Agreement and is subject to the same limitations as the other states. The Commission has manipulated water levels annually and created pot holes by blasting. Because these areas are completely leveed and the water levels controlled, backwater problems, as experienced by un-leveed areas, are not significant. However, any backwater alterations which may be contemplated are subject to the same restrictions as the other states.

The State of Wisconsin manages no lands for fish and wildlife benefits in the GREAT II Study Area.

Fish and Wildlife Service Owned Lands

In addition to the lands and waters owned by the Corps of Engineers, the Service also owns in fee title 15,619 acres in the UMR Refuge. These lands are managed with the same goals and under the same authority as Cooperative Agreement lands.

Other Federal Lands

In addition to lands owned by the Corps of Engineers, the Department of the Army owns the 1,000 acre Arsenal Island in Pool 15 (Army Weapons Command) and approximately 6,500 acres of backwaters and islands in Pools 12 and 13 (Savanna Ordinance Depot).

A Cooperative Plan Agreement for the Conservation and Development of Fish, Forest and Wildlife Resources on the Savanna Ordinance Depot has been approved by the Department of Defense, Department of the Interior and the State of Illinois effective September, 1978. It provides for a general inventory review of fish and wildlife resources; the development, protection and improvement of habitats to secure optimum conditions that do not conflict with the primary mission of the installation; development of a long range (5 years) Fish and Wildlife Management Plan; management of the installation so as to protect and control the watersheds, soil, beneficial forest and timber growth and beneficial vegetative cover as vital elements of this fish and wildlife program; hunting, fishing and trapping in accordance with State and Federal laws governing same.

No backwater alterations have been performed in the past. However, the Long Range Fish and Wildlife Management Plan may provide for such options to counteract the truncating effects of Dam #12 on the backwaters.

Discussion

Table 4 contains a summary of public lands managed by federal and state resource agencies.

With regard to the future of land management practices and their relationship to backwater characteristics, it appears that the authority, management objectives and desire exists within the resource agencies to address side channel and back-water problems. However, their action is severely limited by the funding available to them for habitat improvement. In general, physical alterations are costly and would involve long range planning and funding requests. It is questionable, even, whether a state or federal agency would be willing to expend large amounts of money on lands they don't even own. Consequently,

TABLE 4. APPROXIMATE ACREAGE OF LAND AND WATER MANAGED BY FEDERAL AND STATE RESOURCE AGENCIES

POOL	MANAGEMENT AGENCY USFWS		IOWA*	ILLINOIS*	MISSOURI*	TOTAL
	USFWS OWNED	CORPS OWNED*				
11	6800	11020				17820
12	852	8373				9225
13	6888	22511	827			30226
14	1079	5349	342			6770
15						
16			1548	4492		6040
17		4366	2931	1313		8610
18		1400	4314	2872		8586
19						
20						
21		4831		2556	747	8134
22				3479	1789	5268
TOTAL	15619	57850	9962	14712	2536	100679

*LANDS UNDER COOPERATIVE AGREEMENT WITH THE USFWS AND CORPS

(NOTE, THESE FIGURES INCLUDE FEDERALLY OWNED LANDS ONLY) none of the natural resource agencies contemplate future backwater rehabilitation projects, or if they do, have relegated them to a low priority.

The Corps of Engineers, on the other hand, owns most of the river lands but lacks authority to perform physical alterations for the benefit of fish and wildlife unless it can be demonstrated that channel maintenance activities clearly caused the problem (Norris, 1974).

II. D. Problems Identified

Table 5 lists the problems which the Side Channel Work Group has identified either through personal knowledge, the Side Channel Inventory (Section III. C.) or which were brought to the Work Group's attention by members of the public. Problems numbered 1-10 are of a general nature and encompass the remaining site specific problems.

The Work Group placed priorities on the site specific problems in the following manner:

Priority 1 - sites which have lost considerable habitat value and which continue to lose habitat value at a rapid rate. Remedial action is required immediately if the area is to be preserved.

Priority 2 - sites which may be losing habitat values at a slower rate and should be monitored; or sites which can wait for remedial action until money, equipment, and or authorization becomes available.

Priority 3 - sites which have lost considerable habitat value but for which certain conditions render them virtually impossible to restore or maintain. In general, such sites are non-public lands which have been considerably altered by development interests or are lands and aquatic areas which are so hydraulically active that remedial action would involve considerable expenditure of funds and may not even be effective. This category does not imply that no fish and wildlife values exist in the area, however, and they can still be protected through the regulatory authorities of the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency and various state agencies.

In addition to the above, each problem is identified as to its type or probable cause in the following manner:

Type A - related to operation and maintenance of the navigation channel, i.e. dredging and spoil disposal, regulatory structures, bank stabilization, or barge and tow operation.

Type B - related to "natural" causes, i.e. sediment deposition and erosion.

Type C - man-induced causes other than in Type A, i.e. urban/industrial development, recreation, etc.

TABLE 5. PROBLEM IDENTIFICATION - SIDE CHANNEL WORK GROUP

STATEMENT OF PROBLEM	IDENTIFIED		PRIORITY RATING *	TASKS WHICH ADDRESS THE PROBLEM **	RECOMMENDATIONS WHICH ADDRESS THE PROBLEM
	DATE	BY			
1. Natural sedimentation has caused blockages of access and loss of habitat in backwaters and side channels.	1/78	SCWG		1,2,3,4,7	#3505, 3504, 3505, 3508, 3510, 3511
2. Deposition of dredged material has caused blockages of access and loss of habitat in side channels and backwaters.	1/78	SCWG		1,4,6,7	#3501, 3502 3504
3. Regulatory structures have caused blockages of access and loss of habitat in side channels and backwaters.	1/78	SCWG		1,2,4,7	#3507
4. The effects of altering flows into backwaters are not adequately documented or understood.	1/78	SCWG		1,2,3,7	#3504, 3508, 3512
5. The equipment required to alter a backwater in an environmentally sound manner may not exist.	1/78	SCWG		5,7	#3510
6. Side channels requiring alteration need to be identified and documented.	1/78	SCWG		3,7	#3503, 3504
7. Resource managers need the capability to predict the biological consequences of backwater alterations.	1/78	SCWG		3,7	#3512
8. The fixed portions of dams prevent river flows into the backwaters immediately below them.	1/78	SCWG		4,7	#3504
9. The Corps has no authority to alter side channels except where they are blocked by channel maintenance activities.	1/78	SCWG		7	#3504
10. Operations of barge tows during low flows resuspend sediments that ultimately may settle in backwater areas.	11/1/79	SCWG		1,7	None

* REFER TO PAGE II-45 ** REFER TO TABLE 6

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STATEMENT OF PROBLEM	IDENTIFIED		PRIORITY RATING *	TASKS WHICH ADDRESS THE PROBLEM **	RECOMMENDATIONS WHICH ADDRESS THE PROBLEM
	DATE	BY			
11. Dam 10 (RM 615.1 L). Dam truncates flow to Cassville Slough.	11/1/79	SCWG	1A	4,7	#3504
12. Cassville Slough (RM 614.9 L). Closing structure impedes flow to backwaters.	11/1/79	SCWG	1A	4,7	#3504
13. Swift Slough (RM 614.5 L). Sedimentation of backwater. Dam prevents flow.	11/1/79	SCWG	2A/2B	4,7	#3503
14. Ackerman's Cut (RM 613.9 L). High flows contribute to sedimentation of Cassville Slough.	pre-GREAT	ICC & COE	1B	7	#3504
15. Cassville Slough (RM 612 - 614 L). Sedimentation in backwaters.	pre-GREAT	ICC & COE	1B	7	#3504
16. Goetz Island Side Channel (RM 613.0 - 614.5 R). Blocked by sand.	11/1/79	SCWG	1B	4,7	#3504
17. Goetz Island (RM 613.2 R). Spoil blocked backwaters.	pre-GREAT	Inter-agency	1A	4,7	#3504
18. Goetz Slough (RM 612.5 R). Sedimentation in backwaters aggravated by spoil (#19).	11/1/79	SCWG	2A/2B	4,7	#3503
19. Goetz Slough (RM 612.5 R). Blocked by spoil.	11/1/79	SCWG	2A	4,7	#3503
20. RM 612.3 - 613.0 L. Spoil in side channel.	11/1/79	SCWG	2A	4,7	#3503

* REFER TO PAGE II-45 ** REFER TO TABLE 6

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STATEMENT OF PROBLEM	IDENTIFIED		PRIORITY RATING *	TASKS WHICH ADDRESS THE PROBLEM **	RECOMMENDATIONS WHICH ADDRESS THE PROBLEM
	DATE	BY			
21. RM 610 - 611 R. Spoil in backwaters.	11/1/79	SCWG	2A	4,7	#3503
22. Jack Oak Slough (RM 605.9 L). Erosion and redeposition in side channel.	11/1/79	SCWG	1B	4,7	#3504
23. Jack Oak Island (RM 604.9 - 605.7 L). Sedimentation aggravated by regulatory structures.	pre-GREAT	Inter-agency	2A/2B	4,7	#3503
24. N. Buena Vista (RM 604.3 R). Spoil in backwaters.	11/1/	SCWG	2A	4,7	#3503
25. Sand Cut (RM 604.0 L). Erosion and redeposition.	1/16/80	SCWG	2B	4,7	#3503
26. Bunker Chute (RM 603.0 R). Closing structure prevents access.	1/16/80	SCWG	1A	4,7	#3504
27. Coal Pit Chute (RM 602.5 L). Blocked by natural accretion of sand.	pre-GREAT	Inter-agency	2B	4,7	#3503
28. Bertom Lake (RM 602.5 L). Sedimentation in backwaters.	11/1/79	SCWG	1B	4,7	#3504
29. Kruse's Bar (RM 601.3 L). Blocked by natural accretion.	11/1/	SCWG	2B	4,7	#3503
30. RM 600.3 L. Blocked by natural accretion.	11/1/	SCWG	2B	4,7	#3503

* REFER TO PAGE II-45 ** REFER TO TABLE 6

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STATEMENT OF PROBLEM	IDENTIFIED		PRIORITY RATING *	TASKS WHICH ADDRESS THE PROBLEM **	RECOMMENDATIONS WHICH ADDRESS THE PROBLEM
	DATE	BY			
31. RM 599.5 L. Sedimentation in backwaters.	11/1/79	SCWG	1B	4,7	#3504
32. Hurricane Island and Chute (RM 597.0 - 598.5 L). Spoil in backwaters and regulatory structures gone.	pre-GREAT	Inter-agency	1A	4,7	#3504
33. Dam 11/U.S. 61 (RM 583.1 L). Dam prevents flow to backwaters.	1/16/80	SCWG	1A	4,7	#3504
34. Stump Island (RM 582.0 L). Sedimentation in backwaters aggravated by Dam 11 (#33).	11/1/79	SCWG	1B	4,7	#3504
35. Dubuque Area (RM 580 - 582 R). "Complete loss of backwaters" presumably Hamm Island.	9/77	Public	3C	4,7	None
36. Industrial Chemical Light (RM 578.0 - 579.0 L). Spoil, natural accretion and development impacted backwaters.	pre-GREAT	Inter-agency	1A/1B/1C	4,7	#3504
37. Molo Slough (RM 574.2 R). Spoil from pipeline construction.	11/1/79	SCWG	2C	4,7	#3503
38. Below Menominee River (RM 574.0 L). Sedimentation in backwaters.	11/1/79	SCWG	2B	4,7	#3503
39. Nine Mile Island (RM 572.6 R). Spoil in entrance to side channel.	pre-GREAT	Inter-agency	2A	4,7	#3503
40. Deadman Slough (RM 569.0 L). Sedimentation in side channel.	11/1/79	SCWG	2B	4,7	#3503

* REFER TO PAGE II-45   ** REFER TO TABLE 6

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STATEMENT OF PROBLEM	IDENTIFIED		PRIORITY RATING *	TASKS WHICH ADDRESS THE PROBLEM **	RECOMMENDATIONS WHICH ADDRESS THE PROBLEM
	DATE	BY			
41. Below Sinsinawa River (RM 566.7 - 569.0 L). Sedimentation in backwaters.	11/1/79	SCWG	2B	4,7	#3503
42. Harris Slough (RM 564 - 566 L). Sedimentation in backwaters.	11/1/79	SCWG	1B	4,7	#3504
43. Stone Slough (RM 563.5 L). Sedimentation in backwaters.	11/1/79	SCWG	2B	4,7	#3503
44. Aiken's Landing/Wise Lake (RM 561.5 - 562.5 L). Sedimentation in backwaters.	11/1/79	SCWG	2B	4,7	#3503
45. Wise Lake Cut (RM 560.8 L). Sedimentation in cut.	11/1/79	SCWG	2B	4,7	#3503
46. Above Lock and Dam 12 (RM 556.7 - 560.0 L). Sedimentation in lower pool.	11/1/79	SCWG	2B	4,7	#3503
47. Dam 12 (RM 556.7 L). Dam prevents flow to backwaters.	11/1/79	SCWG	1A	4,7	#3504
48. RM 550.7 R. Sedimentation (possibly spoil) in mouth of side channel.	pre-GREAT	Inter-agency	2A/2B	4,7	#3503
49. Casey's Island (RM 550.1 R). Spoil in side channel.	pre-GREAT	Inter-agency	2A	4,7	#3503
50. Savanna Proving Grounds (RM 546.5 L). Sedimentation or spoil in backwaters.	11/1/79	SCWG	2A/2B	4,7	#3503

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STATEMENT OF PROBLEM	IDENTIFIED		PRIORITY RATING *	TASKS WHICH ADDRESS THE PROBLEM **	RECOMMENDATIONS WHICH ADDRESS THE PROBLEM
	DATE	BY			
51. Lainsville Slough (RM 545.8 R). Side channel blocked by debris and sediment.	pre-GREAT	Inter-agency	1B	4,7	#3504
52. Brown's Lake Complex (RM 544 - 546 R). Sedimentation in backwaters.	11/1/79	SCWG	2B	4,7	#3503
53. Marcus Bottoms Entrance (RM 543.3 L). Sedimentation in backwaters.	11/1/79	SCWG	2B	4,7	#3503
54. Pin Oak Lake (RM 541.9 R). Blocked by debris and sediment.	11/1/79	SCWG	1B	4,7	#3504
55. Savanna Bay/Millers Bay (RM 539.5 - 541.0 L). Sedimentation in backwaters.	11/1/79	SCWG	2B	4,7	#3503
56. Santa Fe Island/Lainsville Light (RM 540 - 541.5 L). Spoil and redeposition in area.	pre-GREAT	Inter-agency	2A	4,7	#3503
57. Boy Scout Islands (RM 538.8 R). Sedimentation in side channel.	pre-GREAT	Inter-agency	2B	4,7	#3503
58. Sabula/Keller's Island Area (RM 535.6 - 540.0 R). "Clear slough, dredge lake".	9/77	public	2B	4,7	#3503
59. Savanna Island (RM 533.5 - 537 L). Sedimentation in backwaters.	11/1/79	SCWG	2B	4,7	#3503
60. Spring Lake Levee (RM 531 - 534 L). Breaks in levee contribute to sedimentation of lake.	11/1/79	SCWG	1B	4,7	#3504

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STATEMENT OF PROBLEM	IDENTIFIED		PRIORITY RATING *	TASKS WHICH ADDRESS THE PROBLEM **	RECOMMENDATIONS WHICH ADDRESS THE PROBLEM
	DATE	BY			
61. Savanna Slough (RM 531 - 533.5 L). Creation and enlargement of dredged material islands.	11/1/79	SCWG	2A	4,7	#3503
62. Cook's Island (RM 532 R). Sedimentation in backwaters.	11/1/79	SCWG	2B	4,7	#3503
63. Big Slough (RM 531 L). Sedimentation due to breaks in Spring Lake Levee (#60).	11/1/79	SCWG	2B	4,7	#3503
64. Thomson (RM 528.0 L). Side channel blocked by fill-subsequent sedimentation.	11/1/79	SCWG	2B/C	4,7	#3503
65. Potter's Slough (RM 524 - 526 L). Sedimentation in side channel.	1/16/80	SCWG	2B	4,7	#3503
66. Michelson's Landing (RM 516.8 R). Sedimentation in area.	11/1/79	SCWG	2B	4,7	#3503
67. Dam 13 (RM 522.5 R). Dam truncates flow to backwaters.	11/1/79	SCWG	1A	4,7	#3504
68. RM 521.5 - 522.5 R Sedimentation in backwaters.	11/1/79	SCWG	2B	4,7	#3503
69. Johnson Creek (RM 521.5 - 522.5 L). Sedimentation in backwaters.	11/1/79	SCWG	2B	4,7	#3503
70. Joyce's Island (RM 519.5 R). Spoil in backwaters.	pre-GREAT	Inter-agency	2A	4,7	#3503

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STATEMENT OF PROBLEM	IDENTIFIED		PRIORITY RATING *	TASKS WHICH ADDRESS THE PROBLEM **	RECOMMENDATIONS WHICH ADDRESS THE PROBLEM
	DATE	BY			
71. Little Rock Island (RM 518.7 L). Spoil at entrance to side channel.	11/1/79	SCWG	2A	4,7	#3503
72. RM 517.3 L. Sedimentation in backwaters.	11/1/79	SCWG	2B	4,7	#3503
73. Sunfish Slough/Beaver Island (RM 516.8 R). Sedimentation in backwaters.	11/1/79	SCWG	2B	4,7	#3503
74. Sunfish/Cattail Slough (RM 516 - 518 L). "Blocked by spoil" (sedimentation).	9/77	public	1B	4,7	#3504, 3508
75. Hanson Slough (RM 509.5 R). Spoil in side channel.	11/1/77	SCWG	2A	4,7	#3503
76. Cordova Nuke (RM 505.9 L). Spoil among islands.	11/1/77	SCWG	2A	4,7	#3503
77. Steamboat Slough (RM 504.5 R). Sedimentation in side channel.	11/1/79	SCWG	2B	4,7	#3503
78. Cordova Slough (RM 503.9 R). Spoil in entrance to backwater.	pre-GREAT	Inter-agency	2A	6,7	#3503
79. Cordova Slough (RM 503.8 R). Spoil in entrance to backwater.	pre-GREAT	Inter-agency	2A	6,7	#3503
80. Arsenal Island (RM 482.7 L). Spoil in backwaters.	11/1/79	SCWG	2A	4,7	#3503

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STATEMENT OF PROBLEM	IDENTIFIED		PRIORITY RATING *	TASKS WHICH ADDRESS THE PROBLEM **	RECOMMENDATIONS WHICH ADDRESS THE PROBLEM
	DATE	BY			
81. Davenport Harbor (RM 480.5 R). Sedimentation in backwaters.	11/1/79	SCWG	2B	4,7	#3503
82. Big Island (RM 479.0 L). Filling due to highway construction.	11/1/79	SCWG	3C	4,7	
83. Andalusia Island (RM 463.5 - 466.5 L). Sedimentation in backwaters.	11/1/79	SCWG	1B	4,7	#3504
84. Dead Slough (RM 461.5 - 464.0 L). Sedimentation in backwaters.	11/1/79	SCWG	1B	4,7	#3504
85. Wyoming Slough (RM 461.5 R). Spoil in wetlands.	11/1/79	SCWG	3A	4,7	
86. Wyoming Slough (RM 458 - 461 R). Sedimentation in backwaters.	11/1/79	SCWG	1B	4,7	#3504
87. Drury Slough (RM 459 - 461 L). Sedimentation in backwaters.	11/1/79	SCWG	1B	4,7	#3504
88. Muscatine Island (RM 453 - 454 L). Spoil among islands.	11/1/79	SCWG	2A	4,7	#3503
89. Blanchard Island Chute (RM 452.3 L). Spoil from pipeline construction.	11/1/79	SCWG	2C	4,7	#3503
90. Blanchard Island (RM 449 L). Sedimentation aggravated by regulatory structures.	11/1/	SCWG	1A/1B	4,7	#3504

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STATEMENT OF PROBLEM	IDENTIFIED		PRIORITY RATING *	TASKS WHICH ADDRESS THE PROBLEM **	RECOMMENDATIONS WHICH ADDRESS THE PROBLEM
	DATE	BY			
91. Kilpeck Island (RM 448 R). Spoil above side channel.	11/1/79	SCWG	2A	4,7	#3503
92. Bogus Island (RM 441 - 444 L). Sedimentation in backwaters.	1/16/80	SCWG	2B	4,7	#3503
93. Turkey/Otter Islands (RM 437.3 - 438.7). Sedimentation in backwaters.	11/1/79	SCWG	3B	4,7	
94. Keg Island (RM 436 R). Sedimentation in backwaters.	11/1/79	SCWG	2B	4,7	#3503
95. Keg Slough (RM 433.7 - 435.0 L). Spoil blocked backwaters.	11/1/79	SCWG	3A	4,7	
96. Sturgeon or Boston Bay (RM 433 - 434 L). "Shallow due to sedimentation".	9/77	public	1B	4,7	#3504
97. RM 429.2 - 430.8 R. Sedimentation in backwaters aggravated by regulatory structures.	11/1/79	SCWG	1A/1B	4,7	#3504
98. Blackhawk Island (RM 427 R). Sedimentation in backwaters.	11/1/79	SCWG	1B	4,7	#3504
99. Blackhawk Island (RM 427 R). Spoil blocked side channel.	11/1/79	SCWG	3A	4,7	
100. Willow Bar/Mapes Island (RM 426 L). Spoil blocked side channel.	11/1/	SCWG	2A	4,7	#3503

* REFER TO PAGE II-45   ** REFER TO TABLE 6

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STATEMENT OF PROBLEM	IDENTIFIED		PRIORITY RATING *	TASKS WHICH ADDRESS THE PROBLEM **	RECOMMENDATIONS WHICH ADDRESS THE PROBLEM
	DATE	BY			
101. Snipe Island (RM 424.7 L). Spoil and natural accretion in side channel.	pre-GREAT	Inter-agency	3A/3B	4,7	
102. Kingston Bar (RM 424 R). Spoil and natural accretion in side channel.	pre-GREAT	Inter-agency	1A/1B	4,7	#3504
103. Campbell Island (RM 419.5 - 423.3 L). Sedimentation in backwaters.	11/1/79	SCWG	1B	4,7	#3504
104. Johnson Island (RM 420 - 421 R). Sedimentation in backwaters.	11/1/79	SCWG	2B	4,7	#3503
105. Camp Island (RM 419.7 R). Spoil in side channel.	pre-GREAT	Inter-agency	2A	4,7	#3503
106. Benton Island (RM 419 L). Sedimentation in backwaters.	11/1/79	SCWG	2B	4,7	#3503
107 Swift Slough (RM 410 R). Natural accretion in side channel.	11/1/79	SCWG	2B	4,7	#3503
108. Otter Slough (RM 407 - 409 R). Spoil and natural accretion in side channel.	11/1/79	SCWG	1A/1B	4,7	#3504
109. Otter Island (RM 408.5 R). Spoil in side channel.	11/1/79	SCWG	1A	4,7	#3504
110. Rush/Baby Rush Islands (RM 406.2 R). Spoil in entrance to side channel.	pre-GREAT	Inter-agency	1A	4,7	#3504

* REFER TO PAGE II-45 ** REFER TO TABLE 6

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STATEMENT OF PROBLEM	IDENTIFIED		PRIORITY RATING *	TASKS WHICH ADDRESS THE PROBLEM **	RECOMMENDATIONS WHICH ADDRESS THE PROBLEM
	DATE	BY			
111. Willow Bar Island (RM 406 L). Sedimentation in side channel aggravated by regulatory structures.	pre-GREAT	Inter-agency	2B	4,7	#3503
112. Gulfport (RM 405 L). Natural accretion in backwaters.	11/1/79	SCWG	2B	4,7	#3503
113. Shokokon Slough (RM 402 L). Sedimentation in side channel.	11/1/79	SCWG	2B	4,7	#3503
114. Millman's/Vaughn Lake (RM 397 - 400 L). Sedimentation in backwaters.	1/16/80	SCWG	2B	4,7	#3503
115. Turkey Chute (RM 395 - 396.5 L). Sedimentation in backwaters.	11/1/79	SCWG	2E	4,7	#3503
116. RM 394.5 R. Log jam blocking side channel.	11/1/79	SCWG	1B	4,7	#3504
117. RM 393 - 394 R. Spoil and natural accretion in side channel.	11/1/79	SCWG	3A/3B	4,7	
118. RM 393 L. Sedimentation in backwaters.	11/1/79	SCWG	3B	4,7	
119. Grape Island (RM 392.5 R). Sedimentation aggravated by regulatory structures.	11/1/79	SCWG	3A/3B	4,7	
120. Grape Island (RM 391 R). Sedimentation in backwaters.	11/1/79	SCWG	1B	4,7	#3504

* REFER TO PAGE II-45 ** REFER TO TABLE 6

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STATEMENT OF PROBLEM	IDENTIFIED		PRIORITY RATING *	TASKS WHICH ADDRESS THE PROBLEM **	RECOMMENDATIONS WHICH ADDRESS THE PROBLEM
	DATE	BY			
121. Lead Island (RM 387.3 R). Sedimentation in backwaters.	11/1/79	SCWG	3B	4,7	
122. Lead Island (RM 385.5 R). Sedimentation in backwaters.	11/1/79	SCWG	3B	4,7	
123. Tyson Creek (RM 383.0 L). "Filling in".	9/77	public	2B	4,7	#3503
124. Rabbit Island (RM 379.5 R). "Needs opening".	9/77	public	2B	4,7	#3503
125. Devil's Creek (RM 377 R). Sedimentation at mouth.	11/1/79	SCWG	2B	4,7	#3503
126. Chaney Creek (RM 365 L). Sedimentation in mouth of creek. Ramp inaccessible.	11/1/79	SCWG	2B	4,7	#3503
127. Grey Chute (RM 358.3 R). Closing structure blocks chute.	pre-GREAT	Inter-agency	2A	4,7	#3503
128. Kusie Island (RM 357.5 L). Sedimentation in side channel.	11/1/79	SCWG	2B	4,7	#3503
129. Hackley Chute (RM 355 L). Spoil above chute.	pre-GREAT	Inter-agency	3A	4,7	
130. Hackley Island (RM 354 L). Spoil and natural accretion in area.	11/1/79	SCWG	3A/3B	4,7	

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STATEMENT OF PROBLEM	IDENTIFIED		PRIORITY RATING *	TASKS WHICH ADDRESS THE PROBLEM **	RECOMMENDATIONS WHICH ADDRESS THE PROBLEM
	DATE	BY			
131. Taylor Chute (RM 353 L). Regulatory structure, spoil and natural accretion blocking chute.	pre-GREAT	Inter-agency	1A/1B	4,7	#3504
132. Huff/Hunt Islands (RM 349 - 350 L). Sedimentation in side channel due to deteriorated structures.	11/1/79	SCWG	1A/1B	4,7	#3504
133. Huff Island (RM 348.0 L). Spoil and natural accretion filled side channel.	11/1/79	SCWG	2A/2B	4,7	#3503
134. Blue Goose Island (RM 346.5 L). Natural accretion and possibly spoil in backwaters.	11/1/79	SCWG	2A/2B	4,7	#3503
135. Missouri Chute (RM 346 R). Sedimentation in side channel.	11/1/79	SCWG	2B	4,7	#3503
136. RM 342 - 343 L. Spoil placed above Canton Chute.	11/1/79	SCWG	3A	4,7	
137. Canton Chute Upper (RM 342 L). Natural accretion and possibly spoil in entrance to chute.	11/1/79	SCWG	2A/2B	4,7	#3503
138. Dave's Chute (RM 341 L). Sedimentation in side channel.	11/1/79	SCWG	2B	4,7	#3503
139. Bear Creek Recreation Area (RM 341.0 L). "Needs opening".	9/77	public	1B	4,7	#3504
140. Smoot's Chute (RM 340.5 L). "Filling in".	9/77	public	2B	4,7	#3504

* REFER TO PAGE II-45 ** REFER TO TABLE 6

TABLE 5. PROBLEM IDENTIFICATION - SIDE CHANNEL WORK GROUP

STATEMENT OF PROBLEM	IDENTIFIED		PRIORITY RATING *	TASKS WHICH ADDRESS THE PROBLEM **	RECOMMENDATIONS WHICH ADDRESS THE PROBLEM
	DATE	BY			
141. Little LaGrange Island (RM 339.5 L). Side channel filled by spoil and natural accretion.	11/1/79	SCWG	2A/2B	4,7	#3503
142. Wyaconda River (RM 337.3 R). "Blocked at mouth" by spoil.	9/77	public	2A	4,7	#3503
143. LaGrange Island (RM 337 L). Spoil in entrance to side channel.	11/1/79	SCWG	2A	4,7	#3503
144. Long Island (RM 333.5 L). Natural accretion in side channel.	11/1/79	SCWG	1B	4,7	#3504
145. Teal Island (RM 332.5 L) Spoil and sediment block backwaters.	pre-GREAT	Inter-agency	1A/1B	4,7	#3504
146. Cottonwood Island (RM 329.5 - 330.5 R). Side channel blocked by sediment and possibly spoil redeposition.	pre-GREAT	Inter-agency	2A/2B	4,7	#3503
147. Triangle Lake (RM 330 L). Sedimentation in backwaters.	11/1/79	SCWG	1B	4,7	#3504
148. Broad Lake/Quincy Bay (RM 328.0 - 329.3 L). "Cut contributes to sedimentation in area".	9/77	public	1A/1B	4,7	#3504
149. Monkey Chute (RM 325.0 R). Sedimentation in backwaters.	pre-GREAT	Inter-agency	1B	4,7	#3504
150. Orton Island (RM 323.5 R). Sedimentation blocked chute, aggravated by wing dam.	pre-GREAT	Inter-agency	2A/2B	4,7	#3503

* REFER TO PAGE II-45   ** REFER TO TABLE 6

TABLE 5. PROBLEM IDENTIFICATION - SIDE CHANNEL WORK GROUP

STATEMENT OF PROBLEM	IDENTIFIED		PRIORITY RATING *	TASKS WHICH ADDRESS THE PROBLEM **	RECOMMENDATIONS WHICH ADDRESS THE PROBLEM
	DATE	BY			
151. Texas Chute (RM 324.0 L). Spoil blocked chute.	11/1/79	SCWG	1A/1B	4,7	#3504
152. Goose Island (RM 318.5 L). Natural accretion in area.	pre-GREAT	Inter-agency	2B	4,7	#3503
153. Beebe Island (RM 316.7 - 318.5 L). Spoil and sediment from Mill Creek filling backwaters.	pre-GREAT	Inter-agency	1A/1B	4,7	#3504
154. RM 316.0 L. Sedimentation or possibly spoil redeposition in side channel.	11/1/79	SCWG	1A/1B	4,7	#3504
155. Whitney Island (RM 315.5 R). Sedimentation in side channel. Aggravated by regulatory structures.	11/1/79	SCWG	2A/2B	4,7	#3503
156. Turtle Island (RM 312 - 313 L). Spoil and natural accretion in side channel.	11/1/79	SCWG	2A/2B	4,7	#3503
157. Zeigler/Glaucus Island (RM 311.9 R). Spoil placed above entrance to chute.	pre-GREAT	Inter-agency	2A	4,7	#3503
158. RM 302 - 302.5 L. Sedimentation in backwaters.	11/1/79	SVWG	2B	4,7	#3503
159. Cottel Island (RM 300 - 301 L). Sedimentation of side channel. Dam precludes flow.	11/1/79	SCWG	1A	4,7	#3504
160. Near St. Louis Woodyard (RM 611.3 R). Spoil at entrance to backwater.	pre-GREAT	Inter-agency			Not enough information to assess problem.

* REFER TO PAGE II-45 ** REFER TO TABLE 6

TABLE 5. PROBLEM IDENTIFICATION - SIDE CHANNEL WORK GROUP

STATEMENT OF PROBLEM	IDENTIFIED		PRIORITY RATING *	TASKS WHICH ADDRESS THE PROBLEM **	RECOMMENDATIONS WHICH ADDRESS THE PROBLEM
	DATE	BY			
161. Near Island 280 (RM 543.2 L).	pre-GREAT	Inter-agency			Not enough information to assess problem.
162. Bellevue Slough (RM 560 R). "Needs opening".	9/77	public			Not enough information to assess problem.
163. Buzzard Chute (RM 349.5 R).	pre-GREAT				Not enough information to assess problem.
164. Near Smith's Ferry. "Slough filled in".	9/77	public			Not enough information to assess problem.

* REFER TO PAGE II-45 ** REFER TO TABLE 6

Each Site was evaluated and given a priority based upon the value of the affected area to fish, wildlife, recreational boating access, water quality, unique features such as rare or endangered species, or any other pertinent factor. Each problem site is located on river charts (Figures 4-55).

The following is a site specific evaluation of Priority 1 sites. It is provided as justification of the need for immediate action to preserve natural values.

Pool 11

#11 Dam 10 - River Mile 615.1 L. The dam has truncated flow into the backwaters below it. Approximately 40 acres of abandoned fish ponds could benefit from additional flow as well as would 110 acres in the upper end of Cassville Slough and about 100 acres of other slough and lake habitat. Culverts should be placed through the dam at several locations.

#12 Cassville Slough - River Mile 614.9 L. Closing dike prevents water flow through the area. Approximately 50 acres of slough below the dike receives very little circulation and is prone to sedimentation. Fishery habitat and water quality suffers through loss of depth, stagnation and potential winter kills. The dike should be removed or notched near the Wisconsin shoreline.

#14 and #15 Ackerman's Cut - River Mile 613.9 L. This cut funnels up to 29 percent of the rivers discharge through Cassville Slough. The sediment carried into the slough has settled out and made it very shallow. A once important sport and commercial fishery in the slough has virtually disappeared due to the shallow conditions. In 39 years, Cassville Slough lost 16 surface acres and 5,130 acre feet of volume. Approximately 800 acres of side channel habitat are affected. A partial closing structure is being contemplated by the Corps and should be constructed.

#16 Goetz Island Side Channel - River Mile 613.0 to 614.5 R. This side channel is blocked by sand (presumably not spoil) sediment. It comprises about 20 acres of side channel habitat. Loss of water flow causes reduced water quality (low dissolved oxygen, high temperatures), potential winter fish kills, loss of boating access, and increases the sedimentation rate of the area. The side channel should be opened and a closing structure at the entrance considered.

#17 Goetz Island - River Mile 613.2 R. Dredged spoil has blocked access and water flow into approximately 20 acres of backwater habitat. This area is important both as a sport (pan-) fishery and a commercial fishery. The decreased depth and water flows result in low dissolved oxygen concentrations and potential winter fish kills. The spoil should be removed and the backwaters opened.

#22 Jack Oak Slough - River Mile 605.9 L. Erosion of the head of Jack Oak Island has caused sediment accumulation in the slough. Access at the recreational site has been affected as well as fishery habitat. Loss of vegetation, low dissolved oxygen, decreased depth, and potential winter fish kills are among the impacts. The head of Jack Oak Island should riprapped

#26 Bunker Chute - River Mile 603.0 L. Access to this 110 acre side channel is precluded from the north by a closing structure. The closing structure should be notched.

#28 Bertom Lake - River Mile 602.5L. This 65 acre backwater has lost approximately 50% of its water surface area to sedimentation and vegetation. In addition to the loss of fishery habitat, the decreased depth, low dissolved oxygen, and increased turbidity increase potential for winter fishkills. A significant loss of boating access has also occurred. The lake and access should be dredged.

#31 River Mile 599.5L. Approximately 40 acres of backwater habitat is being lost to sedimentation and vegetation. Such areas are valuable spawning and nursery habitat and, if left unaltered, will eventually succeed to bottomland hardwood forest. This backwater area should be dredged.

#32 Hurricane Island and Chute. River Mile 597-599L. Dredged spoil deposited on the island has filled secondary side channels and backwaters. Spoil placed above the chute has eroded and redeposited in the chute. Furthermore, the wing dike above the chute is virtually gone and the closing structure is disconnected from the island. All of the above have contributed to a loss of aquatic vegetation, decreased depths and limited boating access, stagnated water and reduced fishing potential in the area. Approximately 250 acres are affected. The wing and closure dikes should be rebuilt and the backwaters cleared of dredged material.

<u>Pool 12</u>

#33 Dam 11 - Highway 61. River Mile 583.1L. Dam and Highway construction truncated flow to approximately 160 acres of backwaters. Heavy accumulations of silt appear to have decreased submergent and emergent vegetation. The area is nearly sterile. Furbearer populations have declined. Culverts placed in the fixed portion of the dam (highway embankment) may scour some of the accumulated silt and improve water quality.

#34 Stump Island. River Mile 582.0L. Described in #33 above.

#36 Industrial Chemical Light. River Mile 578-579L. Dredged material, natural accretion and development has impacted this area. Islands have been created but at the expense of aquatic habitat. Side channels should be opened for small boat access.

#42 Harris Slough. River Mile 565.5L. Approximately 30 acres of backwaters above the Galena River have been converted to non-aquatic habitat due to siltation and Harris Slough could easily become completely blocked. If this happens, the loss of flow could affect hundreds of acres of backwater habitat fed by the slough. In addition, boating access through the area is limited to high water conditions. These backwaters should be kept open.

Pool 13

#47 Dam 12. River Mile 556.7L. The fixed portion of Dam 12 truncated large acreages of backwaters now within the Savanna Proving Grounds. This area is extremely valuable primarily for its relatively undisturbed nature (the general public is excluded.) Culverts placed in the dam could benefit 500 acres of now stagnant backwaters. Culverts should be placed in the fixed portion of the dam.

#51 Lainsville Slough. River Mile 545.8R. This side channel was opened in 1975 (see Appendix Section III.E.3) and work was again performed in 1979. However, additional blockages may occur in the slough. In as much as the slough provides a water source to a very large backwater complex (Upper and Lower Brown's Lake - 600 acres) and provides an important access for recreational boaters, the slough should be kept open.

#54 Pin Oak Lake. River Mile 541.9R. This important backwater fishery habitat is associated with Brown Lake and Lainsville Slough (see Problem #51). It serves as a primary site for public fishing and hunting although boat access is marginal. Approximately 250 acres are involved. Any blockage of debris and sediment should be removed.

#60 Spring Lake Levee. River Mile 531-534L. This diked area was a former levee and drainage district which was abandoned at the time of lock and dam construction. At the present time, the U.S. Fish and Wildlife Service manages the area under Cooperative Agreement with the Corps of Engineers. Several breaks in the levee makes water level management impossible and also contributes to the sedimentation of the lake. Furthermore, Big Slough (problem #63) is receiving sedimentation as a result of the levee breaks. Repair of the levee will restore fish and wildlife values on 2,000 acres of backwaters.

#67 Dam 13. River Mile 522.5R. The dam truncates flow to about 115 acres of backwaters near Clinton, Iowa. Culverts placed in the fixed portion of the dam would preserve fishery values.

Pool 14

#74 Sunfish Slough/Catfish Slough. River Mile 516-518L. This backwater has received heavy accumulations of sediment and boating access to parts is impossible. The area is slated for dredging in relation to the Fulton Levee Project and a follow-up study of fishery response and spoil site management is planned. Habitat improvement in 180 acres of backwaters is expected.

Pool 16

#83 Andalusia Island. River Mile 464-468L. Nearly the entire island complex is undergoing rapid sedimentation. The backwater area is extremely valuable as fish and wildlife habitat and services much of the recreational needs of the Quad Cities urban area. Dredging out selected areas and opening filled access channels would greatly benefit this resource.

#84 Dead Slough. River Mile 461.5-464.0L. Approximately 200 acres of backwater habitat has succeeded to dense, homogenous beds of lotus. The area is too shallow for fisheries other than for spawning and nursery habitat. Boating access is impossible. Selected areas (holes) and channels could be dredged in the area to benefit fish without compromising wildlife values.

#86 Wyoming Slough. River Mile 458-461R. The same conditions prevail as in problem #83.

#87 Drury Slough. River Mile 459-461L. The same conditions prevail as in problem #84.

Pool 17

#90 Blanchard Island. River Mile 449L. Sedimentation in the area is aggravated by the closing dam at the lower end of the island. Fishery values are moderate but decreasing. Approximately 84 acres are affected.

Pool 18

#96 Sturgeon-Boston Bay. River Mile 433-434L. This large backwater area (335 acres) is a valuable fishery and heavily used by recreationists. It acts, however, as a very efficient sediment trap and is rapidly filling in. During low water years, nearly the entire bay is exposed as a mud flat. At times, agricultural runoff from the adjacent drainage district causes water pollution. Selected areas of the bay could be dredged to improve fishery utilization and access.

#97 River Mile 429.2-430.8R. This small (30 acres) backwater area is losing aquatic habitat due to sedimentation. It is partially dry at certain river stages. The problem may be related to the regulatory structures in the area. Presently, fishery values are low but wood duck use occurs. The wing dike could be modified to improve flow to the backwaters.

#98 Blackhawk Island. River Mile 427R. Another small (30 acre) backwater area is suffering from sedimentation and access can be impossible at low flows. Fishery and waterfowl values are high. Selected areas should be dredged.

#102 Kingston Bar. River Mile 424.4L. Spoil and natural accretion has plugged this side channel. In addition, the wing dike probably retards flow. Approximately 8 acres could be restored by opening the side channel.

#103 Campbell Island. River Mile 419.5-423.3L. This large backwater complex is extremely valuable to riverine fish species and waterfowl. Hunting is managed by the Illinois Department of Conservation and blind sites are provided. Approximately 100 acres have been lost to sedimentation and access can be impossible at low flows. The Burnt Pocket backwater opening and study (see Section III.B.) was located here. Selected areas could be dredged to improve access and fishery utilization.

Pool 19

#108 Otter Slough. River Mile 407-409R. This side channel is experiencing severe loss of aquatic habitat due to natural accretion and the deposition of dredged material. The problem may be related to the closing structures at the upper end of the slough. Access through the area is poor and fishing values are currently low. Approximately 250 acres are affected. The aggraded sand could be mined.

#109 Otter Island, River Mile 408-408.7R. Spoil disposal has caused a blockage of approximately 10 acres of side channel habitat. This area should be opened.

#110 Rush-Baby Rush Island. River Mile 406.2R. This small side channel between these two islands has been completely blocked by dredged material. Approximately 15 acres of side channel habitat are affected. The area should be reopened.

#116 River Mile 394.5. A log jam between the upper island and the shoreline prevents access and impedes flow through the area. Fishery values are relatively low but the jam should be opened.

#120 Grape Island. River Mile 391.0-392.5R. Seventy-two acres of backwater habitat in the lower end of this island have suffered severe sedimentation. Fishery values have been lost and the area is now progressing beyond waterfowl values. The loss is significant in the area. Selected areas should be dredged open.

Pool 20

#131 Taylor Chute. River Mile 353L. This area is receiving very large amounts of natural sediment deposition and the Corps of Engineers have disposed of dredged material above the chute. A partial closing structure in the chute may also be contributing to the loss of boating access through the area. Although it is extremely doubtful that the aggradation above Taylor Chute can be stopped, an attempt should be made to maintain access through the chute. This may ultimately prove to be a lost cause. Approximately 75 acres of side channel habitat are affected.

132 Huff-Hunt Islands. River Mile 349-350L. Much sedimentation has taken place in the side channel behind Huff and Hunt Islands due to spoil disposal above the side channel and to the deteriorated condition of the closing dikes. The Corps is proposing to repair these dikes and build them higher to restrict flow and sediment from entering the backwater. Boating access will not be precluded, however. Approximately 300 acres of side channel habitat are involved.

Pool 21

#139 Bear Creek Recreation Area. River Mile 341.0L. This recreational access area is located in Canton Chute and has been affected by the shifting sands in the chute or possibly by spoil disposal near the entrance to the chute. The access area should be dredged out.

#144 Long Island. River Mile 333.5L. Natural accretion has filled the small 15 acre side channel between Long Island and two small islands. Such areas are important for the river fishes which rank highest in sport and commercial value (catfish, carp, buffaloes and drum).

#145 Teal Island. River Mile 432.5L. Spoil and sediment aggradation is blocking off the only entrance to the backwaters of Long Island. This opening should be maintained to provide access for both fish and fishermen to approximately 150 acres of backwaters.

#147 Triangle Lake. River Mile 330L. This area essentially acts as a settling basin for the effluent from the Indian Grave Drainage District. The perimeter has been diked but there is a breach at the lower end. Such backwaters are valuable to the pan fishery (crappie, bluegill, bass) but can result in winter fish kills when too shallow. Dredging access channels and deep holes for fish could improve the habitat of this 240 acre area.

#148. Broad Lake-Quincy Bay. River Mile 328-329.3L. A man-made cut from the main channel to these backwaters has resulted in severe sedimentation of this once valuable area. Many other changes have occured as a result of realignment of the Burlington Northern Railroad bridge. The cut should be completely filled or modified to drastically reduce the sediment inflow to the area. Approximately 100 acres of backwaters have been severely degraded and the loss continues at a rapid rate.

#149 Monkey Chute. River Mile 325.0R. This small backwater area (58 acres) just above Lock and Dam 21 is experiencing sedimentation. Access channels and holes should be dredged to maintain this habitat for fish and fishermen.

Pool 22

#151 Texas Chute. River Mile 324.0L. The Corps placed dredged material at this site in the past. However, being located on the inside of a bendway, it is probably also an area of natural accretion. Sand mining has taken place in the area for some years without apparently diminishing the supply. However, approximately 42 acres of Texas Chute have had its water supply cut off. If an opening cannot be maintained at the present location, perhaps a new opening should be constructed further upstream.

#153 Beebe Island. River Mile 316.7-318.5L. Primarily, large amounts of sand are being deposited by Mill Creek in the area. The Corps has also spoiled in the area. Approximately 53 acres of side channel has closed off as a result. Perhaps the Mill Creek outlet could be re-aligned if this backwater cannot be kept open.

#154 River Mile 316.0L. This small side channel (3 acres) has closed off either from natural sedimentation or spoil redeposition. These small side channels are important to riverine fishes such as carp, buffaloes, drum and catfish.

#159 Cottel Island. River Mile 300-301L. Dam 22 prevents flow from passing behind Cottel Island and sedimentation is the result. Eighty five acres could be maintained if culverts were placed in the fixed portion of the dam.

In addition, the work group developed the following criteria for the determination of appropriate actions in priority 1 backwaters.

A. The FWIC will consult a qualified hydraulic engineer for opinions and recommendations. The following data should be obtained to aid the FWIC in their decision of appropriate remedial action:

   (1) River stage gage readings at the upper and lower ends of the project area.
   (2) Soil borings.
   (3) Hydrographic surveys.
   (4) Water volume and surface area.
   (5) Turnover rates at various stages.
   (6) Water profiles and stage frequencies.
   (7) Stage-discharge relationships for various alternative actions.
   (8) Compute flow necessary for various turnover times.
   (9) Estimate sediment input (if possible) at various stages.
   (10) Biological composition, density, distribution and seasonal variations.
   (11) Dissolved oxygen content and temperature of water.

B. Apply these data to available mathematical models designed to predict the biological consequences of physical alternatives.

   Consider such alternative actions as:

   (1) Diking the perimeter of the area to prevent high water overflows.
   (2) Dredging all or parts of the backwater.
   (3) Opening a channel into the area to provide additional fresh-water flow.
   (4) Closing an existing source of flow partially or completely.
   (5) Utilizing culverts, gated culverts, movable dams, or other water control type structures.
   (6) Utilizing various types of construction equipment such as a barge crane, crawler crane, hydraulic dredge, dynamite, etc.

C. Make a value judgement of the appropriate action based upon:

(1) The intended management goal of the area.
(2) The physical and biological characteristics of the backwater.
(3) The availability of equipment and materials.
(4) The feasibility of the various alternatives.
(5) Cost
(6) Expected benefits (tangible and intangible).

II. E. Work Group Objectives

The Side Channel Work Group has identified the following overall and sub-objectives:

Overall Objectives - To make resource management recommendations that will insure the protection and/or enhancement of fish and wildlife resources and their enjoyment and utilization by the public in off-channel (side channel, backwater) areas; this being in the context of an artificially controlled, riverine ecosystem operated and maintained for commercial navigation.

Sub-objectives -

To inventory and characterize backwaters with respect to their physical and biological components.

To estimate the losses of backwater habitat due to sedimentation since lock and dam construction.

To identify instances of dredge spoil disposal where it has adversely affected backwater and side channel habitat.

To recommend the type of action and methodology or the studies to determine the necessary action to alleviate the problems identified by the above.

To alter specific backwaters and side channels should such projects prove beneficial.

To develop the capability to predict the biological consequences of physical alterations to side channels and backwaters.

To recommend the design specifications of equipment capable of working in backwaters in the most environmentally sensitive manner.

II. F. Work Group Tasks

Work Group Tasks were developed for two purposes, (1) to further identify the nature and extent of known problems and (2) to provide possible solutions to the problems. These tasks are outlined on Table 6 and further discussed in Section III, Work Group Activities and Accomplishments.

TABLE 6. FORMULATION OF TASKS

DESCRIPTION OF TASK	PURPOSE OF TASK	RESPONSIBLE GROUP	PROBLEMS ADDRESSED	ANTICIPATED COMPLETION DATE
1. Literature Review	To search the literature for documentation of the nature and extent of man's impact of backwater habitat and of the value of backwaters to fish and wildlife	Work group	1, 2, 3, 4, 10	On-going
2. Orton-Fabius Side Channel Opening and Study	To assess the impacts of opening a side channel to the main river on limnology and aquatic communities	University of MO Cooperative Fisheries Unit and the Missouri Department of Conservation	1, 3, 4, 150	September 1979
3. Burnt Pocket Backwater Opening and Study	To assess the impacts of opening a backwater to the main channel and to test a predicitive model	University of WI River Studies Center, LaCrosse and work group	1, 4, 6, 7, 103	July 1980
4. Side Channel Inventory	To characterize backwaters and to document habitat and access losses due to sedimentation, spoil disposal, regulatory structures, development, etc.	Work group	1-3, 8, 11-159	On-going
5. Equipment Specifications	To list the specifications for equipment that can be used to perform alterations in side channels and backwaters in the most environmentally sound manner	Work group	5	1979
6. Side Channel Openings	To open side channels and backwaters which have been plugged by Corps channel maintenance activities	Work group, Corps	2, 51, 78, 79	On-going
7. Work Group Discussions	To arrive at solutions to work group problems	Work group	All	On-going

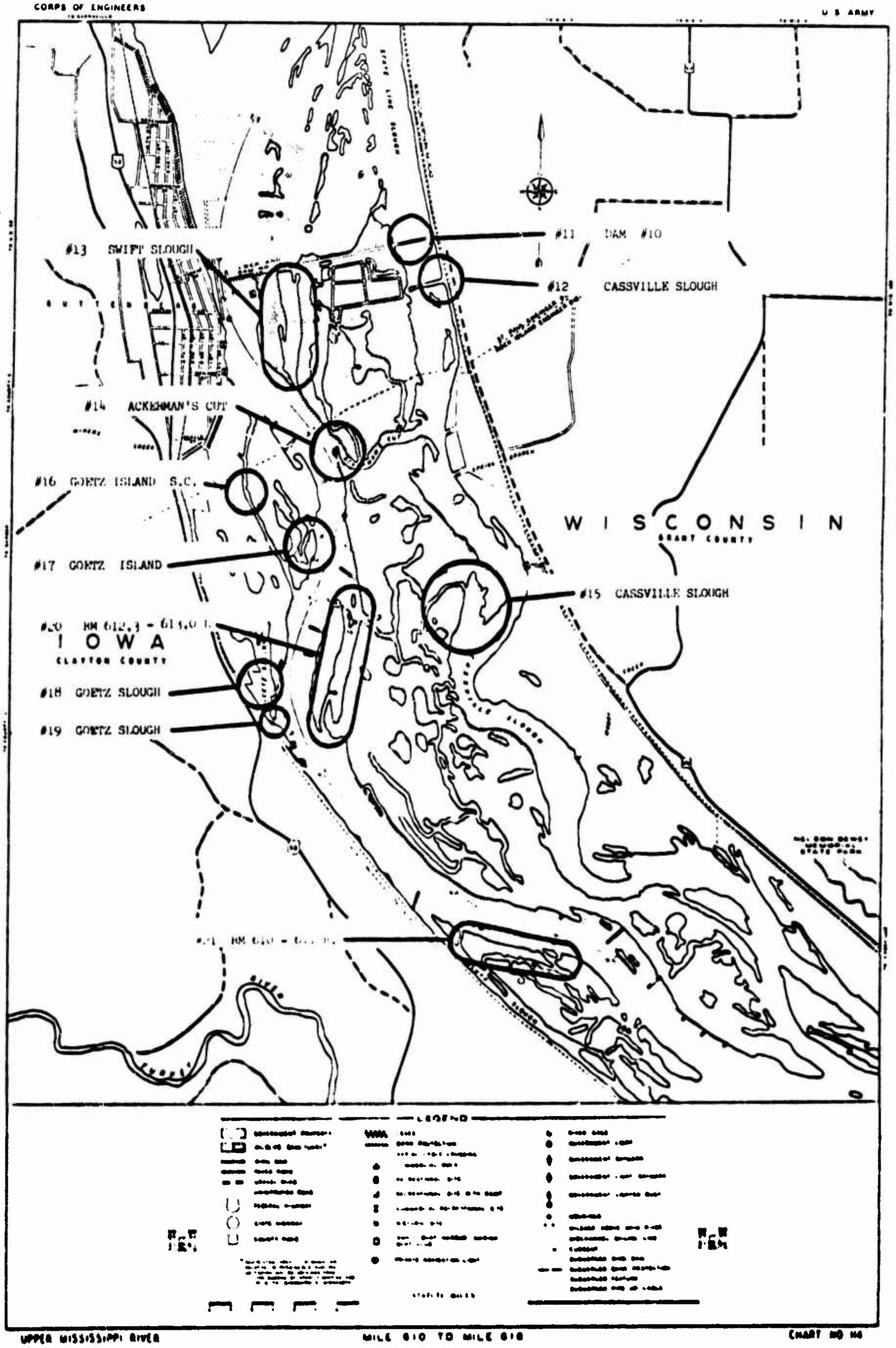


Figure 4. Side channel problem areas (see Table 5).

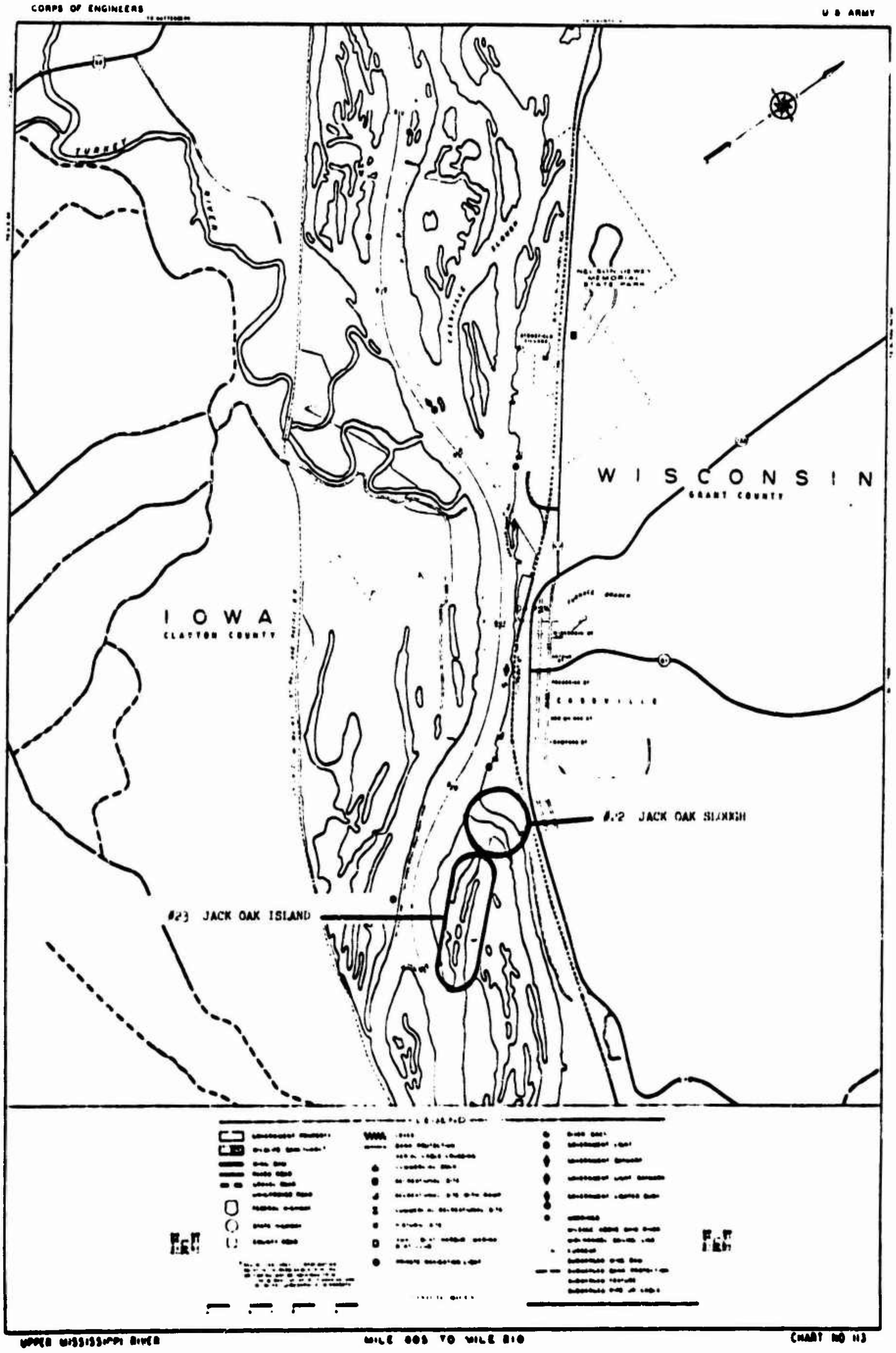


Figure 5. Side channel problem areas (see Table 5).

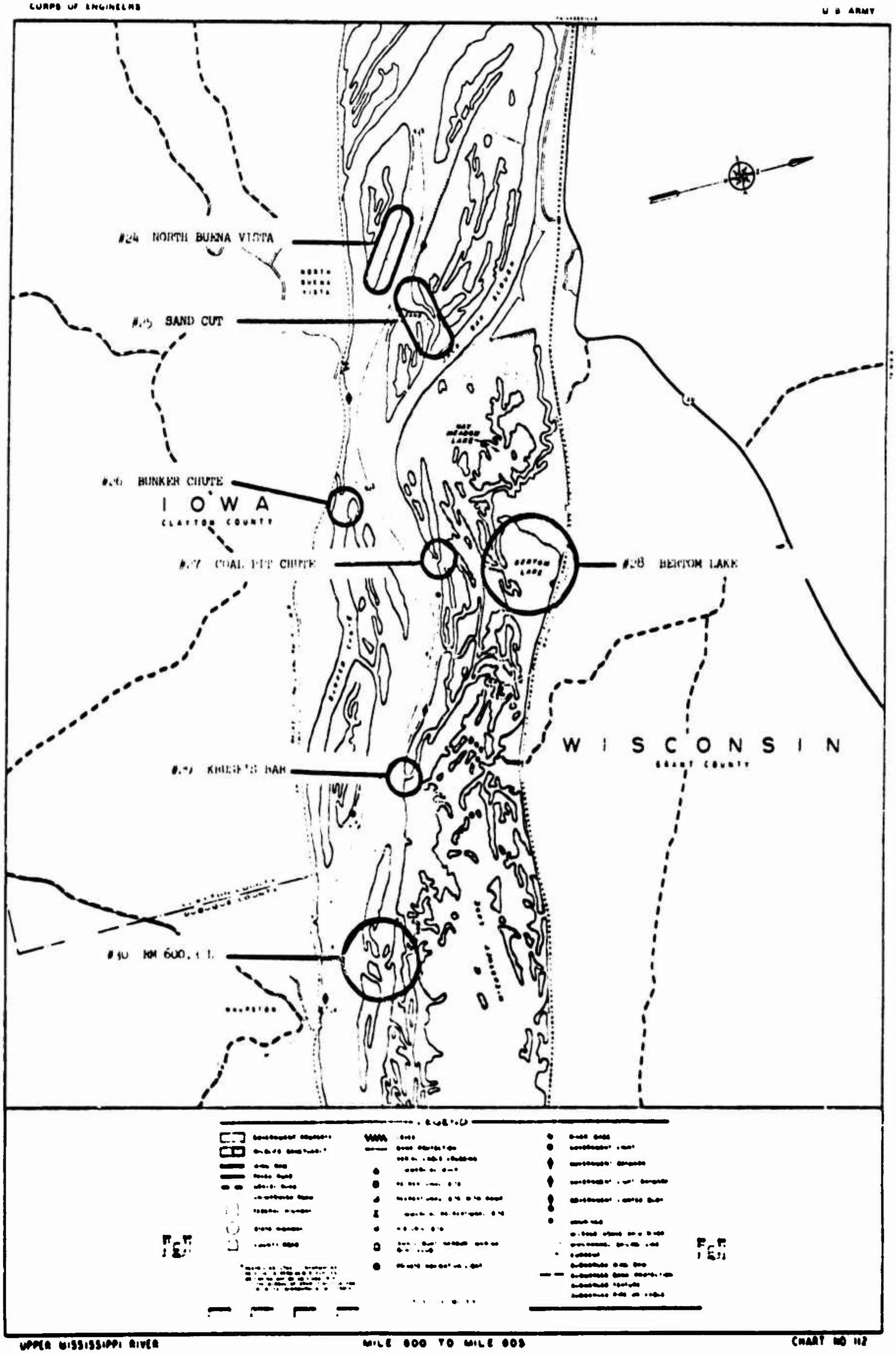


Figure 6. Side channel problem areas (see Table 5).

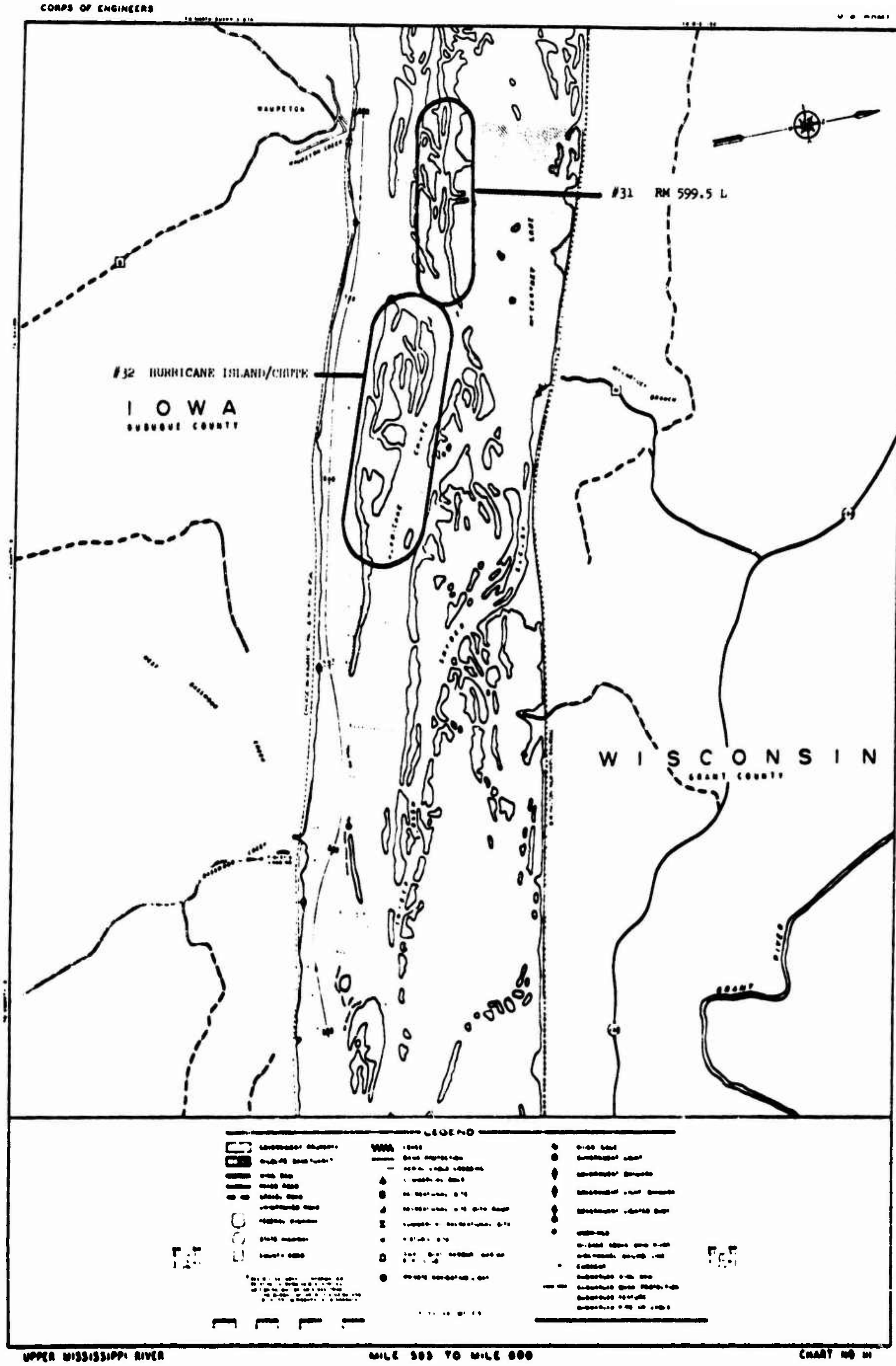


Figure 7. Side channel problem areas (see Table 5).

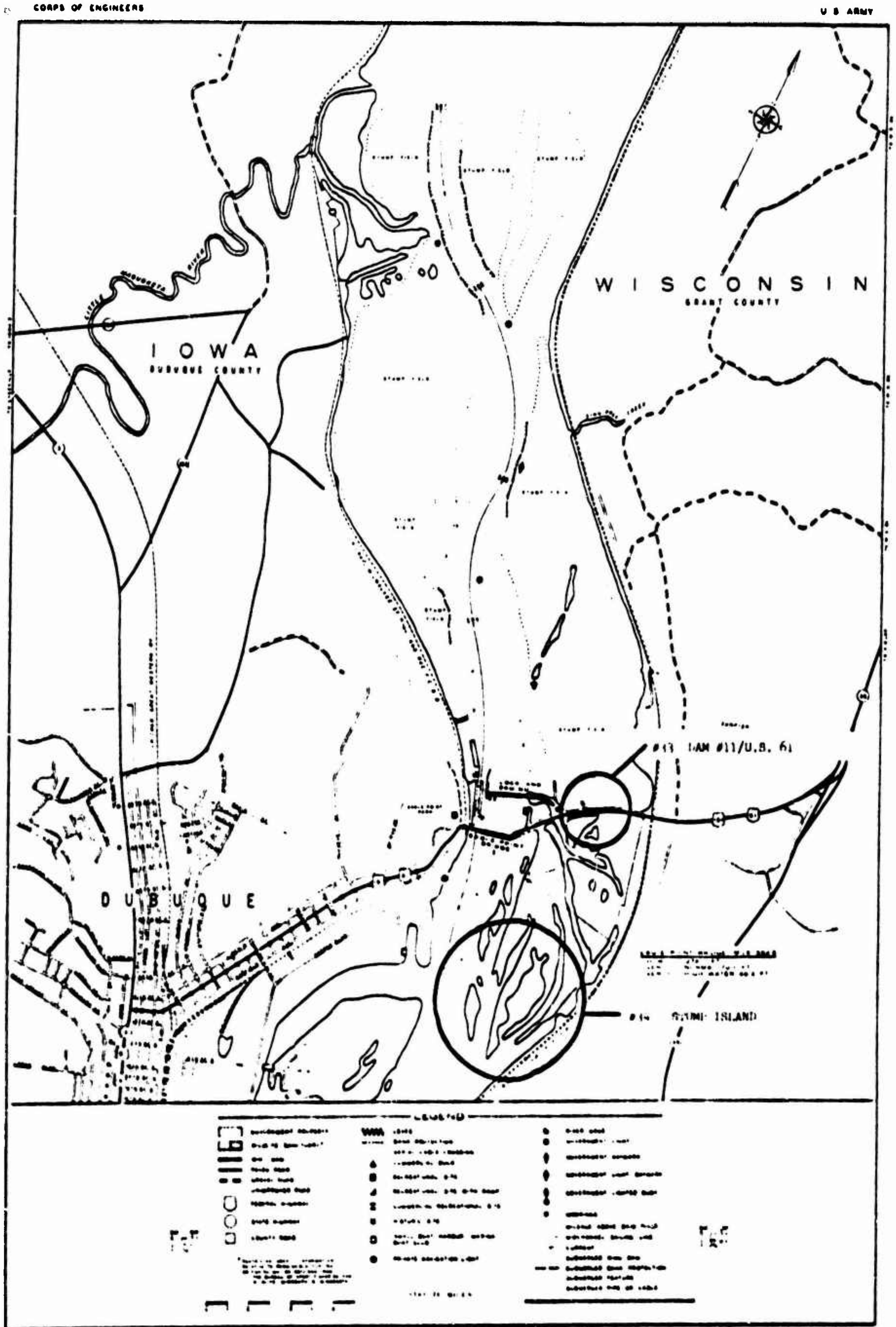


Figure 8. Side channel problem areas (see Table 5).

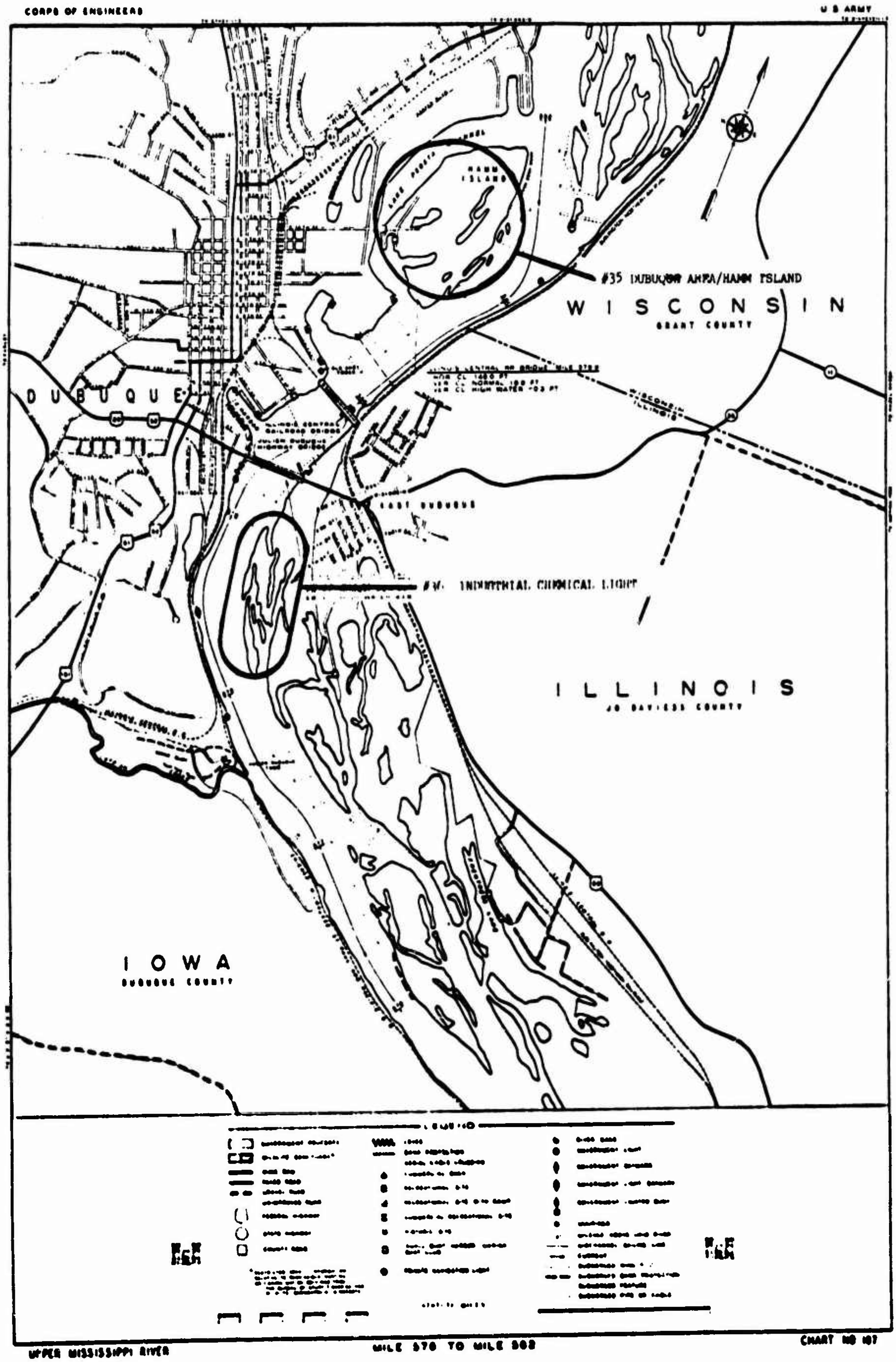


Figure 9. Side channel problem areas (see Table 5).

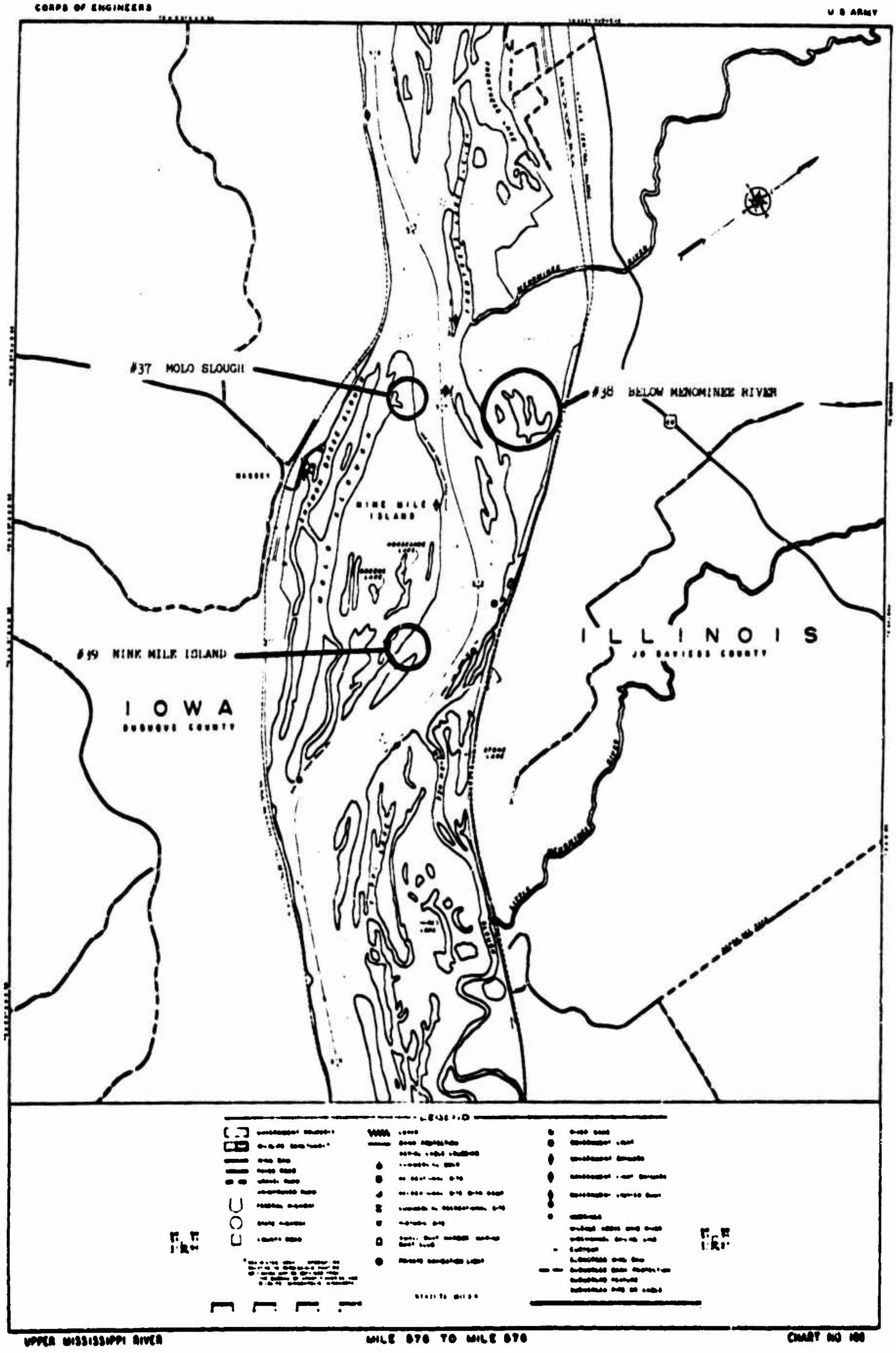


Figure 10. Side channel problem areas (see Table 5).

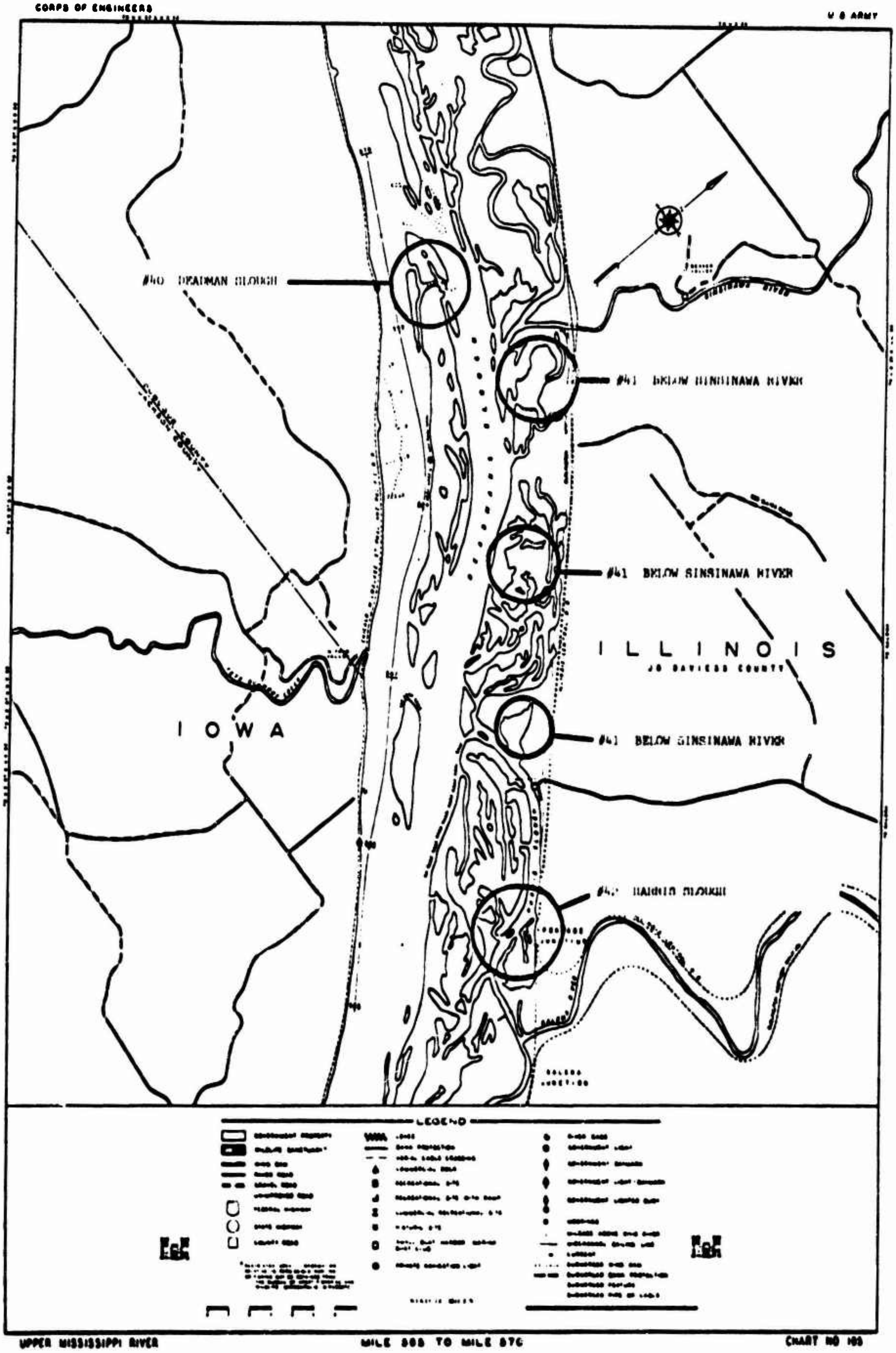


Figure 11. Side channel problem areas (see Table 5).

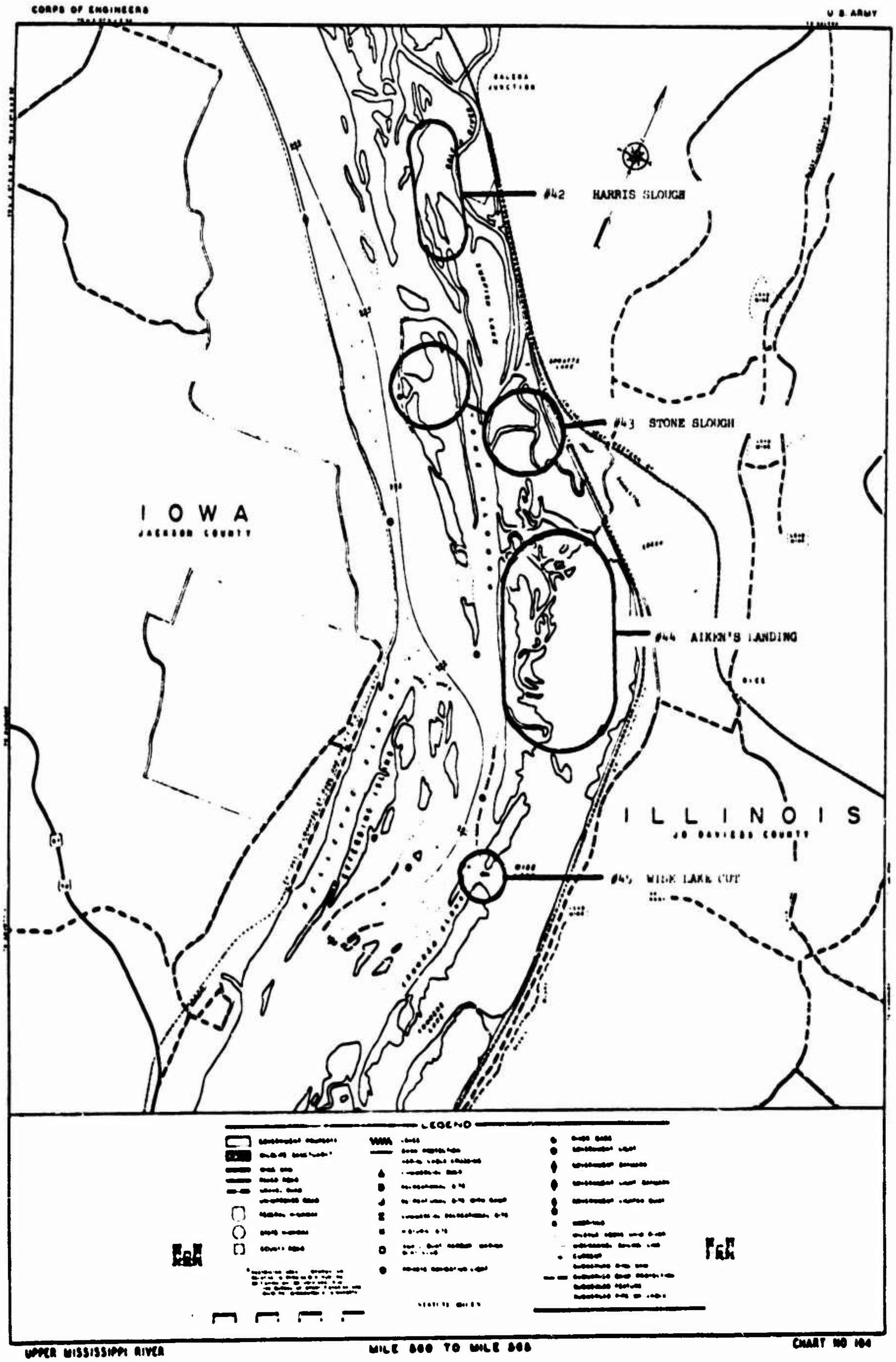


Figure 12. Side channel problem areas (see Table 5).

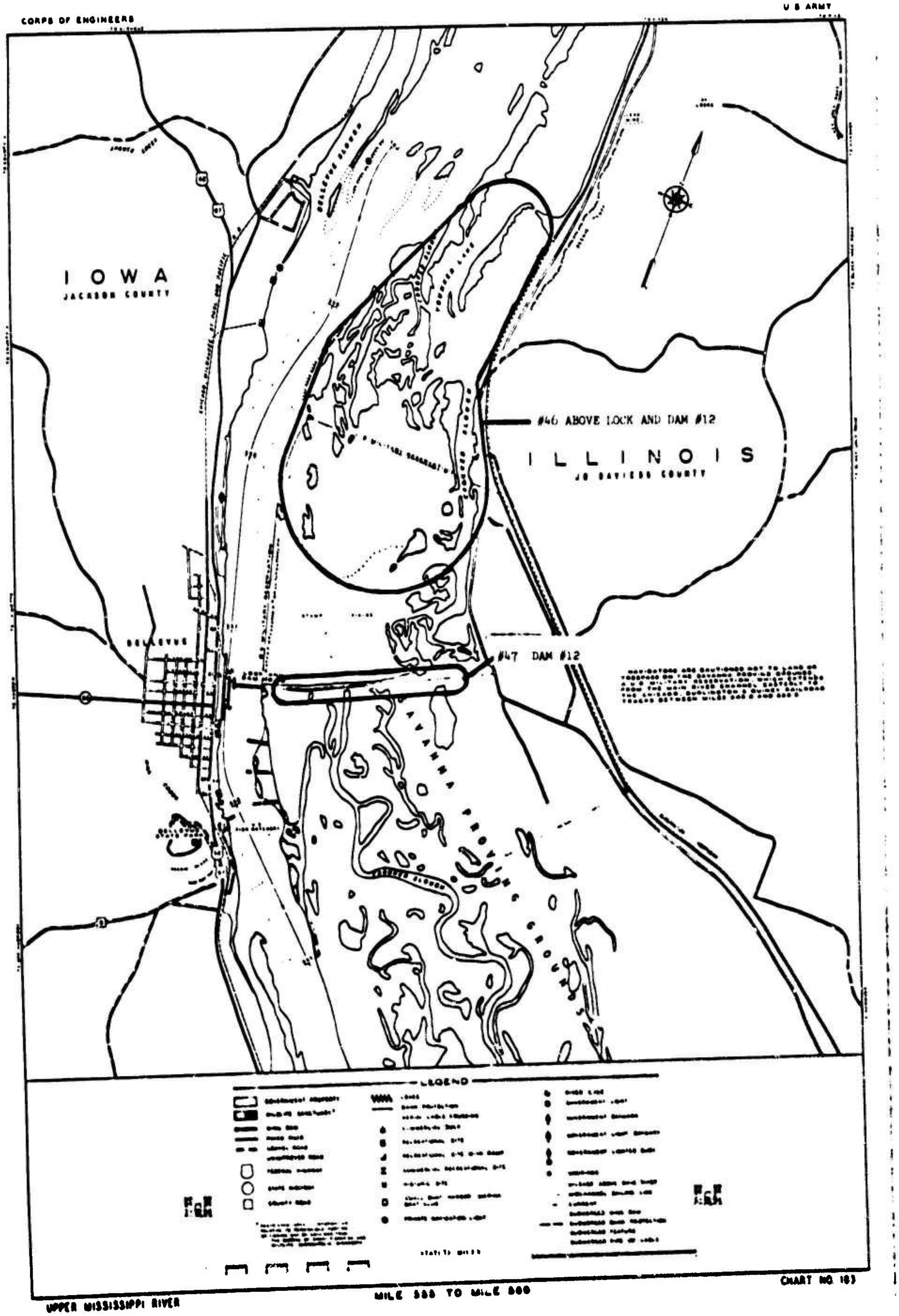


Figure 13. Side channel problem areas (see Table 5).

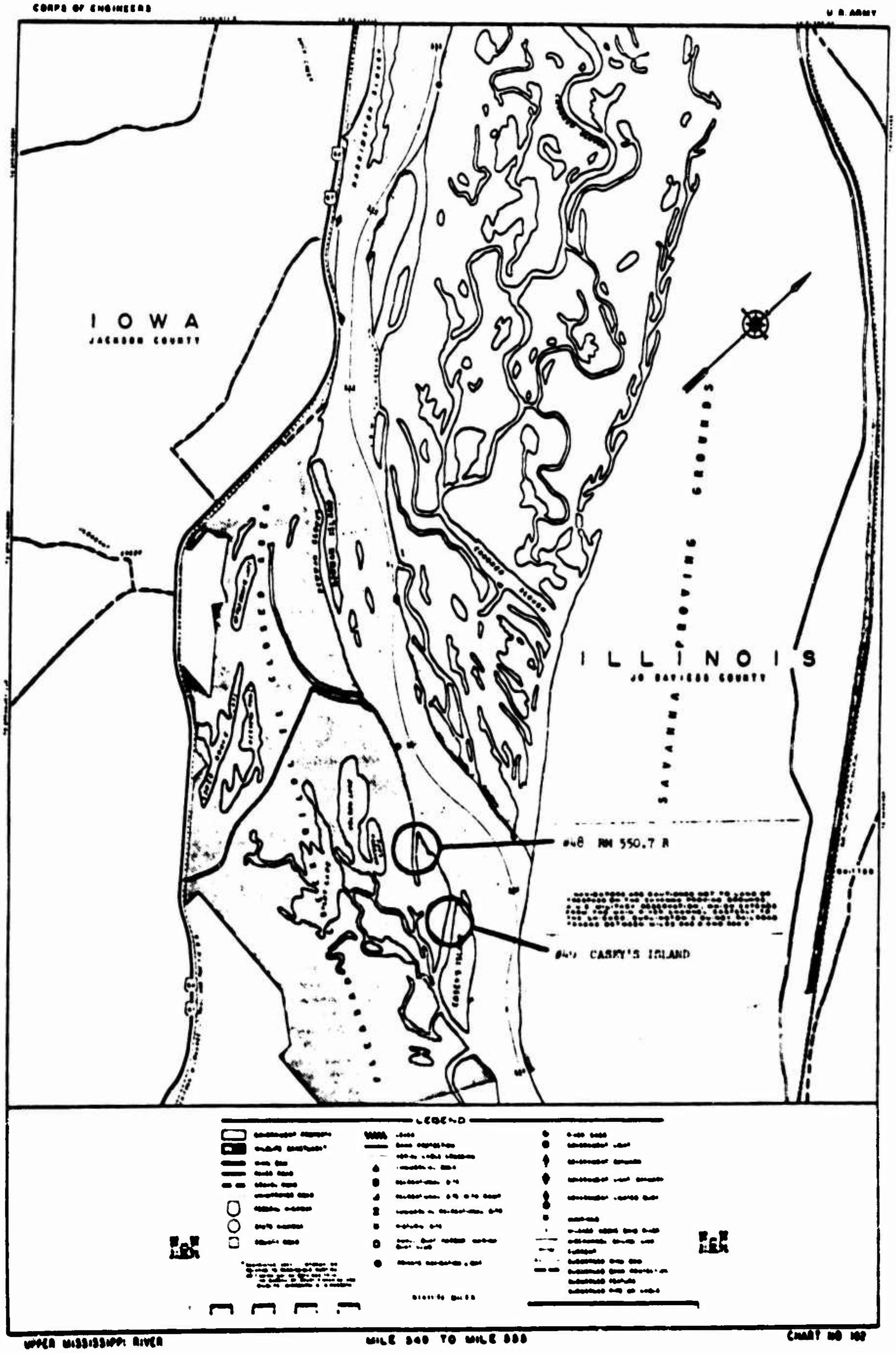
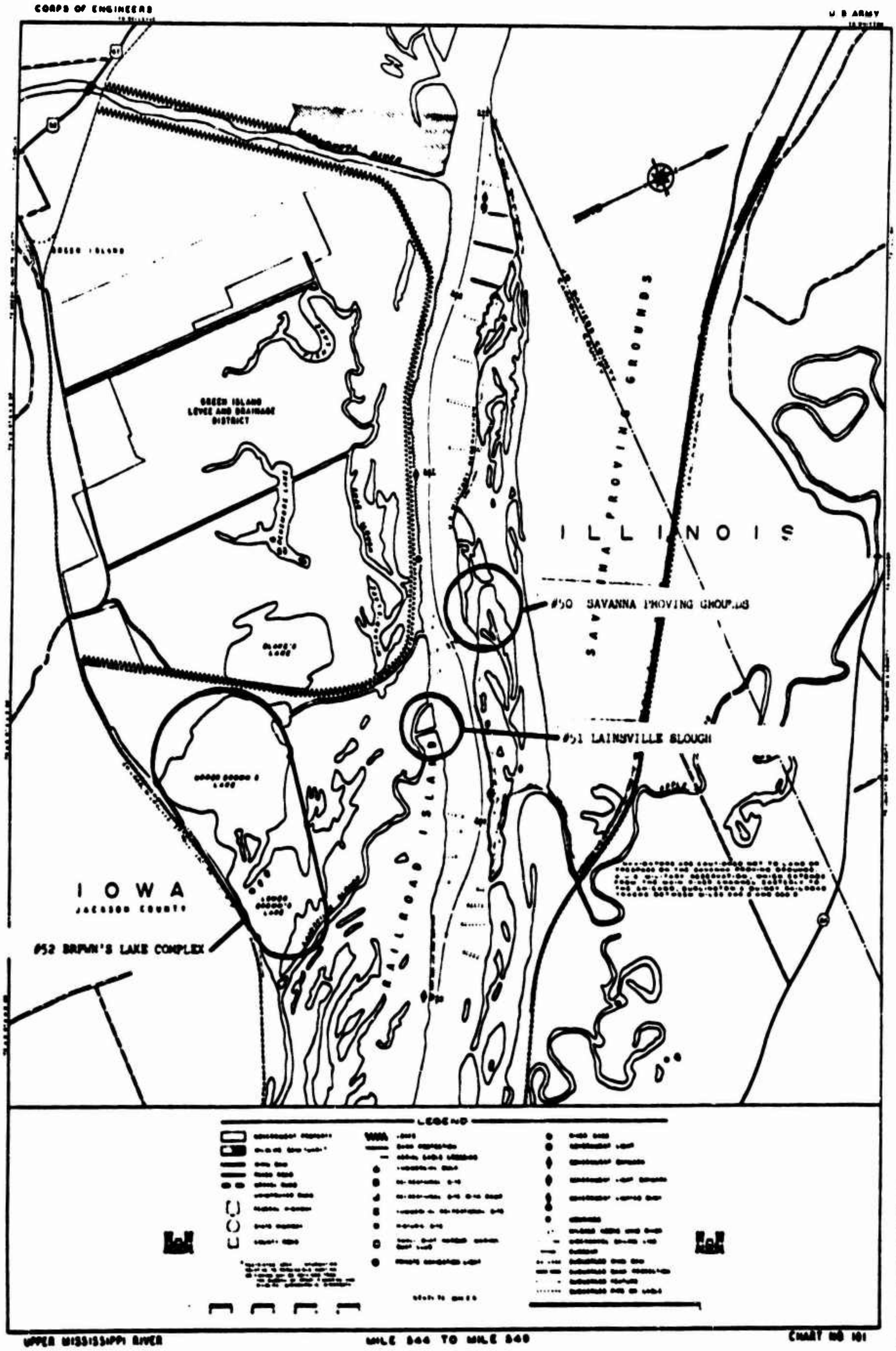


Figure 14. Side channel problem areas (see Table 5).



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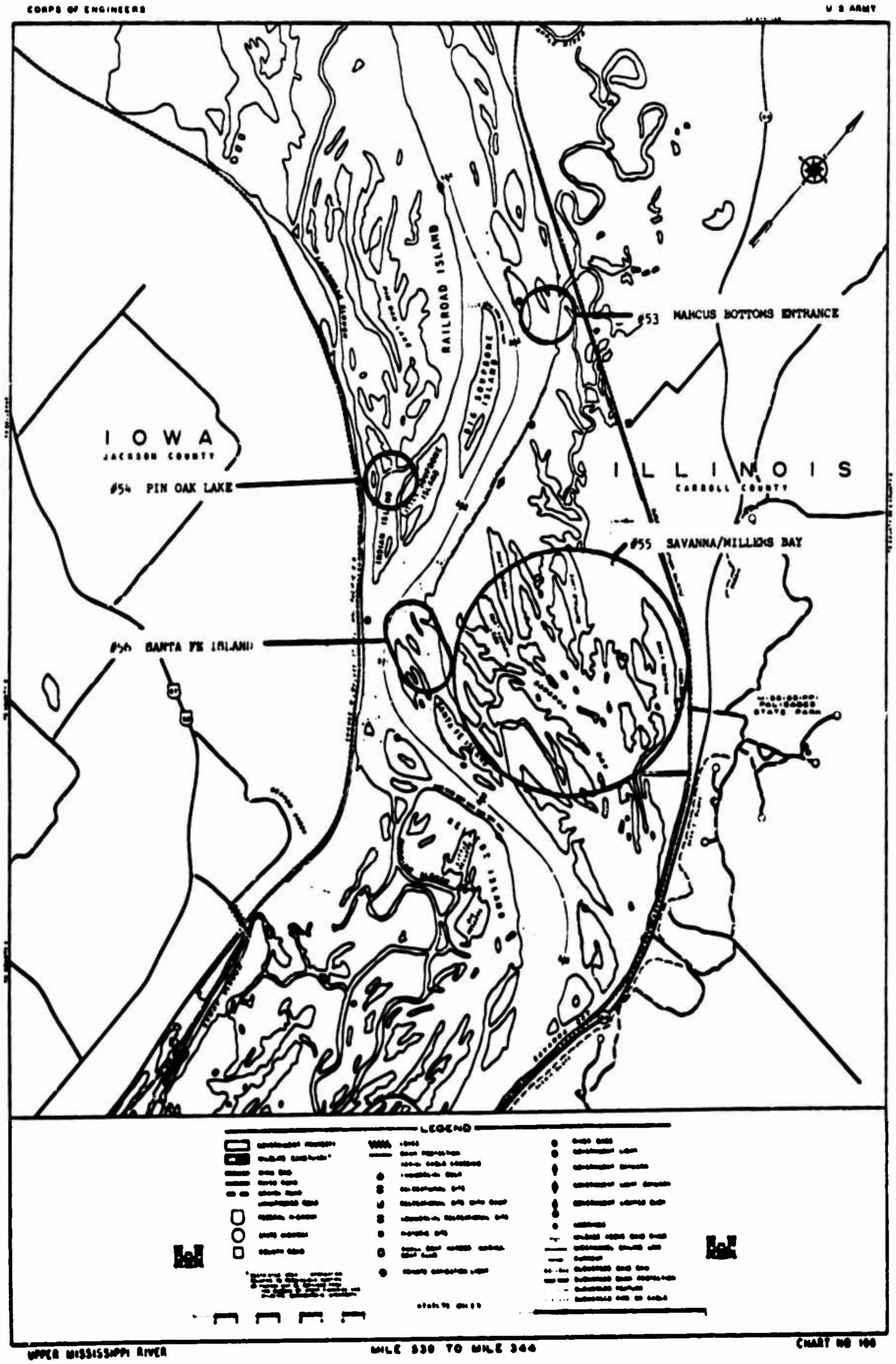


Figure 16. Side channel problem areas (see Table 5).

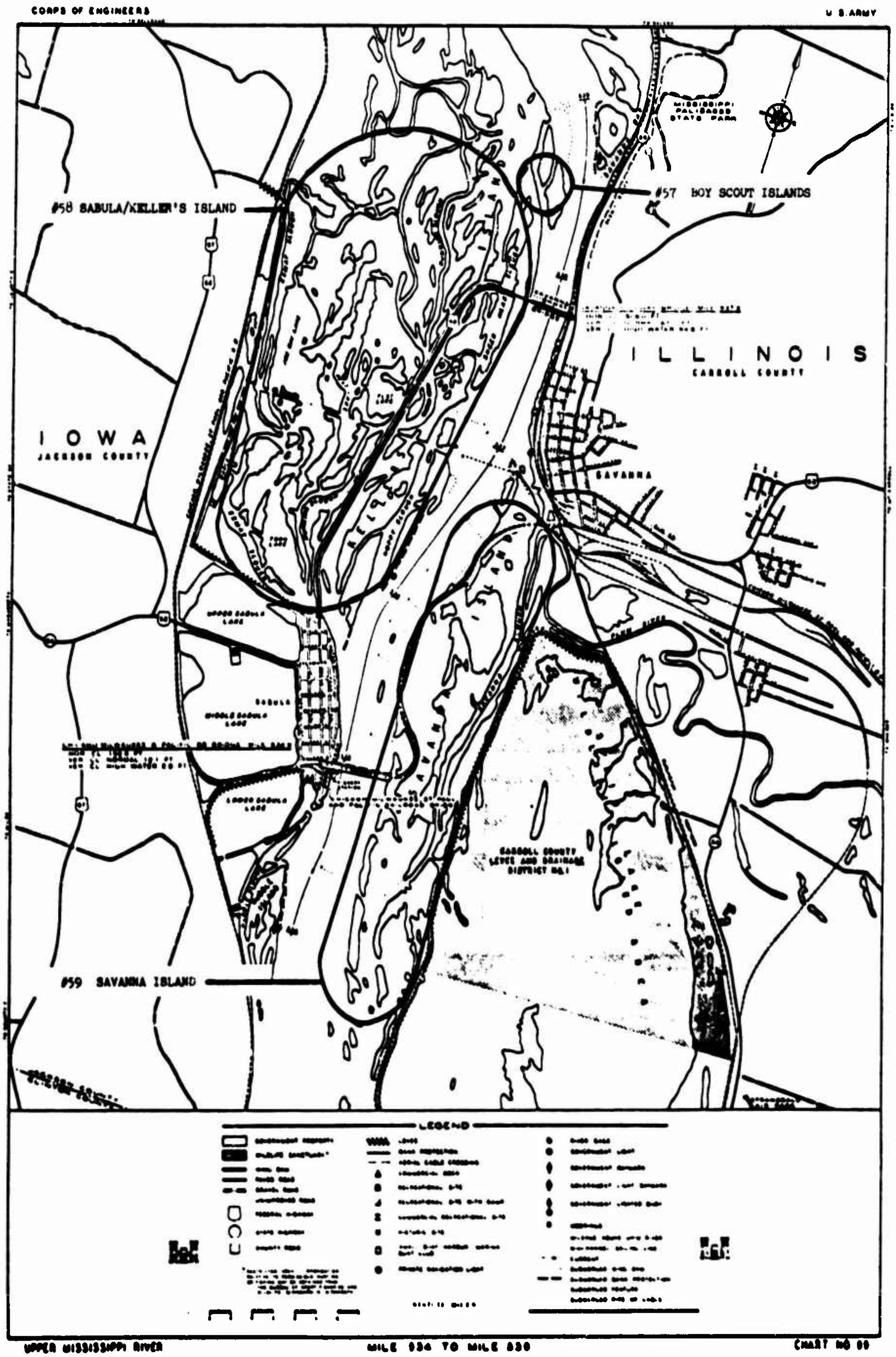


Figure 17. Side channel problem areas (see Table 5).

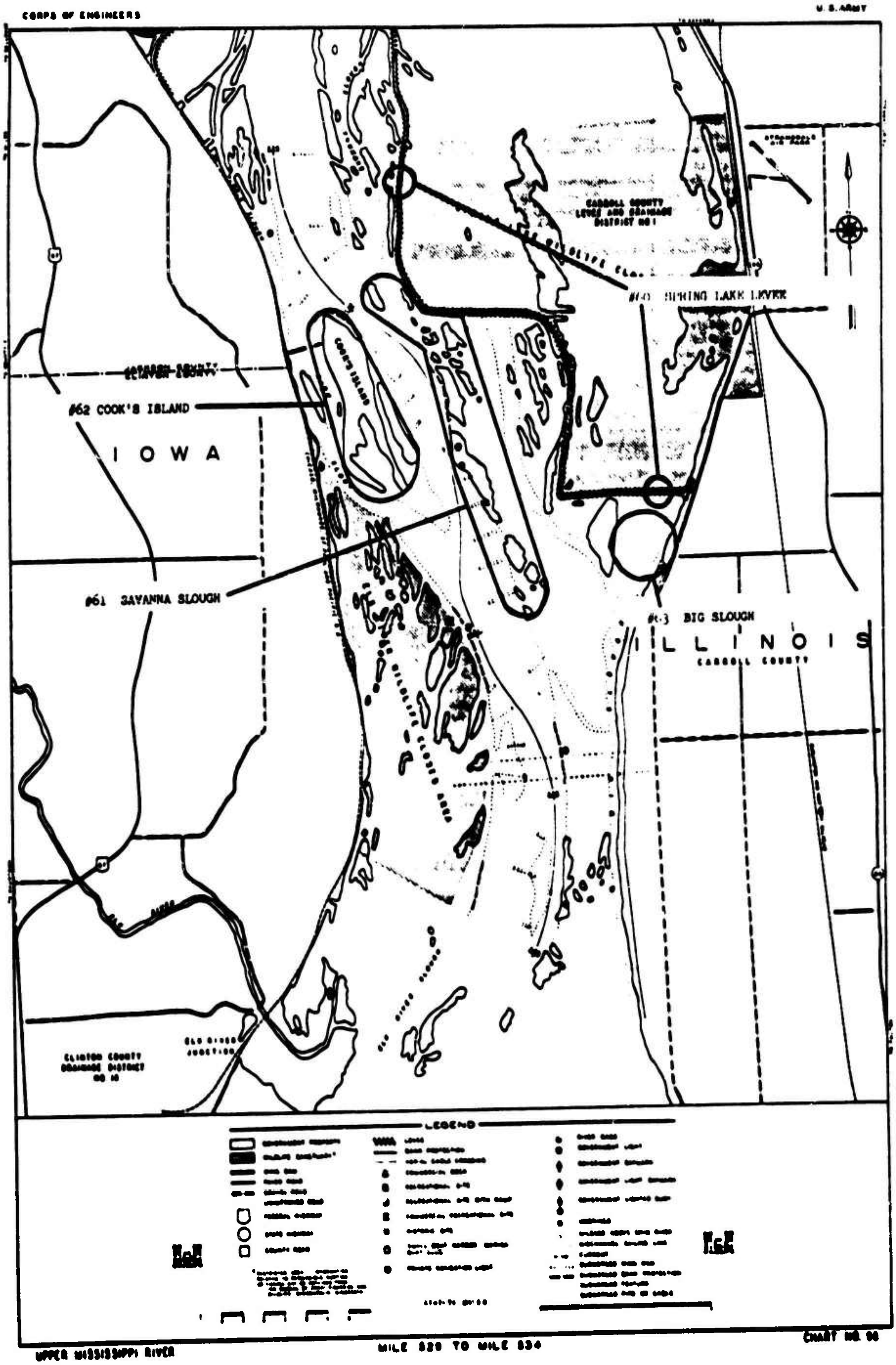
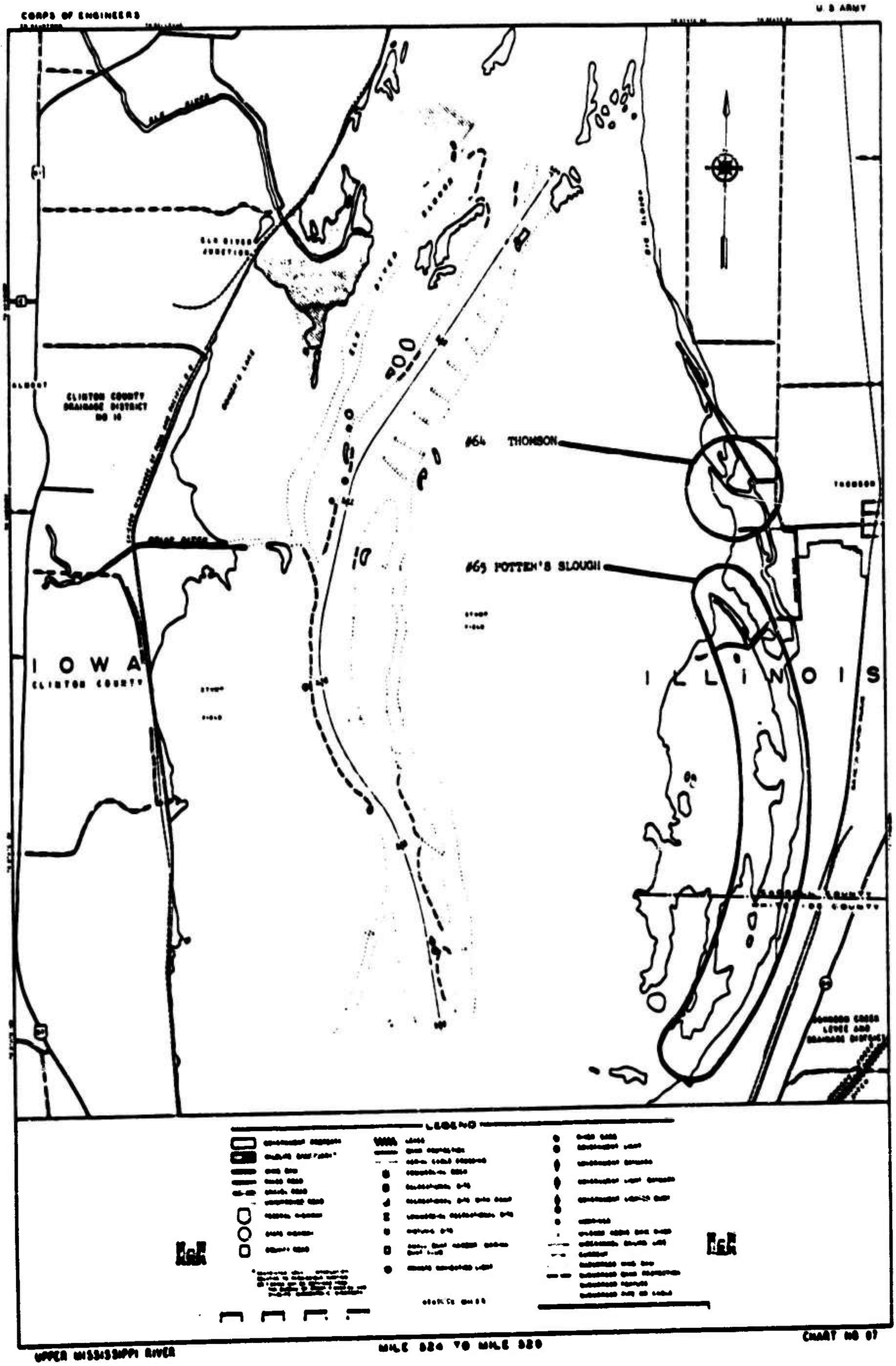


Figure 18. Side channel problem areas (see Table 5).



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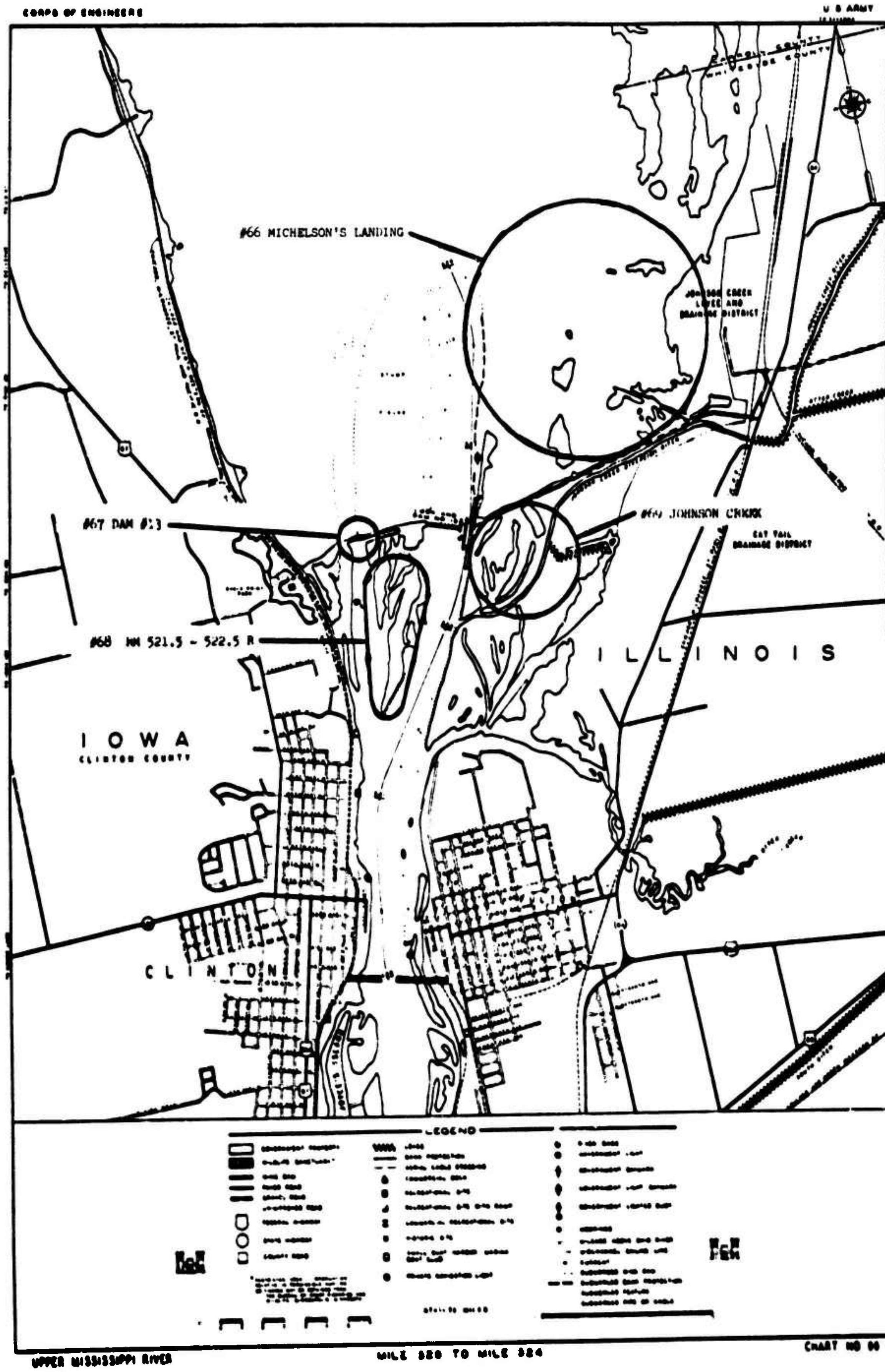

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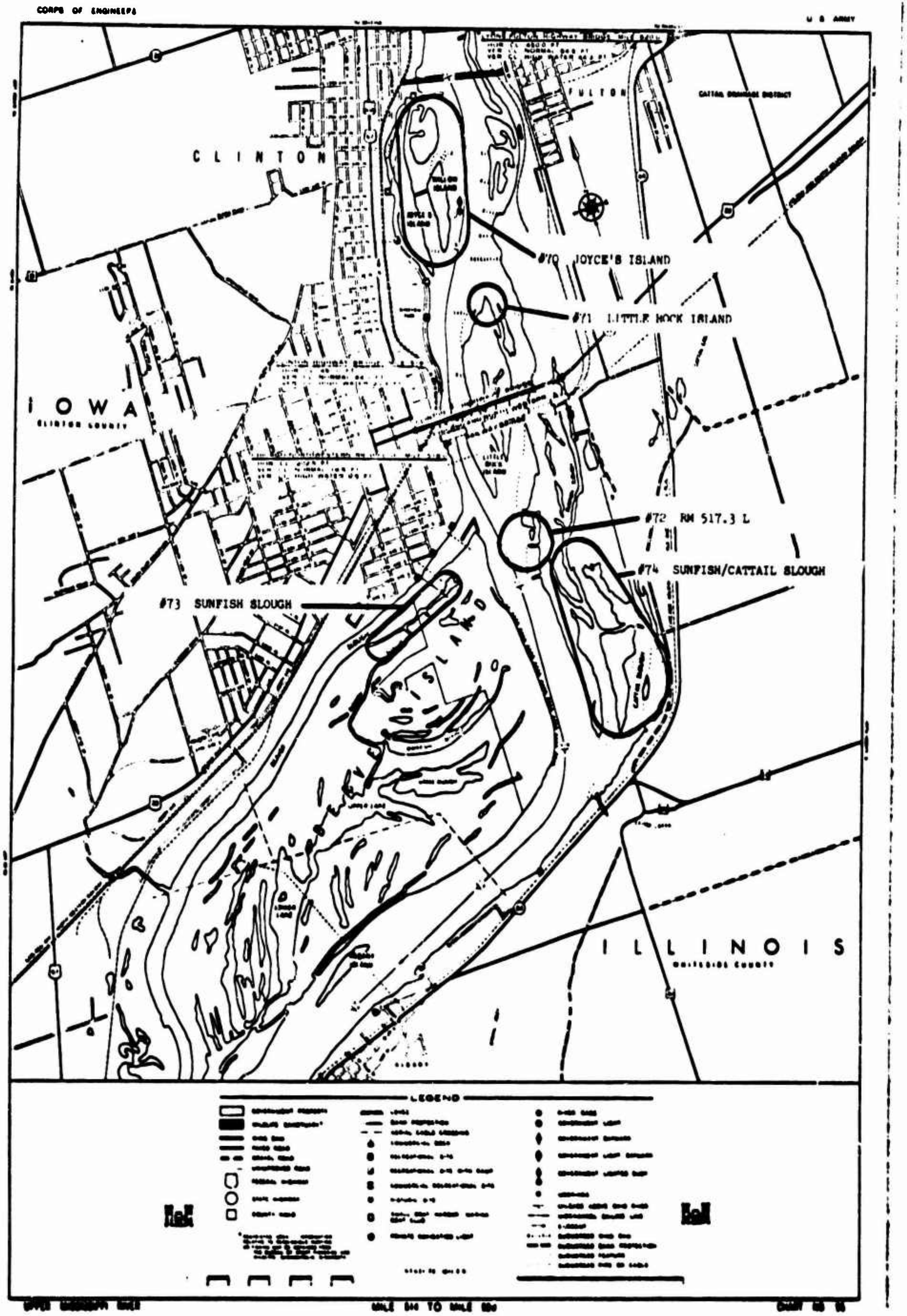

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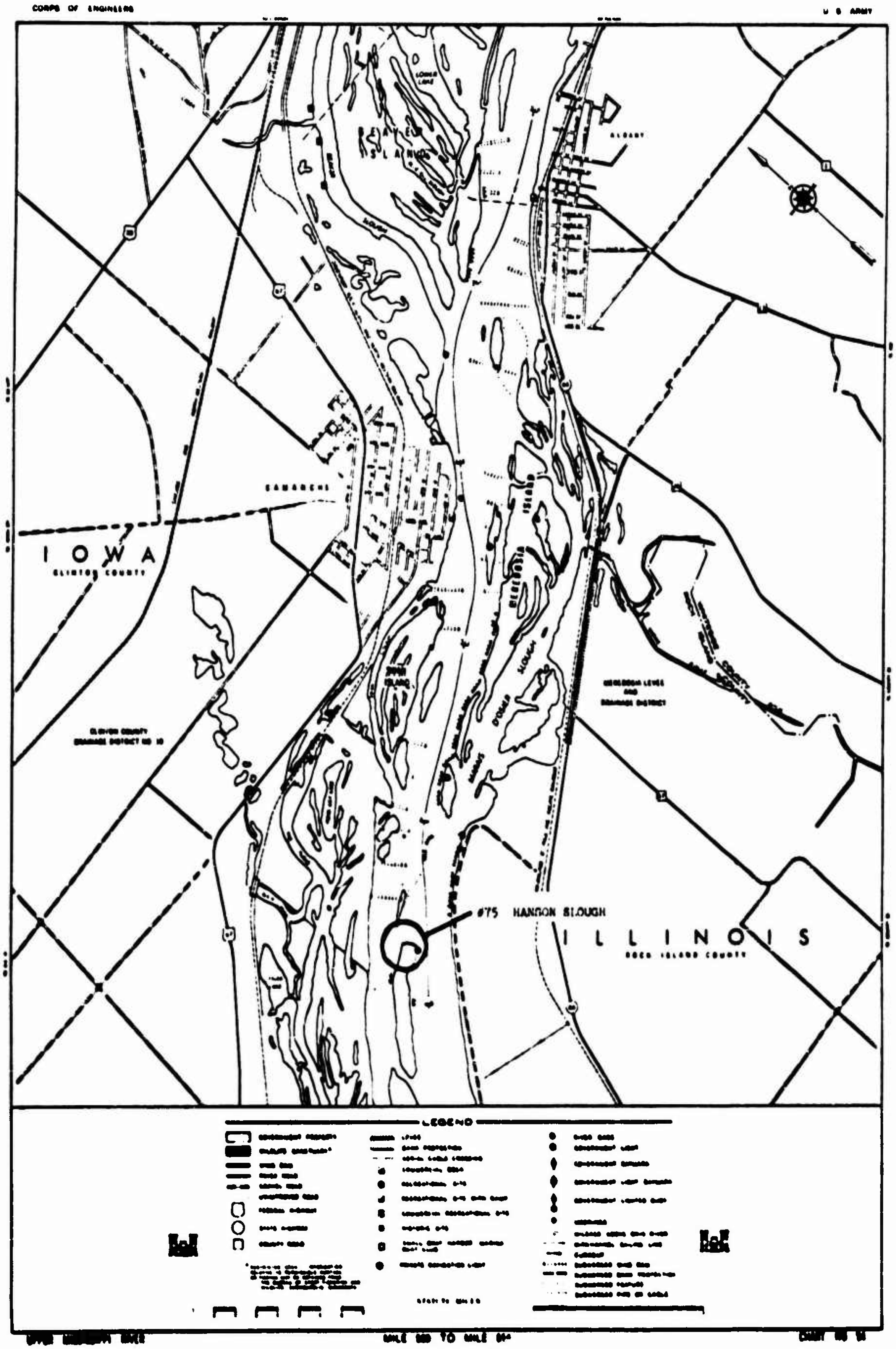

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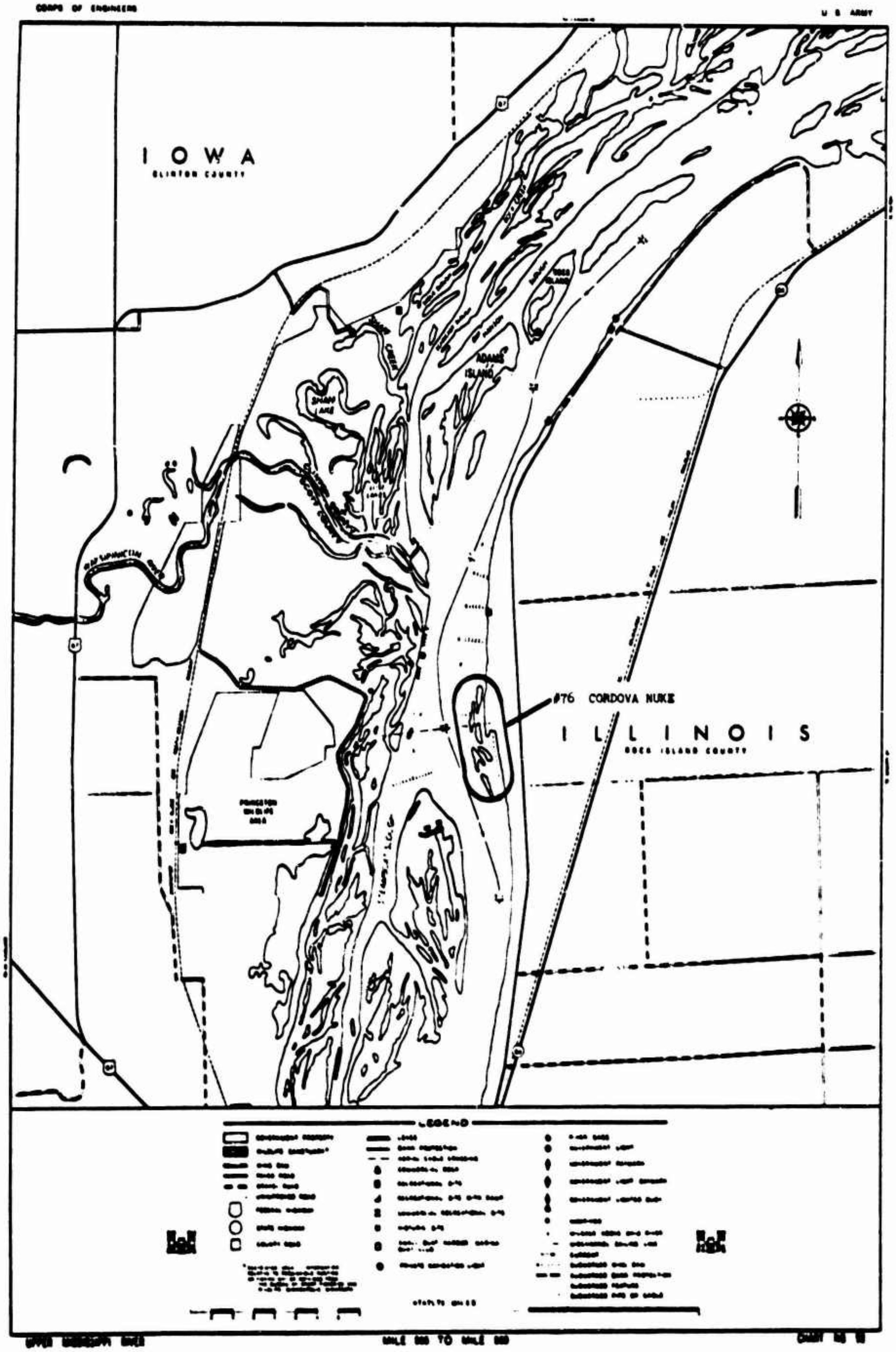

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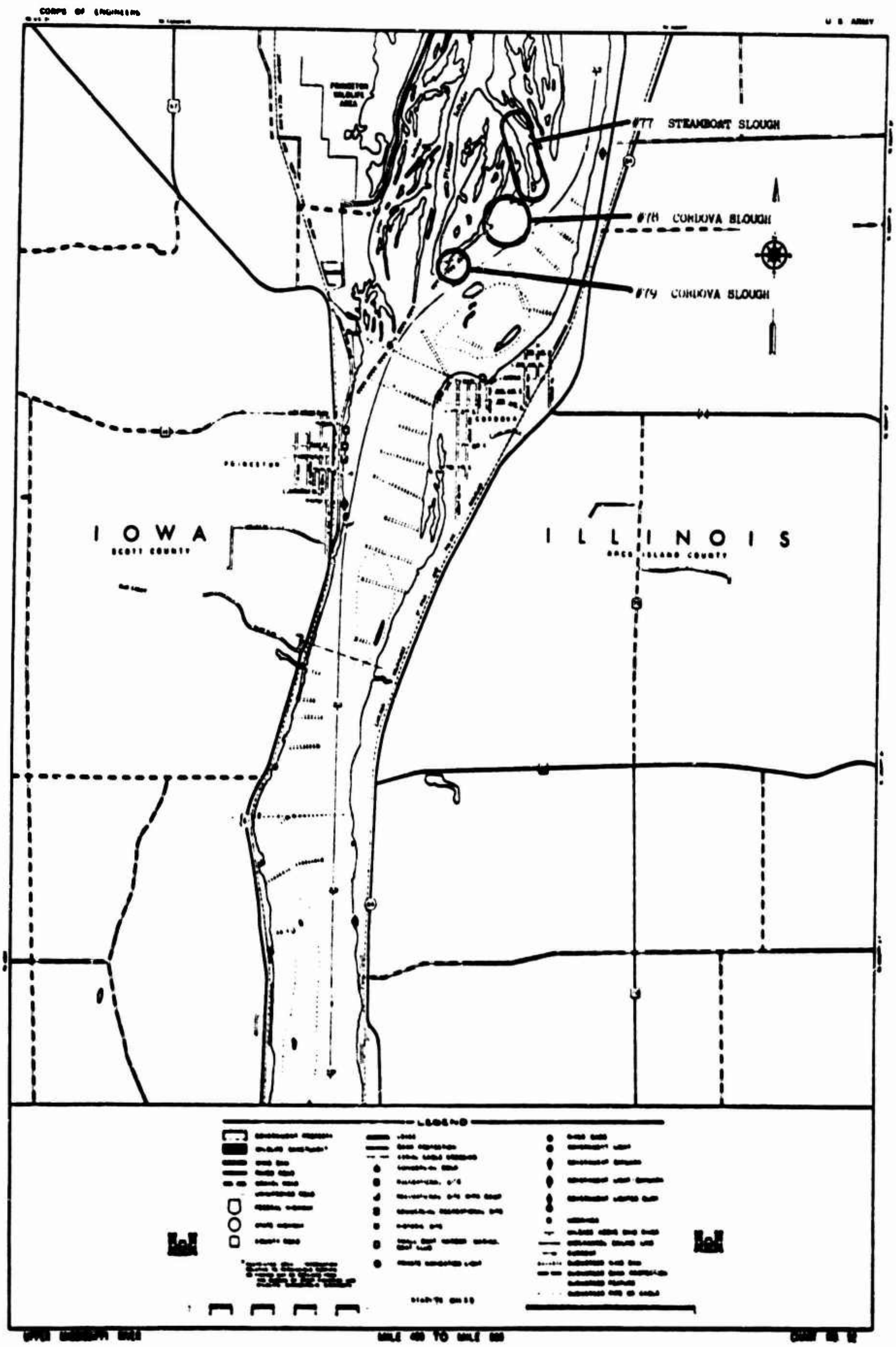

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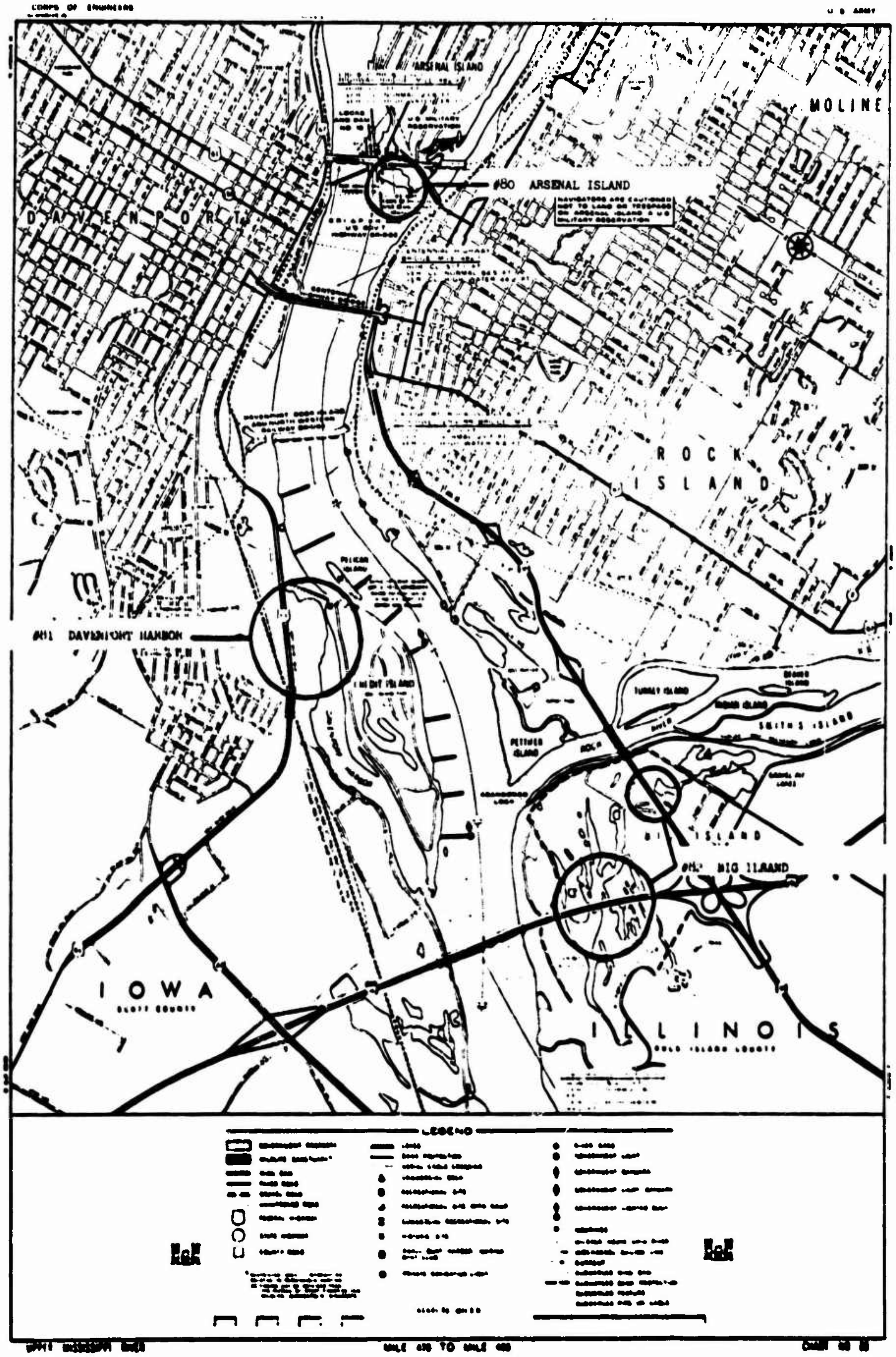

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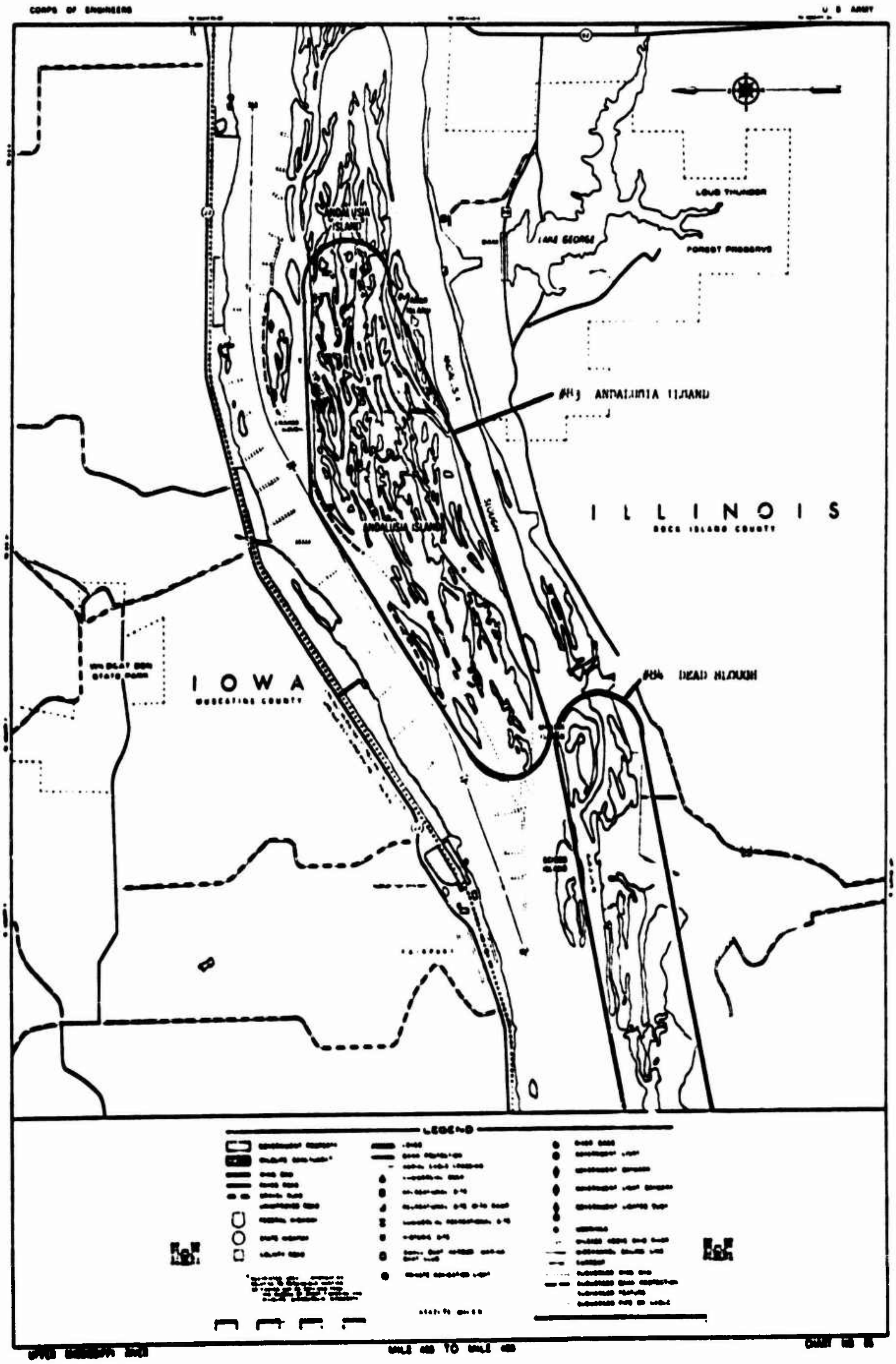

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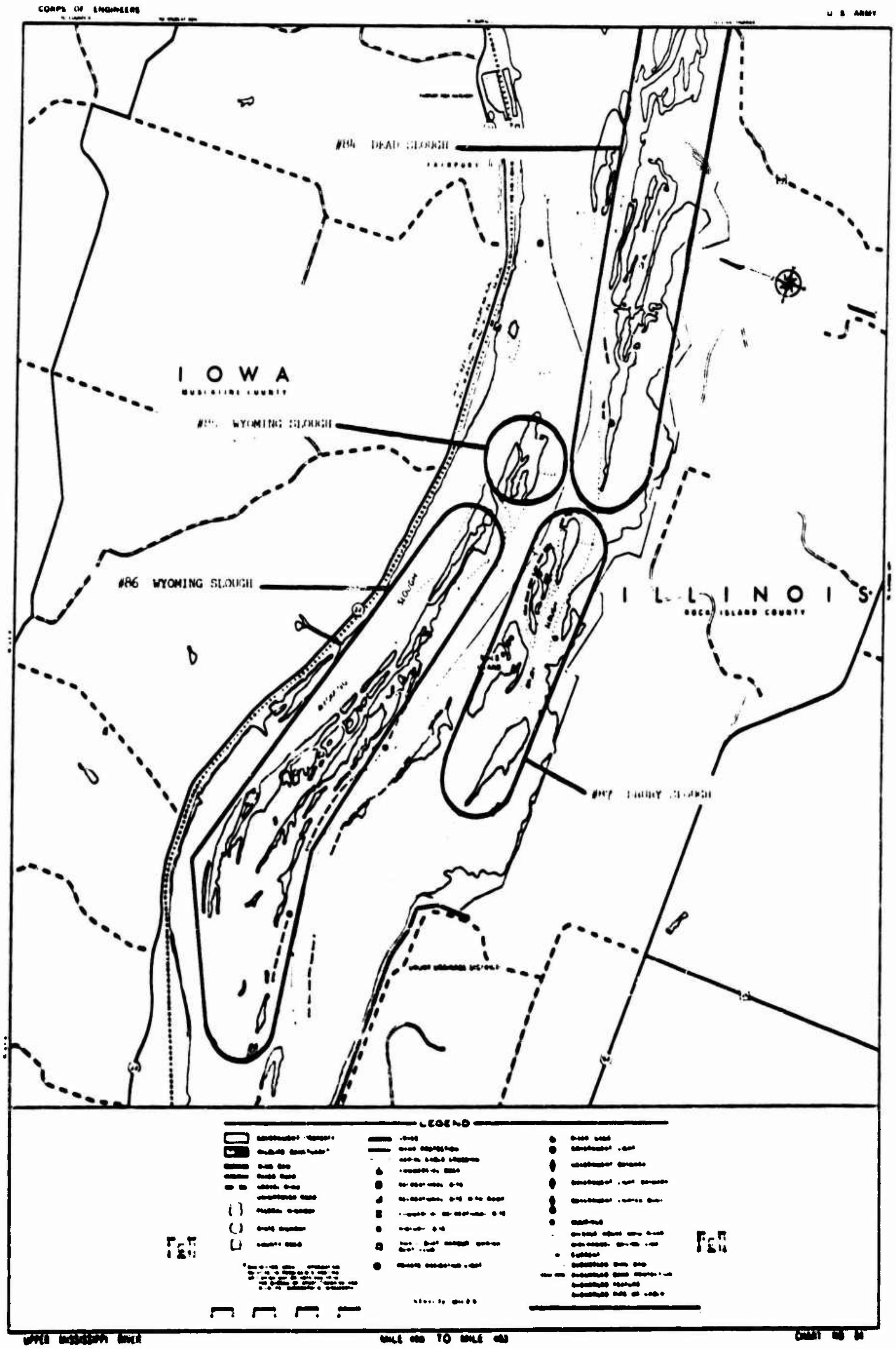

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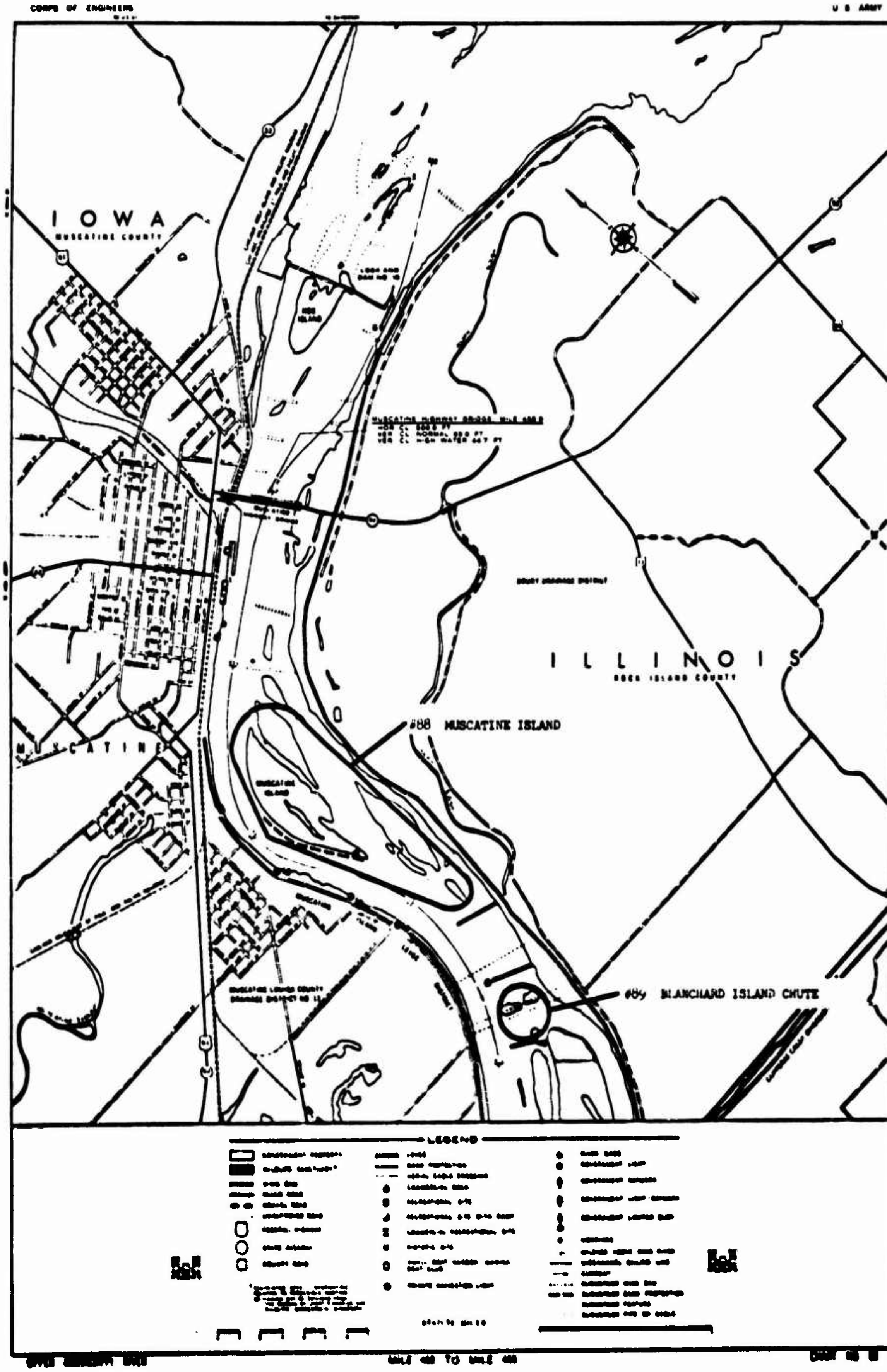

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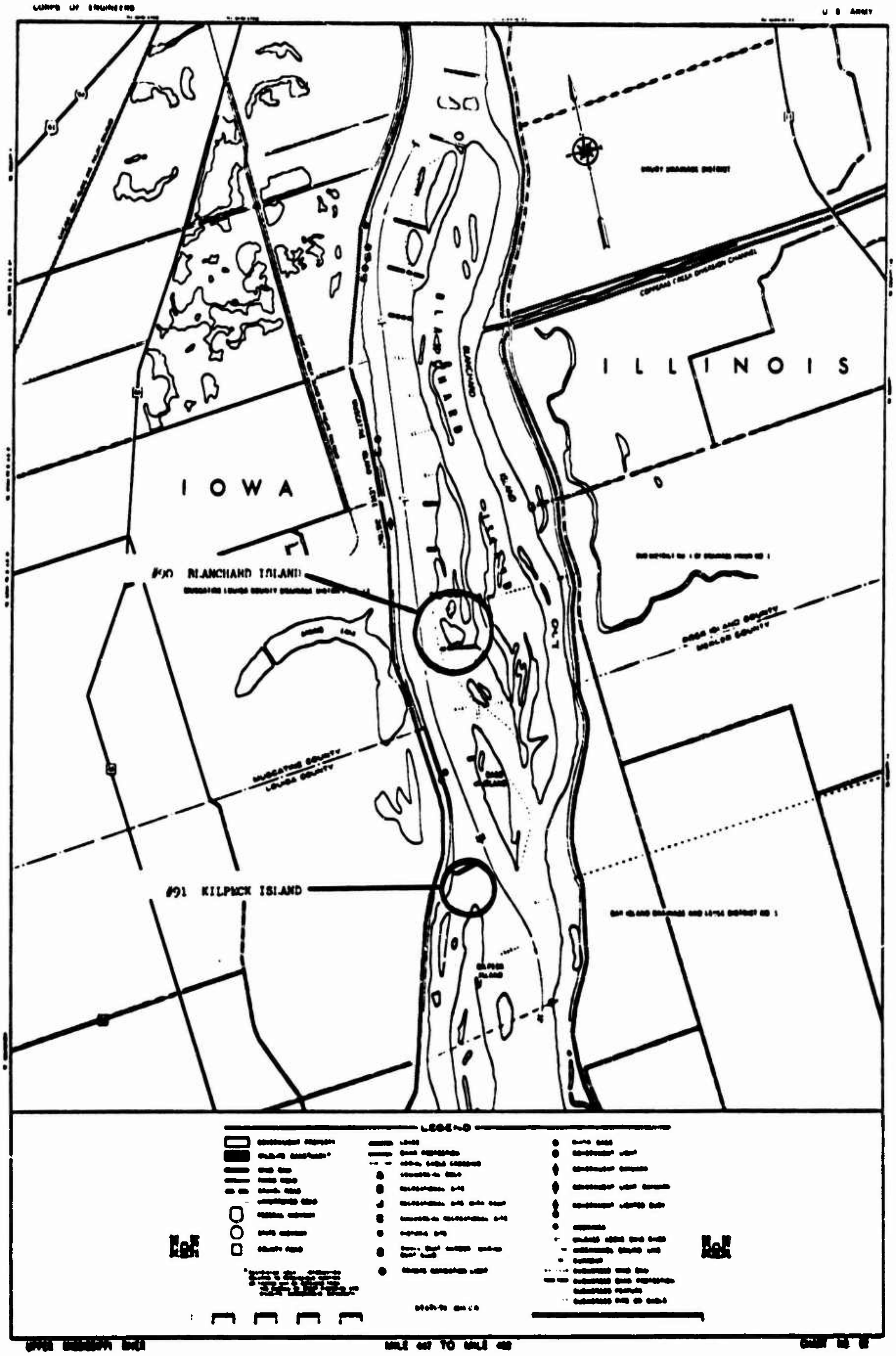

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Figure 30. Side channel problem areas (see Table 5).

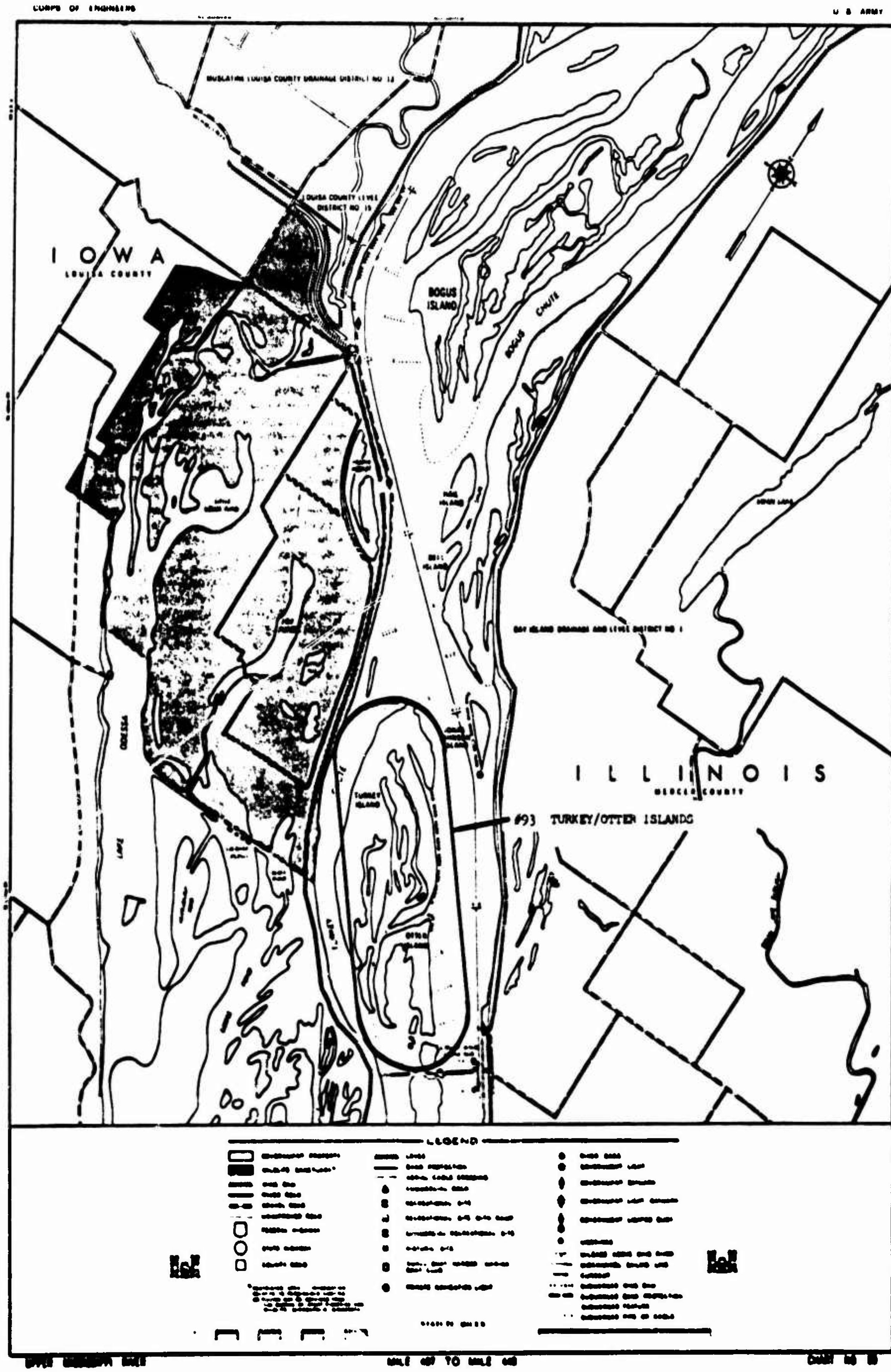

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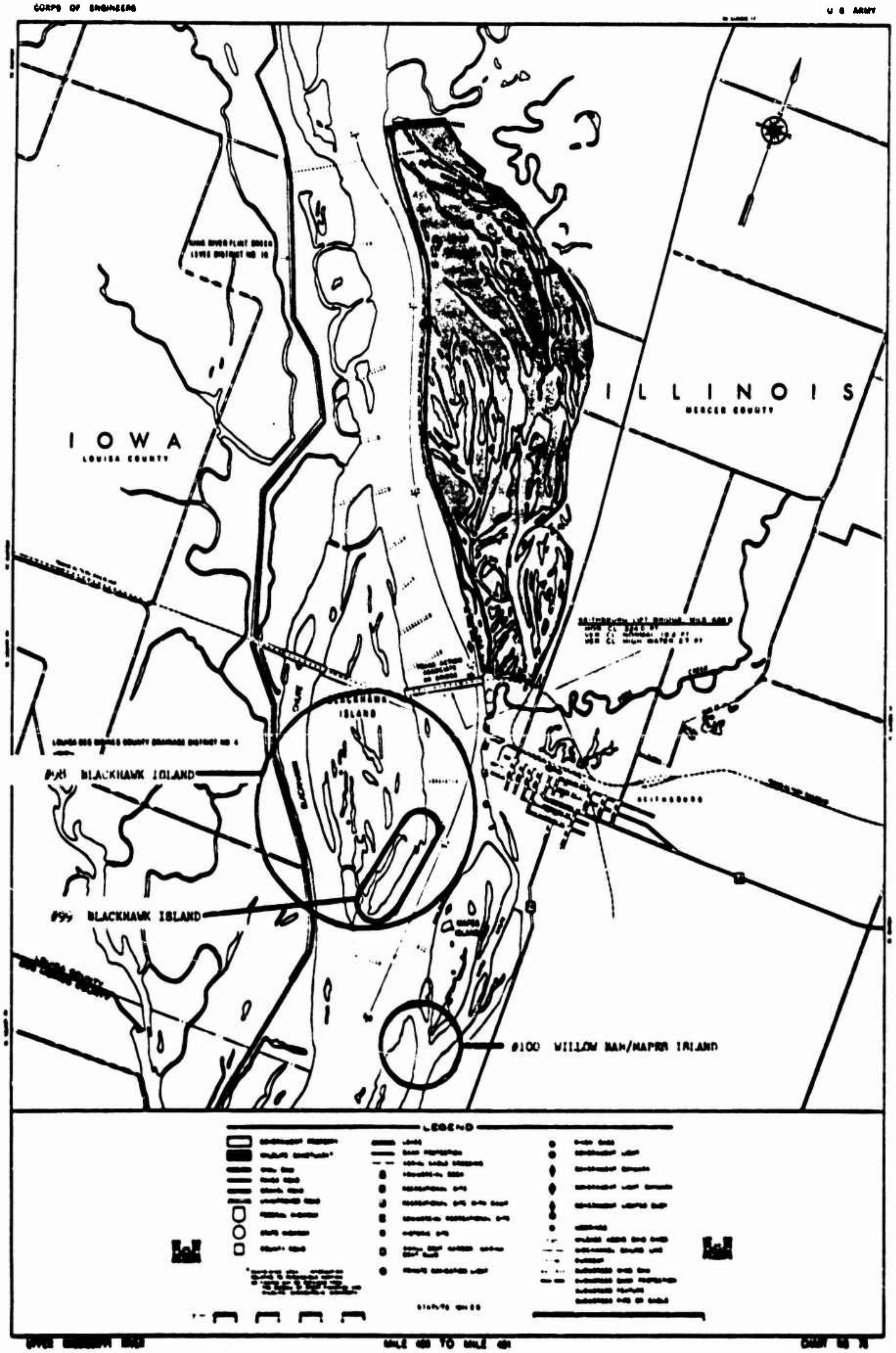
Figure 32. Side channel problem areas (see Table 5).



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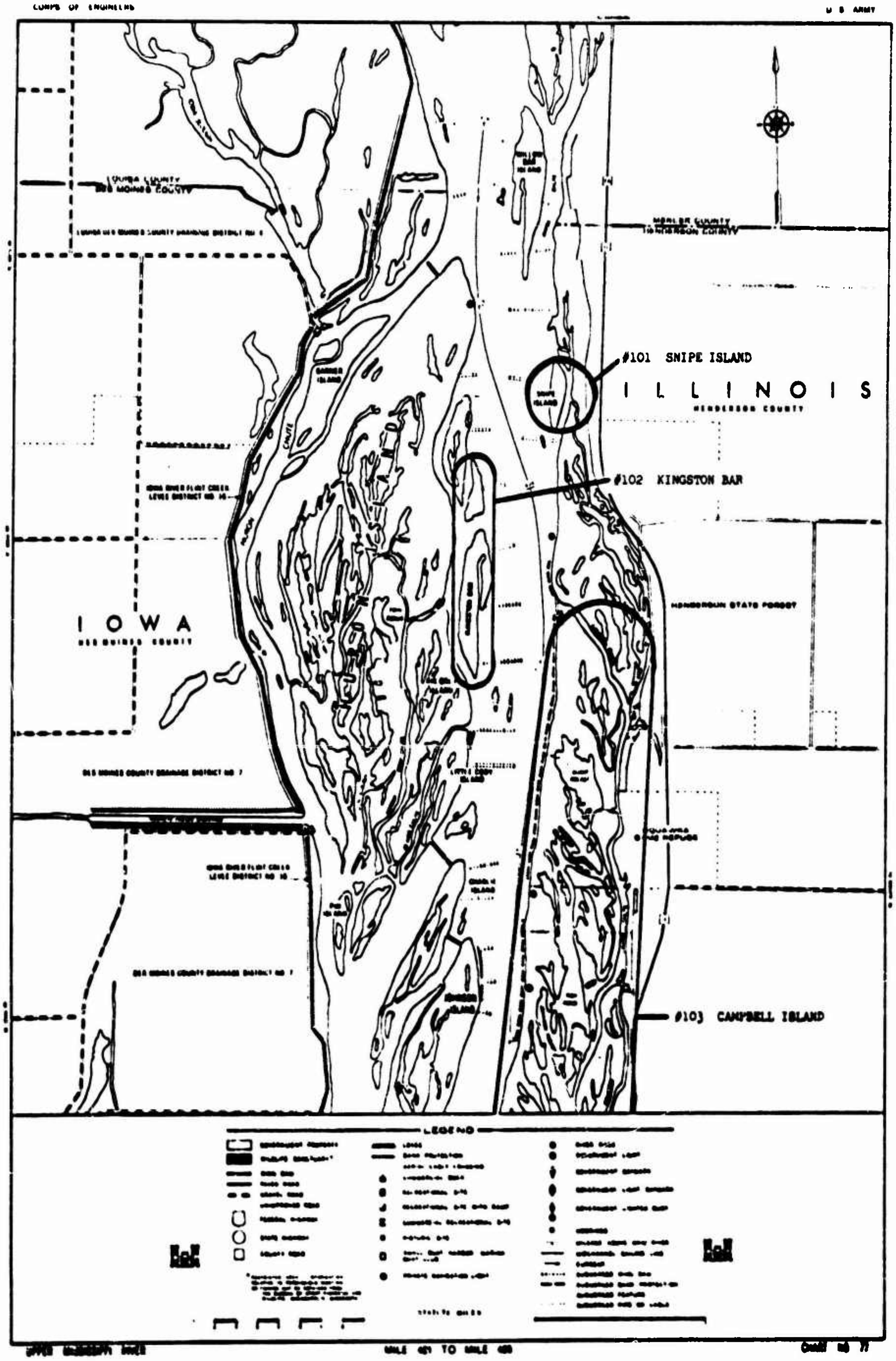

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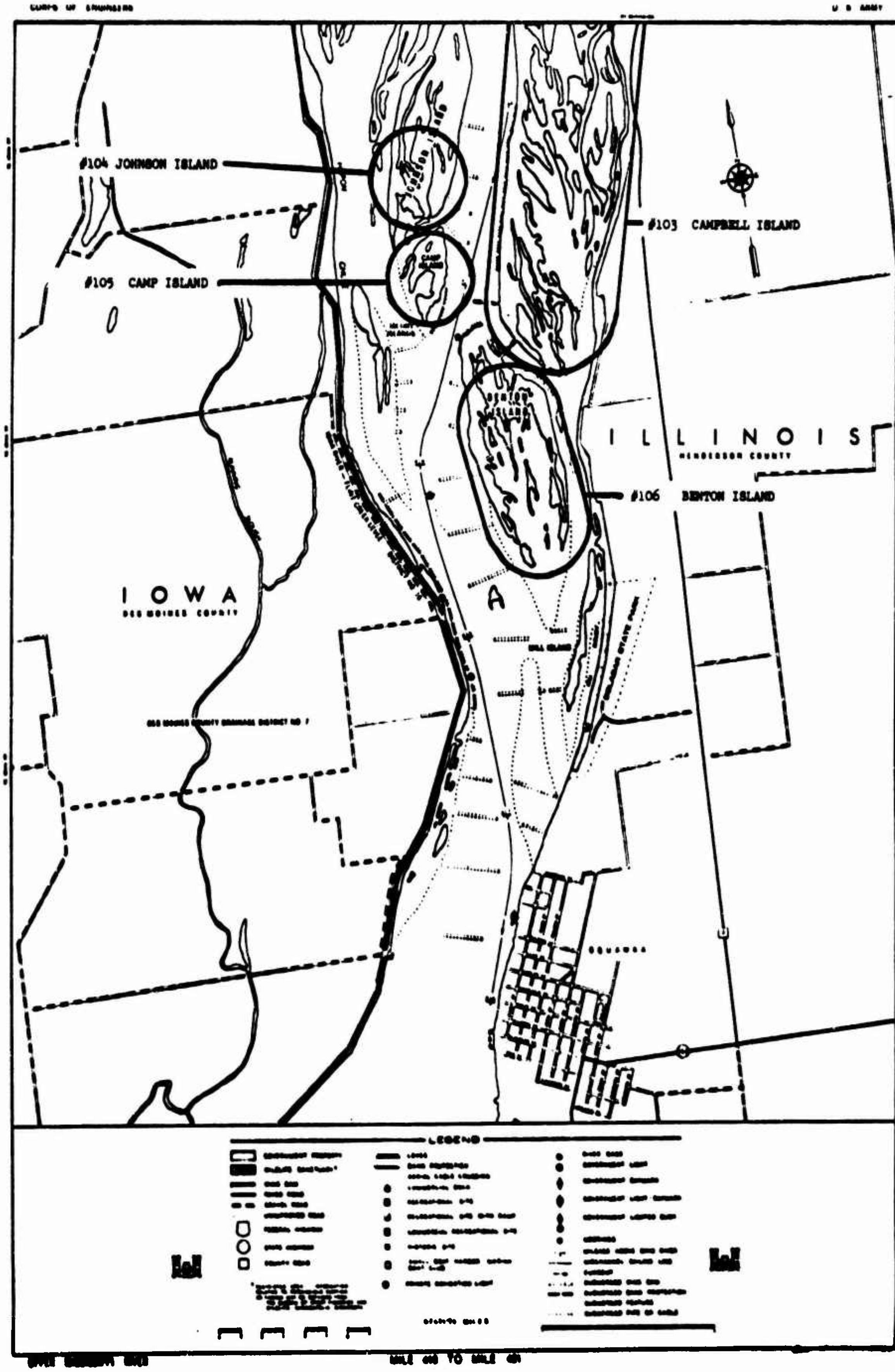

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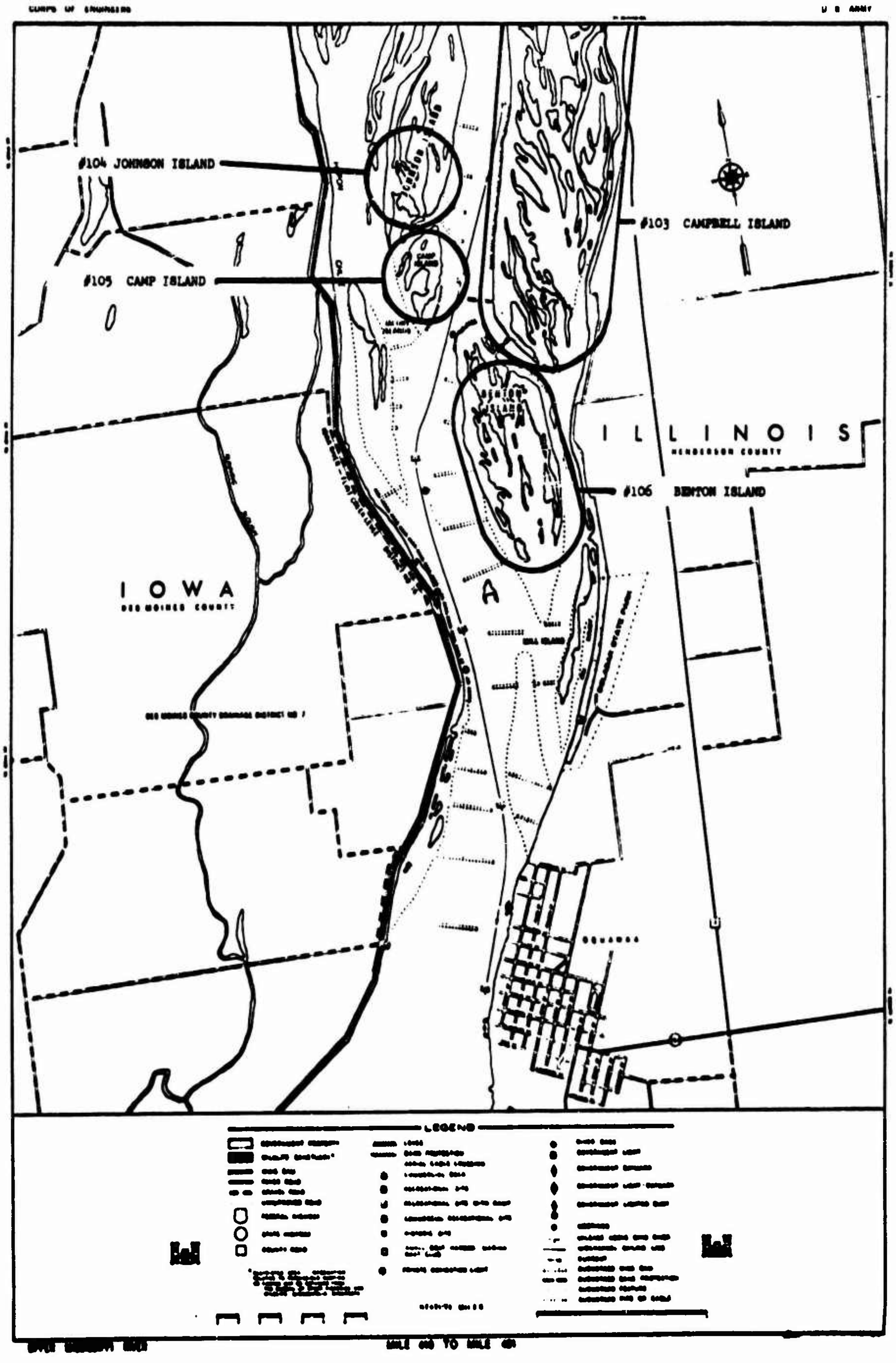

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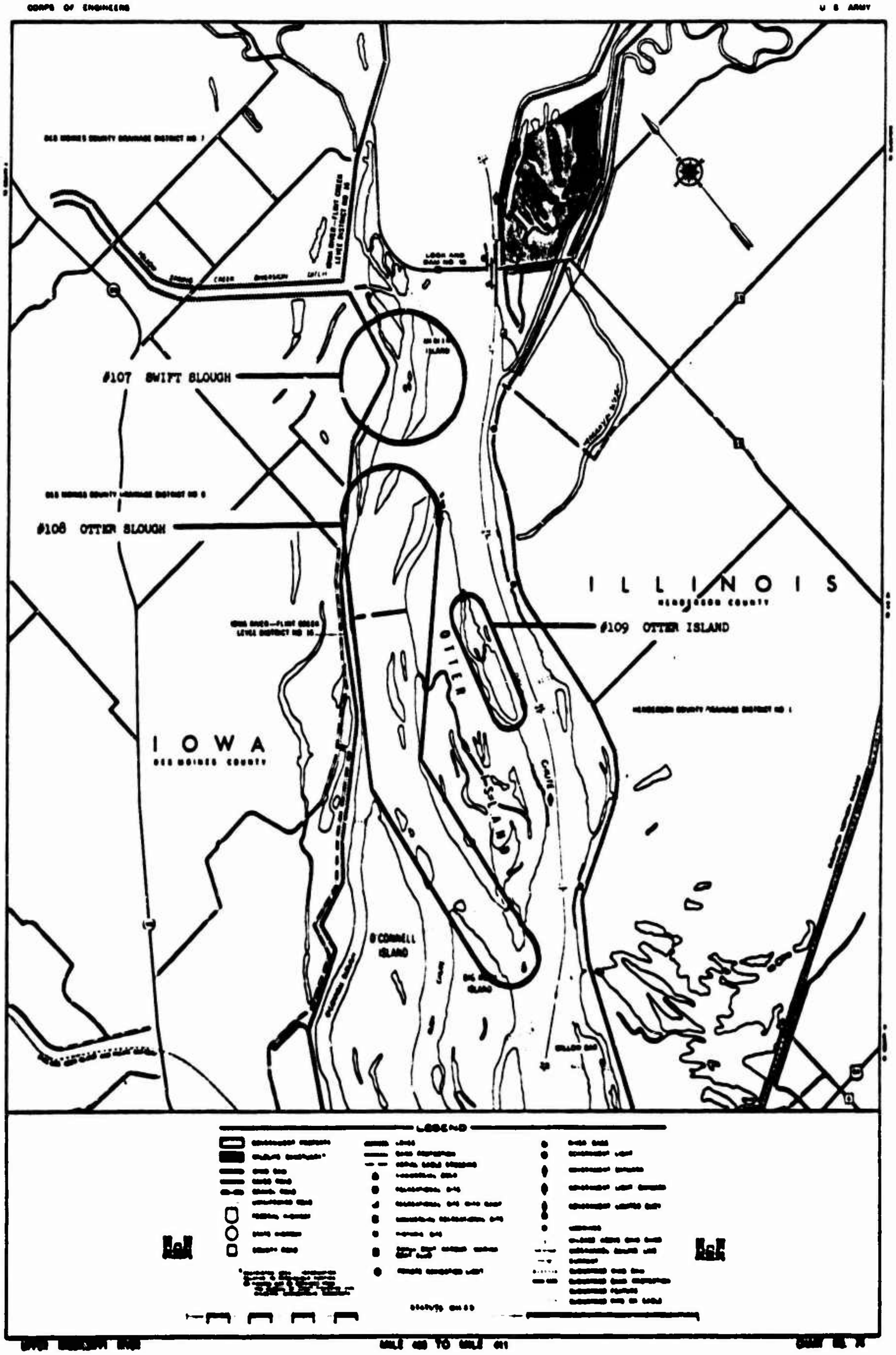

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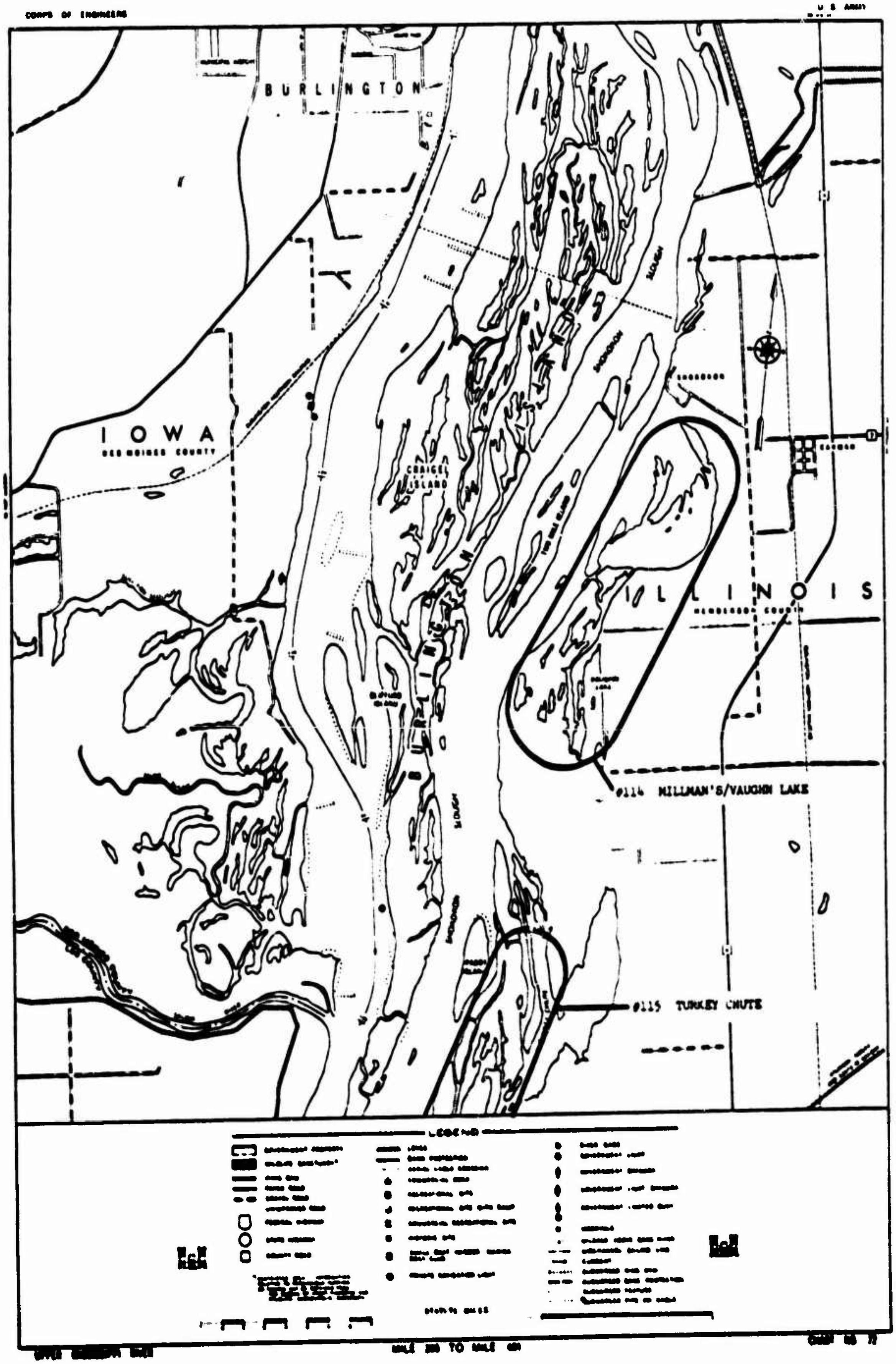
Figure 37. Side channel problem areas (see Table 5).



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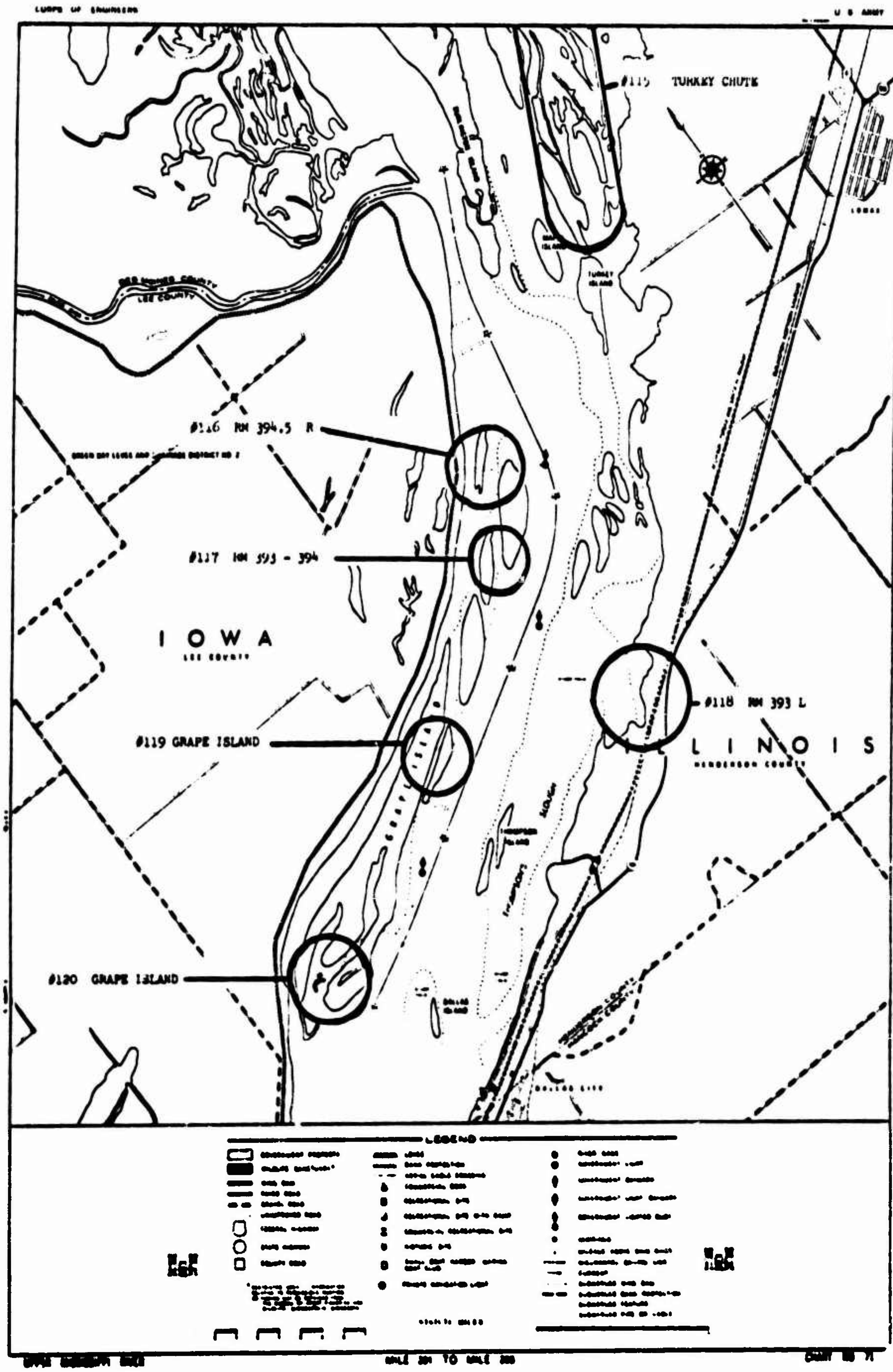

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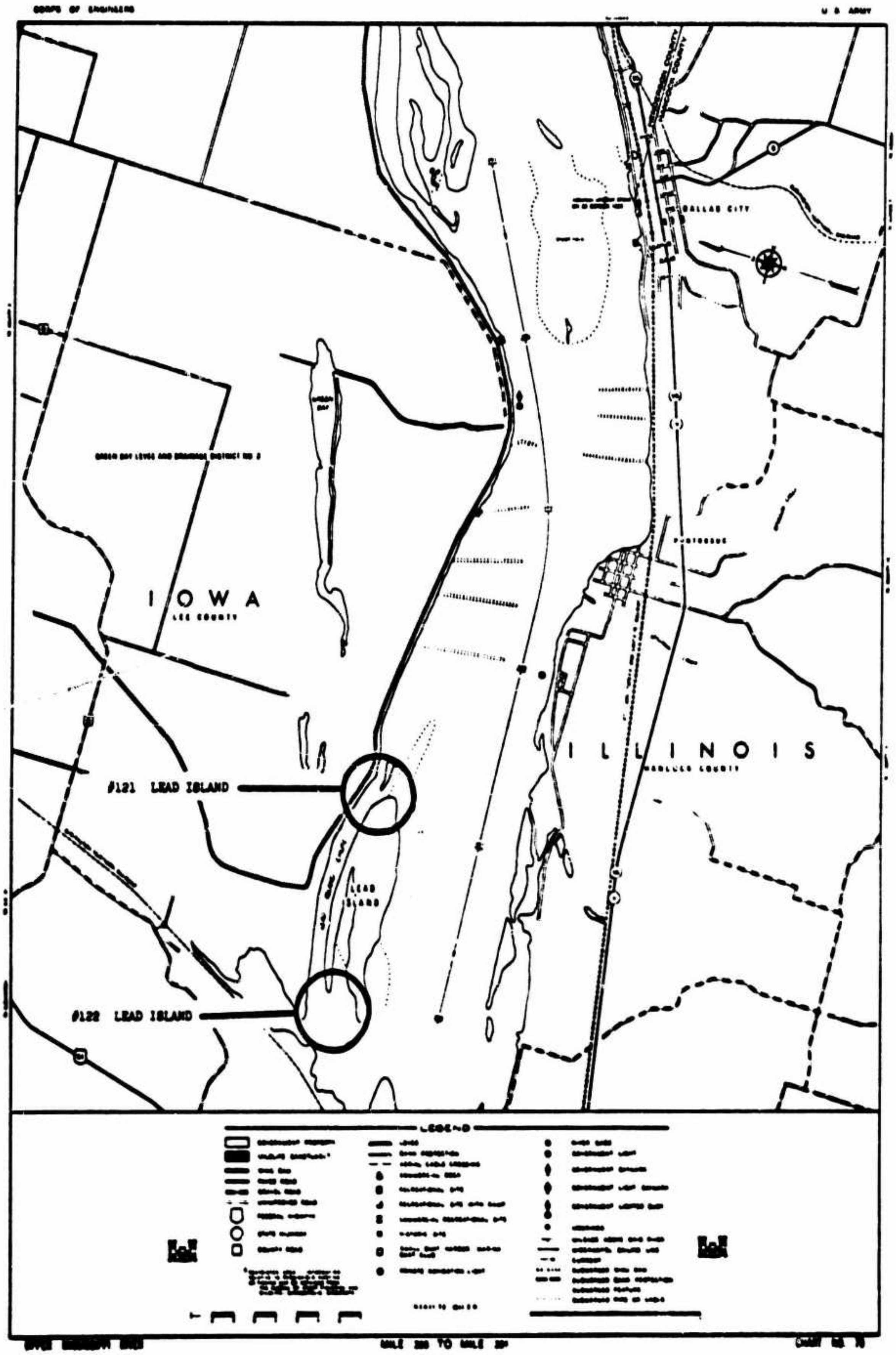

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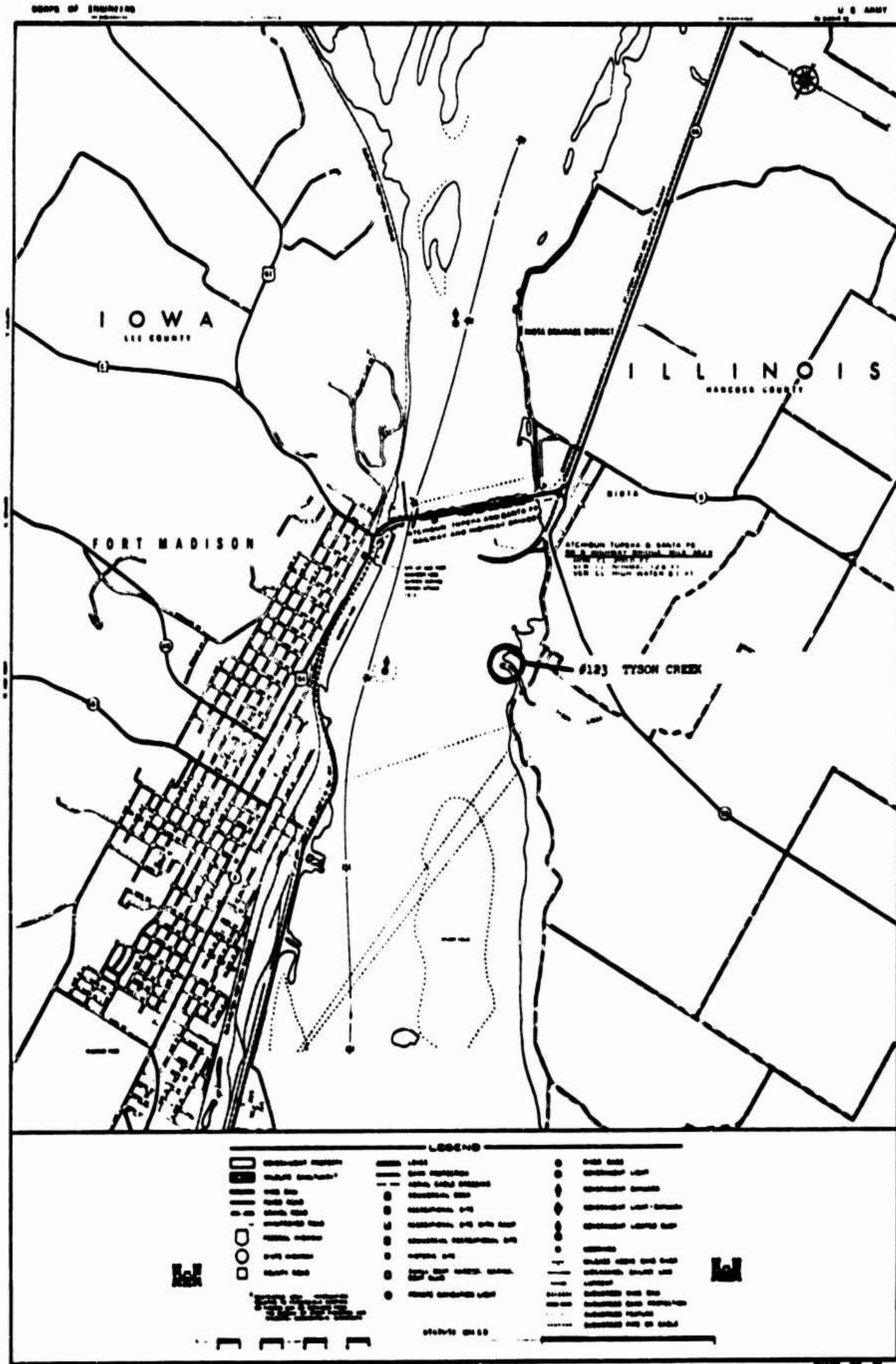

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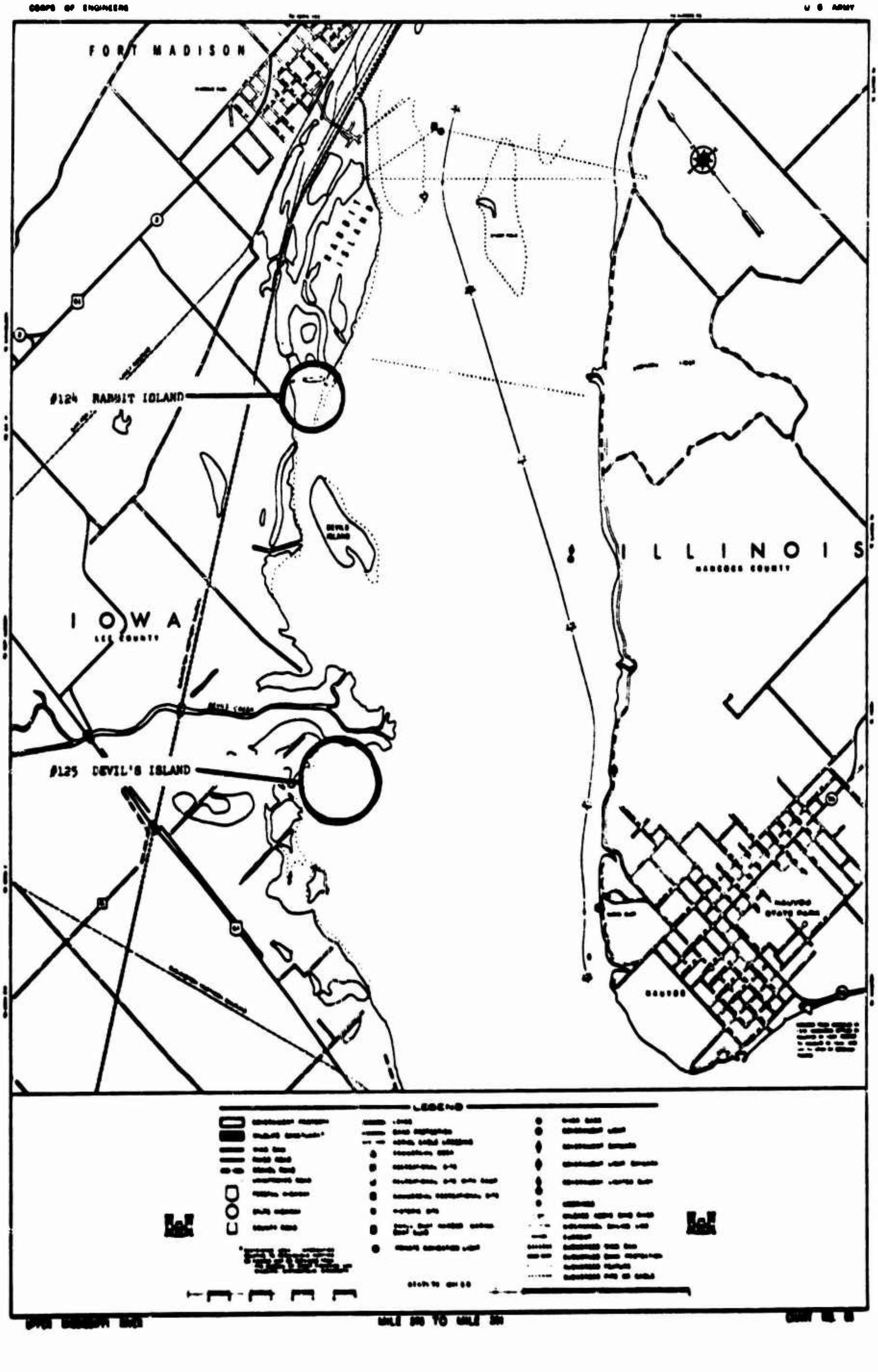

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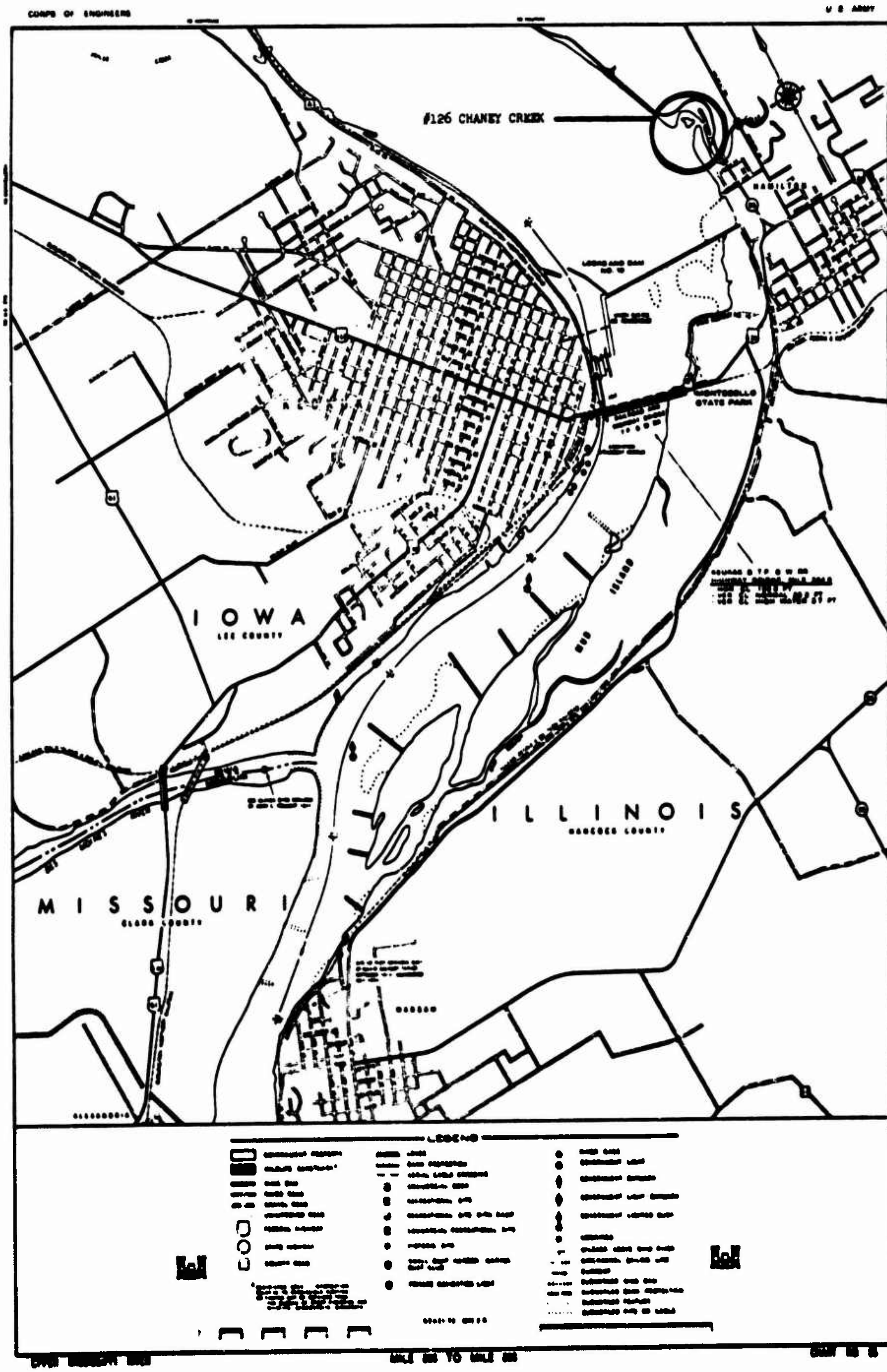

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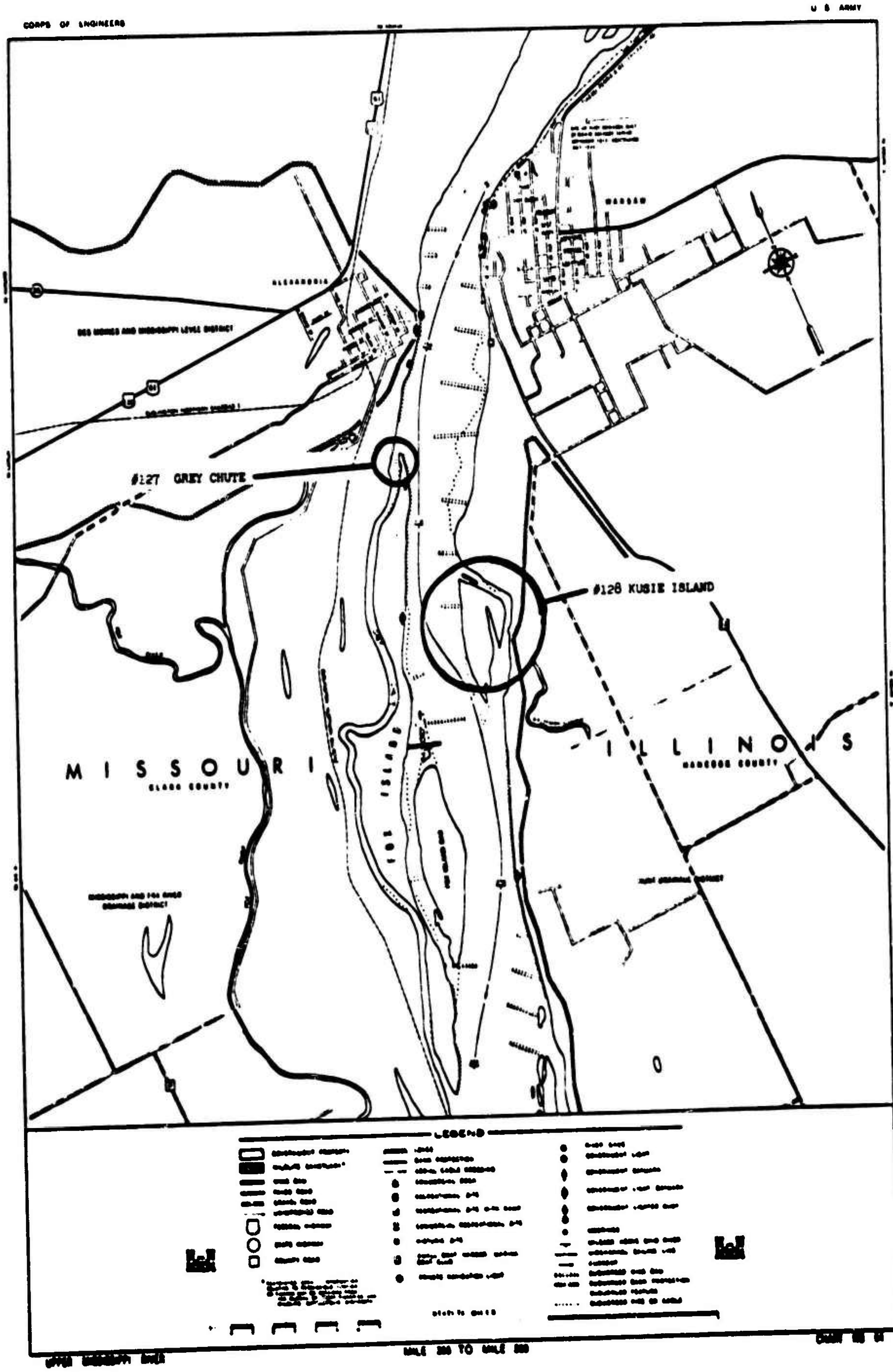

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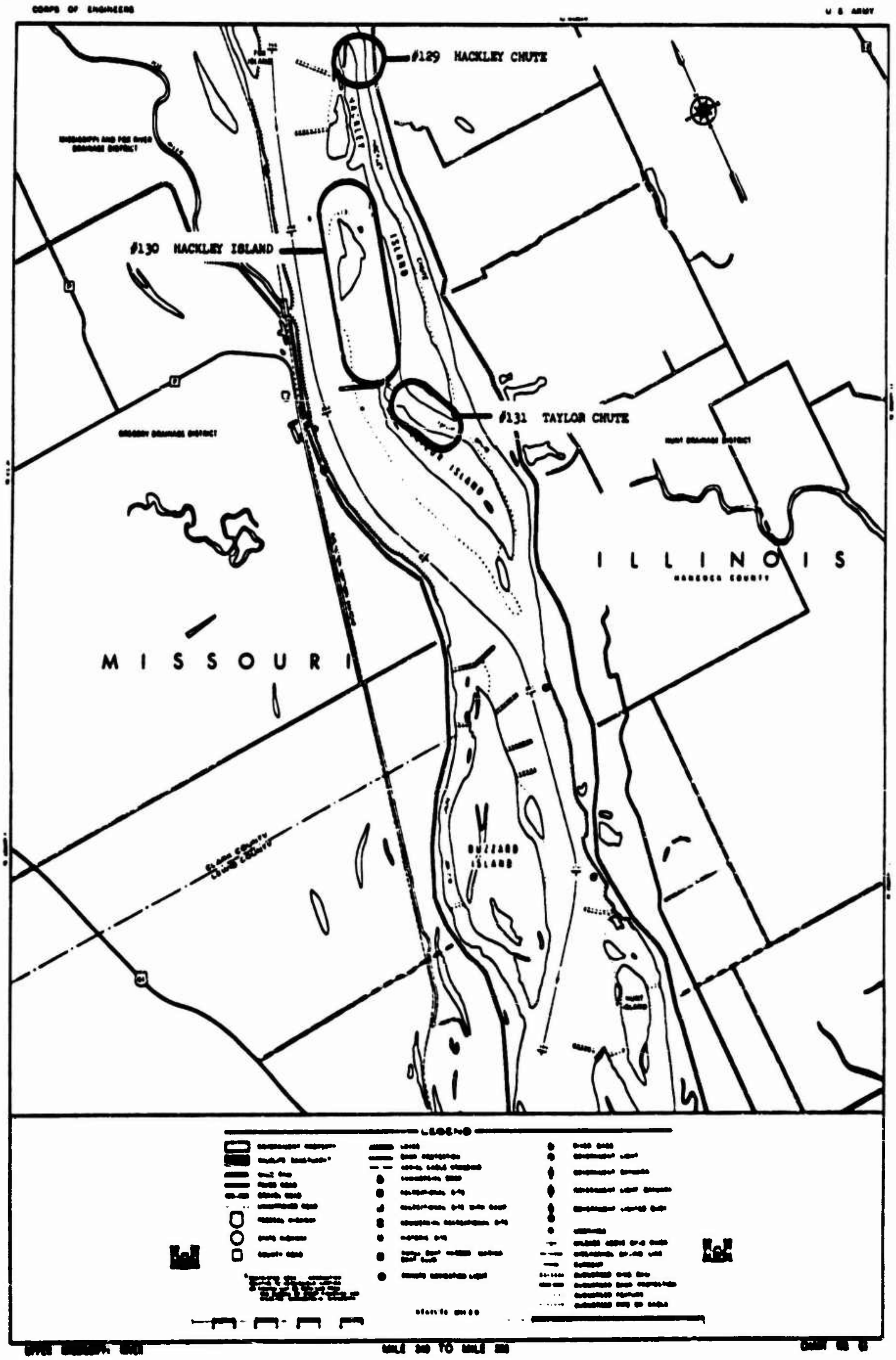

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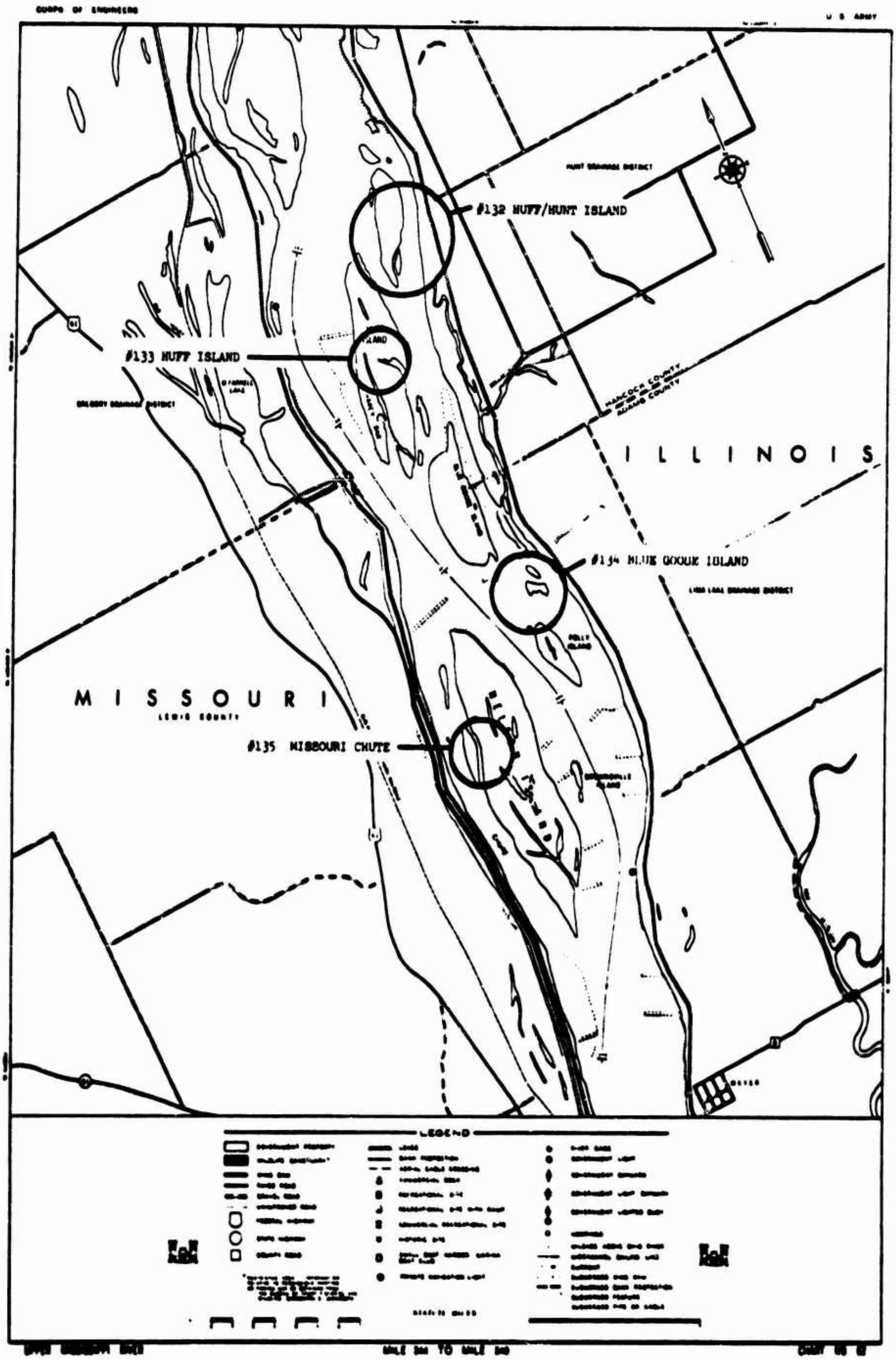

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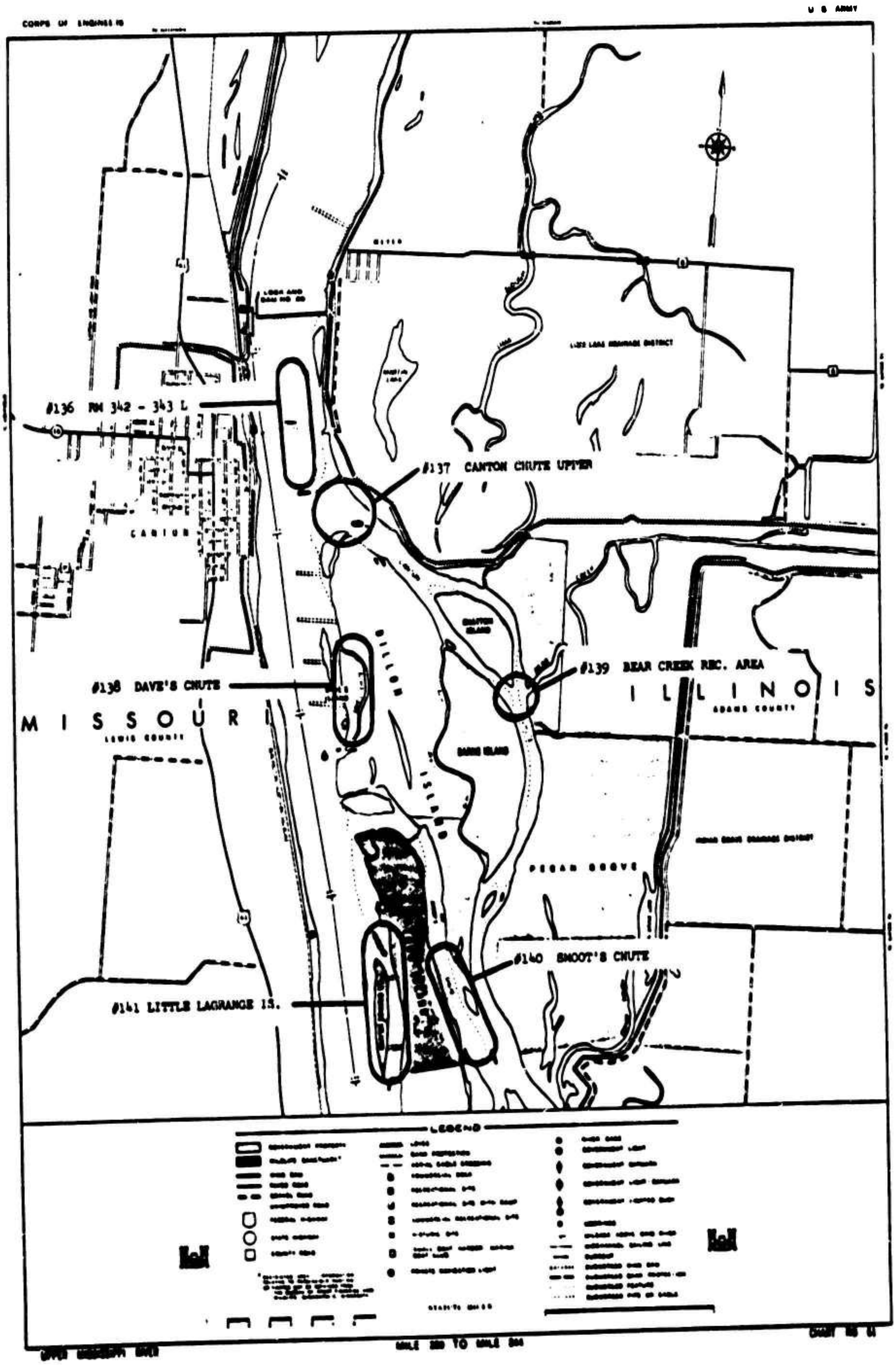

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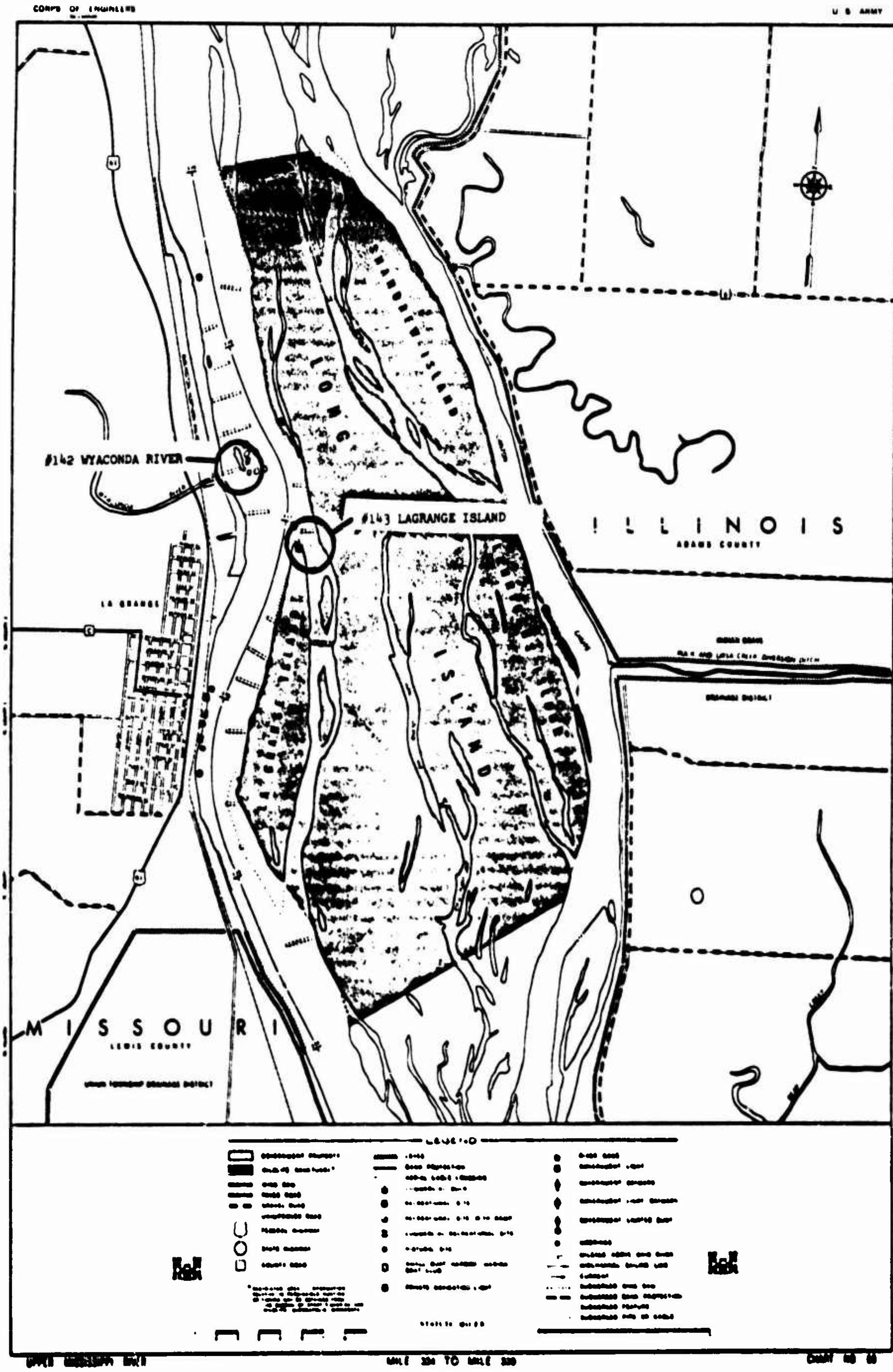

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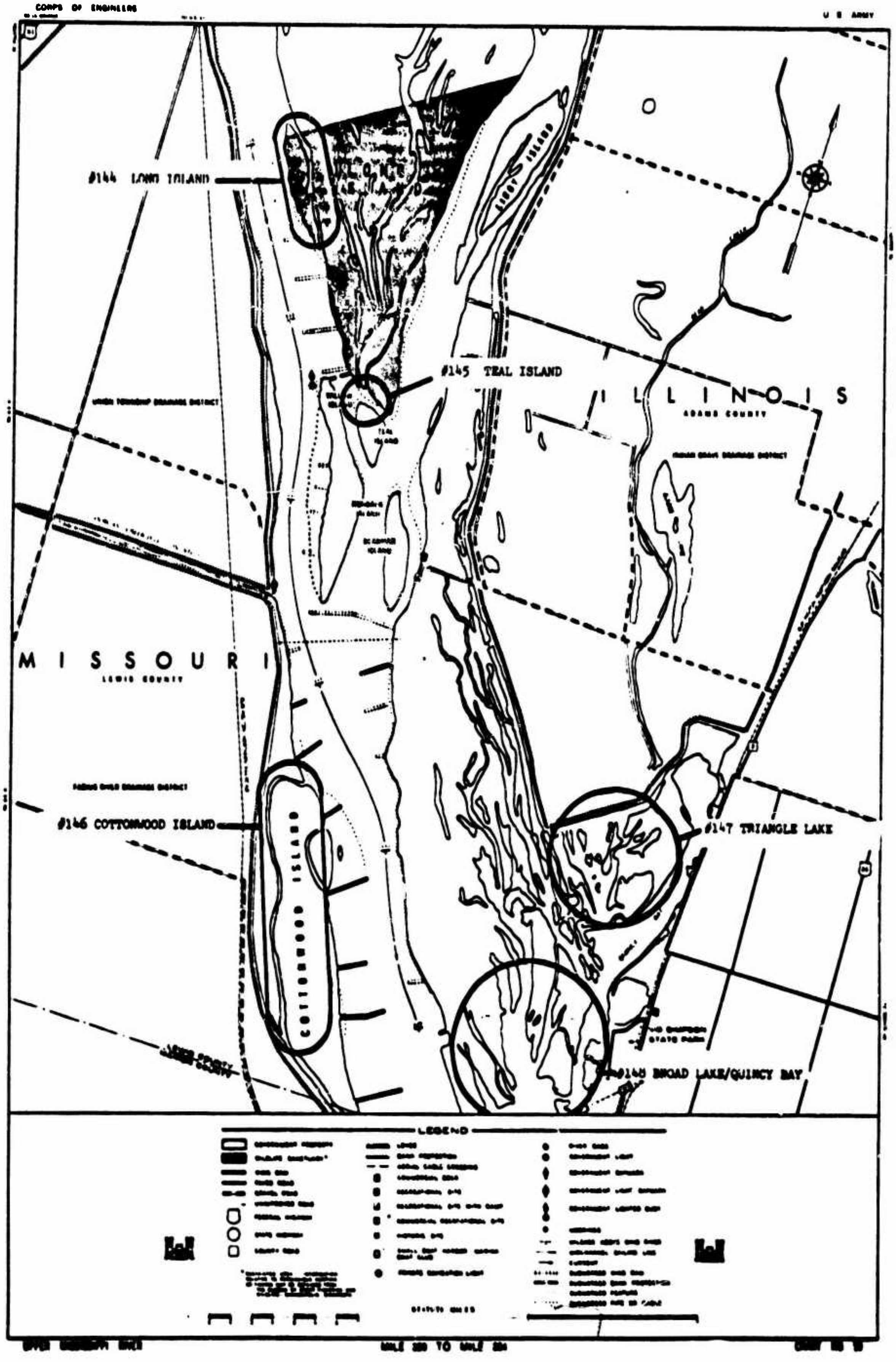

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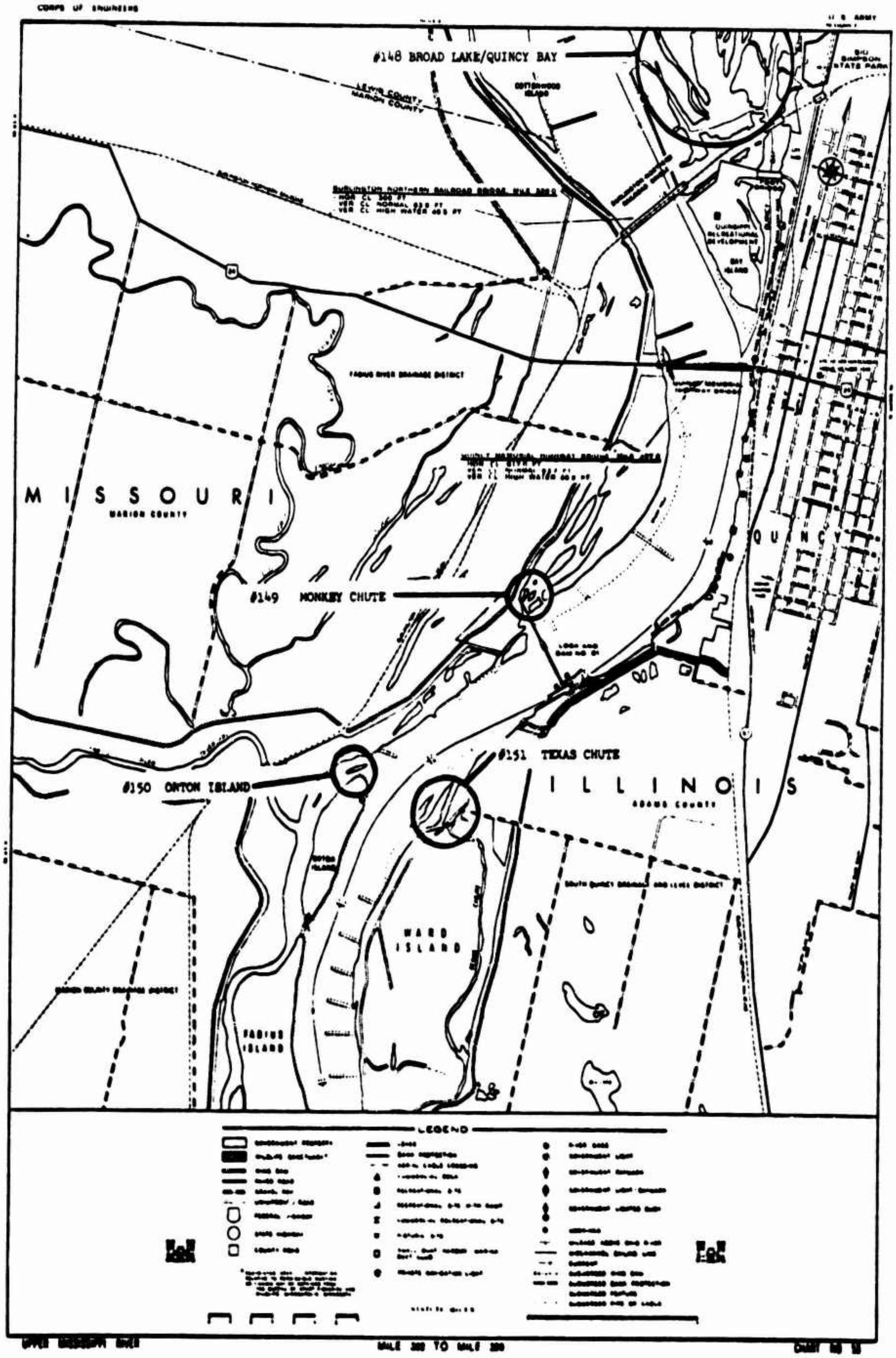

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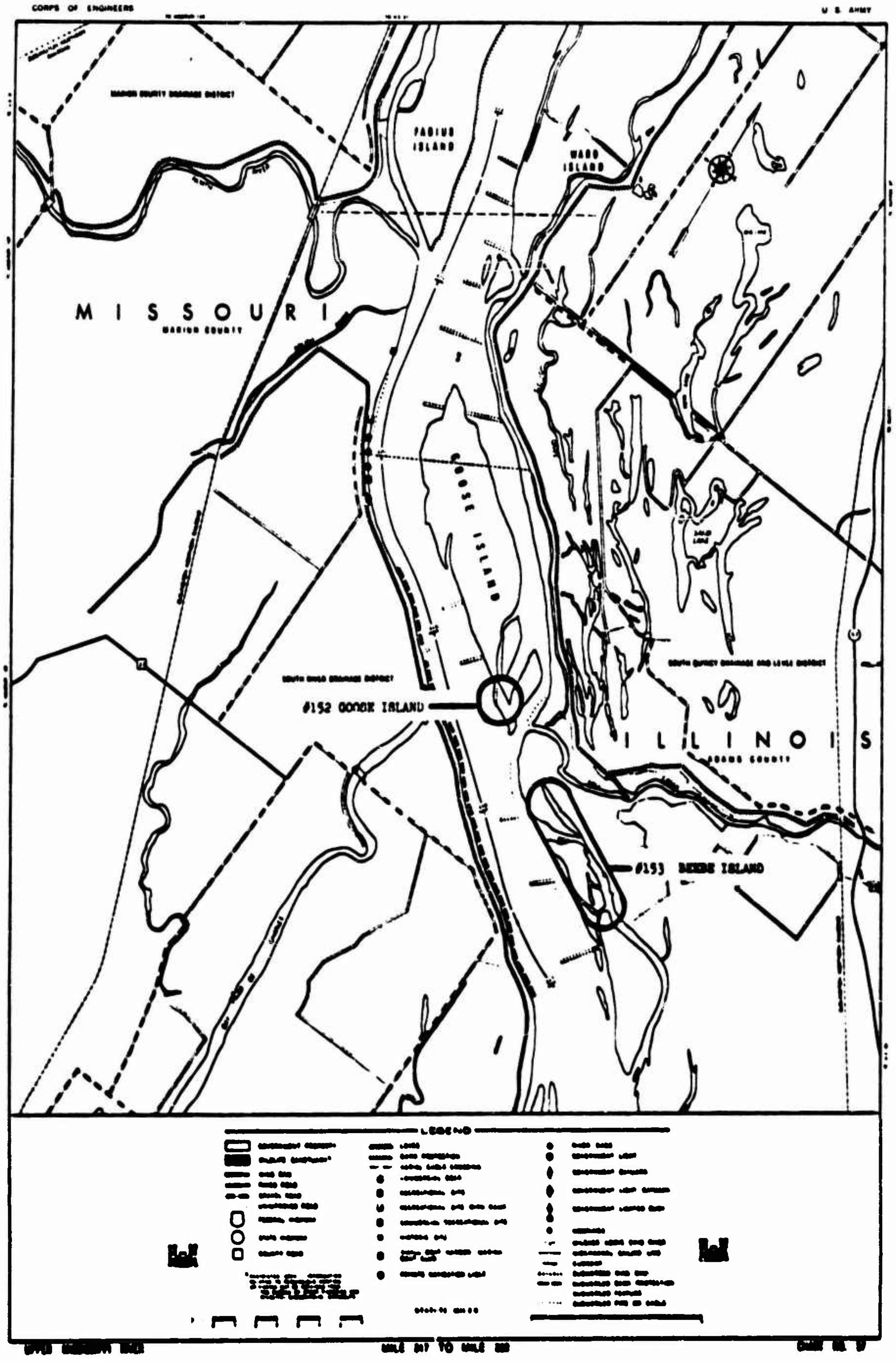
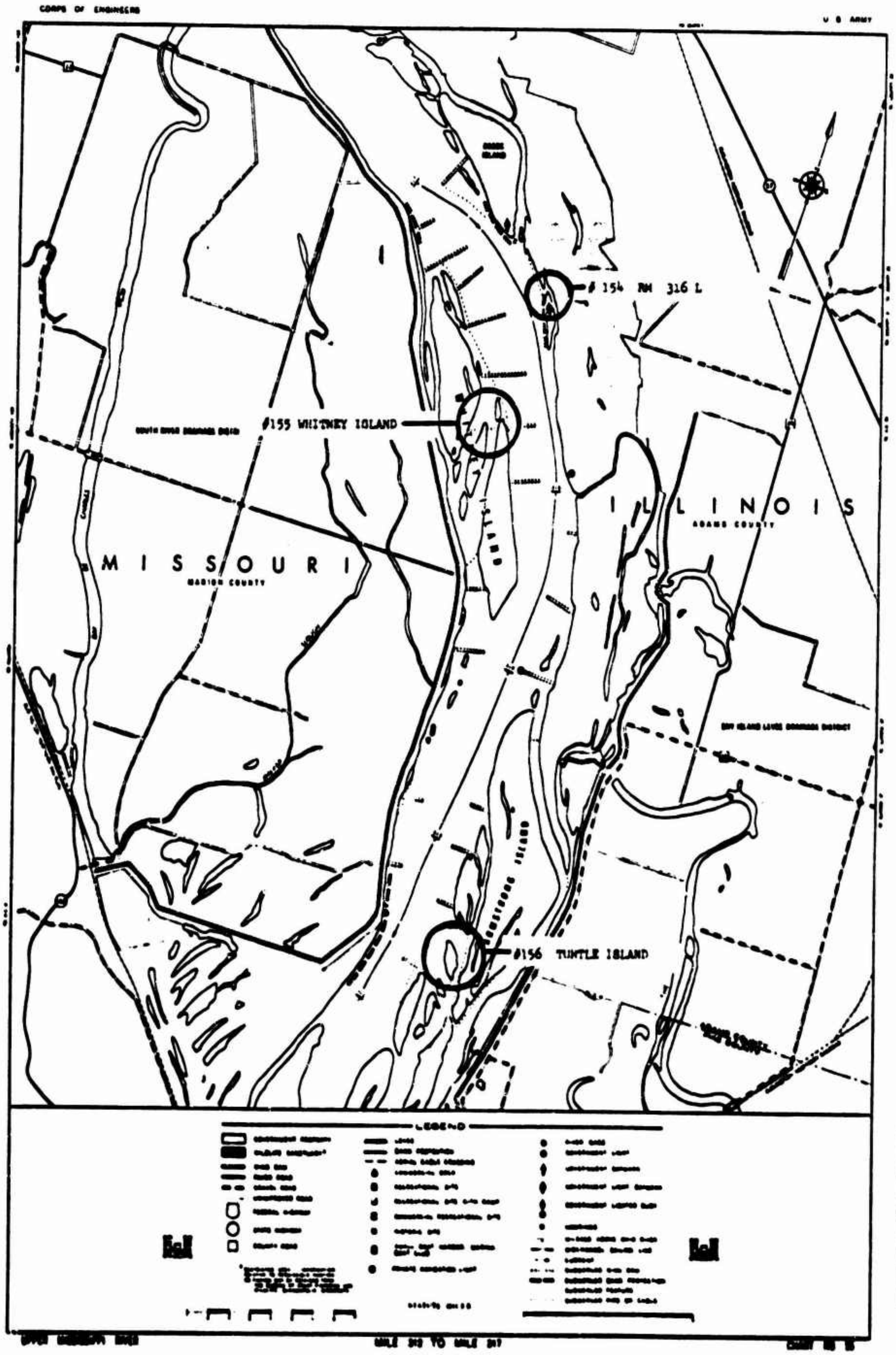


Figure 51. Side channel problem areas (see Table 5).



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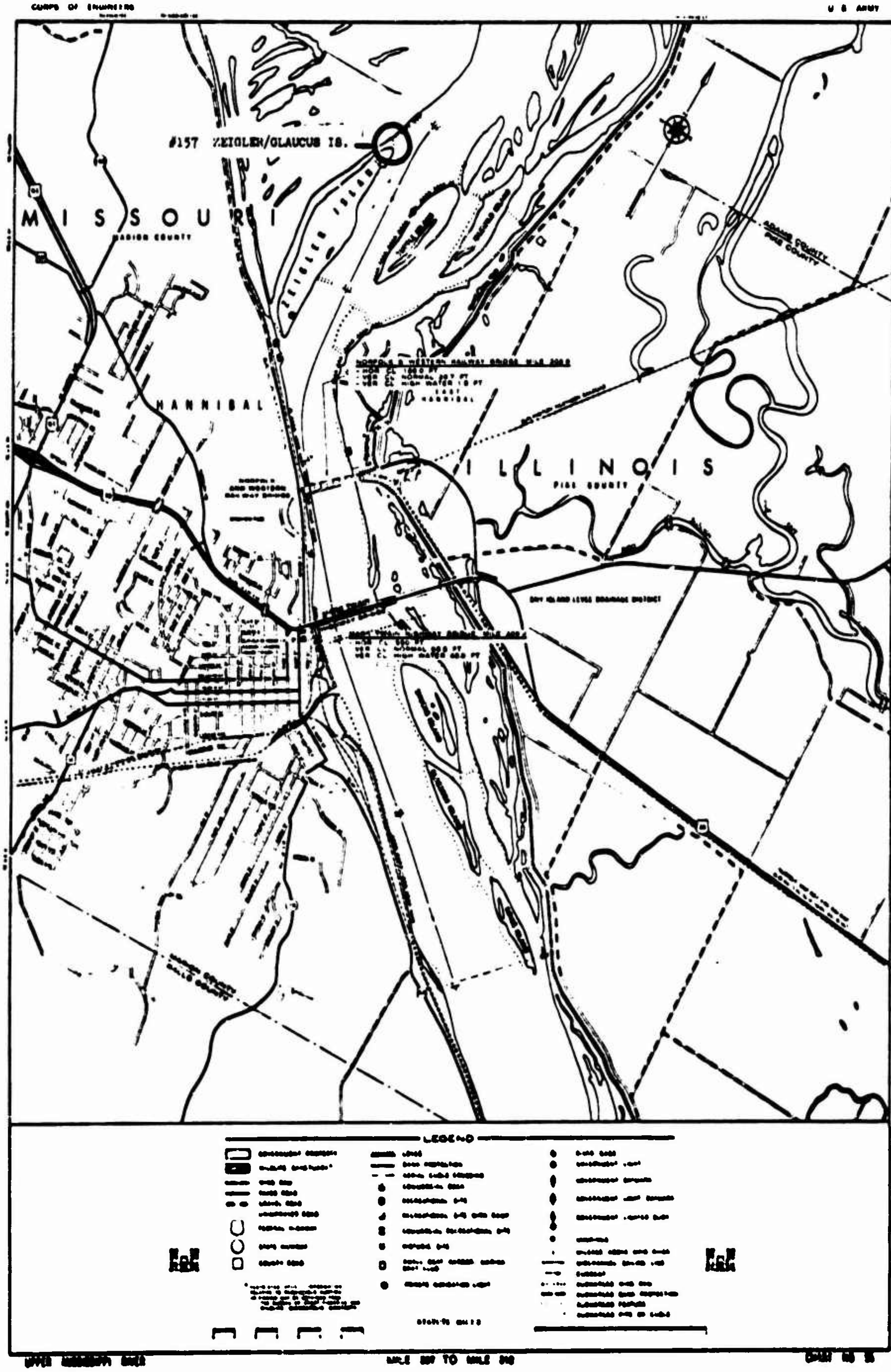

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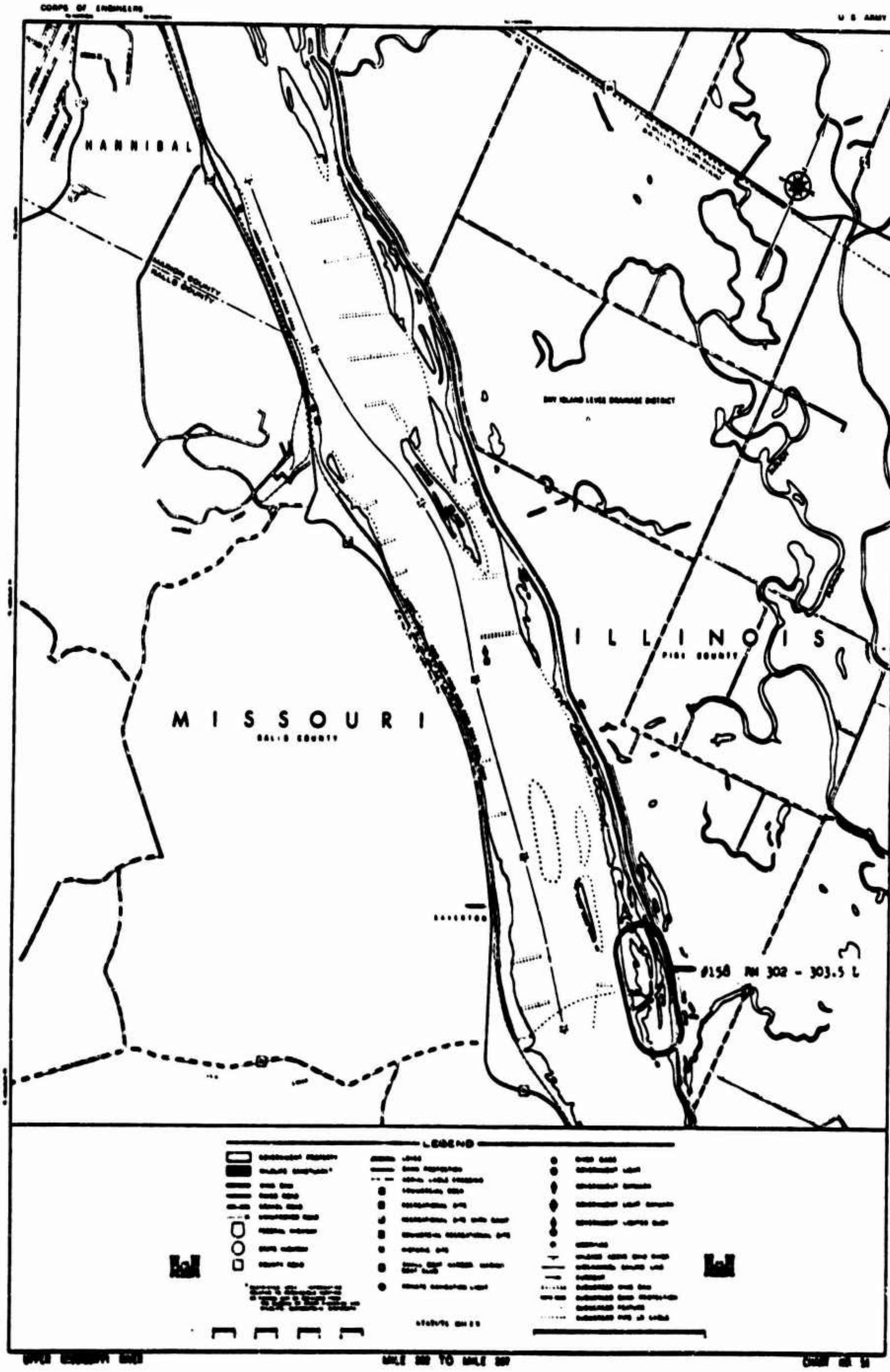

Figure 54. Side channel problem areas (see Table 5).

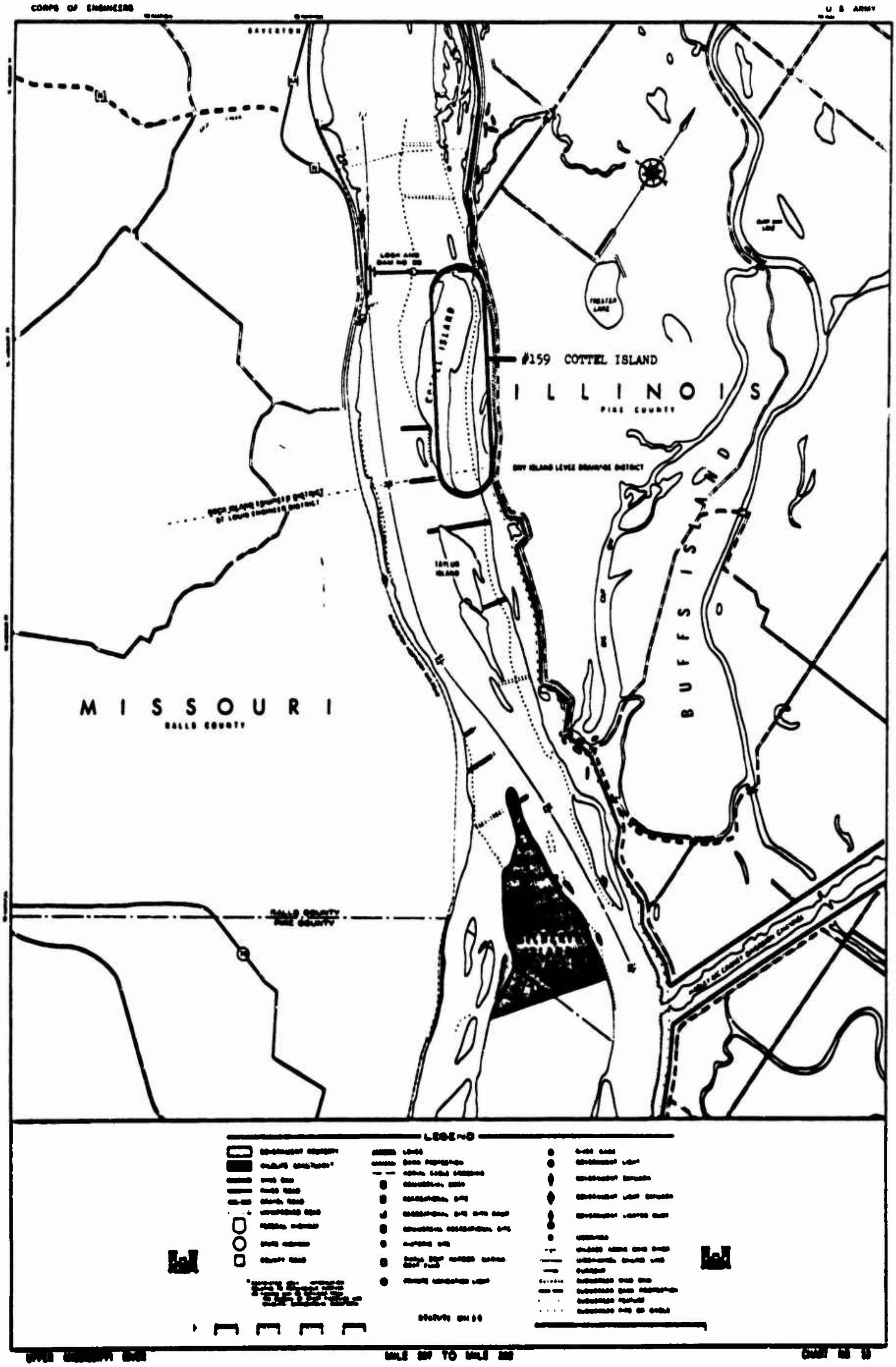

Figure 55. Side channel problem areas (see Table 5).

III. WORK GROUP ACTIVITIES AND ACCOMPLISHMENTS

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III. A. Orton-Fabius Side Channel Opening and Study

III. A. 1. Purpose and Scope

The Side Channel Work Group has identified numerous side channels and backwaters which are being destroyed naturally through sedimentation or from man-made causes such as dredge-spoiling within the side channel. A considered approach to rejuvenating such areas is by constructing an opening or a cut into the isolated area. The addition of flowing water should improve water quality within the backwater, but may require trade-offs in the form of lost spawning and nursery habitat. In some cases, an existing side channel may require partial closing in order to preserve the backwater habitat. In either event, the biological consequences of alterations to side channels and backwaters are not completely known or understood. Such basic information is required before resource biologists can make management decisions in the study area.

The goal of this pilot project was to determine the effects of side channel opening on side channel limnology and the abundance, distribution and composition of fish communities in side channels of the Upper Mississippi River. Figure 56 illustrates the Orton-Fabius area and project.

III. A. 2. Description

The above goal was to be achieved by addressing the following objectives:

a. Determine the normal, seasonal variation of primary physical and chemical features in "control" side channels (i.e., prior to opening).

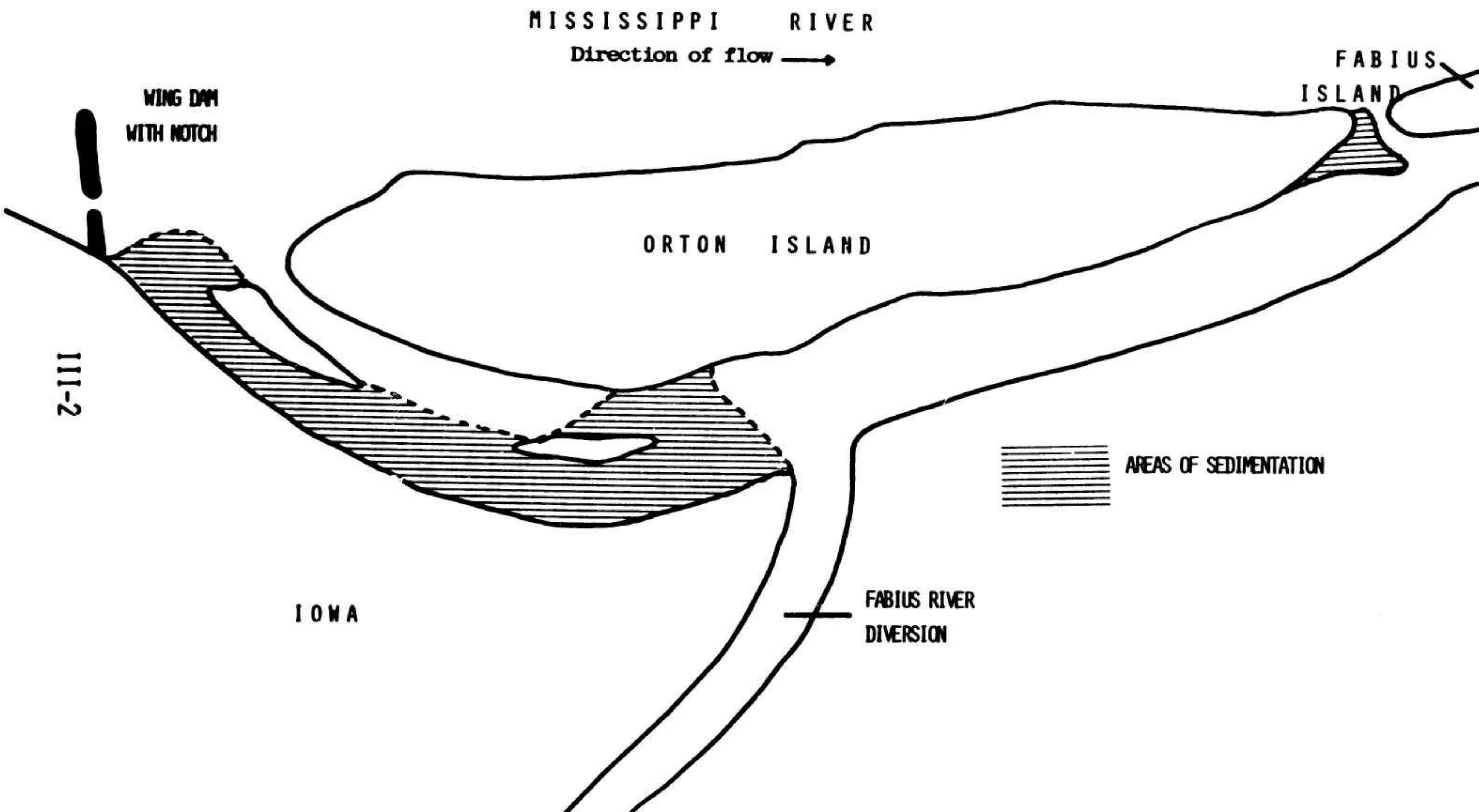
b. Determine the normal, seasonal variation of relative abundance, composition and distribution of fish communities in "control" side channels.

c. Measure the short-term effect of a side channel opening on the primary physical/chemical features and benthos of these side channels.

d. Measure the short-term effect of a side channel opening on the relative abundance, composition and distribution of fish communities of these side channels.

e. Determine which of the study parameters provide reliable

Figure 56 Orton-Fabius Project Area



indices to the changes which occur in the aquatic community as a result of a side channel opening.

The study was a continuation of another study by the Missouri Cooperative Fisheries Research Unit of Columbia, Missouri. Their two year investigations characterized and compared fish abundance, composition and distribution in three side channels representing divergent stages of evolution. The results are reported by Ellis in his Masters Degree Thesis (1978).

It had been determined that, of the three side channels studied (Orton-Fabius, Cottonwood Island and Buzzard Island), the one separating Orton and Fabius islands from the shore was the best candidate for an opening as it represented the intermediate in side channel succession. In addition to excavating an opening into the side channel, it was proposed to excavate a notch in the wing dike immediately upstream of Orton Island and that a natural opening between Orton and Fabius Islands be filled. This notch should induce flows down the improved side channel (Figure 57).

Of particular concern in this project was the influence of the Fabius River which enters the side channel behind Orton Island. Indeed, Corps of Engineers hydrologists attributed the filling of the side channel to the sediment carried by the Fabius River. This view was not shared by others, however, who placed blame for the filling on the two wing dikes above the side channel. At any rate, it was felt that high water in the Mississippi River would keep the new opening flushed out as long as the wing dike was notched.

III. A. 3. Methods

The wing dike notching was performed by the Corps of Engineers. A 25 foot by 5 foot notch was excavated by crane barge and the material was placed on the dike adjacent to the notch. The Missouri Department of Conservation placed dynamite in the area of the proposed side channel opening. Upon loosening the sediments in this manner, the subsequent flow of water maintained an open channel. Filling the gap between Orton and Fabius Islands was also to be done by the Corps of Engineers.

A contract was awarded to the Missouri Cooperative Fisheries Research Unit, Columbia, Missouri, to perform the post-opening studies. The parameters to be measured included:

Dissolved oxygen (surface, bottom)
Temperature (surface, bottom)
Turbidity
Conductivity
Current velocity

Water level duration and periodicity
Side channel morphometry
Abundance and diversity of benthic invertebrates
Abundance and diversity of fish
Size distribution of fish
Juvenile abundance (selected fish species)
Fish distribution within study area
Movement patterns of adult fish

All studies within the Orton-Fabius side channel were to be completely sampled within a 48-hour period and the Cottonwood Island and Buzzard Island side channels were to be sampled within the following two 48-hour periods. This schedule was to be repeated every other week during June-October for the two years following the opening. Hoop netting and electrofishing were chosen as the best sampling methods for the fish species.

The results of the study were to be documented in the Master's thesis of two University of Missouri graduate students.

III. A. 4. Schedule and Cost

The schedule and cost of the various phases of the Orton-Fabius Study are illustrated as follows:

Action	Completion Date	Cost
Notch wing dike	November 1976	No cost to GREAT II
Open side channel:		
blasting	April 1977	MO DNR
dredging	November 1977	$15,000.00
Close gap	Not done	None
Post opening studies	May 1977-October 1978	$32,000.00
Report	November 1979	

III. A. 5. Results

The first attempt to blast an opening into the Orton-Fabius Side Channel (April, 1977) was not successful. It was hoped that high waters from the Mississippi River would keep the new channel open. However, a period followed when stages in the Fabius River were actually greater than the Mississippi causing flows to reverse in the side channel. Sediment carried by the Fabius settled out completely closing the side channel by that fall.

A second attempt to open the side channel was conducted in November by the Corps of Engineers. This channel was dredged between Orton Island and a towhead (small island) just upstream of the confluence with the Fabius River. The dredged material was placed adjacent to the cut. The objective was a channel that would be four feet deep at flat pool.

Two weeks following the excavation, depth transects revealed the channel averaged two feet deep at flat pool and that one location would have been dry at flat pool. The question remains whether the cut silted in this rapidly or whether it was not dredged deeply enough to begin with. At any rate, by the following spring, the side channel had still not been opened.

It was the opinion of the Work Group that removal of all or part of the wing dike upstream of the project area was necessary to insure a successful opening. This possibility was discussed with Corps' hydrologists who reasoned that the wing dam is essential to the maintenance of the navigation channel by directing flow to it. Wing dam removal could not be supported, therefore, and a successful opening became unlikely.

Since the opening could not be accomplished, the purpose of the studies changed from "before and after" research to one of backwater characterization. Three years of empirical data will be added to the data base to increase our knowledge of backwater habitat and its value to fish and wildlife. Furthermore, since the project had essentially failed, it was decided not to continue with plans to fill the gap between Orton and Fabius Islands.

The study results of this project are reported in Ellis, Farabee and Reynolds, 1979 and in the Master's Degree Theses of Ellis, 1978, Neuswanger, 1980 and Gutreuter, 1980 (see Appendix A).

III. A. 6. Conclusions

The conclusions which can be drawn from this project and the attendant studies are as follows:

Side channel characteristics can vary, representing different stages of aquatic succession.

The more riverine side channels exhibit the lowest seasonal fluctuations in dissolved oxygen.

Distinct fish communities accompany the physico-chemical features of the different successional stages of side channels.

As a side channel changes from a riverine to a lacustrine system there is a dramatic increase in the relative abundance of catfish and non-game species groups.

Total number of fish species collected in each side channel was not significantly different.

Side channels with low flow in late summer and fall probably serve as nursery areas for juvenile fishes.

Optimum backwater habitat for channel and flathead catfish may include frequent, sustained current velocities of 4-80 cm/s and base flows of 10 cm/s.

Herpobenthos (organisms inhabiting the bottom sediments) are more abundant in the slough rather than side channel.

Conversely, haptobenthos (organisms attaching to substrates such as snags, rocks, roots, etc.) are more abundant in side channel habitat.

Haptobenthos provided by side channels is a more stable and available macroinvertebrate food supply than sloughs during the summer months.

Current velocity, substrate composition and depth are important factors influencing zoobenthic community structure.

Side channel openings are not possible in cases where channel regulating structures are indispensible to maintaining a channel.

Figure 57. Wing Dam notch above Orton Island, River Mile 323.9, Missouri

III. B. Burnt Pocket Backwater Opening and Study

III. B. 1. Purpose and Scope

As with the Orton Fabius opening and study, the purpose of the Burnt Pocket Opening and Study was to assess backwater opening as a management tool for improving aquatic habitat that has been suffering degradation as a result of sedimentation. The effects of the alteration on the limnology and the abundance, composition and distribution of aquatic communities would be determined.

In addition, resource managers require a tool or methodology for predicting the effects of similar alterations in other backwaters. Should backwater and side channel manipulations prove to be an effective and acceptable technique for improving or maintaining productivity, it would be desirable to have a computer model that would predict the biological consequences. Such models have been or are being developed.

It was the additional goal of this project, therefore, to test the applicability of an existing regression model that was designed to predict the biological consequences of physical alterations to backwaters and side channels.

Figure 58 illustrates the Burnt Pocket area and project.

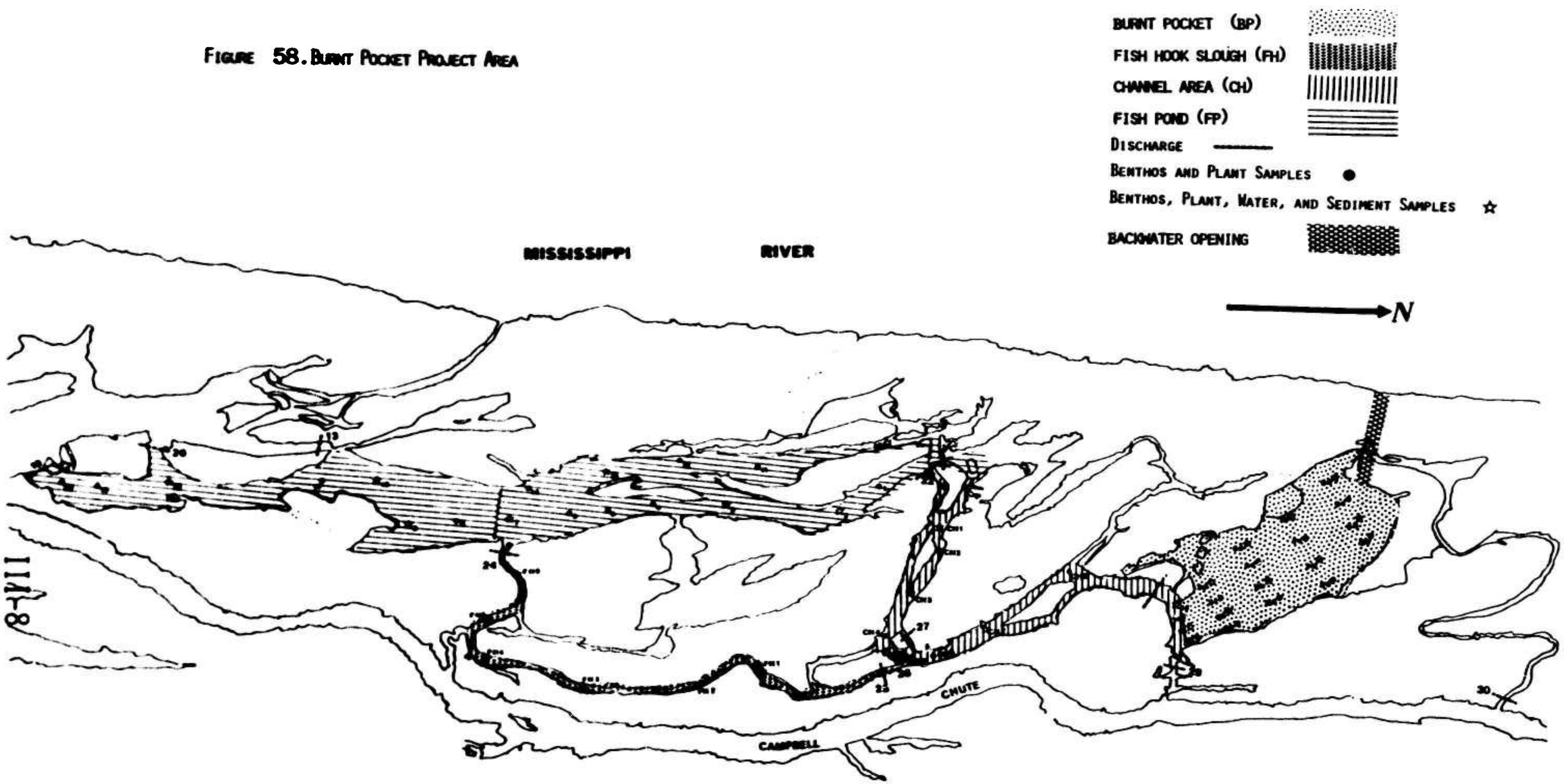
III. B. 2. Description

Burnt Pocket differs from the Orton-Fabius Side Channel in that it is a backwater lake with very little through-flow of water. The Mississippi River carries sediment into the lake and, deposits it at the upper end. Comparison of 1957 aerial photographs with 1975 revealed that the upper one-third of Burnt Pocket has received enough sediment to convert open water to vegetated by shallow water plants (arrowhead, lotus) while the lower one-third remains open. The average depth of the open water in Burnt Pocket is currently 0.8 meter. In the extreme, a small area in the upper pocket has been invaded by willow trees, the first stage in terrestrial evolution.

It is obvious, therefore, that if left unchecked, Burnt Pocket will ultimately lose in excess of two-thirds of its original water surface area. The pocket and adjacent backwaters are managed by the Illinois Department of Conservation as a waterfowl hunting area. Blind sites are provided by that agency and several are located in Burnt Pocket itself. Generally, however, waterfowl hunters have had difficulty reaching their blinds because of the shallow conditions that prevail during the fall, low flow period.

It was felt by the work group that Burnt Pocket provided a unique opportunity to evaluate a relatively new technique for preserving the backwater areas. By constructing a cut from the main river into the pocket, it was hoped that aquatic habitat could be preserved. The additional flow of water through the pocket should not only scour some of the accumulated sediment but would also prevent dissolved oxygen from dropping below life supporting levels.

Figure 58. Burnt Pocket Project Area



Certain trade-offs were anticipated. The entire lake-like characteristic of the pocket would change to a flowing side channel. Sedimentation rates may actually increase in certain locales. Aquatic vegetation, benthos and fish populations would change in composition, and abundance. The site would be less suitable for fish spawning.

The above stated goal would be acheived by addressing the following objectives:

> Determine the normal variation in primary physical and chemical features in a "control" backwater (i.e., prior to opening
>
> Determine the normal variation in selected biological parameters (i.e., fish, benthos, aquatic macrophytes, zooplankton) in a "control" backwater.
>
> Measure the short-term effect of a backwater alteration on the primary physical and chemical features of the backwater.
>
> Measure the short-term effects of the backwater alteration on selected biological parameters (i.e., fish, benthos, aquatic macrophytes, zooplankton).
>
> Apply these data to an existing regression model (designed to predict the biological consequences of physical alterations) in order to determine its applicability to the study area.

Although other alternatives exist for preserving or enhancing the aquatic habitat of the backwater or for reducing its sedimentation none of these completely meet the above objectives and goals. In addition, while an opening may eventually prove harmful to the backwater complex, it must be recognized that the project was an experiment and was designed to obtain answers to specific questions.

III. B. 3. Methods

A contract was awarded to the University of Wisconsin (LaCrosse) River Studies Center to conduct the pre- and post-opening studies. The principal investigator had previously developed a regression simulation model for predicting the biological consequences of physical alterations to side channels and backwaters (Claflin, 1977). It was developed in Pool 8 for the Great River Environmental Action Team (GREAT I). Since the character of the river changes considerably along its linear length, it was decided that this model should be tested for applicability in a lower pool.

The contractor investigated the following parameters both prior to and following the opening:

> depth
> current velocity
> discharge
> temperature
> dissolved oxygen

sediment size
sediment nutrients
aquatic macrophytes
benthic macroinvertebrates

These data would then be applied to the regression simulation model to produce a set of predictions of biological changes prior to the backwater opening. With the post-opening data, the accuracy and applicability of the model would be evaluated.

In addition to the contracted sampling, the work group conducted fish and zooplankton sampling before and after the opening. Fish were sampled using electroshocker and trap nets. Zooplankton were sampled with a Clarke-Bumpus metered plankton net. These data were also used by the contractor to augment and evaluate the regression model.

The actual opening was contracted and completed in November, 1979. A channel approximately 800 feet long was cut through the island and wetland area into the open water of Burnt Pocket (see Figure 59). In addition, stone riprap was placed 75 feet into the opening to protect it from erosion. The cut was designed to be five feet deep during 50 percent flow (approximately one foot above flat pool) and would provide an average of 500 cfs flow into the pocket. It has a 50 foot bottom width and one vertical on two horizontal side slopes. The approximately 10,000 cubic yards of spoil material consisting of sands and silts was placed adjacent to the cut and graded.

The necessary permits were applied for by the work group. These included an Army Corps of Engineers permit pursuant to Section 404 of the Federal Water Pollution Control Act (as amended), an Illinois Division of Water Resources permit and a water quality certificate from the Illinois Environmental Protection Agency. A public hearing was held in Oquawka, Illinois, and the project was coordinated with and reviewed by all interested state and federal agencies and the public.

As a result of concerns expressed during the permit review process, the U.S. Fish and Wildlife Service, Iowa Conservation Commission, and Illinois Department of Conservation have committed their efforts to a five-year monitoring program following the study. This would involve yearly monitoring of physical parameters as well as hunter success, wood duck nesting and fisheries. The fifth year will involve an intensive sampling effort designed to further evaluate the results of the regression model's predictions. If as a result of the monitoring process it becomes apparent that the opening is having a significant adverse impact on the backwaters, the monitoring agencies in consultation with the Corps of Engineers will arrive at the necessary remedial action.

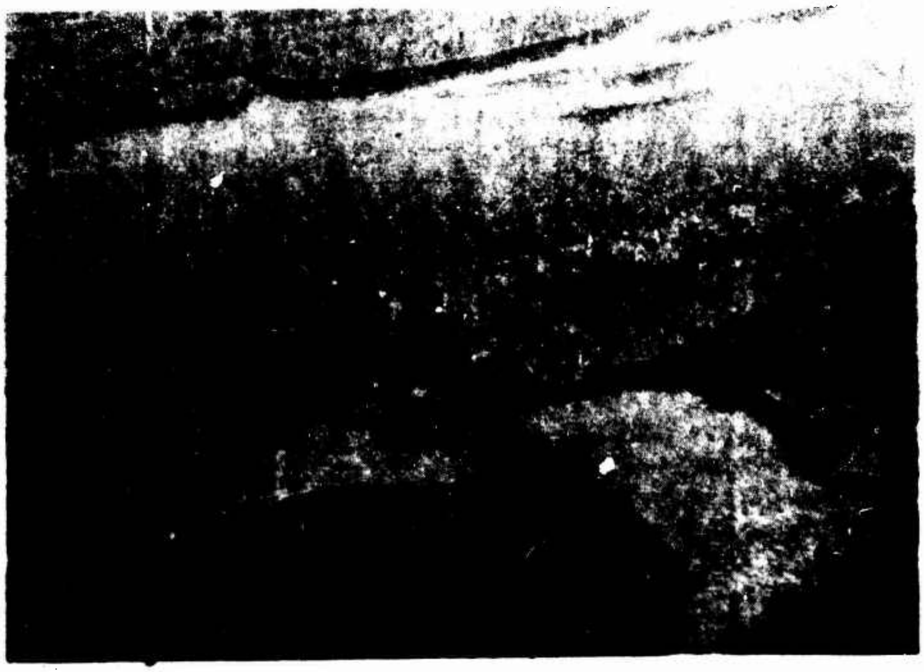


Figure 59. Aerial view of Burnt Pocket backwater opening. River Mile 422.5, Pool 18, Illinois

III. B. 4. Schedule and Costs

The schedule and costs of the various phases of the Burnt Pocket opening and study are illustrated as follows:

Action	Completion Date	Cost
Pre-opening study	September 1978	$15,866
Fish sampling	September 1980	2,000
Zooplankton sampling	September 1980	3,000
Final Report	March 1981	
Opening and riprap	October 1979	80,500
Post-opening study	June 1980	18,970

It should be noted that the original schedule was not followed. The intent was for completion of pre-opening studies in September, 1978, the opening to be constructed in October of that year, and post-opening studies the following summer. However, the opening was delayed a full year due to difficulties in obtaining a permit from the Army Corps of Engineers. These difficulties were the result of objections to the project that were raised by members of the public. Their objections were primarily two-fold: (1) that the opening was designed without the benefit of proper engineering and hydraulic studies to determine the proper course of action in this situation; and (2) that the project was similar to a backwater opening into Broad Lake near Quincy, Illinois, which has caused severe siltation and loss of fishery habitat and recreational access. In his Findings of Fact, however, Colonel Mueller of the Rock Island Army Engineer District concluded that, due to the experimental nature of the project, the relationship of the project to the completion of the GREAT study and the proposed five-year monitoring program, issuance of a permit was in the public interest (U.S. Army Corps of Engineers, 1979).

III. B. 5. Results

The summer of 1980 was unusually dry and the water levels in the river were consequently low. For the most part, water did not flow through the Burnt Pocket opening and the upper end of the pocket became dry. This was the condition at the time the study contractor conducted the post-opening sampling effort. The study did however, identify some significant changes that have taken place.

Pre- and post-opening water routes were essentially the same but differed significantly in total discharge. It is apparent that, at least during the Spring of 1980, the experimental channel carried large quantities of water into the study area. This is evidenced by the erosional patterns (braided channels) that were observed in upper Burnt Pocket. In addition, the grain sizes of Burnt Pocket sediments were more variable during the post-opening period. In short, spatial heterogeneity was introduced due to the increased flow. The sediments of the Channel and Fishhook Slough study areas (see Figure 58) remained relatively unchanged. Fish Pond Slough, however, was affected by the increased discharge. The upstream portion appeared to have a lower percentage of silt- and clay-size sediments during the post-opening period. Furthermore, the percent silt and clay increased in the middle and lower reaches of the slough.

The introduction of heterogeneity in Burnt Pocket is also reflected in the sediment chemistry data. The distribution of TKN (total kjeldahl nitrogen) was much more variable in Burnt Pocket in 1980 and the total pre-opening TKN content was significantly reduced after the opening was made. Similar trends were observed for total-phosphorus. The Channel area remained relatively unaffected. It appears that Fishhook Slough apparently lost a portion of the sediment TKN due to scouring and the subsequent removal of allochthonous organic material. The sediment TKN concentrations were also significantly reduced in Fish Pond Slough. Whereas this seems to be contradictory with the sediment data, the lower concentrations of organic material and associated TKN was probably discharged from the study area. Total-P levels were also reduced in Fish Pond Slough.

Pre- and post-opening water quality characteristics were similar, but variations in the data were less during the post-opening period. The few differences that were noted (i.e. turbidity) were attributed to the low water levels observed during the 1980 sampling season.

Significant increases in macrophyte biomass were observed in 1980 in Burnt Pocket. The cause(s) are obscure, but the construction of the side channel opening appeared to have little effect on either the biomass or distribution of *Nelumbo lutea*, the only species sampled. This was probably due to the subsidence of the water levels prior to the period of active growth of the organism.

Benthic diversity in lower Burnt Pocket was lower during the post-opening phase of the study, but Upper Burnt Pocket was not sampled due to low water. The benthic fauna of the Channel area and Fishhook Slough remained relatively unchanged. However in Fish Pond Slough, the density of organisms and the biomasses were reduced. In addition, the species composition was also altered in this area. Fingernail clam populations decreased and one species of midge (*Tanypus* sp.) increased. This appears to be a response to the aggradation of sediments from upstream areas, presumably Burnt Pocket.

From a gross observation of the study area during the summer of 1980, it is apparent that some erosion of the bank of the opening is taking place just at the end of the riprap protection. It is unknown whether this erosion will continue or where it will stabilize. It is not even known whether additional riprap would even cure the problem or merely displace it. The eroded material is no doubt settling in the backwater areas below and could ultimately cause significant impacts.

Fishery and zooplankton data have not yet been analyzed. However, one significant change can be noted in the fishery composition of the backwater area. In 1980, many northern pike were captured in nets and by electrofishing whereas only one was taken in all pre-opening samples. It is uncertain whether the presence of this species can be attributed to the opening or not.

Model: Simulations were conducted to determine densities of selected benthic invertebrates, total benthic standing crop and total macrophyte standing crop for seven sampling areas within the study area. Simulations were run separately for each of three years where complete input data were available. Actual and predicted values are given in Appendix C.

Differences in actual and predicted values can be noted during all three years of data collection in the study areas. It is difficult to assign specific reasons for these differences. One problem that no doubt, affected the outcomes of the actual standing crops, was the low water level encountered during the post-opening period. It is evident that during the Spring of 1980, that the experimental side channel opening carried appreciable quantities of water to Burnt Pocket. The redistribution of sediments and nutrients supports this. The large fluctuations in total benthic biomass during the study period were not reflected in the predictions. On the contrary, the fluctuations in the predictions appear to be attenuated. Better accuracy, however, was observed in predicting the numbers of specific taxa. For example, the decline of Sphaeridae in Fish Pond Slough was predicted. The decline was judged to be a function of the instability of sediments, created by the opening and sediment characteristics are also included in the model. The model also predicted that the macrophytes would be totally eliminated from Burnt Pocket. Were 1980 a normal water level year, this could well have been the case. The study results are reported in Claflin and Rada, 1980 (see Appendix A).

III. B. 6. Conculsions

The question of applicability of the model is in part answered. The model predicted a few categories with accuracy and recognized a few trends. Because of the limitations of regression systems, and the latitudinal differences in species composition of the invertebrate fauna, the usefulness is limited. The limitations are probably also related to the higher concentrations of smaller particulate suspended sediments during periods of high flow, not encountered in the Pool 8 area. Futhermore, the model fails to take into consideration seasonal (and annual) variations which severely limits its use in a highly variable natural system.

In essence there is no single "model", but rather 34 separate "models" which are equations of the form

$$Y_1 = a + b_1x_1 + b_2x_2 + b_3x_3 + \ldots + b_8x_8$$

where eight independent variables (depth, turbidity, dissolved oxygen, temperature, etc.) are used to predict a dependent biotic value. These are not models in the sense of having any theoretical biological basis or in providing insights into the relationships between abiotic and biotic components. They are merely a series of 34 simple linear multiple regression equations. The data from the Burnt Pocket study can and should be applied to other predictive models or methodologies which are or may become available.

Finally, there is the question of whether or not the cut was appropriate for Burnt Pocket. Trends are difficult to recognize with only one abnormal year of post-opening data. In spite of the increase in macrophyte standing crops in Burnt Pocket, a net loss of nutrients from the system occurred and sediments were at least rearranged. It can be expected that these processes will continue during normal and high flow periods, and that in time the entire area will contain lower concentrations of nitrogen and phosphorus. Existing data do not permit conclusions concerning sediment accumulation. The sediment movement during the first post-opening year however, indicate that the area may in the future, discharge the sediments that it receives. If this occurs, then the opening would certainly have a net beneficial effect.

III. C. Side Channel Inventory

III. C. 1. Purpose and Scope

The purpose of the Side Channel Inventory was three-fold: (1) to characterize and describe the physical and biological elements of side channels and backwaters which contribute to their value as fish and wildlife habitat; (2) to identify problems associated with backwaters and side channels particularly as these problems relate to operation and maintenance, diking and draining, urban development, etc. Completion of the Side Channel Inventory enabled the work group to draw conclusions and to make recommendations regarding channel maintenance, disposal of dredged material and enhancement of backwater habitat.

By characterizing backwater habitat, it was hoped that resource biologists can better use the information available from many sources to plan for fish and wildlife on the UMR. It provides a baseline for determining and evaluating changes in habitat in the future. It may eventually be possible to correlate certain characteristics of a backwater with quality hunting and fishing. And, finally, it gives us a better handle on what we have to work with.

III. C. 2. Methods

The Side Channel Inventory consisted primarily of comparisons of 1956-1958 aerial photographs of the GREAT II study area with the 1975 Habitat Inventory Maps. Changes were noted on matte acetate overlays and cross-hatched with zipatone. Each change was identified as to its type (i.e. open water to emergent vegetation, open water to dredged spoil, etc.) and quantified by polar planimeter where areas were not already measured on the 1975 vegetation overlays.

Comparisons were done without the aide of optics for the most part unless changes were so complex so as to be impossible to delineate them. In these instances a zoom transfer scope was utilized to superimpose one photograph onto the other.

Aerial photography was obtained from the Aerial Photography Field Office of the Department of Agriculture in Salt Lake City, Utah. They were in the form of 9 x 9 inch contact prints on a scale of 1:20,000. Index sheets were also obtained for each county covered.

Considerable error is introduced into this technique of comparing aerial photography because of location inaccuracies, differences in pool elevations, habitat delineation and measurement. Two assumptions had to be made in this phase of the inventory: (1) that water levels were approximately equal in each series of photographs. An analysis of pool elevations (see Table 7) reveals that river stages were generally lower in 1975 than in 1956-1958 for pools 11-16 while pools 17-22 exhibited generally higher in 1975. Theoretically, these discrepancies cancel each other out and we can assume that total measured habitat is reasonably accurate for the study area if not on a pool basis. At a minimum, we can look at the pools which had a higher stage in 1975 and still note considerable change (loss) in aquatic habitat due to the deposition and subsequent vegetation of fine sediment in backwaters. (2) The presence of aquatic vegetation (i.e. *Sagittaria, Nelumbo, Nymphaea,* etc.) indicates a shallow water condition which was caused by sedimentation. This is based on knowledge and experience of river succession.

The second component of the inventory consisted of a characterization and description of side channel and backwater habitat. It included all off-channel habitat exclusive of the main channel border. It also included the stump fields in the lower ends of the pools which were islands prior to lock and dam construction.

Acreages of habitat had been calculated and summarized by Hagen, Werth and Meyer (1977) for the Habitat Inventory Maps. The habitat types were grouped into the following categories and the acreages were determined for each type by pool:

Open Water - side channels, sloughs, lakes, ponds, chutes
Unvegetated - sand, mud
Submerged Aquatic Vegetation
Aquatic and Moist Soil Vegetation - including *Potamogeton sp.*, Lemnaceae, *Numphaea sp.*, *Polygonum sp.*, *Leersia sp.*, *Typha sp.*, and *Eragrostis sp.*
Herbaceous Vegetation - including grasses, forbs, *Echinocystis lobata*, and *Phalaris arundinacea*
Woodland Vegetation - including cottonwood, willow, lowland hardwoods and buttonbush
Agriculture
Developed
Stump Fields - submerged islands in lower portions of pools

Percentages of each habitat type of the total off-channel habitat (i.e., exclusive of the main channel and main channel border) were calculated. Acreages of stump fields were determined from the W.N. Brown Survey Maps of the Upper Mississippi prepared in 1929-1930.

Thirdly, the inventory included a field reconnaisance of known instances of Corps spoiling in side channels and backwaters in order to assess their present condition.

TABLE 7

Differences in Pool Elevations* for Various Aerial Photography Series of the UMR used in the Side Channel Inventory

Pool	Date (D) Tailwater Elevation (T)	1956–1958 Series					1975 Series		Net Change (Range)	Mid-Value
11.	D	7/6/57	7/9/57				9/1/75			
	T	10.5	11.4				6.1		(-)4.4-5.3	-4.85
12.	D	7/9/57					9/13/75			
	T	11.6					6.4		(-)5.2	-5.2
13.	D	6/28/56	7/9/57	7/10/57			9/13/75			
	T	7.0	11.3	11.4			4.8		(-)2.2-6.6	-4.4
14.	D	6/28/56					9/11/75	9/13/75		
	T	5.4					4.8	4.4	(-)0.6-1.0	-0.8
15.	D	6/28/56	9/11/57				9/13/75			
	T	6.2	5.4				4.4		(-)1.0-1.8	-1.4
16.	D	6/17/57	5/28/57	9/10/57	5/9/58		9/1/75			
	T	4.2	5.5	4.6	4.1		5.4		(-)0.1-(+)1.3	+0.7
17.	D	8/31/57	5/8/58	5/9/58			8/23/75	9/1/75		
	T	4.6	4.3	4.1				6.0	(+)1.4-1.9	+1.65
18.	D	9/7/56	7/24/57	8/4/57	8/15/57	8/31/57	8/23/75			
	T	1.0	5.2	3.9	1.7	2.1	1.0		(-)0-4.2	-2.1
19.	D	9/2/56	8/4/57	8/5/57	9/23/57	9/29/47	8/21/75			
	T	4.7	5.3	4.8	2.1	5.2	8.4		(+)3.1-6.3	+4.7
20.	D	10/1/57	10/2/57				8/21/75	9/1/75		
	T	2.8	2.9					7.0	(+)4.1-4.2	+4.1
21.	D	10/2/57	10/18/57	10/27/57			9/1/75			
	T	3.0	3.1	3.3			7.5		(+)4.2-4.5	+4.35

*Source U.S. Army Corps of Engineers, Rock Island District.

III. C. 3. Schedule and Cost

The Side Channel Inventory was accomplished during 1979 and into 1980. Costs incurred in completing this task are itemized below:

Aerial Photographs & Matte Acetate Overlays	$2,000
Employees and Travel (excluding chairman)	$4,000

III. C. 4. Results

Section II. B. 2. summarizes the results of this exercise as well as Tables 1 and 2. The overlays produced in the comparison of aerial photographs are in the possession of the U.S. Fish and Wildlife Service, Rock Island Field Office, 1830 Second Avenue, Rock Island, Illinois. These can be viewed upon request. Figures 4-55 delineate problem areas identified by the Side Channel Inventory and Table 5 provides a listing of those problems.

Comparison of aerial photographs has revealed that considerable change has taken place in the backwaters of the river in the last two decades. Sedimentation has caused the spread of aquatic and moist-soil vegetation to a considerable extent since 1956. Approximately 4,650 acres of open water have become vegetated representing an 8 percent loss in backwater habitat. Extrapolating to the time of lock and dam construction, this loss amounts to about 16 percent of the original backwaters.

In addition to sedimentation, the deposition of dredged spoil has caused losses in backwaters and side channels. It would appear, however, that spoiling on the driest portions of islands results in the least change. As long as the material is prevented from entering backwater sloughs or wetlands, it rapidly revegetates and is relatively unnoticeable from the air.

III. C. 5. Conclusions

It can be concluded from this excercise that, although lock and dam construction originally created a significantly better habitat for fish and wildlife (Green, 1960), the interim has seen serious degradation due to sedimentation and dredge spoil disposal. The long-term result of sedimentation will be the filling of the backwaters. The general tendency is for backwater sloughs, lakes and ponds to become isolated from the main channel. The river is attempting to restore the hydraulic equilibrium which existed prior to lock and dam construction. The flow cannot support the amount of river cross-section that currently exists. Ultimately, the river surface will approach what it was prior to lock and dam construction except that the river has ceased to create new backwaters. Consequently, backwaters will ultimately be lost and a series of riverine pools will exist.

With regard to dredged spoil disposal, impacts are not of the magnitude that sedimentation represents. However, adverse effects have occurred in the past and will occur in the future unless changes in channel maintenance practices are implemented.

Furthermore, some degradation of fish and wildlife habitat has occurred in backwater sloughs and side channels as a result of urban development, municipal and private development, agricultural expansion and recreational development. In a few instances, these changes have been significant (e.g. Hamm Island, Dubuque, Iowa). In most cases, however, losses are primarily the result of small, incremental encroachments which singularly do not yield noticeable adverse effects but which cumulatively may add up to a considerable loss over many years.

III. D. Equipment Specifications

III. D. 1. Purpose, Scope and Methods

The work group felt that the equipment may not be presently available which could be used to perform alterations to side channels in the most efficient and environmentally safe manner. They did not contract a research and development study nor did they solicit ideas from the general public or private industry. They did, however, list what they felt to be the specifications of a machine which could accomplish their management goals. These were transmitted to the Material and Equipment Needs Work Group for their evaluation and comment.

III. D. 2. Results

The following general specifications were transmitted to the Material and Equipment Needs Work Group:

- Shallow draft
- Capable of long distance (out-of-floodplain) disposal
- Capable of handling large volumes
- Self propelled
- Capable of handling logs and stumps

The Material and Equipment Needs Work Group's response is found in Appendix D. They conclude that no equipment presently exists which would move large volumes of dredged material out of the flood-plain in a reasonable time nor is it possible to modify existing equipment to meet all the work groups specifications. They feel that the combination of moving large volumes of material and being capable of working in areas cluttered with logs and stumps is probably impossible to attain.

In addition, a private citizen (Mr. Wiley Woodall, Davenport, Iowa) volunteered a plan for a machine which he envisioned could be utilized not only in the backwaters of the Upper Mississippi, but in areas all around the country which are suffering from sediment deposition. Essentially, this machine could be assembled from currently available equipment and "dredges" by a combination slicing/conveyor mechanism. It disposes of the material in its natural condition (i.e. water saturated but without the need for large volumes of water for transport as in a hydraulic dredge). Furthermore, since there is no return flow from the spoil site, water quality impacts are minimal.

The material cannot be transported large distances, however, and may result in adverse impacts from spoil disposal. These impacts could be mitigated by spoil site management such as planting of vegetation of benefit to wildlife and/or of commercial value (e.g. walnut, hickory, pecan).

One desirable advantage of this proposed machine is the volume of material it can move and the cost of moving it. The machines designer estimates that at 100 percent efficiency, it could move 300,000 cubic yards of material in one hour for a cost of only 2½ cents per yard (actual dredging). Even at 50 percent efficiency its capability is astonishing.

The Material and Equipment Needs Work Group questioned whether or not such a machine could gain enough traction to move forward while cutting very large volumes of sediment, particularly in backwater areas. They felt that the District Office lacked the authority to consider such a proposal and referred Mr. Woodall to the Corps of Engineers Waterway Experiment Station in Vicksburg, Mississippi.

III. D. 3. Conclusions

The Side Channel Work Group concludes, that presently available equipment may be adequate for selected backwater alterations in the short term. Dredging entire backwaters would be time consuming and costly with existing small hydraulic or bucket-type dredges. However, fishery habitat can be improved by dredging "holes" in a backwater, thus providing deeper water areas for over-wintering.

In the longer term, it is obvious that backwater rehabilitation will be required on a large scale. Backwaters are being lost to sedimentation at an alarming rate and action must be taken soon. The work group recommends that a research and development program be initiated by the Government to develop the kind of equipment that would be required for backwater rehabilitation. It seems highly possible that an innovative design such as Mr. Woodall's could be adapted to other types of earth moving problems (such as oil shale mining) or to some of the problems identified by GREAT regarding channel dredging (such as a barge loading capability) as well as to backwater rehabilitation.

III. E. Side Channel Openings

In addition to side channel and backwater openings designed for improving biological productivity or for studying the effects of physical changes on the biota, several openings were accomplished to restore recreational (boating) access to backwaters. These openings were accomplished by the Corps of Engineers with operations and maintenance funds under existing authority for the maintenance of the 9-foot navigation channel (Norris, 1974). No pre- or post-studies were done in conjunction with these openings.

III. E. 1. Cordova #1, RM 503.9 R, north of Cordova, Illinois.

This site is located on an island which was spoiled upon by the Corps of Engineers in 1972 and 1973. The spoil effectively and totally blocked all access to the interior waters of the island. The sand beaches created by the spoiling created a phenomenal public use of the area. The Corps dredged an opening with a dragline in December, 1975.

The opening is slowly filling in as the river redeposits the dredged material. In order for backwater area to maintain a water connection to the river, the opening will undoubtedly need to be redredged in the future (see Figure 60).

III. E. 2. Cordova #2, RM 503.8 R, north of Cordova, Illinois

This site is located on the same island and one-tenth of a mile upstream from Cordova #1. The Corps spoiling had blocked another portion of interior waters and precluded recreational access. In August, 1976, the Corps completed an opening at this site by dragline.

This opening too is filling in and will require redredging (see Figure 61).

III. E. 3. Lainsville Slough, RM 545.6 R, 11 miles south of Bellevue, Iowa

This side channel joins the main channel with the Upper and Lower Brown's Lake backwater complex. The original opening became plugged with debris and sediment precluding recreational access. In August, 1976, the Corps constructed a new opening and riprapped the entrance. In June 1979, the Corps place additional riprap in areas of the cut experiencing erosion.

This backwater opening is the most successful that was conducted by the Side Channel Work Group in GREAT II. However, the area needs to be monitored to insure that it does not become plugged again. (See Figures 62 and 63).

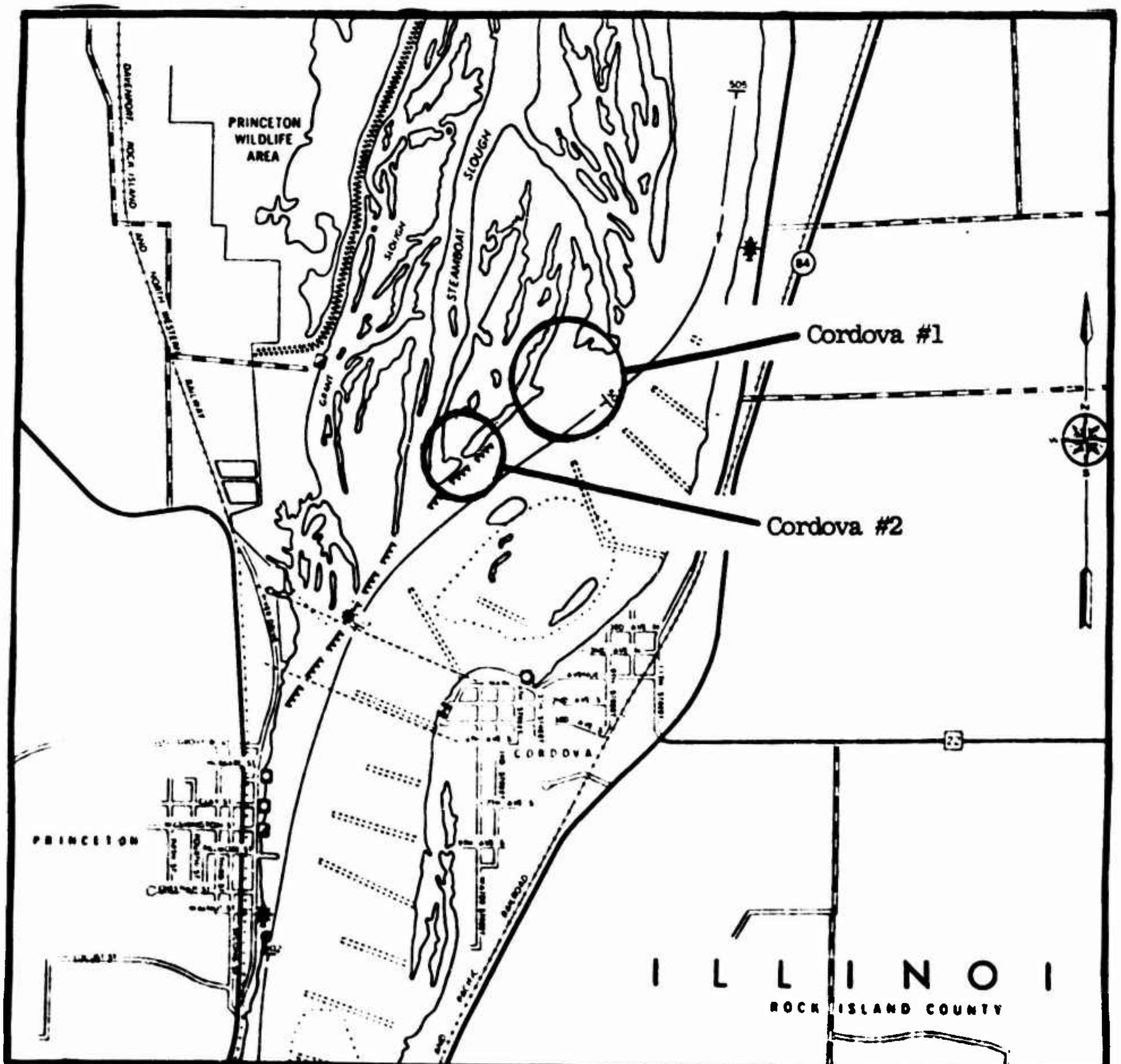


Figure 60. Locations of Cordova #1 and Cordova #2 backwater openings, River Miles 503.5 - 504, Pool 14, Iowa.

Figure 61. Aerial view of Cordova #2 backwater opening, River Mile 503.8, Pool 14, Iowa

Figure 62. Aerial view of Lainsville Slough side channel opening, River Mile 545.6, Pool 13, Iowa

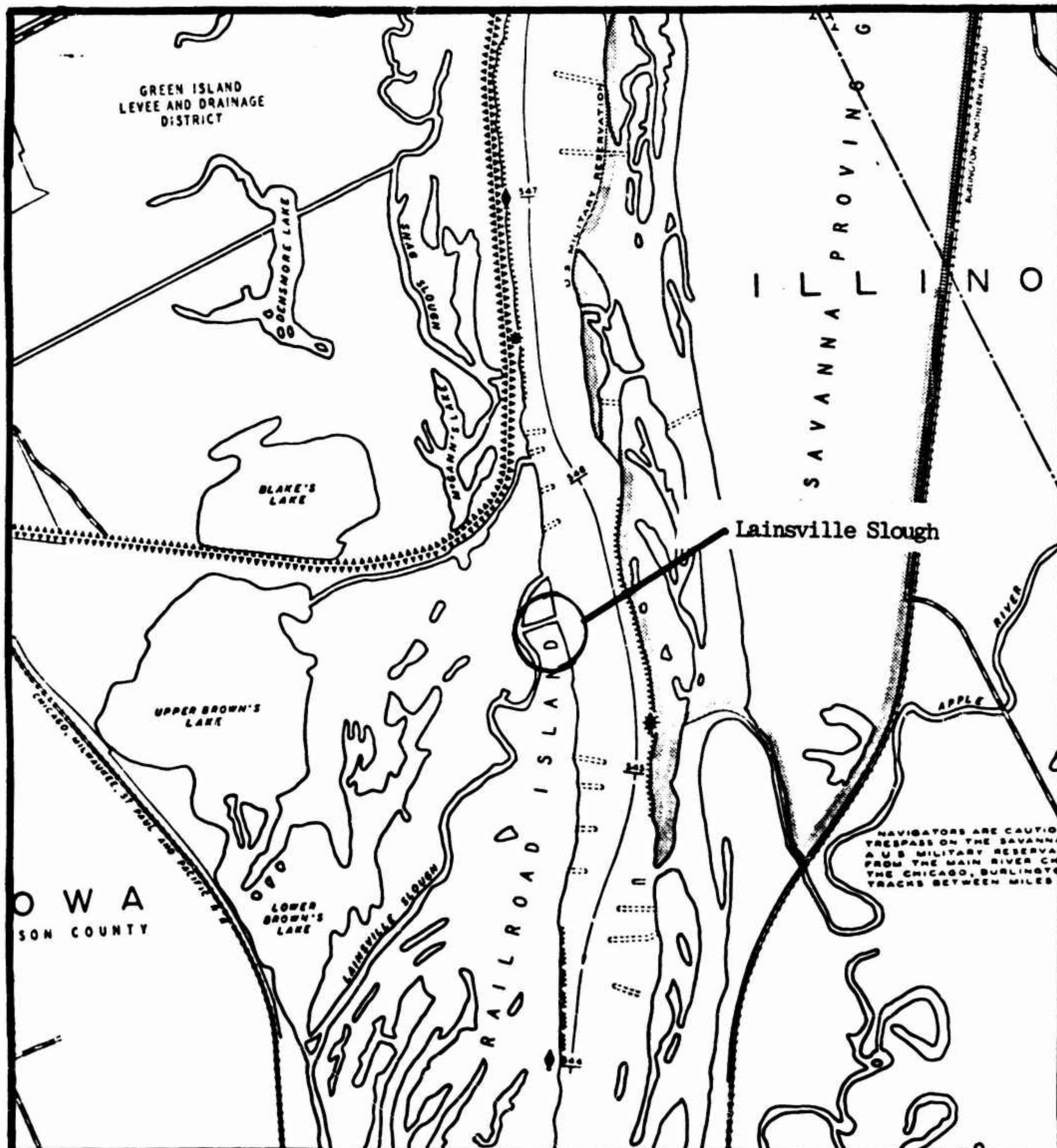


Figure 63. Location of Lainsville Slough side channel opening, River Mile 545.6, Pool 13, Iowa.

IV. ALTERNATIVES AND RESULTANT RECOMMENDATIONS

IV. ALTERNATIVES AND RESULTANT RECOMMENDATIONS

IV. A. Formulation of Alternative Solutions and Development of Recommendations Process

The tasks that each work group chose to accomplish varied by work group, by type of problem they were addressing and by the existing knowledge they had about that problem. All work groups needed to collect and organize background information. This background information was used to identify further problems, to provide input and data for other work groups and as part of the narrative for their work group appendix. Where little background information existed, baseline data was collected and/or research studies conducted.

As all tasks were completed, the results were distributed to members of the pertinent work group. Conclusions were then drawn by members of the work group based on the results of their work groups' tasks.

The conclusions developed by each work group led to the identification and consequent development of potential alternatives to their problems. The results of <u>some</u> tasks indicated that there still was not enough available information to ensure a knowledgeable assessment of the potential alternative solutions to a problem. In these cases, no alternatives could be formulated and the only recommendation which could be made was for further study of the problem. Where completion of work group tasks led to identification of potential solutions, the alternatives were displayed. The alternatives varied in specificity from site specific guidelines to general policy changes, dependent upon the problem they were addressing. Alternatives were assessed and one or more alternative was selected on the basis of a judgmental impact assessment. Once an alternative was selected, the rationale for its selection and all available supporting documents, information and studies supporting its selection were identified and displayed. This information was used to compile a brief summary of the types of impacts that would result if the recommendation were implemented. Based on the impact assessment and careful evaluation of the recommendation the work group, through its voting procedures, either approved or rejected the recommendation.

All work group approved recommendations were sent to the GREAT II impact assessment coordinator for review and advice. The coordinator would then mail this information, complete with comments, back to the appropriate work group chairman. The work group then did a more thorough and detailed assessment of the impact potential of their recommendations. This information was recorded on the Recommendation Impact Assessment Form. Each work group was responsible for obtaining or estimating the necessary information for their impact assessment through their studies, work group meetings, discussions with other work groups, discussions with other agencies having expertise in that particular field, discussions with economists and discussions with the impact assessment coordinator. When this form was completed to the work groups' satisfaction, sufficient copies were brought to the next Plan Formulation Work Group meeting. The impact assessment was reviewed by all members present and additions, changes or suggestions were made to the impact assessment. Each work group chairman made the appropriate revisions and brought a final version of the impact assessment to the next Plan Formulation Work Group meeting for final review.

At this time, these recommendations were dropped from further active consideration, until all recommendations were submitted by all of the work groups. When all of the recommendations had been submitted to the Plan Formulation Work Group, the development of integrated and final plans began.

The recommendations brought to the Plan Formulation Work Group varied in specificity and implementability and were grouped into the following general categories:

Implementable actions with existing authority
Implementable actions requiring legislation
Implementable studies within existing authority
Implementable studies requiring legislation
Feasibility studies, etc.
Policy changes

Within each of the six groups above, the recommendations varied from general recommendations applying to the river as a whole to those recommendations site specific in nature. Three categories of specificity used to help organize the recommendations into action plans are listed below:

General - apply to entire GREAT II reach or entire Upper Mississippi River Basin
Pool - apply to a specific pool or group of pools
Site - apply to a specific site(s) within a pool

The following recommendations represent those of the Side Channel Work Group before they were modified by the Plan Formulation Work Group in the plan development process.

SIDE CHANNEL WORK GROUP
(SCWG) RECOMMENDATION #3501

Pool No. All

River Mile District Wide

Date Approved by Work Group 7-03-79

In the course of maintaining the navigation channel, the Corps of Engineers (COE) must dredge and dispose of the dredged material. Often-times this material has been placed either directly in side channel or backwater habitat or where it can indirectly impact backwaters through erosion and redeposition.

Corps disposal practices are limited by the equipment they have and the choice of disposal site is dictated more by convenience than environmental considerations. With increased equipment capability (e.g. three miles of pipeline, barging) a greater percentage of sites could be reached that are out of the floodplain with little environmental impact.

The work group, therefore, recommends that the Corps be provided, through legislative authority and funding, the capability to dispose of dredged material in out-of-floodplain sites.

1. General problem addressed (taken from Table 3):

   #2 Deposition of dredged material has caused blockages of access and loss of fish and wildlife habitat in backwater sloughs and wetlands and the mouths of side channels.

2. Sub-problem addressed: N/A

3. Sub-objective addressed (taken from Section II.E.):

   To recommend the type of action and the methodology or the studies necessary to determine the type of action to alleviate problems associated with dredged spoil disposal.

4. Tasks accomplished to address problem (taken from Table 4):

   1. Literature Review
   4. Side Channel Inventory
   6. Side Channel Openings
   7. Work Group Discussions

5. Listing of alternatives to problem:

   a. No action. Retain practice of spoiling in most convenient, cost efficient manner.
   b. Provide the COE, through legislative authority and funding, with the capability to dispose of dredged spoil in out-of-floodplain sites.
   c. Retain within-floodplain spoiling practices but assure protection of backwaters through spoil containment procedures.

6. Selected alternative ___b___.

7. References used to select alternative:

   National Environmental Policy Act (NEPA)
   Fish and Wildlife Coordination Act (FWCA)
   Clean Water Act Amendments of the Federal Water Pollution Control Act (FWPCA)
   Executive Order 11988 (Floodplain Management)
   Executive Order 11990 (Wetland Management)
   Results of Side Channel Inventory (Section III.C.4).
   Work Group Discussions

8. Rationale for elimination of other alternatives:

   (a) Does not meet work group objectives.
   (c) Meets work group objectives but does not address concerns expressed in E.O. 11988.

9. Preliminary impact assessment of selected alternative:

   Protection/Preservation of Fish and Wildlife Habitat
   Initial cost of equipment (assumes additional equipment capabilities necessary)
   Increased operation and maintenance costs
   Increased energy use
   Availability of material for productive uses
   Removal of other lands from productive uses

10. Implementing Agency(ies):

   U.S. Congress
   Corps of Engineers

RECOMMENDATION #3501
IMPACT ASSESSMENT FORM

1. List Of Impacts	2. Units To Be Measured In	3. Present Condition As Of Jan. 1, 1979 For Each Impact	4. Description Of Most Probable Future (2025) Without Recommendations	5. Description of Most Probable Future (2025) With Recommendations	6. Measure Of Impacts
Protection/preservation of fish and wildlife habitat.	Acres	Spoil disposal has impacted approximately 1800 acres between 1956-1975 (90 acres/year)	Additional 4500 acres impacted assuming historical practices and a linear relationship	a) All material removed from floodplain. b) RFFP as per channel maintenance plan	Preserve and protect 4500 acres of habitat
Cost of equipment.	$	Equipment currently available	Continue to use available equipment		
Operation and Maintenance Costs	$	Currently no RFFP Disposal takes place	Continue with Current Practices	Acquisition, site preparation and transport costs unknown.	
Energy Use		unknown	No Increase	Additional energy used	Increase by some unknown amount
Availability of Material for Productive Uses	$	Limited use of material other than for beach nourishment	No change	Demand for 10,093,390 cubic yards an average value of $2.62 = $26,444,682	$26,444,682
Removal of other lands from productive use	acres	None	None	a) Total RFFP assuming 12' spoil depth = 776 acres. b) Selected RFFP per CMP = 387 acres.	a) 776 acres b) 387 acres

SIDE CHANNEL WORK GROUP
(SCWG) RECOMMENDATION #3502

Pool No. All

River Mile District Wide

Date Approved by Work Group 7-03-79

Because of the same rationale as seen in Recommendation 3501, the work group futher recommends that the Corps be prohibited from placing spoil in wetlands, side channels, sloughs and other aquatic habitat unless such placement clearly benefits fish and wildlife.

1. General problem addressed (taken from Table 5):

   #2 Deposition of dredged material has caused blockages of access and loss of fish and wildlife habitat in backwater sloughs and wetlands and the mouths of side channels.

2. Sub-problem addressed: N/A

3. Sub-objective addressed (taken from Section II.E.):

   To recommend the type of action and methodology or the studies to determine the necessary action to alleviate problems associated with dredged spoil disposal.

4. Tasks accomplished to address problem (taken from Table 4):

   1. Literature Review
   4. Side Channel Inventory
   6. Side Channel Openings
   7. Work Group Discussions

5. Listing of alternatives to problem:

   a. No action. Retain practices of spoiling in the most convenient, cost efficient manner.
   b. The Corps should be prohibited from placing spoil in wetlands, side channel, sloughs and other aquatic habitat unless such spoiling clearly benefits fish and wildlife.

6. Selected alternative b .

7. References used to select alternative:

   National Environmental Policy Act (NEPA)
   Fish and Wildlife Coordination Act (FWCA)
   Federal Water Pollution Control Act (FWPCA) as amended

Executive Order 11998 (Floodplain Management)
Executive Order 11990 (Wetland Management)
Results of Side Channel Inventory
Work Group Discussions

8. Rationale for elimination of other alternatives:

   (a) Will not meet work group objectives nor objectives expressed in the above referenced federal laws and orders.

9. Preliminary impact assessment of selected alternative:

   Protection/Preservation of Fish and Wildlife Habitat
   Initial cost of equipment (assuming additional equipment capability is necessary).
   Increased operation and maintenance costs.
   Availability of material for productive uses.
   Increased energy costs.
   Removal of other lands from productive uses.

10. Implementing agency(ies):

   U.S. Congress
   Corps of Engineers

RECOMMENDATION #3502
IMPACT ASSESSMENT FORM

1. List Of Impacts	2. Units To Be Measured In	3. Present Condition As Of Jan. 1, 1979 For Each Impact	4. Description Of Most Probable Future (2025) Without Recommendations	5. Description of Most Probable Future (2025) With Recommendations	6. Measure Of Impacts
Protection/preservation of fish and wildlife habitat	Acres	Spoil disposal has impacted approximately 1800 acres between 1956-1975	Additional 4500 acres impacted assuming historical practices and a linear relationship	All material removed from floodplain (RFFP)	Preserve or protect 4500 acres of habitat
Cost of equipment	$	Equipment currently available	Continue use available equipment		
Operation and maintenance costs	$	Currently no RFFP Disposal takes place	Continue with current practices	Acquisition, site preparation and transport costs unknown	
Energy use		Current level unknown	No increase	Additional Energy Use	Increase by some unknown amount
Availability of material for productive uses	$	Limited use of material other than for beach nourishment	No change	Demand for 10,093,390 cubic yards at an average value of $2.62/cy = 26,444,682	$26,444,682
Removal of other lands from productive use	Acres	None	None	Total RFFP assuming 12' spoil depth = 776 acres	776 acres

SIDE CHANNEL WORK GROUP
(SCWG) RECOMMENDATION #3503

Pool No. All

River Mile District Wide

Date Approved by Work Group 7-03-79

The Side Channel Work Group in its Side Channel Inventory identified numerous aquatic areas which are in critical need of remedial action lest they be lost due to the deposition of fine sediment. This study, however, did not enable the work group to accurately project the productive life expectancy of these or other backwaters sites or allow priorities to be placed on them when considering which sites should be rehabilitated first. One means of arriving at such conclusions is by estimating the rate of sedimentation in a given backwater and applying this knowledge to the physical characteristics of the site. This would allow resource managers to predict how much aquatic, moist spoil, or terrestrial habitat would remain after a given time period and at what point remedial action should be taken to preserve the values being managed for.

The Sediment and Erosion Work Group of GREAT I (LePage, 1979) has conducted sedimentation rate studies in Pools 4-10 using Cesium 137, fathometer and spud measurements and found the rate to vary between 25 and 50 centimeters per year. Translating this into 2½-5 meters per century reveals that most backwaters having a depth of less than 3 meters, have some what less than 100 years of productive life left. Ekblad et.al. (1977) studied sedimentation in a floodplain lake in Pool 9 of the Upper Mississippi and estimated a productive life of between 43 and 62 years.

Any of the methods described by the SEWG of GREAT I could be utilized or an alternate method of comparing aerial photographs and measuring the changes in vegetation could be used. Since most backwater areas are extremely shallow, sedimentation will be represented by changes from open water to marsh or moist soil vegetation and then to pioneer woody vegetation.

The Side Channel Work Group therefore recommends that off-channel areas should be monitored by the U.S. Geological Survey to provide an estimate of sedimentation rates. If necessary, specific funding and authority should be provided to the USGS or the Corps of Engineers (COE) to delegate and transfer the USGS.

It is suggested that the USGS choose monitoring sites from those listed as having Priority 2B in Table 5. In addition, such factors as location in the pool, relationship to an inflowing tributary, and size and complexity of the backwater system be considered. Emphasis should be given to sites which are high in fish or wildlife value or where rapid sedimentation is suspected.

1. General problem addressed (taken from Table 3):

   #1 Natural sedimentation has caused blockages of access and loss of fish and wildlife habitat in backwater sloughs, side channels and wetlands.

2. Sub-problem addressed:

   Side channels and backwaters requiring remedial action need to be identified and given a priority. Sedimentation rates in the study area are unknown and future losses of habitat are speculative at best.

3. Sub-objective addressed (taken from Section II.E.):

   To recommend the type of action and the methodology necessary or the studies to determine the proper action to alleviate problems associated with backwater sedimentation.

4. Tasks accomplished to address problem (taken from Table 4):

   1. Literature Review
   2. Orton-Fabius Opening
   3. Burnt Pocket Opening
   4. Side Channel Inventory
   7. Work Group Discussions

5. Listing of alternatives to problem:

   a. No action
   b. Off-channel areas should be monitored by the USGS to provide an estimate of sedimentation rates. If necessary, specific funding and authority should be provided to the USGS or the COE to delegate and transfer to the USGS.

6. Selected alternative ___b___ .

7. References used to select alternative:

   Work Group Bibliography Citations
   LePage, (1979)
   Starrett and Fritz (1965)
   Ekblad, et.al. (1977)

8. Rationale for elimination of other alternatives:

   (a) Will not meet the objective.

9. Preliminary impact assessment of selected alternative:

Cost of equipment, personnel and supplies to conduct hydrographic surveys or (other means) to determine sedimentation rates.

Increased knowledge of the riverine system and the factors contributing to its destiny.

Better data with which to make decisions.

10. Implementing Agency(ies):

U.S. Congress
U.S. Geological Survey

RECOMMENDATION #3503
IMPACT ASSESSMENT FORM

1. List Of Impacts	2. Units To Be Measured In	3. Present Condition As Of Jan. 1, 1979 For Each Impact	4. Description Of Most Probable Future (2025) Without Recommendations	5. Description of Most Probable Future (2025) With Recommendations	6. Measure Of Impacts
Direct Cost of equipment, personnel supplies, travel and et cetera to conduct hydrographic surveys, interpret aerial photography, and communicate the knowledge and experience of river resource managers	$	No comprehensive and coordinated monitoring currently takes place	No change	Equipment - $3000/yr 60 man days @ $100/day laboratory costs-$500/site monitor one site each pool on 2 year cycle (total of 24 sites) to run depth transects and take sediment samples and write report.	$15,000/yr
Indirect Additional knowledge for improved decision-making	None	Currently very little data regarding sedimentation rates and life expectancy of backwaters	Data may be gained but slowly and haphazardly	Data will enable decision-makers and resource managers to better provide for environmental values in their planning process	Increased ability to make management decisions based on sound data. Enhancement and preservation of fish and wildlife resources

SIDE CHANNEL WORK GROUP
(SCWG) RECOMMENDATION #3504

Pool No. All

River Mile District Wide

Date Approved by Work Group 7-3-79

The Side Channel Work Group, as well as the public, has identified many backwater areas which are in critical need of remedial action due to natural and man-induced sedimentation and the deposition of dredged material. It has been estimated by various authors that backwater lakes, ponds and sloughs will be completely converted to terrestrial vegetation within 100 years (Ekblad, 1977; LePage, 1979; Bellrose, et. al, 1977). In a riverine system that has been altered and controlled by man, the quality of fish and wildlife habitat must also be artificially maintained.

Several methods of altering backwaters are available and some have been implemented and studied by the Side Channel Work Groups of both GREAT I and II (see Section III A and C of this Appendix as well as the Appendix of the Fish and Wildlife Work Group of GREAT I). "Criteria for Consideration of Backwater Alterations to Enhance, Preserve, or Restore Fish and Wildlife Values and/or Recreational Access" have been developed (See Section II. D.) and should be used as a guide in prioritizing backwater problems for remedial action and for determing what remedial action to take. These criteria were applied to the problems identified by the work group (see Table 5) and the Priority 1 Sites (requiring immediate action) are discussed in Section II. D. of this report.

The work group recommend that the Corps of Engineers be provided with the authority and funding to perform alterations to backwater areas for the benefit of fish and wildlife as recommend by the Fish and Wildlife Interagency Committee (FWIC-see FWMWG Recommendation #3004).

1. General problem addressed (taken from Table 3):

   (1), (2), and (3) Natural sedimentation, deposition of dredged material and sedimentation encouraged by regulating structures have cause blockages of access and loss of habitat diversity in backwater sloughs, wetlands and side channels.

2. Sub-problem addressed: N/A

3. Sub-objective addressed (taken from Section II.E.):

   To recommend the type of action and methodology necessary or the studies to determine the proper action to alleviate problems with backwater sedimentation.

4. Tasks accomplished to address problem (taken from Table 4):

   Literature Review
   Orton-Fabius Opening
   Burnt Pocket Opening
   Side Channel Inventory
   Side Channel Openings
   Work Group Discussions

5. Listing of alternatives to problem:

   a. No action.
   b. Restore the Upper Mississippi River to a free-flowing, natural riverine ecosystem.
   c. Provide the Corps of Engineers with the authority and funding to perform alterations to backwater areas for the benefit of fish and wildlife.

6. Selected alternative: c

7. References used to select alternative:

   Work Group discussions based upon hydraulic engineering and biological experience and expertise.
   Work Group Bibliography Citations:
   Claflin, 1977
   Claflin and Rada, 1979
   Claflin and Rada, 1980
   Fremling, et al, 1979
   Nielson, ed, 1978
   Vanderford, ed., 1979
   Ellis, 1978

8. Rationale for elimination of other alternatives:

   a. Does not meet work group objectives.
   b. Impractical given the state of development on the river and the economic dependency on commercial navigation in an artificially maintained channel.

9. Preliminary impact assessment of selected alternative:

   Cost of Alterations
   Preservation/Protection of Habitat Diversity
   Energy Use
   Preservation/Protection of Recreational Use
   Manpower Requirements

10. Implementing Agency(ies):

    U.S. Congress
    Corps of Engineers
    U.S. Fish and Wildlife Service
    State Resource Agencies

RECOMMENDATION #3504
IMPACT ASSESSMENT FORM

1. List Of Impacts	2. Units To Be Measured In	3. Present Condition As Of Jan. 1, 1979 For Each Impact	4. Description Of Most Probable Future (2025) Without Recommendations	5. Description of Most Probable Future (2025) With Recommendations	6. Measure Of Impacts
Cost of administrative functions including design, engineering, hydraulics, coordination, and constructing services, plus 100% overhead	$	Currently Corps has no authority nor administration for backwater alteration projects	No change	One man/year $60,000	$60,000/year
Cost of alterations	$	No cost	No change	Unable to assess until decisions of type of action can be made	Unknown
Preservation/enhancement of fish and wildlife habitat	Acres	4100 - 4600 acres have suffered habitat losses at priority 1 sites	Additional acreage will be lost	3500 - 4000 acres can be maintained or restored to productive backwater habitat	Maintenance or restoration on 3500 - 4000 acres
Preservation/enhancement of recreation use	Acres	Access to 4100 - 4600 acres of backwaters has been lost or severely degraded	Access to additional acreage will be lost	Access can be restored or maintained to 3500 - 4000 acres	Restore or maintain access to 3500 - 4000 acres

SIDE CHANNEL WORK GROUP
(SCWG) RECOMMENDATION #3505

Pool No. All

River Mile District Wide

Date Approved by Work Group 11-01-79

Studies have shown that the fine sediment reaching the backwaters of the Upper Mississippi comes from the surrounding farmlands in the drainage basin (LePage, 1979). It therefore stands to reason that the primary effort in combatting this problem is to treat it at the source.

More topsoil is now being lost from agricultural land each year than was lost in the worst of the Dust Bowl Years. This problem threatens to become more acute as the demands of the world market push up U.S. food production, causing more intensive cultivation, and bringing into use marginal land that is more susceptible to erosion. The energy crisis adds to this demand as grain alcohol is used for gasohol. (Culver, Senator John, 1979).

Soil Conservation practices currently exist which could reduce soil erosion by 50% if applied to 100% of tilled lands. However, new techniques have been developed that could reduce erosion by by 90% if applied to 100% of tilled lands. (LePage, 1979 and Lindstrom, et.al 1979).

No-till and conservation till farming practices reduce erosion by leaving crop residues in the field overwinter and by disturbing the soil a minimum and then only in one operation jointly with spring planting. Pilot projects have shown that these techniques can be employed with little or no reduction in overall yield. A realistic goal of treatment of 80% of tilled lands with conventional and new conservation techniques should be set.

The work group recommends that the U.S. Department of Agriculture seek additional funding to increase cost-sharing specifically for no-till and conservation-till practices and give them immediate priority. Current conservation practices should be continued as well with the exception of those that result in habitat losses (e.g. conversion of brushy or wooded ravines to grassed waterways). The Environmental Protection Agency should seek funding under the 208 Water Quality Program to promote the reduction of soil losses through standard conservation practices and new technology. Tax incentives should be provided to promote the use of best management practices in soil conservation.

1. General problem addressed (taken from Table 3):

#1 Natural sedimentation has caused blockages of access and loss of habitat in backwaters and side channels.

2. Sub-problem addressed:

   The source of fine sediment entering the backwaters is erosion of farmlands in the watershed.

3. Sub-objective addressed (taken from Section II E):

   To recommend the action and methodology or the studies to determine the necessary action to alleviate problems in side channels and backwaters.

4. Tasks accomplished to address problem (taken from Table 4):

   1. Literature Review
   2. Orton-Fabius Study
   3. Burnt Pocket Study
   4. Side Channel Inventory
   7. Work Group Discussions.

5. Listing of alternatives to problem:

   a. No action - soil conservation and farming practices should continue at present levels.
   b. U.S. Department of Agriculture should seek additional funding to increase cost-sharing specifically for no-till and conservation-till practices and give them immediate priority.
   c. Environmental Protection Agency should seek funding under the 208 Water Quality Program to promote reduction of soil losses through standard conservation practices and new technology.
   d. Current conservation practices should be continues with the exception of those that result in habitat losses (e.g. conversion of wooded or brushy ravines to grassed waterways).
   e. Tax incentives should be provided to promote use of best management practices in soil conservation.
   f. Congress should mandate no-till and conservation-till farming practices as being in the best national interest.

6. Selected alternative b,c,d,e, .

7. References used to select alternative:

   Work Group Literatue Citations
   LePage, (1979)
   Lindstrom, et.al (1979)
   Culver, Senator John (1979)

8. Rationale for elimination of other alternatives:

   a) will not meet work group objective
   f) too restrictive and probably impossible to enforce

9. Preliminary impact assessment of selected alternative:

Preservation of fish and wildlife habitat
Conservation of soil
Improved Water Quality (reduced turbidity)
Degraded Water Quality (increased pesticide use)
Energy savings
Altered river hydraulics

10. Responsible Agency(ies):

Congress, U.S. Department of Agriculture, States, Counties

RECOMMENDATION #3505
IMPACT ASSESSMENT FORM

1. List Of Impacts	2. Units To Be Measured In	3. Present Condition As Of Jan. 1, 1979 For Each Impact	4. Description Of Most Probable Future (2025) Without Recommendations	5. Description of Most Probable Future (2025) With Recommendations	6. Measure Of Impacts
Preservation of fish and wildlife habitat	Acres	57,000 acres of backwater habitat	Estimated loss due to sedimentation is 12000-28,000 acres (average= 20,000)	Reduce backwater losses by 7,000 acres assuming ½ of sediment originates on agricultural lands and proposed treatment will reduce that by 70%	Backwater losses due to sedimentation reduced by 7,000 acres.

NOTE: See the Sediment and Erosion Control Work Group Appendix for an assessment of costs and impacts as a result of land treatment, technical assistance, and cost sharing for erosion control programs.

SIDE CHANNEL WORK GROUP
(SCWG) RECOMMENDATION #3506

(Note: Recommendation #3506 was combined with #3504 during the PFWG evaluation process).

SIDE CHANNEL WORK GROUP
(SCWG) RECOMMENDATION #3507

Pool Number All

River Mile District-Wide

Date Approved by Work Group 11-1-79

In order to maintain a navigation channel, the Corps of Engineers constructs regulatory structures (wing and closure dikes) to direct water away from side channels and into the main channel. On occasion, these structures cause the complete blockage of water flow or of small boat access to a backwater.

These structures, on the other hand, do provide habitat for small fish and invertebrates and oftentimes create deep scourholes attractive to fish. Furthermore, by reducing the flow of water to a backwater, the input of fine sediment is also reduced. Thus the life of a backwater could be extended with a closing structure.

The impacts of these activities are varied and conflicting. Each must be assessed on an individual basis. In an attempt to answer the questions of effect of regulatory structures on fish resources, studies were initiated by the Fish and Wildlife Management Work Group (See FWMWG Appendix). With the information from these studies, it is hoped that regulatory structures can be designed, built and maintained in a manner that will provide maximum benefits to aquatic resources.

The Work Group recommends that the Corps of Engineers should construct, maintain and alter regulatory structures to provide beneficial effects to fish, wildlife, and recreation as well as navigation according to criteria identified by the wing dam modification study of the FWMWG.

1. General problem addressed (Taken from Table 3):

   (3) Regulatory structures have caused blockages of access and loss of habitat in backwater sloughs and side channels.

2. Sub-problem addressed: N/A

3. Sub-objective addressed (taken from Section II.E.):

   4 To recommend the type of action and methodology or the studies necessary to determine the action required to alleviate problems in backwaters and side channels.

4. Tasks accomplished to address problem (taken from Table 4):

   (3) Side channel inventory identified problems. Wing dam Studies (FWMWG) provided criteria.

5. Listing of alternatives to problem:

   a. Continue to construct and maintain regulatory structures for the sole purpose of operation and maintenance of the 9-foot navigation project.

   b. The COE should construct, maintain and alter regulatory structures to provide beneficial effects to fish, wildlife, and recreation as well as navigation according to criteria and parameters identified by wing dam modification studies of GREAT II.

6. Selected alternative: b

7. References used to select alternative:

   Work Group Discussions
   Corps of Engineers - Nine-Foot Navigation Channel EIS (1974)

8. Rationale for elimination of other alternatives:

   a. Will not meet work group objectives.

9. Preliminary impact assessment of selected alternative:

   Cost of alterations to existing structures.
   Improvement/Preservation of fish and wildlife habitat.
   Improved/Restored recreational access.
   Changes in operation and maintenance costs.
   Navigation impacts.

10. Implementing Agency(ies):

   Corps of Engineers on recommendations from the U.S. Fish and Wildlife Service and State Conservation Agencies.

RECOMMENDATION #3507
IMPACT ASSESSMENT FORM

1. List Of Impacts	2. Units To Be Measured In	3. Present Condition As Of Jan. 1, 1979 For Each Impact	4. Description Of Most Probable Future (2025) Without Recommendations	5. Description of Most Probable Future (2025) With Recommendations	6. Measure Of Impacts

NOTE: No costs other than a minor increase to consider fish and wildlife input. This assumes only design changes of structures under consideration for maintenance or reconstruction or for new structures

SIDE CHANNEL WORK GROUP
(SCWG) RECOMMENDATION #3508

Pool No. All

River Mile District Wide

Date Approved by Work Group 11-1-79

In considering methods that can be employed to rehabilitate backwaters, much emphasis has been placed on flow augmentation either through openings or closures of the backwater. One method that has not been attempted is that of removing the sedimentation which has accumulated over the years. Reasons for this may be (a) that existing equipment does not exist which can dredge large volumes of material in a cost efficient and environmentally sound manner (see Recommendation #3510), (b) environmental problems related to spoil disposal; and (c) it is easier and cheaper to construct a cut or close one than to dredge several acres of backwater. The alternative of dredging remains to be viable, however, and should not be eliminated from any consideration of backwater rehabilitation.

The work group, therefore, recommends that the FWIC conduct a pilot study(ies) to determine the feasibility and impacts of dredging a silted backwater to restore its previous depths and hence prolong its productive life.

The study should be designed to answer the following questions:

1. Is existing equipment adequate for such purposes. If not, what modifications could be made or to what specifications should new equipment be fabricated?

2. What changes in biota take place after the alteration? (composition, density, distribution)

3. What changes in physical characteristics take place?

4. What changes in water quality take place?

5. What are the adverse impacts associated with spoil disposal?

6. What opportunities exist to manage and render the spoil sites more productive (wildlife plantings)?

7. How could this technique be made more cost efficient and less time consuming?

This recommendation supports (but is not totally satisfied by) a proposed study to accompany dredging for material for a flood control levee at Fulton, Illinois. Many of the above questions will be addressed by the study and it has support of the Corps of Enginners, U.S. Fish and Wildlife Service, and Illinois Department of Conservation.

1. General problem addressed (taken from Table 3):

   (7) Resource managers need the capability to predict the biological consequences of backwaters alterations.

2. Sub-problem addressed:

   The effects of backwater rehabilitation by dredging are not adequately documented or understood.

3. Sub-objective addressed (taken from Section II.E.):

   (7) To develop the capability to predict the biological consequences of physical alterations to side channels and backwaters.

4. Tasks accomplished to address problem (taken from Table 4):

   Work group discussions

5. Listing of alternatives to problem:

   a. No action
   b. The FWIC should conduct a project and studies to determine the feasibility and impacts of dredging a silted backwater to restore its original depths and hence prolong its productive life.

6. Selected alternative: b

7. References used to select alternative:

   Work group discussions

8. Rationale for elimination of other alternatives:

   a. Will not meet the work group's objectives.

9. Preliminary impact assessment of selected alternative:

   Cost (of study and dredging)
   Alteration of aquatic habitat
   Alteration of terrestrial habitat
   Energy used
   Creation of jobs
   Additional knowledge for decision making

10. Responsible Agency(ies):

   Fish and Wildlife Interagency Committee (FWIC)

RECOMMENDATION #3508
IMPACT ASSESSMENT FORM

1. List Of Impacts	2. Units To Be Measured In	3. Present Condition As Of Jan. 1, 1979 For Each Impact	4. Description Of Most Probable Future (2025) Without Recommendations	5. Description of Most Probable Future (2025) With Recommendations	6. Measure Of Impacts
Cost of dredging and study	$	Fulton Levee project and study planned	150,000 cubic yards @$2.00 per yard=$300,000 plus 20 man days @$150/day=$3000	$75,000 for study plus cost of dredging (depending on amount)	$75,000 +
Alteration of aquatic habitat	Acres	Fulton Levee project and study planned	Deepen ±24 acres of backwaters by 2-6 feet	Depends on specifics of the project	Unknown
Alteration of other habitats	Acres	Fulton Levee project and study planned	Raise elevation of 20± acres of bottomland hardwood forest and plant trees	Depends on specifics of the project	Unknown
Energy used		Fulton Levee project and study planned	Unknown	Unknown	Unknown
Additional knowledge for decision-making		Fulton Levee project and study planned	Data will enable decision-makers & resource managers to better provide for the environmental values in their planning process	Same	Improved decision-making

SIDE CHANNEL WORK GROUP
(SCWG) RECOMMENDATION #3509

(Note, this recommendation was withdrawn by the work group).

SIDE CHANNEL WORK GROUP
(SCWG) RECOMMENDATION #3510

Pool Number N/A

River Mile N/A

Date Approved by Work Group 11-1-79

It is apparent to the Side Channel Work Group that in order to combat the rapid and pervasive sedimentation of backwater areas, it will be necessary to perform alterations to backwater habitat on a large scale. The problem arises of the non-existence of equipment that can perform alterations to backwater habitat on a large scale and in a cost efficient, environmentally sound manner.

The Work Group identified the following specifications for equipment suitable for backwater alterations:

a) shallow draft
b) capable of long distance (out-of-floodplain) disposal
c) capable of handling large volumes
d) self-propelled
e) capable of handling logs and stumps

It seems highly probably that the development of such a piece of equipment could also answer some of the problems identified with spoil disposal from main channel dredging (e.g. barge loading, out-of-floodplain disposal) as well as adapting it to other earth moving tasks (oil shale mining).

At the present time there is no incentive for private enterprise to develop such equipment. Therefore, the U.S. Government would be the logical choice with the expertise available at the Corps of Engineers Waterway Experiment Station, Vicksburg, Mississippi.

Therefore, the Corps of Engineers should initiate a research and development project to determine the equipment (or pieces of equipment or equipment system) necessary for performing large scale backwater alterations.

1. General problem addressed (taken from Table 3):

   (5) The equipment required to alter a backwater in an environmentally sound manner may not exist.

2. Sub-problem addressed: N/A

3. Sub-Objective addressed (taken from Section II.E.):

   To recommend the type of action and methodology or the studies to determine the necessary action to alleviate problems in side channels and backwaters.

4. Tasks accomplished to address problem (taken from Table 4):

   (6) Equipment specifications for equipment to alter backwaters were transmitted to the Material & Equipment Needs Work Group for evaluation.

5. Listing of alternatives to problem:

   a. No action, rely on existing equipment for altering backwaters.

   b. Corps of Engineers initiate a research and development program to determine the equipment (or pieces of equipment or equipment system) necessary for performing large scale backwater alterations.

   c. Rely on private enterprise to develop the equipment for altering backwaters.

6. Selected alternative: b

7. References used to select alternative:

   Report by Material and Equipment Needs Work Group to Side Channel Work Group (see Appendix D)
   Work Group Discussions.

8. Rationale for elimination of other alternatives:

   a. Current equipment is not adequate to meet work group objectives.
   c. No incentive at this time for private enterprise to develop such equipment.

9. Preliminary impact assessment of selected alternative:

   Cost of program
   Eventual cost of equipment (secondary effect)
   Conservation, rehabilitation, enhancement of habitat (secondary)
   Spoil disposal impacts (±)

10. Responsible Agency(ies):

Corps of Engineers
Congress
Resource Management Agencies

RECOMMENDATION #3510
IMPACT ASSESSMENT FORM

1. List Of Impacts	2. Units To Be Measured In	3. Present Condition As Of Jan. 1, 1979 For Each Impact	4. Description Of Most Probable Future (2025) Without Recommendations	5. Description of Most Probable Future (2025) With Recommendations	6. Measure Of Impacts
Direct					
Cost of program	$	No incentive to develop equipment for working in backwaters	No change	$100,000 and up depending on level of development (i.e. concept-design-specifications-prototype)	$100,000
Indirect					
Eventual cost of equipment	$	No equipment available	No equipment developed	Pending results of this study	Pending
Conservation, rehabilitation, enhancement of backwater habitat	Acres	Approximately 9000 acres of backwater areas have been or are being vegetated as a result of fine sediment accumulation	An additional 12000-28,000 acres are expected to be lost	Many acres of habitat can be preserved with the proper equipment	Preservation, enhancement, rehabilitation of an unknown acreage of backwater habitat pending funding and equipment availability
Channel Maintenance and spoil disposal		Use of 20" dredge precludes options such as barge loading and dike construction	Emphasis on hydraulic dredging with increased distance capability	New technology may be applicable to barge loading of spoil or out of floodplain disposal.	Decreased environmental impacts and increased productive uses of material.

SIDE CHANNEL WORK GROUP
(SCWG) RECOMMENDATION #3511

Pool No. 19

River Mile

Date Approved by Work Group 2/19/80

Pool 19 (Keokuk Pool) of the UMR is the most important inland area for diving ducks in North America. Diving ducks depend heavily on Pool 19's rich supply of benthic organisms (primarily fingernail clams) for a source of food during the fall and spring migration. However, chemical and ecological parameters indicate that the Pool is in trouble ecologically and may be on the brink of collapse as an ecosystem. Resource management of this Pool is necessary to preserve its unique stature.

It is the oldest and longest of the pools, covering over 46 miles and 30,000 acres. Multiple demands for it's use include the generation of hydroelectric power, commercial navigation, sport and commercial fishing, hunting and trapping, recreational boating and swimming, and municipal and industrial water supply among others. Management of Pool 19 for fish and wildlife becomes increasingly difficult as these various demands increase, and is compounded by private ownership of nearly all the adjoining land areas. Piecemeal development and impacts by private citizens, industry, and municipalities are having a cummulative effect which must be more closely monitored and regulated to ensure protection of fish and wildlife resources.

Management strategies are available, and some have been recommended to enhance Pool 19 for specific components of the fish and wildlife community and their utilization. However, there is a need to coordinate these various strategies and managemnet objectives between the agencies and interests involved for proper management of the fish and wildlife resources as a whole. This comprehensive management plan for the fish and wildlife resources of Pool 19 is needed to enhance those resources and to better protect them from adverse impacts of encroachment, development, and other demands.

The work group recommends that the FWIC be responsible for the development of a comprehensive fish and wildlife management plan for Pool 19. The plan should include, and federal and state resource agencies should pursue, cooperative agreements with the primary land owner(s) of the pool in an effort to get more of these leands in public management (see FWMWG #3039).

1. General problem addressed (taken from Table 3):

   The Corps has no authority to alter side channels except where they are blocked by channel maintenance activities.

2. Sub-problem addressed:

Pool 19 is primarily privately owned and therefore outside of the public management arena.

3. Sub-objective addressed (taken from Section II.E.):

To make resource management recommendaitons that will insure the protection and/or enhancement of fish and wildlife resources in off-channel areas.

4. Tasks accomplished to address problem (taken from Table 4):

(7) Work group discussions

5. Listing of alternatives to problem:

a. No action
b. The FWIC should be responsible for the development of a comprehensive fish and wildlife management plan for Pool 19. The plan should include, and federal and state resource agencies should pursue, cooperative agreements with the primary land owner(s) of the pool in an effort to get more of these lands in public management (see FWMWG #3039).

6. Selected alternative: b

7. References used to select alternative:

Work group discussions

8. Rationale for elimination of other alternatives:

a. Could jeopardize the continued existence of an extremely valuable resource.

9. Preliminary impact assessment of selected alternative:

Development of a plan will cause no significant impacts. Potential impacts of plan implementation include:

Preservation/enhancement of fish and wildlife and their habitat
Improved water quality
Cost to management agencies for administration and management

10. Responsible agency(ies):

U.S. Fish and Wildlife Service
Illinois Department of Conservation
Iowa Conservation Commission
Fish and Wildlife Interagency Committee

RECOMMENDATION #3511
IMPACT ASSESSMENT FORM

1. List Of Impacts	2. Units To Be Measured In	3. Present Condition As Of Jan. 1, 1979 For Each Impact	4. Description Of Most Probable Future (2025) Without Recommendations	5. Description of Most Probable Future (2025) With Recommendations	6. Measure Of Impacts
Direct					
Cost of developing plan	$	$0 No active planning	$0 Piecemeal planning	Up to $60,000 depending on available information	+ $60,000
Indirect					
Protection of fish and wildlife habitat	Acres and habitat quality	Loss of habitat	Continued loss of habitat	Improved management and protection decisions	Improved habitat quality on the 30,000 acres of the pool.

SIDE CHANNEL WORK GROUP
(SCWG) RECOMMENDATION #3512

Pool No. N/A

River Mile

Date Approved by Work Group 2/19/80

The side channel work groups of both GREAT I and II tested the only available mathematical model for predicting the biological consequences of physical alterations to backwaters. The Instream Flow Group (IFG) as well as others are also working on models and methodologies for making such predictions. These should also be tested with the same data to compare accuracy and determine the best tool for our needs.

The work group recommends that the FWIC apply the physical, chemical and biological data from Burnt Pocket, Fountain City Bay, and any other side channel alteration studies to other computer models or methodologies as may be available (e.g. Instream Flow Group) or which may be developed in the future to further test and refine the capability to predict the biological consequences of physical alterations to side channels and backwaters.

1. General problem addressed (taken from Table 3):

   (7) Resource managers need the capability to predict the biological consequences of backwater alterations.

2. Sub-problem addressed: N/A

3. Sub-objective addressed (taken from Section II.E.):

   To develop the capability to predict the biological consequences of physical alterations to side channels and backwaters.

4. Tasks accomplished to address problem (taken from Table 4):

   (3) Burnt Pocket Backwater Opening and Study
   (7) Work Group Discussion

5. Listing of alternatives to problem:

   a. No action
   b. Rely on the model which was tested at Burnt Pocket
   c. Apply the physical, chemical and biological data from Burnt Pocket, Fountain City Bay, and any other side channel alteration study to other computer models or methodologies

as may be available (e.g. Instream Flow Group) or which may be developed in future to further test and refine the capability to predict the biological consequences of physical alterations to side channels and backwaters.

6. Selected alternative: c

7. References used to select alternative:

SCWG - Bibliographical Citations
Claflin, T.O., 1977
Claflin, T.O. and R.G. Rada, 1979
Claflin, T.O. and R.G. Rada, 1980

8. Rationale for elimination of other alternatives:

a. Will not meet work group objectives.
b. Is impracticaland poor planning.

9. Preliminary impact assessment of selected alternative:

No impacts except minor cost of computer time (± $1000)

10. Responsible agency(ies):

Fish and Wildlife Interagency Committee

RECOMMENDATION #3512
IMPACT ASSESSMENT FORM

1. List Of Impacts	2. Units To Be Measured In	3. Present Condition As Of Jan. 1, 1979 For Each Impact	4. Description Of Most Probable Future (2025) Without Recommendations	5. Description of Most Probable Future (2025) With Recommendations	6. Measure Of Impacts
Cost	$	No testing planed	Additional models and methodologies may be tested	Additional models and methodologies will be tested. Cost up to $1000 of computer time	± $1,000

V. SUMMARY

V. SUMMARY

V. A. Introduction

The Side Channel Work Group identified 164 problems in the course of their study. The vast majority of these are site-specific and fall into one of ten general categories. Of the 164 identified problems the work group feels it has totally resolved 4 (Nos. 2, 3, 6 and 9). It addressed one (No. 10) but could not resolve it. The remainder (159) were partially resolved by establishing a procedure wherein they will be or can be resolved at some future time.

The work group's overall objective was to make resource management recommendations that would insure the protection and/or enhancement of fish and wildlife resources and their enjoyment and utilization by the public in off-channel (side channel, backwater) areas; this being in the context of an artificially controlled, riverine ecosystem operated and maintained for commercial navigation. This objective could only be partially met. It is realized that the river is attempting to reduce its cross-section through a natural process of filling the backwaters and that this process is essentially irreversible. Although certain individual areas may be preserved by some form of physical alteration, the river will experience an overall loss of fish and wildlife habitat in the next 50 years regardless of man's attempts to prevent it. Consequently, the recommendations presented by this work group can be considered as short term methods to delay the inevitable. It is hoped that this delay may allow for an improved state-of-the-art which would then more effectively address this serious problem.

The following paragraphs summarize the 10 general problems from the work group's standpoint and identify the tasks and resultant conclusions and recommendations that address each problem. In addition, any unaddressed problems or future needs to solve these problems will be identified. (Note: problem numbers refer to Table 5 of this Appendix).

V. B. <u>Summary</u>

V. B. 1. Problem 1:

Natural sedimentation has caused blockages of access and loss of habitat in backwaters and side channels.

<u>Sub-Objectives</u>:

To estimate the losses of backwater habitat due to sedimentation since lock and dam construction.

To identify specific side channels and backwaters requiring remedial action to improve productivity, extend their functional life, and/or improve recreational access.

To alter specific backwaters and side channels should such projects prove beneficial.

Tasks:

Literature Review
Burnt Pocket Backwater Opening and Study
Side Channel Inventory
Work Group Discussions
Orton Fabius Side Channel Opening and Study

Results and Conclusions:

Sedimentation of backwaters is the number one problem affecting aquatic habitat in the UMR today.

Unless something is done to reverse, or at least slow the trend of backwater sedimentation, a near complete loss of backwaters is inevitable. It is projected that between 12,000 - 28,000 acres of backwater habitat will be lost over the next 50 years.

The primary source of the fine sediment being deposited in backwaters is farmland erosion. Secondarily is streambank erosion.

Man's attempts to control the river (dams, regulating structures, dredging and disposal) has contributed to the backwater sedimentation problem.

Physical alterations made to backwaters and side channels can be beneficial in decreasing the amount of sediment entering backwaters.

Decreasing/stopping sediment at its source is implicit in alleviating this problem.

Recommendations:

#3503 - Off-channel areas should be monitored by the U.S. Geological Survey to provide and estimate of sedimentation rates. If necessary, specific funding an authority should be provided to the USGS or to the Corps of Engineers to delegate and transfer to the USGS. Priority sites are listed on Table 5.

#3504 - Provide the Corps of Engineers with the authority and funding to perform alterations to backwater areas as recommended by the Fish and Wildlife Interagency Committee (see #3004). Priority sites are listed in Section II. D..

#3505 - U.S. Department of Agriculture should seek additional funding to increase cost-sharing specifically for minimum till conservation practices and give them immediate priority. U.S. Environmental Protection Agency should seek funding under the 208 Water Quality Program to promote reduction of soil losses through standard conservation practices and new technology. Current conservation practices should be continued with the exception of those that result in habitat losses (e.g. conversion of wooded or brushy ravines to grassed waterways). Congress and state legislatures should provide tax incentives to promote the use of best management practices in soil conservation.

#3508 - The FWIC should conduct a project and studies to determine the feasibility and impacts of dredging a silted backwater to restore its original depths and hence prolong its productive life.

#3510 - The Corps of Engineers should initiate a research and development program to determine the equipment necessary for performing large scale backwater alterations.

#3511 - The FWIC should be responsible for the development of a comprehensive fish and wildlife management plan for Pool 19. The plan should include, and federal and state resource agencies should pursue, cooperative agreements with the primary land owner(s) of the pool in an effort to get more of these lands in public management.

Unaddressed Problems/Future Needs:

Assuming the proper agencies receive the funding and authority to alter backwaters and reduce the impacts of sedimentation, somebody (presumably resource biologists) needs to decide how the river is to be managed. For example, what ratio of moist soil vegetation and open water habitats should be maintained in order to maximize benefits to both fish and waterfowl. Although the magnitude of the sedimentation problem is such that resource biologists may never have to be concerned about the optimum trade-off between fish and waterfowl, these decisions should never-the-less be made to provide a framework in which to operate. (See Recommendations 3016, 3017 and 3039 of FWMWG)

V. B. 2. Problem 2:

Deposition of dredged material has caused blockages of access and loss of habitat in side channels and backwaters.

Sub-Objectives:

To identify instances of dredged material disposal where it has adversely affected backwater and side channel habitat.

To identify specific side channels and backwaters requiring remedial action to improve productivity, extend their functional use, and/or improve recreational access.

To alter specific backwaters and side channels should such projects prove beneficial.

Tasks:

Literature Review
Side Channel Inventory
Side Channel Openings
Work Group Discussions

Results and Conclusions:

Dredged material disposal has impacted side channels and backwaters. In the period between 1956 and 1975, approximately 1800 acres of off-channel, open-water habitat has been affected including the blockage of several side channels.

The magnitude of impacts associated with spoil disposal in backwaters is slight compared to those related to sedimentation.

It is projected that as much as 4500 acres of backwaters would be affected over the next 50 years by dredged material disposal assuming historical practices.

Of historical type disposal practices, the method which least impacts backwaters is disposal on the highest and driest portions of floodplain woodlands where redeposition due to wave action and floodflows is at a minimum.

Recommendations:

#3501 - Provide the Corps of Engineers, through legislative authority and funding, with the capability to dispose of dredged material in out-of-the-floodplain sites.

#3502 - The Corps should be prohibited from placing dredged material in wetlands, side channels, sloughs, and other aquatic habitat unless it clearly benefits fish and wildlife.

#3504 - Provide the Corps with authority and funding to perform alterations to backwater areas as recommended by the Fish and Wildlife Interagency Committee (See #3004). Priority sites are listed in Section II. D..

Unaddressed Problems/Future Needs:

The equipment necessary to alleviate dredged material disposal problems in backwaters may not be available or may be prohibitively expensive to obtain.

V. B. 3. Problem 3:

Regulatory structures have caused blockages of access and loss of habitat in backwaters and side channels.

Sub-Objectives:

To identify specific side channels and backwaters requiring remedial action to improve productivity, extend their functional life, and/or improve recreational access.

To alter specific backwaters and side channels should such projects prove beneficial.

Tasks:

Literature Review
Orton Fabius Side Channel Opening and Study
Side Channel Inventory
Work Group Discussions

Results and Conclusions:

Wing dams and closing structures restrict the flow of fresh water into side channels and backwaters.

Wing dams and closing structures may restrict the amount of suspended sediment entering backwaters and side channels.

Wing dams and closing structure reduce the velocity of water flowing through side channels and backwaters.

Regulatory structures may restrict access to backwaters and side channels.

Regulatory structures have various benefits and detriments for fish and wildlife resources.

Recommendations:

#3507 - The Corps should construct, maintain and alter regulatory structures to provide beneficial effects to fish, wildlife and recreation as well as navigation according to the criteria and parameters developed by the wing dam modification studies of GREAT II (see FWMWG Appendix).

Unaddressed Problems/Future Needs:

Refer to the Fish and Wildlife Management Work Group Appendix.

V. B. 4. Problem 4:

The effects of altering flows into backwaters are not adequately documented or understood.

Sub-Objectives:

To develop the capability to predict the biological consequences of physical alterations to side channels and backwaters.

Tasks:

Literature Review
Orton Fabius Side Channel Opening and Study
Burnt Pocket Backwater Opening and Study
Work Group Discussions

Results and Conclusions:

Side channel and backwater openings can be beneficial in improving the quality of aquatic habitat in certain circumstances.

Side channel openings are not appropriate nor effective in all cases.

The model developed by the River Studies Center (LaCrosse, WI) and tested at Burnt Pocket is partially applicable to the GREAT II study area but is subject to limitations. It appears to be accurate in predicting a few categories.

Most studies have dealt with flow augmentation as a tool for improving backwater habitat. Dredging silted backwaters to restore and rehabilitate their productivity has not been studied.

Selection of the appropriate remedial action for any given backwater problem site requires careful consideration of the physical, hydraulic and biological characteristics of the area.

Recommendations:

Section II. D. lists "criteria for consideration of alternatives to enhance, preserve, and restore fish and wildlife values and/or recreational access" in backwaters.

#3508 - The Fish and Wildlife Interagency Committee (see #3004) should conduct a project and study to determine the feasibility and impacts of dredging a silted backwater to restore its original depths and hence prolong its productive life.

#3512 - The FWIC should apply the physical, chemical and biological data from the Burnt Pocket study, Fountain City Bay study, and any other side channel alteration studies to other computer models or methodologies as may be available (i.e. Instream Flow Group) or which may be developed in the future to further test and refine the capability to predict the biological consequences of physical alterations to side channels and backwaters.

V. B. 5. Problem 5:

The equipment required to alter a backwater in an environmentally sound manner may not exist.

Sub-Objectives:

To recommend the design specifications of equipment capable of working in backwaters in the most environmentally sensitive manner.

Tasks:

Equipment Specifications
Work Group Discussions

Results and Conclusions:

In order to combat the rapid and pervasive sedimentation of backwater areas, it will be necessary to perform backwater alterations on a large scale. The equipment necessary to perform such alterations on a large scale, cost-efficiently and in an environmentally sound manner does not exist.

The following specifications for suitable equipment would be highly desirable:

a) shallow draft (less than 4 ft.)
b) capable of long distance (out-of-floodplain) disposal
c) capable of handling large volumes
d) self propelled
e) capable of handling logs and stumps.

Specifications (c) and (d) are probably mutually exclusive.

Equipment with the above specifications may also have applicability to some channel maintenance problems (i.e. barge loading, out-of-floodplain disposal) or could be adapted to other earth-moving tasks (i.e. oil shale mining).

Currently available equipment (i.e. small hydraulic dredges) can be utilized in the short term and on a small scale.

At the present time, there is no incentive for private enterprise to develop such equipment. Therefore the task falls on the U.S. Government.

Recommendations:

#3510 - The Corps of Engineers should initiate a research and development program to determine the equipment (or pieces of equipment, or equipment system) necessary for performing large scale backwater alterations. It should include as many of the above listed specifications as are engineeringly feasible.

V. B. 6. Problem 6:

Side channels requiring alteration need to be identified and documented.

Sub-Objectives:

To identify specific side channels and backwaters requiring remedial action to improve their productivity, extend their functional life, and/or restore recreational access.

Tasks:

Side Channel Inventory
Work Group Discussions

Results and Conclusions:

Many sites have been impacted by dredged material and require alteration to restore access or biological productivity.

Many more areas are experiencing widespread sedimentation and are rapidly losing aquatic habitat. These areas require rehabilitation.

Access to several sites has been restricted or precluded by regulatory structures.

Recommendations:

#3503 - This recommendation identifies sites which should be monitored in order to assess the rate of habitat loss.

The information so gathered will enable resource managers to better plan for the needs of backwaters.

Section II. D. lists the sites identified as having the highest priority for restorative action.

V. B. 7. Problem 7:

Resource managers need the capability to predict the biological consequences of backwater alterations.

Sub-objectives:

To develop the capability to predict the biological consequences of physical alterations to side channels and backwaters.

Tasks:

Burnt Pocket Backwater Opening and Study.

Results and Conclusions:

The regression model (developed for Pool 8) is applicable to the ecological conditions of Pool 18 and is at least accurate in predicting benthic biomass changes resulting from flow augmentation.

Other methodologies or mathematical models that may exist or will be forthcoming should also be tested for their accuracy and applicability to the study area.

Recommendations:

#3512 - The FWIC (see Recommendation #3004) should apply the physical, chemical and biological data from Burnt Pocket, Fountain City Bay (Pool 5A) and any other side channel alteration study to other computer models or methodologies as may be available (e.g. Instream Flow Group) or which may be developed in the future to further test and refine the capability to predict the biological consequences of physical alterations to side channels and backwaters.

V. B. 8. Problem 8:

The fixed portions of dams prevent river flows into the backwaters immediately below them.

Sub-Objectives:

To identify specific side channels and backwaters requiring remedial action to improve productivity, extend their functional life, and/or improve recreational access.

Tasks:

Side Channel Inventory

Results and Conclusions:

The fixed portions of the following dams truncate river flow into approximately 1100 acres of backwaters and side channels:

Lock & Dam 10
Lock & Dam 11
Lock & Dam 12
Lock & Dam 13
Lock & Dam 22

Recommendations:

Section II. D. identifies priority sites for backwater alterations including the above listed dams.

Unaddressed Problems/Future Needs:

Prior to placing culverts in the fixed portions of dams to provide freshwater flow into the backwaters below, the impacts of such an action need to be assessed by qualified river hydraulogists and biologists.

V. B. 9. Problem 9:

The Corps of Engineers has no authority to alter side channels except where they are blocked by channel maintenance activities.

Sub-Objectives:

To recommend the type of action and methodology or the studies to determine the necessary action to alleviate the problems experienced in backwaters and side channels.

Tasks:

Work Group Discussions

Results and Conclusions:

The U.S. Fish and Wildlife Service as well as state resource management agencies have the authority to alter backwaters and side channels (assuming compliance with the permit requirements of various regulatory agencies) on lands they manage through Cooperative Agreement with the Corps of Engineers.

State and federal agencies with management authority generally lack the funding for such alterations.

The backwaters of the Upper Mississippi River should be managed as an integrated unit, i.e. on an ecosystem level.

The Corps of Engineers has within their agency the expertise and resources necessary to design and construct physical alterations to backwaters but lacks the statutory authority.

Recommendations:

#3504 - Congress should provide the Corps of Engineers with the authority and funding to perform physical alterations to backwater areas for the benefit of fish and wildlife as recommended by the FWIC (see recommendation #3004, FWMWG)

Unaddressed Problems/Future Needs:

Comprehensive management plans are lacking for the Upper Mississippi River. These should include land use as well as fish and wildlife management (Recommendations 3016, 3017, 3039).

V. B. 10. Problem #10:

Operation of barge tows during low flow periods resuspend sediments that ultimately may settle in backwater areas.

Sub-Objective:

To recommend the type of action and methodology or the studies to determine the necessary action to alleviate the problems experienced in backwaters and side channels.

Tasks:

Work Group Discussions
Literature Review

Results and Conclusions:

Sediment resuspended by the passage of barge tows can find its way into side channels and backwaters.

Lateral movement of resuspended sediment does occur during normal as well as low pool conditions.

Effect of sediment resuspended and transported into side channels is particularly noticeable when the side channel is located on the outside of a bend.

Recommendations:

None

Unaddressed Problems/Future Needs:

This problem could not be resolved with a reasonable recommendation. Any attempt to limit barge traffic to certain periods (e.g. cease barge traffic when low flow conditions prevail) would severely impact the commercial navigation industry. This is particularly true as low flow conditions usually coincide with peak grain tranport in the late fall. Furthermore, the work group feels that since resuspended sands settle rather quickly, the magnitude of the problem is probably slight. Specific problems, if significant, could be treated with a structural deflector at the opening to the side channel.

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APPENDICES

APPENDIX A

ACCOMPANYING DOCUMENTS/DISTRIBUTION LIST

A. Accompanying Documents

The study process of the Side Channel Work Group has resulted in the following documents:

Claflin, T.O. and R.G. Rada. 1980. A Study of the effects of diverting water into upper Burnt Pocket, navigation pool No. 18, Illinois and a field test of the regression simulation model previously developed on navigation pool No. 8. Draft Final Report. U.S. Army Corps of Engineers, Rock Island District. Contract No. DACW 25-78-C-0047.

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B. Distribution

The above referenced documents with the exception of Ellis, 1978, will be deposited at the following locations:

US Army Engineer District, Rock Island
ATTN: Library, Room 212
Corps of Engineers
Clock Tower Building
Rock Island, Illinois 61201

Richard J. Fleischman
US Army Engineer District, Rock Island
Corps of Engineers
Clock Tower Building
Rock Island, Illinois 61201

Upper Mississippi River Conservation Committee
Chairman
1830 Second Avenue
Rock Island, Illinois 61201

Upper Mississippi River Basin Commission
Federal Building, Room 510
Fort Snelling
Twin Cities, Minnesota 55111

US Army Engineer Waterways Experiment Station
ATTN: WESTL/Library Branch
P.O. Box 631
Vicksburg, Mississippi 39180

US Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161

Kathryn J. Gesterfield, Director
State Library
Office of the Secretary of State
Centennial Building
Springfield, Illinois 62706

Barry L. Porter, Director
State Library Commission
Historical Building, East Wing
East Twelfth and Grand Avenue
Des Moines, Iowa 50319

Charles O'Halloran, State Librarian
State Library
308 East High Street
Jefferson City, Missouri 65101

W. Lyle Eberhart, Assistant Supervisor
Division for Library Services
Department of Public Instruction
126 Langdon Street
Madison, Wisconsin 53702

APPENDIX B

COMMENTS ON DRAFT REPORT

The following comments were received on the Draft Side Channel Work Group Appendix. Responses to these comments are provided:

From U.S. Fish and Wildlife Service:

> "Page 44 - Economics and not technology is more likely the limiting factor in restoration of Priority 3 sites."

> Response: See page II-45 for a more complete discussion of the meaning and intent of the Priority 3 category.

> "Page 143, Item 28 - Recommends dredging a backwater lake and access for fishing. It is unlikely the FWS would permit this action in a needed waterfowl sanctuary designated as a closed area."

> Response: The classification and suggested remedial action to treat side channel and backwater problem areas was reviewed and approved by all Side Channel Work Group members, including representatives of the U.S. Fish and Wildlife Service. Nevertheless, the process by which such a recommendation would be implemented begins with the proposed Fish and Wildlife Interagency Committee (FWIC) on which the U.S. Fish and Wildlife Service would have membership. It is at that stage that the pros and cons of a specific project would be completely discussed and conflicts resolved. The purpose of the recommendations is to propose a possible solution to an identified backwater problem.

From the Department of Transportation:

> "From the information provided, it appears inevitable that the river will return to a pre-impoundment cross section. The problems dealt with by this work group related mostly to means of slowing the process down or the impacts of these changes. Unless a method is devised to reverse this process, the recommendations of this work group will result only in short term benefits. These short term benefits must be weighed against the cost and impacts to the transportation industry and the expenditure of public funds."

> Response: Portions of the SCWG Appendix, particularly the conclusions and summary, have been revised to more accurately reflect the short-term nature of the proposed recommendations. It is acknowledged that, given the present state-of-the-art, it is extremely unlikely that a reversal of the current sedimentation trend can be accomplished. In that light, the work group recommendations are indeed short-term. However, the mechanisms

have been proposed which will continually review the status of backwaters and side channels and evaluate solutions given the advancing state-of-the-art as well as any other pertinent factors. Conceivably solutions will be found to address this problem on a long-term basis and in the general public interest.

"Page 105 - An indication of flow direction is needed in Figure 39.

Response: So done, now Figure 56.

"Page 117 - Were attempts made to verify assumptions, i.e. record search of water levels, or field investigations of sample areas (besides dredge disposal areas)?"

Response: See expanded discussion of this task, page III-16.

"Page 122 - Fourth paragraph - If a 20,000 cubic yard dredging job over a 2-day period causes disposal problems, what would you do with 300,000 cubic yards in an hour? Theoretically it may work, but it is a practical impossibility. Also, the 2½ cents per yard would have to be at 100% efficiency with equipment time uitilization."

Response: The work group agrees with the comment that, given the proposed design and operational statistics, spoil disposal would indeed be a problem. However, the work group feels that the idea bears some merit and would perhaps be applicable in our situation on a much smaller scale or it may be applicable to dredging/mining situations elsewhere in the country. We would hate to see innovative ideas simply be dismissed without serious consideration.

APPENDIX C

Table 8a

Actual and predicted values of selected benthic invertebrates, total benthic biomass and total macrophyte biomass, Navigation Pool No. 18, Illinois, (1978 physical/chemical data used as input).

	Oligochaeta	*Hexagenia*	Chironomidae	Sphaeridae	Benthic Total Biomass	Macrophyte Total Biomass
BP (Upper)						
Actual	1353	302	217	11	14.1	0
Predicted	1760	481	43	0	17.8	93.1
BP (Lower)						
Actual	1425	207	171	12	18.2	0
Predicted	2360	370	216	1	13.0	91.6
CH						
Actual	215	3	38	19	4.7	0
Predicted	173	0	13	1	1.0	0
FH						
Actual	316	75	91	5	14.6	0
Predicted	74	7	11	1	4.9	0
FP (Upper)						
Actual	1310	359	67	33	21.8	0
Predicted	790	371	217	3	25.3	21.6
FP (Middle)						
Actual	1751	83	41	145	17.1	0
Predicted	610	311	291	270	24.7	22.5
FP (Lower)						
Actual	826	101	73	21	14.4	0
Predicted	684	343	308	281	13.1	24.7

Table 8b

Actual and predicted values of selected benthic invertebrates, total benthic biomass and total macrophyte biomass, Navigation Pool No. 18, Illinois, (1979 physical/chemical data used as input).

	Oligochaeta	*Hexagenia*	Chironomidae	Sphaeridae	Benthic Total Biomass	Macrophyte Total Biomass
BP (Upper)						
Actual	1417	460	296	144	4.01	0
Predicted	1813	371	47	0	13.8	87.3
BP (Lower)						
Actual	1955	361	161	110	7.8	0
Predicted	2410	373	211	43	8.1	81.2
CH						
Actual	478	38	61	60	1.0	0
Predicted	186	0	16	11	1.2	0
FH						
Actual	46	259	19	140	5.0	0
Predicted	67	1	19	13	3.7	0
FP (Upper)						
Actual	300	544	121	321	8.3	0
Predicted	684	371	209	37	21.6	18.3
FP (Middle)						
Actual	609	457	109	287	1.3	0
Predicted	612	393	261	280	22.2	17.9
FP (Lower)						
Actual	122	359	93	539	1.2	0
Predicted	673	301	233	497	16.7	19.6

Table 8c

Actual and Predicted values of selected benthic invertebrates, total benthic biomass and total macrophyte biomass, Navigation Pool No. 18, Illinois, (1980 physical/chemical data used as input).*

	Oligochaeta	*Hexagenia*	Chironomidae	Sphaeridae	Benthic Total Biomass	Macrophyte Total Biomass
BP (Upper)						
Actual	4321	0	202	0	22.3	80.5
Predicted	2070	31	49	0	26.1	0
BP (Lower)						
Actual	1820	352	202	43	6.4	45.1
Predicted	3128	483	49	27	35.7	0
CH						
Actual	215	3	97	3	2.9	0
Predicted	136	16	46	1	0	0
FH						
Actual	409	51	621	47	5.5	0
Predicted	77	14	1012	0	3.2	0
FP (Upper)						
Actual	339	129	535	35	7.1	0
Predicted	258	126	558	0	26.0	0
FP (Middle)						
Actual	126	136	814	25	9.6	0
Predicted	154	128	506	8.4	20.1	0
FP (Lower)						
Actual	366	127	349	65	5.2	0
Predicted	152	127	430	8.4	17.4	0

*Current velocity values were calculated for modeling purposes assuming 285 cfs flow from Campbell Chute + 500 cfs through experimental opening.

Appendix D RESPONSE BY MATERIAL AND EQUIPMENT NEEDS WORK GROUP TO POTENTIAL DREDGING EQUIPMENT AND EQUIPMENT SPECIFICATIONS FOR USE IN BACKWATERS

The GREAT River

Great River Environmental Action Team

HENRY C. PFIESTER, Chairman
Material & Equipment Needs Work Group - GREAT II
US Army Engineer District, Rock Island, Clock Tower Building,
Rock Island, Illinois 61201 Phone: 309-788-6361, X-275

Memorandum

To: Chairman, Side Channel Work Group, GREAT II

From: Chairman, Material and Equipment Needs Work Group, GREAT II

Date: 17 October 1979

Subject: Potential Dredging Equipment and Equipment Specifications for Use in Backwaters

Reference your letter of 25 September 1979, subject as above, in which an evaluation of the feasibility of a dredge plan submitted by Mr. Wiley Woodell is requested and in which are listed Side Channel Work Group specifications for new or modified equipment.

Operations Division staff members met with Mr. Woodell on 12 October to discuss the feasibility of his machine. Questions of technical capability center around whether or not the machine could gain enough traction to move forward while cutting very large volumes of sediment, particularly in backwater areas. Considerations of this type are outside the authority of the Rock Island District, and the suggestion was made to Mr. Woodell that he might submit his design to the Corps of Engineers Waterway Experiment Station, which has responsibility for research and development of such equipment. Habitat and pollution problems might exist, with a side casting dredge of this type, because the dredged material would be deposited near the area of operation. No practical means of transporting such large volumes of sediment presently exists.

The specifications submitted by the Side Channel Work Group for new or modified equipment to perform alterations in backwater lakes and side channels were reviewed to answer the four questions asked. It was determined that:

a. No equipment presently exists which would move "large" volumes of dredged material out of the floodplain in a reasonable time.

b. Likewise, it is not possible to modify existing equipment to accomplish all the objectives in an economically feasible manner.

c. The next step in obtaining the necessary equipment would be the initiation of a research and development program within the Government or by a private concern.

Shallow draft and self-propulsion do not appear to be major obstacles, but equipment capable of working in areas cluttered with logs and stumps could probably not move large volumes.

In general, it appears that no single machine or system could accomplish all the objectives listed. High volume dredges are not practical in areas cluttered with logs and drag lines and backhoes do not move large volumes quickly. A contract is presently being let by the Rock Island District to evaluate existing equipment or potential alterations of existing equipment. However, the problems stated will probably not be solved in the contracted study.

HENRY C. PFIESTER, P.E.
Chairman, Material and Equipment Needs Work Group, GREAT II