U.S. Army Corps
of Engineers

2004

MISSOURI RIVER SHALLOW WATER HABITAT REPORT

MISSOURI RIVER
SHALLOW WATER HABITAT
REPORT FOR 2004

Executive Summary

The Endangered Species Act (ESA) requires that the U.S. Army Corps of Engineers (Corps), in coordination with the appropriate resources agency, will ensure that any action authorized, funded, or carried out is not likely to jeopardize the continued existence of any federally listed threatened or endangered species or result in the destruction or adverse modification of critical habitat. Formal consultation between the U.S. Fish and Wildlife Service (FWS) and the Corps under Section 7 of the ESA culminated with the "Biological Opinion on the Operation of the Missouri River Main Stem System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project (BSNP), and Operation of the Kansas River Reservoir System" (Opinion), dated November 30, 2000. The Opinion concludes the existing operation of Missouri River Main Stem System (System), the maintenance and operation of the BSNP and operation of the Kansas Reservoir System jeopardizes the existence of the endangered interior least tern and pallid sturgeon and the threatened piping plover. It also concluded an incidental take of bald eagles.

On December 16, 2003, and in response to the Corps' request for the reinitiation of consultation, the FWS issued an amendment to its 2000 Biological Opinion (2003 Amended BiOp). The FWS determined that the 2000 Biological Opinion reasonable and prudent alternative (RPA), modified by the omission of flow changes and the addition of the proposed new RPA elements, will continue to avoid jeopardizing the continued survival and recovery of the Interior least tern and the Northern Great Plains population of piping plovers. With respect to the pallid sturgeon, the FWS determined the Corps' actions continue to appreciably reduce the likelihood of both survival and recovery of the species, thus jeopardizing the continued existence of the pallid sturgeon. The 2003 Amended BiOp includes RPA Section VII.1.a., which calls for a low summer release from the System of 25,000 cubic feet per second (cfs) each year beginning no later than July 1 and lasting for a minimum of 30 days. RPA Section VII.1.b provides that when approximately 1,200 acres of new shallow water habitat has been made available above that which currently exists between Sioux City and Omaha (approximately the amount that would be developed through flow management) the Corps, in consultation with the FWS, may modify flows to take advantage of that habitat and more fully meet project purposes.

Since the receipt of the 2003 Amended BiOp, the Corps has been working with the FWS on plans for near-term SWH development sufficient to implement Section VII.1.b of the 2003 Amended BiOp. In a letter dated February 13, 2004, the Corps provided new information to support a request that the 1,200 acres of new SWH development be applied from Ponca State Park to the mouth of the Osage River, rather than limiting SWH development to the Sioux City to Platte River reach identified in the 2003 Amended BiOp. The FWS evaluated this request and concurred in a letter dated March 5, 2004.

A list of potential sites suitable for SWH development were originally selected by the Corps based on a number of criteria including: meeting the SWH definition in the 2003 Amended BiOp; land ownership; ability to comply with the National Environmental Policy Act, Section 404 of the Clean Water Act, and Section 10 of the Rivers and Harbors Act of 1899; logistics of awarding a contract;

logistics of Corps in-house crews being able to work at the site before July 1; and cost per acre of return on the created habitat. The Corps' original list was vetted with the FWS, the Department of Agriculture's Natural Resource Conservation Service, and the states of Iowa, Kansas, Missouri, and Nebraska in a January, 2004 meeting. The FWS and States also offered additional sites where work might be possible. The list was vetted one final time with the FWS and then within the Corps, particularly with the river engineers to ensure feasibility of the proposed work. It was recognized by both agencies that the list was not necessarily complete, as some sites might be added as opportunities presented themselves and that some sites might drop out. The FWS agreed that the list provided in the March 2, 2004, letter identified a sufficient number of potential sites generally suitable for the purposes of implementing RPA Section VII.1.b.

The FWS March 5, 2004, letter also provided further technical guidance on the characteristics of SWH to assist river engineers and biologists in developing pallid sturgeon habitat. FWS also provided technical guidance for and supported the use of notching dikes as a means to diversify aquatic habitat. This technical guidance was utilized as SWH plans were developed and constructed.

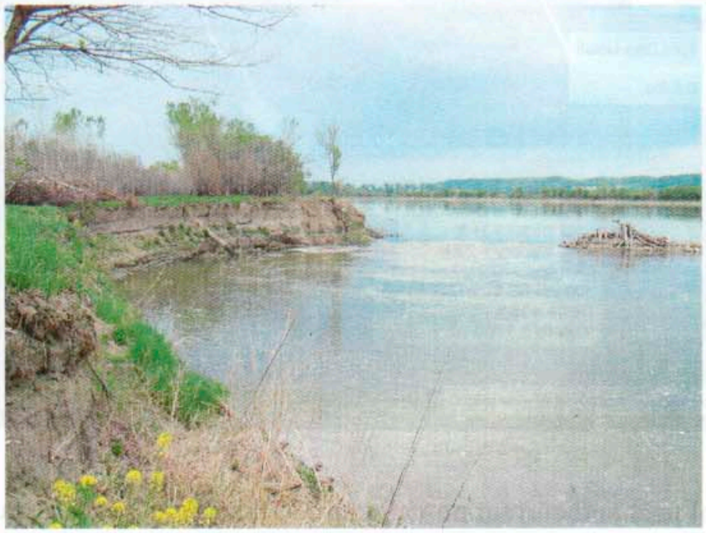
Corps' projects designed to create SWH include bank, dike, and revetment notches, dredging to widen the existing channel and to connect backwater areas, creation of pilot channels and chutes, and major dike modifications. Notching was begun as early as 1975 in an effort to halt the accretion process that was narrowing the topwidth of the river and in an effort to improve the aquatic habitat of the river. The four main types of notches the Corps is using in development of SWH for 2004 include revetment notches, bank notches, dike notches and type B notches. A notch serves to increase the percent time that flow occurs through a particular section of the dike. Most notched dikes have an elevation of between +1 and +3 construction reference plain (CRP). At these elevations the dikes are overtopped approximately 50% to 20% of the time. Thus, 50% to 80% of the time the dike cuts off all flow from upstream to downstream. In order to increase the percent of time of flow through a section of the dike, a notch cut to –4 CRP will have some flow through the notch up to 95% of the time. This effectively creates SWH for a broader range of flows. The length and depth of the notch must take into consideration that too much flow through the notch could reduce the effectiveness of the dike.

The following discussion describes in more detail the types of projects the Corps is constructing to develop a minimum of 1200 acres of SWH for the benefit of pallid sturgeon. The suitability of this newly created SWH will be maximized with releases equal to or higher than full service. Accordingly the Corps is proposing to operate consistent with the 2004 AOP dated March 19, 2004, based on meeting the provisions of Section VII.1.b. of the 2003 Amended Biological Opinion.

BANK NOTCHES. These are 75' wide notches excavated to –5 construction reference plain (CRP) constructed entirely landward of the high bank. These notches are constructed in straight out dikes or L-head dikes using land-based equipment. Bank notches have numerous immediate and long-term benefits for the pallid sturgeon.

The immediate benefits include the creation of a secondary channel adjacent to the high bank. Water enters from the upstream notch and flows along the bank through the downstream bank notches. Deposition will occur riverward of the secondary channel resulting in sandbar formation and shallowing of the area between the dikes. The resulting habitat has greater depth and velocity variation than the pre-notch condition. In addition, the excavated overbank will erode and create a more dynamic alluvial process within the dike field. Also, the cleared vegetation disposed of in the river during construction, along with trees falling into the river as the bank erodes, will provide structure for benthic organisms.

The long-term benefits are fairly rapid erosion of the high bank and widening of the top-width of the river. As the river widens, the total amount of aquatic habitat available is increased and sandbar formation within the dike field increases in a riverward direction. The following figure illustrates the erosion that will occur downstream of a bank notch.

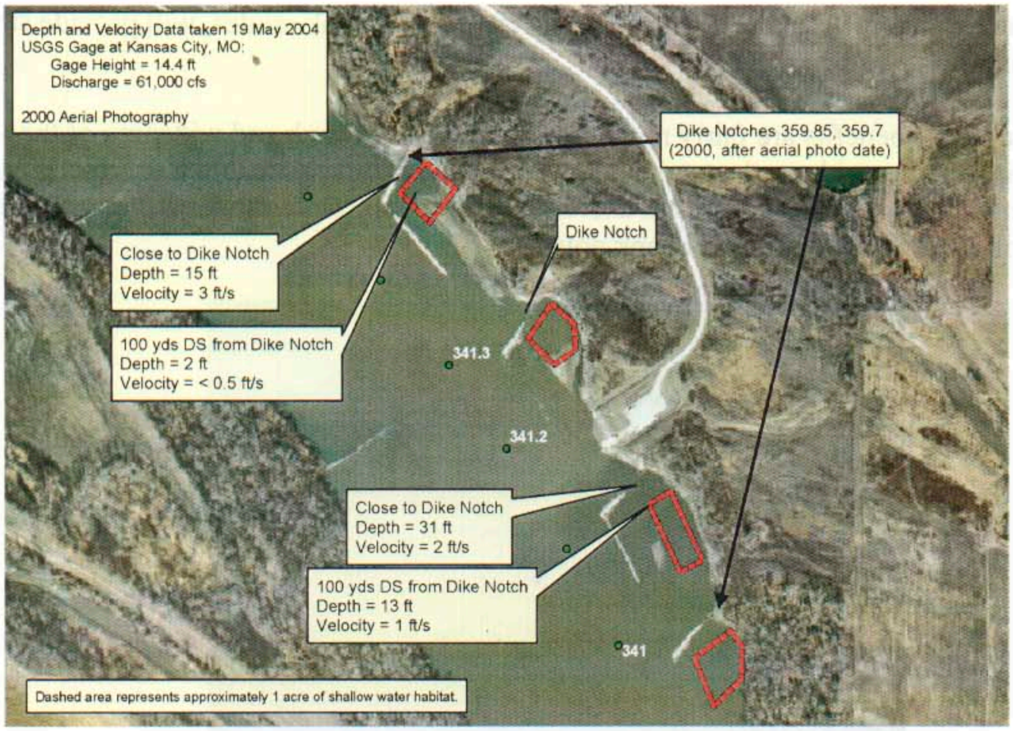


Based on analysis of past and current bank notching efforts, one bank notch will create between 4 and 6 acres of diverse shallow water habitat. The Corps will construct 75 bank notches creating between 300 and 450 acres of diverse shallow water habitat. Fifty notches are completed and an estimated 25 notches will be constructed between June 7 and June 30.

DIKE NOTCHES. These notches range in width between 50' to 100' and are excavated to either –4 or –5 CRP. These notches are excavated along the river portion of the dike between the high bank and no more than half-way out on the dike.

As with a bank notch, dike notches have immediate benefits. These notches improve the depth and velocity diversity upstream and downstream of the dike by allowing a portion of the river flow to flow within the dike field. As the flow spreads out downstream and riverward of a notch, the velocity slows down creating a high degree of velocity variability. In addition to the increased velocity diversity, a deep scour hole will form immediately downstream of a notch and deposition will generally occur further downstream and riverward from the notch increasing the depth diversity. The result is an area with a high degree of depth and velocity diversity upstream and downstream of the notch.

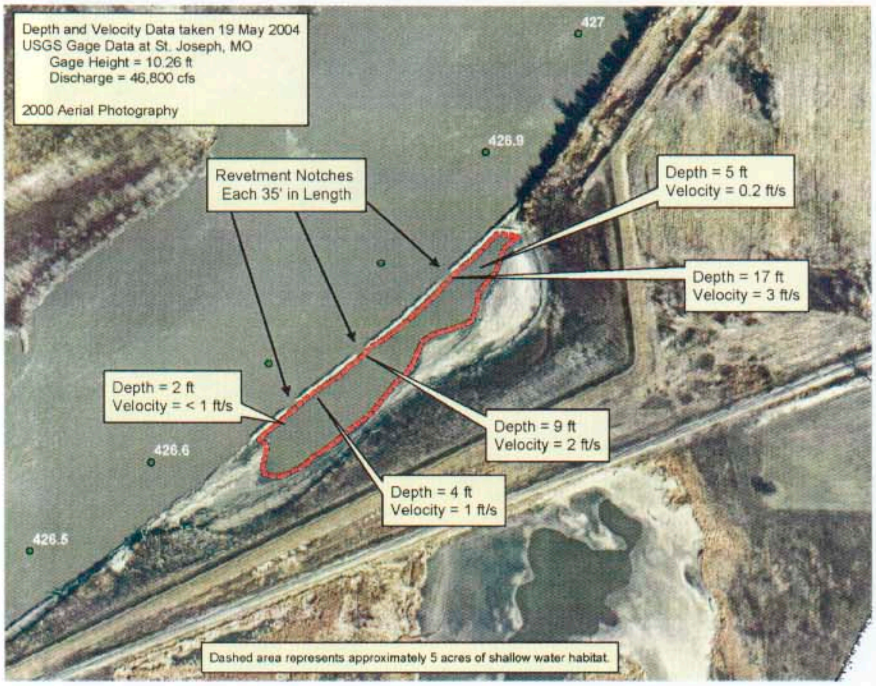
The following figure illustrates the depth and velocity diversity resulting from a series of notches constructed in dikes by Cooley Lake. Depth and velocity data was collected May 2004 at low navigation stages. Red squares represent one acre of shallow water habitat.



Based on analysis of past and current notching, a 50' dike notch will create one acre of diverse shallow water habitat and a 100' notch will create two acres of diverse shallow water habitat. The Corps will construct 427 dike notches ranging from 50' to 100' wide resulting in approximately 492 acres of SWH. Currently 313 dike notches are completed and an estimated 114 notches will be constructed by June 30, 2004.

REVETMENT NOTCHES: These notches are cut in stone fill revetments at locations where a slack water pool is separated from the main channel by a stone fill revetment. Without notches in the revetment, these aquatic areas are poorly connected to the main channel at normal summer flows, and therefore, have little to no flow and no velocity diversity. These notches range in width between 50' to 100' and were excavated to either –4 or –5 CRP. In most cases notches were cut at the upstream and downstream end of the pool to maximize the effects of the notches.

A revetment notch increases the connectivity of the slack water pool with the main channel. The increased connectivity increases the flow in the slack water area, which increases the velocity diversity and increases the depth diversity of the area. The following figure illustrates the increased connectivity and depth and velocity diversity that results from revetment notches. Depth and velocity data were collected during May 2004 at low navigation stages.



Based on analysis of past and current revetment notching efforts, a 50' revetment notch will create one acre of diverse shallow water habitat and a 100' revetment notch will create two acres of diverse shallow water habitat. There are 91 revetment notches ranging from 50' to 100' that are estimated to create 118 SWH acres. Currently 82 of these notches are completed and an estimated 9 notches will be constructed by June 30, 2004.

TYPE B NOTCH. Type B notches were constructed in the reach from Sioux City, Iowa to Rulo, Nebraska (BiOp Segments 12 and 13). Type B notches were constructed in a total of 48 dikes (6 bends) in Segment 12, and a total of 75 dikes (6 bends) in Segment 13. Type B notches were monitored both qualitatively and quantitatively.

During these inspections erosion was observed, trapping of large woody debris was noted and the change in surface flow patterns between modified and unmodified dikes was readily seen. The extent of the effect ranged from one notch width to several notch widths in the downstream direction, depending on the length of the exposed dike and the angle of the dike to the direction of flow. Quantitative assessments were made using pre-and post construction surveys. Depth diversity and bankline irregularity were increased over an area of roughly two acres per notch. It is important to note that the diversity changes extended to the limits of the survey, so it is reasonable to assume that the changes extend beyond the surveyed area. The following figure shows typical depth diversity in the vicinity of a type B notch. Considering the above information, and information contained in the 2003 Amended Biological it is likely that each type B notch would provide 1-2 acres of SWH. There are a total of 124 type B notches that are estimated to result in 124 to 248 SWH acres.

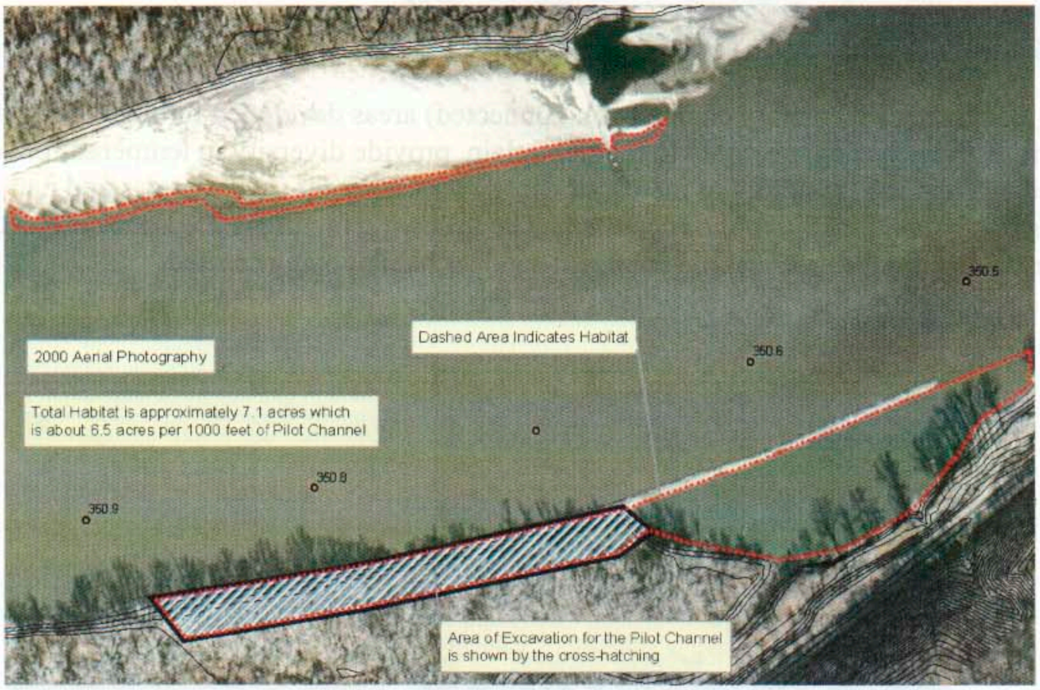
DREDGING. During the Spring of 2004, there are four backwater areas to be dredged in the Missouri River from Ponca State Park to Blair, Nebraska: California Bend, Soldier Bend, Tyson Bend and Ponca. All of the backwater dredge areas are under construction and will be completed by July 1, 2004. The estimated shallow water habitat from the dredging projects is 135 acres.

Habitats created from dredging operations fall into two primary categories. Dredging in chute habitats (Secondary Channel Connected) such as the projects at California Bend, Soldier Bend and Tyson Bend result in channel widening; whereas the dredging operations at sites such as Ponca result in the formation of a backwater (Secondary Channel Non-Connected) habitat or re-connects a backwater habitat restoring connectivity back to the river. Biological benefits of channel widening (chutes) include the enhancement of a range of depths and velocities available to native river species, provides connectivity to the floodplain, provides off-channel habitat for spawning and promotes the erosive processes (i.e., sediment and woody debris) resulting in enhanced ecosystem diversity and function. The following picture is looking upstream at the California Bend with construction nearly complete.

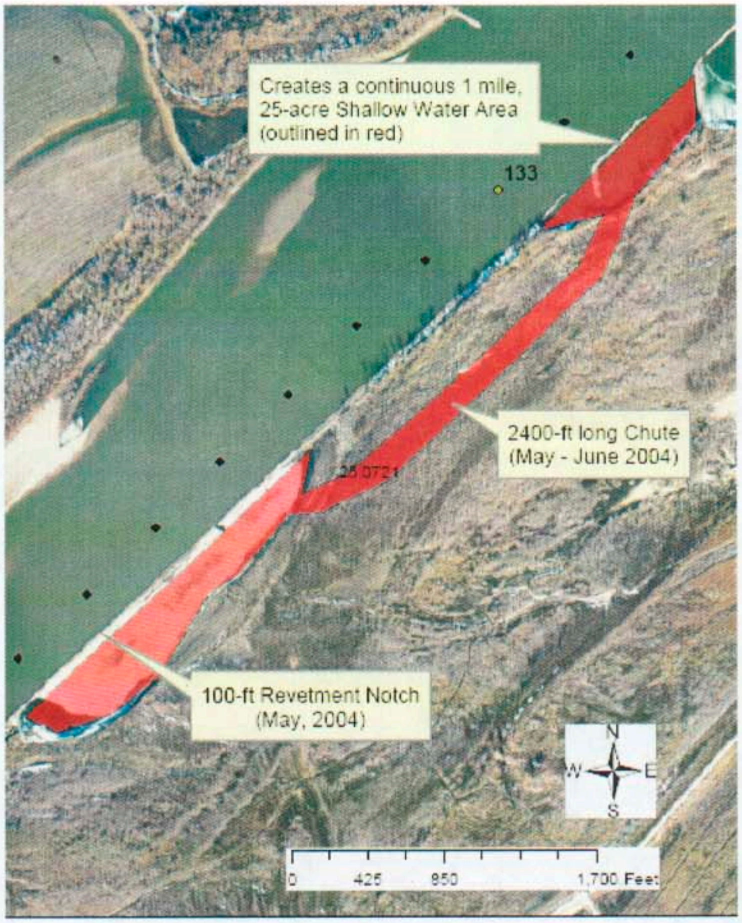
Backwater (Secondary channel non-connected) areas developed through dredging such as the Ponca Project increase connectivity to the floodplain, provide diversity in temperature, velocity, increased nutrient load resulting in increased energy necessary for invertebrates and native fish species while restoring functionality to the ecosystem. The following picture is the Ponca project looking southwest at the dredge area and the emergent sandbar habitat being created.

PILOT CHANNELS. Pilot channels are trenches excavated immediately landward of a stone fill revetment. Pilot channels have at least a 50' bottom width and range between 1000' and 2400' in length. By excavating the overbank, pilot channels have the immediate effect of increasing the amount of available shallow aquatic habitat. This desirable habitat will be immediately adjacent to and highly connected to the main channel. In addition, the excavated overbank and woody debris disposed on the riverside of the revetment will provide additional habitat as the organic matter is washed into the river. Pilot channels are in general located upstream of slack water off-channel pools so that the flow through the pilot channel will flow into the pool and diversify the habitat of the pool.

It is expected that by the first of July, the pilot channels will erode to a topwidth of 100'. The result will be 2.3 acres of aquatic habitat per 1000' of pilot channel. In addition, the increased diversity of the pool area downstream of a pilot channel and the deposition in the dike field across the river will result in an additional 1.7 acres of aquatic habitat per 1000' of pilot channel. The net effect is the creation of 4 acres of shallow water habitat per 1000' of pilot channel. The following picture shows area of improved aquatic habitat as a result of pilot channel construction at Liberty Bend near river mile 350. It is estimated that constructing approximately 11,000 feet of pilot channels will create approximately 44 acres of SWH.



CHUTES. Chutes are trenches excavated entirely within the overbank and connected to the river at the entrance and the exit. The secondary channel increases the total amount of aquatic habitat available. During normal summer flows, the flow in the chutes will be shallow and slow with a high degree of diversity. The chute bottom will be very dynamic with a sandy substrate. The following picture shows the area of improved aquatic habitat as a result chute construction at Smokey Waters. A total of 78 acres of SWH will result due to the construction of chutes.



MAJOR DIKE MODIFICATIONS. Major dike modifications consist of lowering a large portion of the riverward ends of the dikes and construction of a chevron structure between approximately every pair of lowered dikes. This type of modification is placed at 6 bends in the river. The dike lowering will allow the high bank to erode an amount approximately equal to the amount the dike is lowered into the high bank. The chevrons will perform two functions. First, the chevrons will create an area where sediment can accumulate in and adjacent to the main channel. The second function is to force a portion of the flow against the high bank, thus facilitating the erosion process. The erosion process adds to the top width of the river, adds large woody debris to the main channel, and provides for a slight increase in the amount of sediment available for alluvial processes. The combination of these two effects leads to a greater diversity of depths and velocities through the bends. The following picture is a chevron and sandbar at RM 555.0 approximately 6 weeks after construction.

Qualitative analysis of these modifications indicates the erosion process leading to a greater diversity of depths and velocities can occur very quickly. During the joint inspection conducted on April 27, 2004, pre-construction depths in Snyder and Winnebago Bends were 17-20 feet. Chevrons were constructed on April 28-30. During the joint inspection conducted on May 4, 2004, depths of 2-6 feet were observed in the same area under similar discharge conditions. These changes were further verified during the joint inspection on June 2-3, 2004. Based on all of the information available on this type of modification, the increase in SWH is 8-15 acres per mile of modification. As of July 1, 2004, construction of 85 lowered dikes and 40 chevrons will result in an estimated range of 130 to 246 acres of SWH.

SUMMARY OF SWH CONSTRUCTION. The Corps has developed SWH by modifying the existing channel and bank stabilization structures. As described above, this work has included bank, dike, and revetment notches, dredging to widen the existing channel and connect backwater areas, creation of pilot channels and chutes, and major dike modifications. While these modifications will effectively operate over a wide range of flows, it is important to understand that these modifications have been designed to function most effectively in creating shallow water habitat at or near service level flows in order to meet all project purposes. The technical engineering studies conservatively estimate that as of July 1, 2004, the Corps will have created between 1420 and 1810 acres of shallow water habitat since the issuance of the 2003 Amended Biological Opinion. The following table summarizes SWH by structure type.

*Summary Table SWH Acres		
Structure Type	Minimum Acres	Maximum Acres
Bank Notches	300	450
Dike Notches	492	492
Revetment Notches	118	118
Type B Notches	124	248
Dredging	135	135
Pilot Channels	43	43
Chutes	78	78
Dike Modifications	130	246
TOTAL SWH ACRES	1420 Minimum	1810 Maximum

CONCLUSION

Section VII.1.b. of the Amended Biological Opinion provides that when approximately 1,200 acres of new shallow water habitat has been made available above that which currently exists between Sioux City and Omaha (approximately the amount that would be developed through flow management) the Corps, in consultation with the Service, may modify flows to take advantage of that habitat and more fully meet project purposes.

As addressed in the Corps' letters dated February 13 and March 2, 2004, the Corps believes that based on new information, it is biologically warranted for the benefit of the pallid sturgeon, to extend the geographic reach of the 1,200 acres of new shallow water habitat set forth in the 2003 Amended Biological Opinion, from Ponca State Park to the mouth of the Osage River. The information provided included engineering analysis of current shallow water habitat deficiencies, biological studies of the drifting phase of pallid sturgeon, population assessment sampling below the Platte River, and sampling within the Platte River itself. The FWS letter of March 5, 2004, evaluated the information and concurred in the modification of the geographical reach of river for habitat development in Section VII.1.b.

The Corps is developing over 1,200 acres of shallow water habitat by modification of the existing channel and bank stabilization structures from the Ponca State Park to the Osage River. As described above, this work has included bank, dike, and revetment notches, dredging to widen the existing channel and to connect backwater areas, creation of pilot channels and chutes, and major dike modifications. These modifications will effectively operate over a wide range of flows, however, they will perform most effectively for pallid sturgeon shallow water habitat with discharges approximately equal to or slightly higher than full service.

The Corps' technical engineering studies conservatively estimate that as of July 1, 2004, between 1420 and 1810 acres of shallow water habitat will have been created since the issuance of the 2003 Amended Biological Opinion. This shallow water habitat meets the criteria discussed in the 2003 Amended Biological Opinion and further described in the FWS March 5, 2004, letter to the Corps. Over time, flows that meet all project purposes are expected to increase the effectiveness of these structural modifications and further expand the amount of shallow water habitat already created as well as increase the biological productivity of these sites.

The Corps is proposing to operate in accordance with the 2004 AOP dated March 19, 2004, based on meeting the provisions of Section VII.1.b. of the 2003 Amended Biological Opinion. The AOP provides for releases of 30,000 cfs in July and August to meet flow targets as downstream tributary flows decline, but as noted in the AOP, actual releases will be dependent on the hydrologic conditions existing at that time. Should the tributary flows drop below the high run-off flows experienced in early May, the Corps will consider increasing the Gavins Point Dam releases to more than 30,000 cfs. However, if wet conditions persist downstream of Gavins Point Dam, releases less that 30,000 cfs will be considered to meet service levels and to conserve water in the upstream reservoirs. As stated above, the releases above those described in Section VII 1.a., are intended to optimize the newly created shallow water habitat maximizing benefits to pallid sturgeon while providing for authorized purposes on the lower river.

TABLE OF CONTENTS

List of Tables

List of Figures

List of Photographs

I. INTRODUCTION

The purpose of this report is to describe and document the development of Shallow Water Habitat (SWH) completed by the U.S. Army Corps of Engineers (Corps) since the submission of the November 2003 Final Biological Assessment on the Operations of the Missouri River Mainstem Reservoir System, the Operation and Maintenance of the Bank Stabilzation and Navigation Project, and the Operation of the Kansas River Reservoir System (BA). The reinitiation of formal consultation under section 7 of the Endangered Species Act (ESA) led to the U.S. Fish and Wildlife Service (FWS) December 16, 2003 Amended Biological Opinion on the Corps operation of the Missouri River (2003 Amended BiOp).

1. Biological Opinion Requirements for SWH

The Endangered Species Act (ESA) requires that the Corps, in consultation with the FWS, will insure that any action authorized, funded, or carried out is not likely to jeopardize the continued existence of any federally listed threatened or endangered species or result in the destruction or adverse modification of critical habitat. Formal consultation between the FWS and the Corps under Section 7 of the ESA culminated with the "Biological Opinion on the Operation of the Missouri River Main Stem System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project, and Operation of the Kansas River Reservoir System" (Opinion), dated November 30, 2000. The Opinion concludes the existing operation of Missouri River Main Stem System, the maintenance and operation of the BSNP and operation of the Kansas Reservoir System jeopardizes the continued existence of the endangered interior least tern and pallid sturgeon and the threatened piping plover. It also concludes an incidental take of bald eagles.

On December 16, 2003, and in response to the Corps' request for the reinitiation of consultation, the FWS issued an amendment to its 2000 Biological Opinion (2003 Amended BiOp). The FWS determined that the 2000 Biological Opinion reasonable and prudent alternative (RPA), modified by the omission of flow changes and the addition of the proposed new RPA elements, will continue to avoid jeopardizing the continued survival and recovery of the Interior least tern and the Northern Great Plains population of piping plovers. With respect to the pallid sturgeon, the FWS determined the Corps' actions continue to appreciably reduce the likelihood of both survival and recovery of the species, thus jeopardizing the continued existence of the pallid sturgeon. The 2003 Amended BiOp includes RPA Section VII.1.a., which calls for a low summer release from the System of 25,000 cubic feet per second (cfs) each year beginning no later than July 1 and lasting for a minimum of 30 days. RPA Section VII.1.b provides that when approximately 1,200 acres of new shallow water habitat has been made available above that which currently exists between Sioux City and Omaha (approximately the amount that would be developed through flow management) the Corps, in consultation with the FWS, may modify flows to take advantage of that habitat and more fully meet project purposes.

Since the receipt of the 2003 Amended BiOp, the Corps has been working with the FWS on plans for near-term SWH development to meet the intent of the 2003 Amended BiOp; therefore allowing the Corps to operate for all congressionally authorized purposes the summer of 2004. In a letter dated February 13, 2004, the Corps provided new information to support a request that the 1200 acres of new SWH development be applied from Ponca State Park to the mouth of the Osage River, rather than limiting SWH development to the Sioux City to Platte River reach identified in the 2003 Amended BiOp. The FWS evaluated this request and concurred in a letter dated March 5, 2004.

The March 5, 2004 FWS letter also agreed that the list provided in the March 2, 2004, letter identified a sufficient number of potential sites generally suitable for the purposes of implementing RPA Section VII.1.b. (See Appendix B for letters.)

The information on the development of over 1200 acres of new shallow water habitat is provided on a site-specific basis, below. The suitability of this newly created SWH will be maximized with releases equal to or higher than full service. Accordingly the Corps is proposing to operate consistent with the 2004 AOP dated March 19, 2004, based on meeting the provisions of Section VII.1.b. of the 2003 Amended Biological Opinion.

2. US Fish and Wildlife Service Technical Clarifications for SWH

The 2000 Opinion generally described SWH as less than 5 feet and less than 2 feet per second. In the FWS letter dated March 5, 2004, the FWS provided technical assistance to assist the Corps with implementation of the 2003 Amended BiOP. Specifically the FWS provided technical guidance on the characteristics of SWH to assist river engineers and biologists in developing pallid sturgeon habitat as follows:

> Restoration of cutoff channel habitats for shallow water classification, needs to incorporate an active bed transport that functions much like secondary or main channels, that is sustainable over the long term. Flows need to be sufficient to create a mosaic of shallow, submerged sand bar (sand dune) habitats that mimic the historical frequency distribution of depths and velocities. These shallow sandbar habits that are closely associated with a thalweg are typically where pallid sturgeon juveniles and young of the year shovelnose sturgeon are found. These habitats provide the fish access to the variety of depths and flows dependant on activity and life stage. Connectivity with the main channel needs to be maintained in order to allow movement of fish among these habitats under a variety of flow conditions, seasons and species' needs over all life stages.
>
> Pallid sturgeon prefer areas where flows converge (i.e., main channel and side channel, island tips, tributary mouths). Ideally, habitat should be available over a wide range of flows. An area may provide more than one type of habitat for various life stages as the depths and velocities in that area change in response to river discharge. Thus variable river flow is as large a factor in abundance, location, and longevity of suitable habitat as the geomorphology that underlies it.
>
> Preferred shallow water habitats should be in channel with the above mentioned characteristics.
>
> Existing examples of secondary channels that have experienced success are the Lisbon Bottoms prior to modification in 2000 and Hamburg Bend. There is both biological and physical information from those areas, as well as some historic geomorphic data on DeSoto Bend (as the river), to explore potential future pallid sturgeon habitat restoration opportunities in that area. While feasible, such efforts would require considerable technical coordination, modeling, monitoring and assessment to adequately implement a project.
>
> Modeling to help inform the design process and describe project outputs is critical.

FWS also provided technical guidance for and supported the use of notching dikes as a means to diversify aquatic habitat as follows:

> The Service supports notching as an effective tool to contribute to pallid sturgeon habitat in the main channel of the river by diversifying aquatic habitat downstream of the notches. Based on discussions with the Corps regarding their most recent proposal, notches would be between 50' and 75' wide with a minimum depth of - 4' CRP. The size of the notch would depend, to a large extent, on adjacent land ownership (i.e., larger more landward notches on public lands). The results would depend on the specific location and size, but in general notches would develop a scour downstream and an associated shoal or shallower area downstream of that. The notches would also favorably modify velocities in the area around the notches. Notches in L-dikes can help flush the surrounding area, maintaining clean sand substrates. Notches in dikes at the ends of islands can improve flows and fish movement to the existing side channels.
>
> The Service's Fisheries Management Office in Columbia, Missouri (CMFRO) has documented sturgeon associated with various types of notches and believe the notches improve habitat for a number of native river species. While the true value of larger notches will likely be realized with higher flows, notches can begin responding immediately, and a variety of notch sizes and depths should help take advantage of varying habitat over a range of flows. Located throughout the lower river, the resulting habitat would also be available to young fish that hatched at different locations, and experienced varying larval drift distances. Modifications of these dikes can be accomplished this winter and spring and meet the Corps' goal of 1200 new acres of shallow water habitat available to sturgeon by July 1, 2004.

This technical guidance was utilized as SWH plans were developed and constructed.

3. SWH Construction completed under the 2000 BiOp

a. 2001

Approximately 110 new notches were cut at various locations between river mile 426 and river mile 8. These notches were larger and deeper than previous maintenance notches. The larger size notches allow for more aggressive (faster and more acreage) habitat development.

The Missouri River Bank Stabilization and Navigation Project Fish and Wildlife Mitigation Project (BSNP Fish and Wildlife Mitigation Project) created approximately 835 acres of SWH and 3,635 acres of reconnected floodplain in Fiscal Year (FY)2001. Complete details and locations are available in the Missouri River Bank Stabilization and Navigation Project Fish and Wildlife Mitigation Annual Implementation Report dated January 2002.

b. 2002

One hundred fifty six notches were constructed between Missouri River miles 456 and 110. Notches averaged 75 feet wide with a bottom depth of 4 feet below construction reference plane (CRP). The sizing and placement of these notches varied widely according to the particulars of each location. Approximately 100 of these large notches that were excavated immediately adjacent to the bank or into the bank to encourage erosion of the high bank. The remainder of the notches were smaller notches constructed at least 100' riverward of private property. The smaller notches diversify existing SWH without eroding the high bank.

The BSNP Fish and Wildlife Mitigation Project created approximately 530 acres of SWH and 1200 acres of reconnected floodplain in FY 2002. Complete details and locations are available in the Missouri River Mitigation Project Annual Implementation Report dated January 2003.

c. 2003

The following activities were completed in calendar year 2003 as part of the SWH development program and will result in over 400 acres of new SWH when the projects are fully developed.

Eighty-five notches were constructed between river miles 21 and 112. The notches are up to 100' wide and were excavated between 2' and 5' below normal navigation stage.

Twenty-one additional notches were excavated.approximately 100' back into the bank. A pilot chute to and from each notch was excavated to the river. These notches were excavated along Overton Bottoms for the purpose of eroding the bank and increasing the amount of SWH habitat in the river.

Two chutes were constructed at Overton South . The chutes are approximately 1200' in length. Other work included realigning and enlarging the existing Overton North chute. The purpose of this work was to increase the amount and frequency of flow in the chute and to encourage erosion and widening of the chute.

Dike modification and chevron construction also took place between River Miles 555 and 541. A total of nine river miles were modified under the BSNP Fish and Wildlife Mitigation Project.

Multiple side chute projects were constructed along the right bank of the California Bend site, located north of Blair, Nebraska.

The Tieville-Decatur Bend Mitigation Project backwater area was also constructed. This is a multi-purpose project that includes native river fish benefits, waterfowl benefits, and increased flood plain connection.

4. Coordination

Since the issuance of the 2003 Amended BiOp, the Corps has been coordinating with the FWS on the implementation of the various elements of the Amended BiOp. In January 2004, the Corps held several meetings with the FWS, the Department of Agriculture's Natural Resource Conservation Service (NRCS), and the states of Iowa, Kansas, Missouri, and Nebraska to identify potential SWH sites and further clarify the characteristics of SWH to assist river engineers and biologist.

The result of this coordination resulted in the Corps letter of February 13, 2004, to the FWS. In that letter, the Corps identified new information that it is biologically warranted for the benefit of the pallid sturgeon, to extend the geographic reach of the 1,200 acres of new shallow water habitat set forth in the 2003 Amended Biological Opinion, from Ponca State Park to the mouth of the Osage River. The information provided included engineering analysis of current shallow water habitat deficiencies, biological studies of the drifting phase of pallid sturgeon, population assessment sampling below the

Platte River, and sampling within the Platte River itself. In addition, the Corps provided an initial list of SWH projects to be considered in implementing RPA Section VII.1.b.

Following the transmittal of the February 13, 2004 letter, the Corps and FWS held additional meetings on implementing Section VII.1.b of the 2003 Amended BiOP. The Corps committed to implement this RPA element by July 1, 2004, to aggressively address biological needs for pallid sturgeon and to avoid interruption in the navigation season. In addition, only shallow water habitat suitable for the various life stages of young pallid sturgeon constructed since November 2003 would be credited toward implementation of RPA VII.1.b., consistent with the environmental baseline in the 2003 Amended BiOp. In a letter dated March 2, 2004, the Corps requested technical assistance from the FWS regarding a revised list of SWH sites in order to make certain that the listed projects would provide biological benefits for pallid sturgeon.

The FWS responded in a March 5, 2004, letter. The FWS evaluated the information concerning expanding the geographical reach of river for habitat development in Section VII.1.b. and concurred. The FWS also agreed that the list provided in the March 2, 2004, letter identified a sufficient number of potential sites generally suitable for the purposes of implementing RPA Section VII.1.b. The letter also provided further technical guidance on the characteristics of SWH to assist river engineers and biologists in developing pallid sturgeon habitat. FWS also provided technical guidance for and supported the use of notching dikes as a means to diversify aquatic habitat. This technical guidance was utilized as SWH plans were developed and constructed.

Since March 2004, the Corps has worked collaboratively with the FWS, the NRCS and affected state offices to implement the identified SWH. This coordination included development of site-specific designs, field inspections of constructed sites, and identification of reference sites for verification plans.

Two meetings were held to check on the progress of SWH construction, confirm approach to verifying acres of SWH, outline reports and develop schedules for exchange of information to implement RPA Section VII.1.b. The FWS letter of May 13, 2004, discussed the results of the April 20, 2004, meeting between the FWS and the Corps. It outlines the process for monitoring and evaluating sites, the future exchange of information, and evaluation of compliance with the 2003 Amended BiOp. On May 17, 2004, one additional meeting was held to outline the content of this report.

II. DESCRIPTION OF METHODS AND PROCESS FOR 2004 SWH EFFORT

1. Work Descriptions and Definitions

a. River Structure Notching

Notching was begun as early as 1975 in an effort to halt the accretion process that was narrowing the topwidth of the river and in an effort to improve the aquatic habitat of the river. The early notches were small (less than 50' wide and between +2 and –3 CRP in depth). They were located to prevent further accretion and to improve the aquatic habitat between the structures.

This notching effort has been expanded over the last few years in an effort to increase the amount and quality of aquatic habitat for the pallid sturgeon. Recent notches are generally wider and deeper and placed closer to the bank than those constructed in past years. Most of the recent notching projects have shown great promise as a means of producing aquatic habitat for the pallid sturgeon.

The main benefit of notches is the immediate introduction of flow at specific points in the structures during stages lower than the top elevation of the structure. Depending on the size and location of the notch, the flow can be used to erode the bank and increase diversity upstream and downstream of the notch or, if bankline erosion cannot be tolerated, the flow can be used to simply increase diversity. In general, the larger the notch and the closer the notch is located to the bank, the more the adjacent bank will erode and the more diversity will increase in the general area. The four main types of notches used to develop SWH in 2004 are revetment notch, bank notch, dike notch and type B notch.

A notch also serves to increase the percent time that flow occurs across a particular structure. Most notched dikes have an elevation of between +1 and +3 CRP. At these elevations the dikes are overtopped approximately 50% to 20% of the time. Thus, 50% to 80% of the time the dike cuts off all flow from upstream to downstream. A notch cut to –4 CRP will have some flow through the notch up to 95% of the time, greatly increasing the percent time of flow across the structure. The length and depth of the notch must take into consideration that too much flow through the notch could reduce the effectiveness of the dike.

Velocities through a notch generally will range between 3-4.5 fps. Thus a standard notch 50' wide excavated to –4 CRP, with river stage and top of dike at elevation at +1, will have a discharge of up to 1125 cfs. This discharge will fall to zero as the river stage decreases to the bottom elevation of the notch.

Revetment Notch: Revetment notches are cut in revetments that separate the main channel of the river from existing aquatic areas landward of the revetment. At normal summer stages, these aquatic areas are poorly connected to the main channel, have little to no flow, and therefore have no diversity of velocities.

A revetment notch increases the connectivity of the aquatic area with the main channel, and increases the velocity diversity of the aquatic area and to a lesser degree increase the depth diversity of the area.

Bank Notch: Bank notches are constructed at locations where the landowner can tolerate a high degree of bank erosion and land disturbance. They are constructed on every dike in a particular reach of river so that the effects of the notch are greatly multiplied. Bank notches have numerous immediate and long-term benefits.

The immediate benefits are the creation of a secondary channel adjacent to the high banks. Water enters the upstream notch and flows along the bank through the downstream adjacent bank notches and then back out into the river. Sandbar formation and shallowing occurs in the area between the dikes and riverward of the secondary channel. The resulting habitat has greater depth and velocity variation than without the notches. In addition the excavated overbank will erode and create a more dynamic alluvial process within the dike field. Also, the cleared vegetation, which is disposed of in the river, and trees falling into the river as the bank erodes, provide structure for benthic organisms.

The long-term benefits are fairly rapid erosion of the high bank and widening of the top-width of the river. As the river widens, the total amount of aquatic habitat available is increased and sandbar formation within the dike field increases in a riverward direction.

Dike Notch: These notches range in width between 50' to 100' and are excavated to either –4 or –5 CRP. These notches are excavated along the riverward length of the dike between the high bank and no more than half-way out on the dike. As with the bank notch, the effects of a dike notch will have immediate benefits. These notches improve the depth and velocity distribution upstream and downstream of the dike by allowing a portion of the rivers flow to flow within the dike field. This point flow sets up a velocity gradient as the flow spreads out downstream and riverward of the notch. In addition to the increased velocity diversity, a deep scour hole will form immediately downstream of the notch and deposition will occur further downstream and riverward from the notch which will increase the depth diversity. The result is an area with a high degree of depth and velocity diversity upstream and downstream of the notch.

Type B Notch: A type B notch consists of excavating a 75' wide section of the dike. The excavation is 5' below the CRP. One third, or 25' of the notch width is on the exposed portion of the dike and 50 feet (2/3 of the notch) is cut into the high bank (See Figure 1 below). This allows a significant amount of flow to leave the main channel via this notch. At minimum service flows, the amount of flow through the notches would range from 350 to 1250 cfs, or 1 to 5 percent of the total flow. This split flow has two primary effects. The first is erosion of the high bank both upstream and downstream of the notch. This erosion provides for a local increase in the top width of the river, adds large woody debris to the channel, and provides for a slight increase in the amount of sediment available for alluvial processes. The second effect is an increase in the hydraulic shadow of the remaining dike, which in-turn increases the area over which the dike can influence the velocity distributions. The combination of these two effects leads to a greater diversity of depths and velocities in the vicinity of the dikes as well as riverward of the dike.

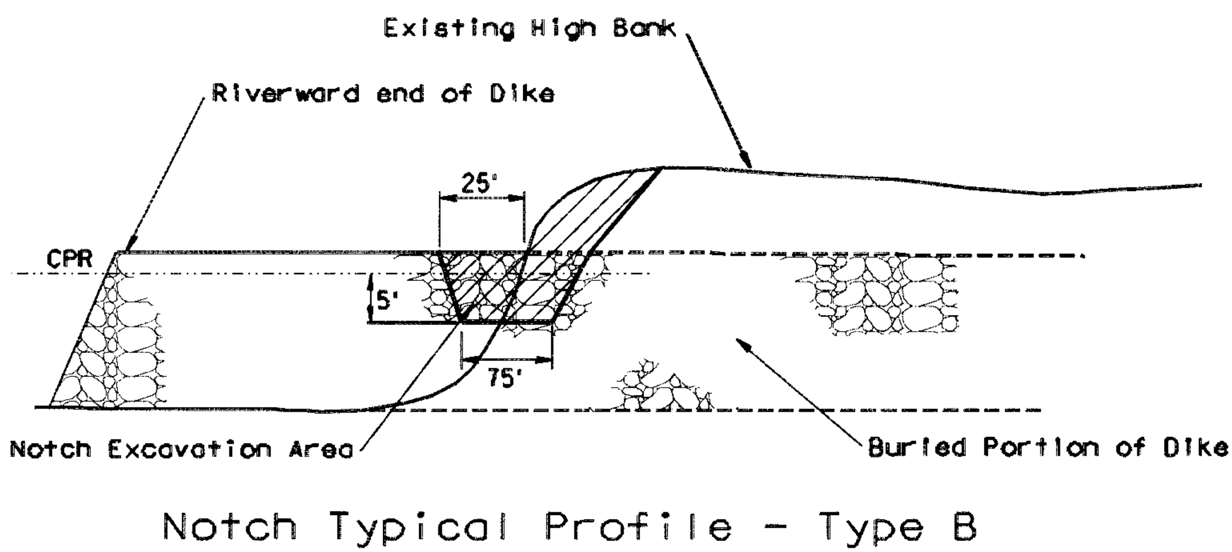


Figure 1. Type B Notch Design.

b. Dredging

The material is dredged with a hydraulic dredge and then discharged into the Missouri River. The side slopes are the angle of repose of the soil. The end of the discharge pipe is submerged at a location in the water column where mixing and integration into the bed load occur quickly. Studies and construction experience for other projects indicate that suspending the discharge 4 to 6' off the bottom of the river provides for adequate entrainment of the dredge material.

c. Pilot Channel

These are trenches excavated immediately landward of a stone fill revetment. The earthen trenches are connected to the river by notches in the adjacent revetment. Pilot channels are at least 50' wide, excavated to –3 CRP in depth, and range between 1000' and 2400' in length. Approximately 40 cubic yards of bank material is excavated per foot of channel. Cleared vegetation and excavated bank material is placed riverward of the adjacent revetment. It is also expected that the aquatic habitat in the dike field across the river from a pilot channel will experience some shallowing due to the redirection of water out of the main channel.

d. Chute

These are earthen trenches excavated within the overbank to create a secondary channel connected to the river only at the entrance and exist. The excavated material is disposed of in spoil piles immediately adjacent to the high banks of the chute or into the river.

e. Major Dike Modification

(Dike Lowering and Chevron Construction)

Dike Lowering: Modification of the 85 dikes is accomplished by removing rock starting from the riverward end of the dike and extending 100 to 125 feet back into the bank. Removal of material at the bankline and landward involves "unburying" the dikes via excavation of alluvial material and then removal of stone from the dike. The dikes are lowered to –5 feet CRP. The rock removed from the dikes is used to construct the chevrons. Excess material (sand, stones, trees, brush, etc.) is placed just downstream of the existing structure and at least 100 feet landward from the end of the dike excavation, allowing the river to eventually reclaim it through erosion. Any pilings that are in the dikes aree broken off at the desired elevation using an excavator and disposed of by either taking them to a landfill or burying them in an excavated hole with at least five feet of fill placed over top. This disposal occurs at least 100' landward from the end of the dike excavation.

Dike Lowering Goals:

1. Allow the river to erode the portions of the bank where the rock has been removed in order to increase the topwidth of the river and create shallow water adjacent to the main channel.

2. The varying elevations would allow a diversity of depths and velocities to be established in order to increase the chances of always having some portion of the modified area within the recommended 0 to 5-foot depth range as river discharges fluctuate.

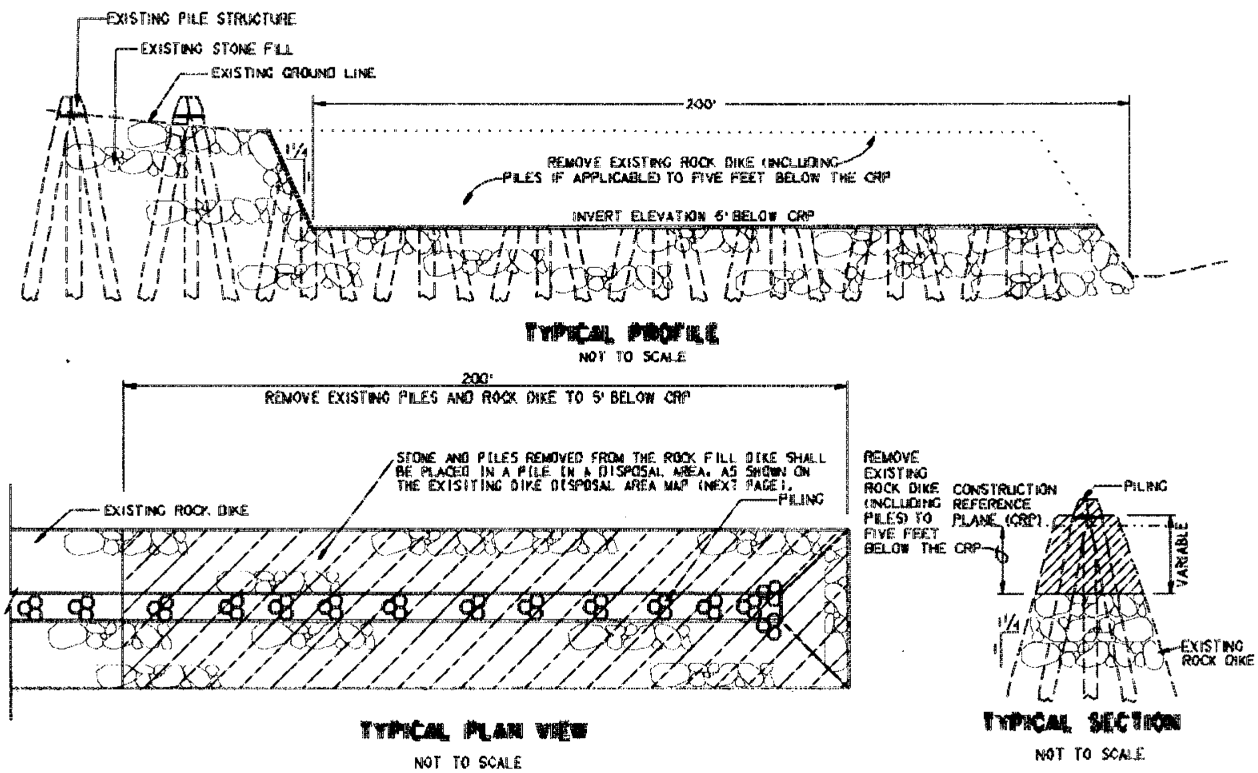


Figure 2. Typical Dike Lowering Details.

Chevron Construction: The chevrons are V-shaped rock structures with a gap at the point of the V so that the two sides of the V do not touch. The two sides of the V flare out in the downstream direction forming a 60-degree angle. Because the desire is to maintain open water between the chevron and riverbank, the landward wings need to be short enough to allow a significant amount of flow around the right side of the structure. Assessment of the dike fields indicate an inboard wing length of 75 feet would allow water to circulate between the chevron and the river bank. Each chevron would be placed out from the bank in line with the riverward ends of the existing dikes about half way between the nearest upstream and downstream dikes at any of the 40 locations. The chevrons would be constructed at varying elevations at, or one foot below CRP.

Chevron goals:

1. To direct flows towards the riverbank to create erosion and scour in the areas where the dikes would be lowered.

2. To create deposition of sand bars downstream of the chevrons. It has been shown that a chevron constructed in the proposed configuration will create sandbars that occupy 30 to 50 percent of the length between the two dikes it is constructed between (Remus and Davinroy, 2001).

3. To direct flows toward the navigation channel to prevent the formation of shoals, which could interfere with navigation.

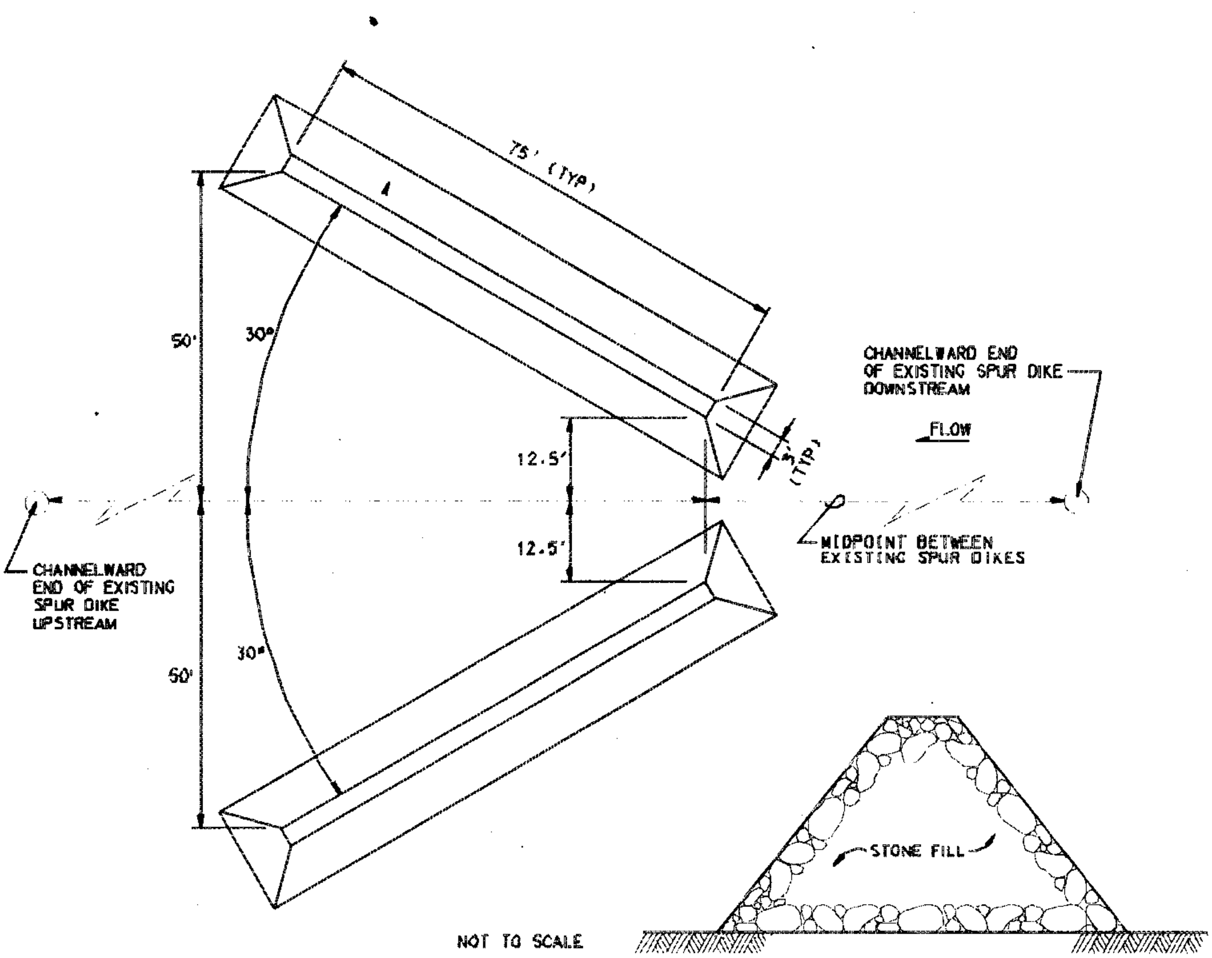


Figure 3. Typical Chevron Construction Details.

2. Site Selection Process

A list of potential sites suitable for SWH development were originally selected by the Corps based on a number of criteria including: meeting the SWH definition in the 2003 Amended BiOp; land ownership; ability to comply with the National Environmental Policy Act, Section 404 of the Clean Water Act, and Section 10 of the Rivers and Harbors Act of 1899; logistics of awarding a contract; logistics of Corps in-house crews being able to work at the site before July 1; and cost per acre of return on the created habitat. The Corps' original list was vetted with the FWS, the Department of Agriculture's Natural Resource Conservation Service, and the states of Iowa, Kansas, Missouri, and Nebraska in a January, 2004 meeting. The FWS and States also offered additional sites where work might be possible. The list was vetted one final time with the FWS and then within the Corps, particularly with the river engineers to ensure feasibility of the proposed work. It was recognized by both agencies that the list was not necessarily complete, as some sites might be added as opportunities presented themselves and that some sites might drop out. The FWS agreed that the list provided in the March 2, 2004, letter identified a sufficient number of potential sites generally suitable for the purposes of implementing RPA Section VII.1.b.

An example of a site where work has been postponed is the Tobacco Island Major Dike Modifications where a nesting bald eagle forced a ½ mile construction buffer to avoid disturbing the nesting birds. Work will proceed at Tobacco Island after the eagles fledge and leave. Other sites dropped out for a variety of reasons as explained in the remarks. The vetted list is Table 1.

Site	Remarks
Ponca	Dredging Project with ESH
Winnebago/Snyder	Dike Modification Project
Tieville-Middle Decatur Bend	Chute and backwater area
Soldier Bend	Dredge project
Tyson Bend	Dredge project
Desoto Bend Dikes	Dredge project
Tobacco Bend	Postponed due to eagle nest
Upper Hamburg Bend	Dike Modification
Lower Hamburg Bend	Dike Modification
Langdon Bend	Dike Modification
Deroin Bend	Type B Notching
Rush Bottoms	Postponed due to real estate issues
NWO Dike Notching	120 Type B notches in the Omaha District
NWK Dike Notching	400 Dike Notches in the Kansas City District
Bob Brown	Deleted because too close to the levee
Monkey Mountain	Bank Notching
Worthwine Island	Bank Notching
French Bottoms	Deleted because too close to the levee
Benedictine Bottoms	Bank notches
Fort Leavenworth	Dike and bank notches
Weston Bend State Park	Bank notches
Kansas City Reach	100 dike and bank notches
Liberty Bend	Bank Notching
Baltimore Bend	Bank Notching
Grand Pass	Bank Notching
Lisbon – Jameson Island	Chute Construction
Franklin Island	Bank Notching
Diana Bend	Bank Notching
Overton Bottoms South	Postponed due to real estate issues
Eagle Bluffs	Bank Notching, revetment notching
Marion Bottoms	Chute, revetment notching
Smokey Waters	Chute, Bank notching

Table 1: List of Proposed SWH Construction Sites

3. Physical Monitoring

HISTORICAL:

Although many of the construction methods such as notching, pilot channel and chutes have been used in the past to create shallow water habitat, very little survey data has been collected at any of these sites due to limited funding. Assessment of the suitability of the resulting habitat has been limited to pedestrian surveys on site visits and discussions with fisheries biologists as to the suitability of the created habitat.

A number of the existing projects constructed over the last seven years have yielded high quality, slow, shallow and diverse aquatic habitat. The engineering and results of these projects served as the basis for the designs of the current work effort. It is expected that the results of the current projects will be similar to the results of these past projects.

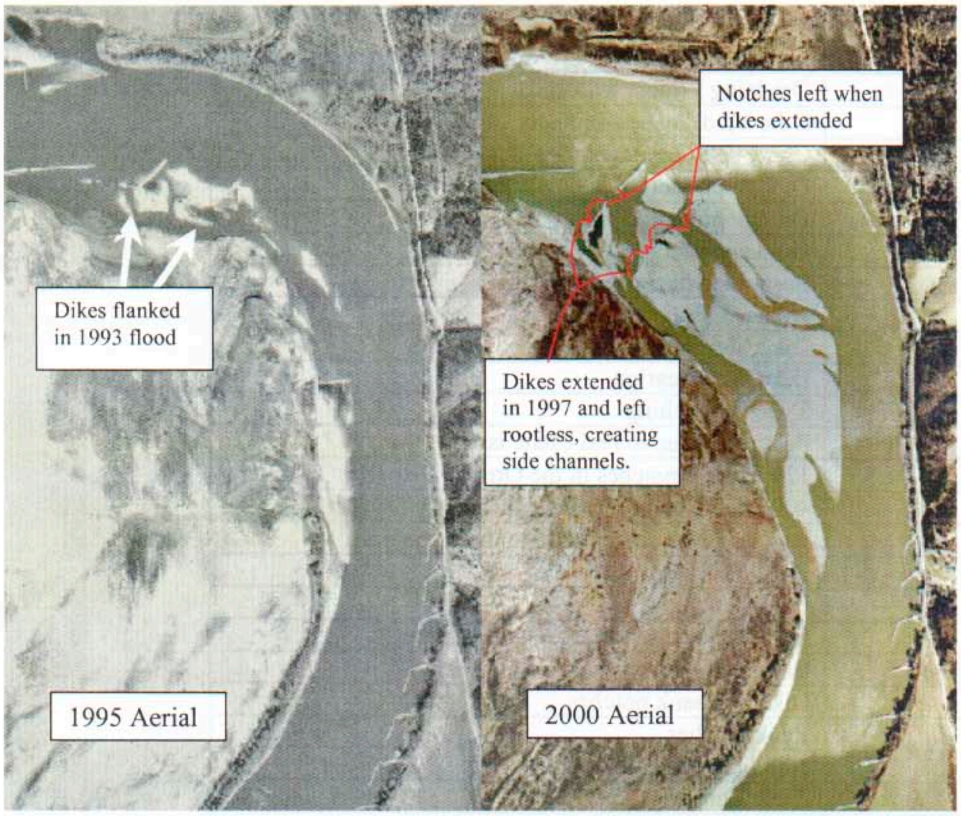


Figure 4: Jameson Island. These pictures illustrate the habitat that developed as a result of structure modifications on two dikes at Jameson Island. These two dikes were heavily damaged by the 1995 flood. The dikes were repaired with large notches and detached from the bank. Bank notches function much like rootless dikes.

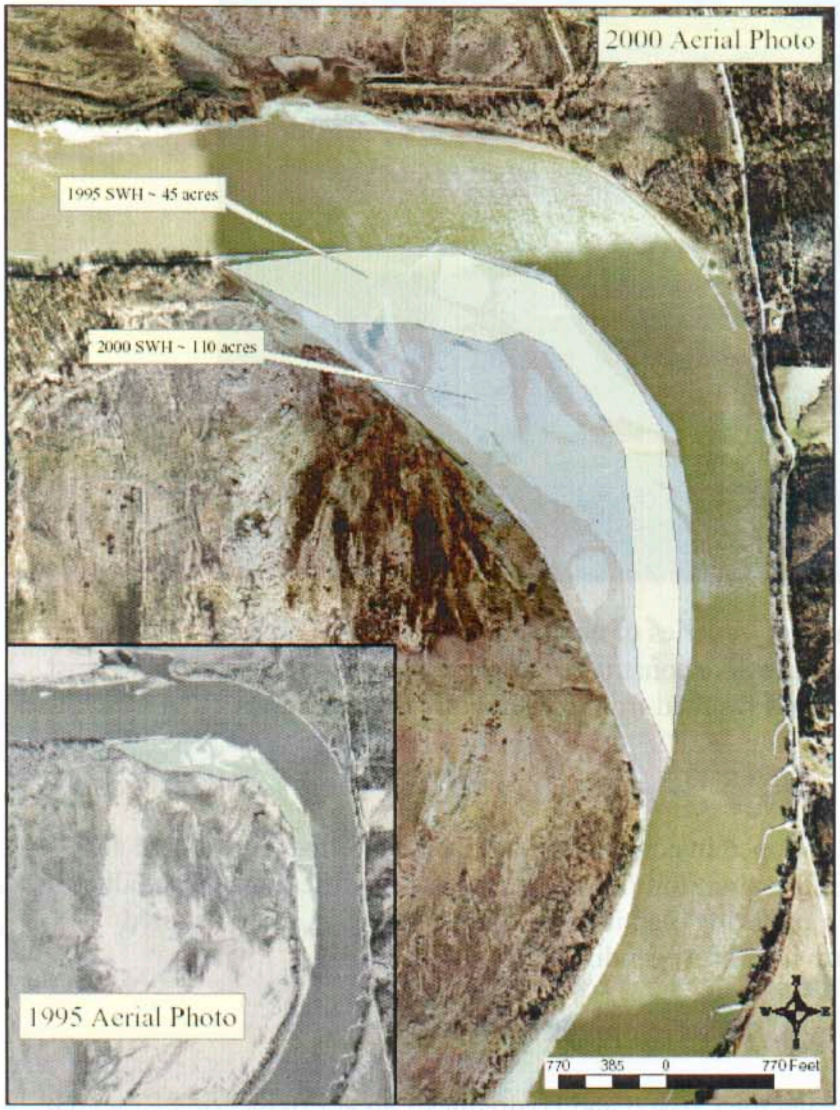


Figure 5: Jameson Island. This figure illustrates the amount of aquatic habitat developed between 1995 and 2000 as a result of the notched and rootless dikes. Considerable landward migration of the bankline has occurred leaving high quality aquatic habitat.

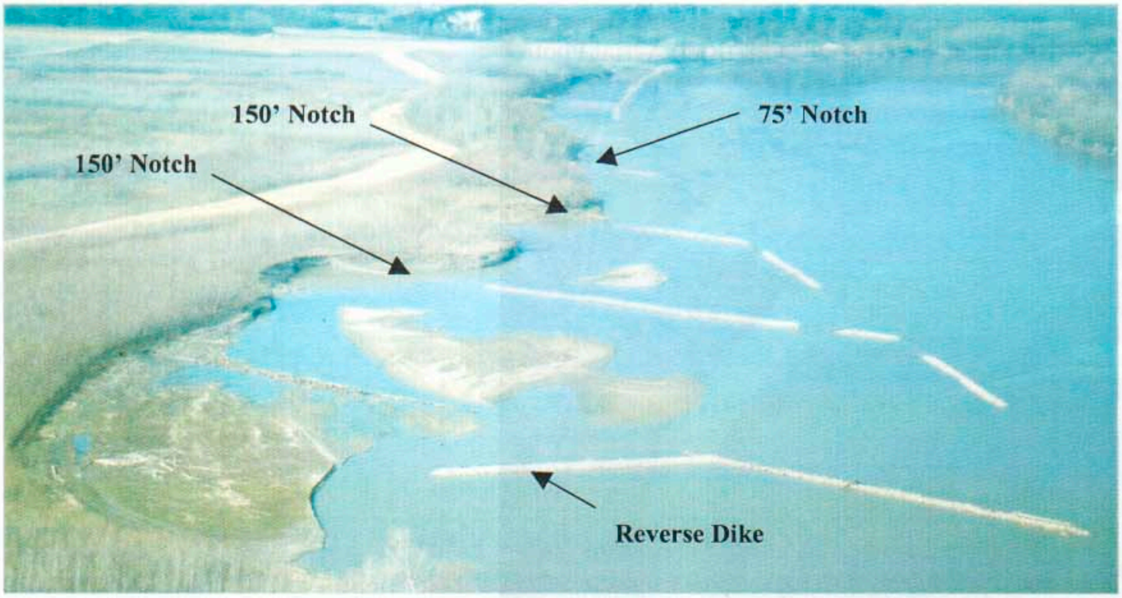


Figure 6: Plowboy Bend Mitigation Site. A series of notches were cut in the dikes to create a secondary channel by the bank and a reverse dike constructed at the lower end to force water against the bank. Highly diverse aquatic habitat has resulted from the structure modifications.

PRESENT:

Physical monitoring plans were developed in conjunction with the FWS that were aimed at gathering quantitative and qualitative information for the various project modifications, from all of the separate river segments. The physical monitoring plan is summarized below. A more detailed description of the monitoring plan is provided in Appendix D.

a. ERDC Support

The Corps' Omaha District contracted the Coastal and Hydraulics Lab at Engineering Research and Development Center (ERDC) to obtain detailed bathymetry and velocity data for a six mile reach of the Missouri River from river mile 556 to 550 (Upper and Lower Hamburg Bends). The original intent was to use this data to construct and calibrate a 2-dimensional math model of this reach. Upper and Lower Hamburg Bends are located in 2000 Biological Opinion Segment 13. The river control structures in these two bends were modified from the summer of 2003 through the spring of 2004. After completion of the river modifications, ERDC was contracted to repeat the original survey in order to obtain data that could be used to verify the model, and to provide further insight as to the type and extent of channel geometry changes that could be expected over the near-term. Bed contour maps from both the pre- and post construction surveys were generated. Depth analysis was performed on both contour maps for discharges of 26,000, 30,000 and 35,000 cfs, which correspond to Gavins Point releases of 21,000, 25,000 and 30,000 cfs, respectfully.

b. Verification Inspections

Joint verification inspections were conducted during the construction period. The purpose of these inspections were to view the modifications while they were being constructed, verify construction was taking place, and develop a common understanding of the possible river response. The inspection dates were as shown in the table below.

Inspection Date	River Reach (miles)	Participating Agencies
April 27. 2004	715 to 627	Corps of Engineers, U.S. Fish and Wildlife Service
April 28, 2004	591 to 550	Corps of Engineers, U.S. Fish and Wildlife Service
May 4, 2004	715 to 681	Corps of Engineers, Omaha Tribe, Iowa DNR
May 5, 2004	569 to 516	Corps of Engineers, Iowa DNR, Missouri Department of Conservation, Nebraska Game and Park Commission.
June 3, 2004	722 to 642	Corps of Engineers, U.S. Fish and Wildlife Service
June 4, 2004	591 to 542	Corps of Engineers, U.S. Fish and Wildlife Service

Table 2: SWH Verification Inspections

c. Pre and Post Construction Surveys:

Kansas City District

Physical monitoring of selected sites was conducted in order to help quantify the number of acres of aquatic habitat created from the various types of construction methods. Under ideal conditions the pre-construction data set would be collected immediately prior to construction when the river's discharge was at a minimum navigation flow and the post construction data set would be collected at the end of June under similar discharge conditions. This sequencing would have allowed more time to elapse between pre and post construction data sets and offered the most realistic assessment of the amount of habitat available on July 1. In contrast, the short timeline for this current assessment required that the post construction data sets be collected before the end of May, one full month before the habitat is scheduled to be fully functional. In addition, at some locations data sets collected up to four years prior to construction were used as the pre construction survey because scheduling conflicts prohibited data set collection immediately prior to construction.

The restrictions on timing of data set collection means that any analysis of the data should used only be used as a guide in determining acres of habitat produced from the various construction methods and will not fully represent the acreage developed. Furthermore, the usefulness of the data sets is restricted at some locations by the absence of velocity data or if included, velocity data that was not collected at minimum navigation discharges.

1. Pre and post construction bathymetry data was collected at six sites by in-house survey crews. The six sites were at locations of dike and revetment notches excavated by floating plant. The pre-construction bathymetry was collected May 11 and 12. The post construction bathymetry was collected May 25. Thus less than 15 days elapsed between the pre and post surveys during which time stages were slightly below normal. Of the four sites, one site contained three structures with one notch each and three sites contained one structure with one notch. Therefore, 6 notches were analyzed as part of this effort. This analysis is in Appendix D.

2. In-house survey crews also collected bathymetry data for bank notches constructed at Baltimore Bend, Grand Pass and Benedictine Bottoms. At Baltimore Bend, pre-construction bathymetry was collected May 6 and post-construction bathymetry was collected on May 28. At the two other sites, the pre-construction bathymetry consisted of data gathered during 1999 and the post construction bathymetry was collected on May 24 and 28. This analysis is in Appendix D.

3. The USGS collected pre and post-construction bathymetry, velocity, and substrate data at 5 sites. The five sites contained dike and revetment notches constructed by floating plant. The pre construction data was collected during summer 2003 as part of an ongoing study by the USGS. The post construction data was collected May 21 and 24.

Omaha District

Major Dike Modifications. A dike-chevron-dike complex was selected at two of the six major dike modification sites listed in Section VI. The selected sites are Desoto Bend (RM 644 to 642), which is located in BiOp Segment 12, and Tobacco Island (RM 589 to 586), which is located in BiOp Segment 13. A pre-construction survey was obtained at each of the sites that included both bathymetry and velocity data. The original plan included bi-monthly bathymetric surveys at index ranges to monitor the rate at which changes occurred. Due to the compressed construction schedule the bi-monthly surveys could not be obtained. General construction quantity over runs and high water during the week of May 24th, 2004 slowed the rate of construction from the Contractor's original schedule. The initiation of post construction surveys at Desoto Bend were delayed by 10 days. This slip in the overall schedule will not allow the post construction data to be included in this report. When the data are received, they will be processed in a similar manner to the ERDC data and the results provided to the FWS. It is schedule to provide this information prior to June 30, 2004.

Also, due to the presence of an active Bald Eagle nest, only the upstream and downstream ends of the Tobacco Island site could be constructed by July 1, 2004 and counted towards the 1,200 acres. The remainder of the construction will be completed once the eaglets have fledged. The most likely completion date will be early to mid August 2004. Once the construction at Tobacco Island is complete, and the site has had time to under go some adjustments, the post construction survey will be completed, data analyzed and the results shared with the FWS. The surveys described in this paragraph will be used to further verify the SWH acreages, aid in the refinement of future project modifications, and support the biological monitoring. These data were collected by A-E contract.

Type B Notch. The U.S. Geological Survey (USGS) – Council Bluffs, Iowa Office was contracted to complete pre- and post construction surveys on 16 dikes that received type B notched dikes. At each selected dike, a series of cross sections were obtained upstream and downstream of the dike. Cross sections were approximately perpendicular to the general flow line of the river and extended from high bank to high bank. The first upstream cross section was located approximately 25' upstream of the dike and the second and third cross sections were spaced at approximately 50' intervals further upstream. The first downstream cross section was approximately 25' downstream of the dike and the remaining cross sections were spaced at approximately 50' intervals downstream for a total of 6 downstream cross sections. Two longitudinal profiles were obtained. The first longitudinal profile was from the most upstream cross section through the notch to the most downstream cross section. The second longitudinal profile was approximately parallel to the first profile and extended from the most upstream to the most downstream cross section and was immediately riverward of the end of the dike. This survey provides an accurate estimate of the aerial extent of riverbed changes. Velocity data was collected at four points along each cross section. These locations are along a line approximately parallel to the edges of the notches (two locations), at a point approximately equal to the end of the dike, and approximately 1/2 the length of a dike length riverward of the end of dike. At each dike a minimum of four velocity measurements were obtained in depths of less than 5 feet. At each location that velocity data was obtained, the velocity at the riverbed and at the mid point of the water column was recorded.

The pre-construction surveys were completed as scheduled, but high water during the week of May 24 and May 31, 2004, caused a delay in collection of the post construction field data. For this reason, not all data for all the dikes will be incorporated into this report. This information will be provided to the FWS prior to June 30, 2004. Also, four dikes that were surveyed during the pre-construction activities were not notched, due to Iowa Department of Natural Resources denial of permission to notch at these sites. Therefore a total of 12 type B notches will be included in the final analysis. Data from a total of 6 dikes were included in the analysis for this report.

Dredging. The physical verification process for the dredging will be based on pre- and post construction surveys conducted as part of the construction contract. Construction is not scheduled to be complete until the latter half of June 2004 and this information is therefore not available for this report. However, the construction contract requires specified areas and depths as indicated in Section VI. Completion of the dredging contracts will serve as verification of channel changes.

4. Biological Monitoring

Biological Monitoring Plan for 2004 SWH: The Corps has assembled a team of scientists (Shallow Water Habitat Monitoring Team) represented by various state agencies, federal agencies and academia to develop the criteria (physical and biological) to evaluate the various types of river modifications resulting in shallow water habitat. This team will identify goals and objectives and then work toward developing the specific criteria to set up the sampling strategy.

State and federal entities will be used to conduct the field biological data collection efforts. When applicable, the framework and standardized protocols for the ongoing "Pallid Sturgeon Population Assessment" program will be utilized (i.e., segment numbers, species codes, etc.). This approach will provide consistency and power (statistical) to the overall pallid sturgeon program.

Data sheets will be standardized and a single entity will be responsible for data entry, QA/QC, and Analysis. The agencies/field crews collecting the data will be responsible for putting together an annual report. A standardized format for reporting will be developed.

This information will be used in an "Adaptive Framework" to help guide future modifications and maximize the biological benefits for these river modifications.

Current SWH Monitoring: The Columbia Fishery Resource Office's 2002 sampling efforts collected 12 pallid sturgeon. Of these, 7 pallid sturgeon were captured in the "Overton Bottoms" area where a great deal of dike notching has taken place as well as the development of the chute. Notched L-dikes provide flow sufficient to move sediments resulting in the creation of bar habitats behind these structures. Pallid sturgeon, lake sturgeon, young of year paddlefish and shovelnose sturgeon have all been collected during fisheries sampling in conjunction with these modifications. Pallid sturgeon and associated native species have been collected on both the channel side and bank side of these L-Dike structures downstream from various notching efforts.

In 2003/2004, the Nebraska Game and Parks Commission have conducted sampling in the Missouri River from the Platte River to the Kansas River. This crew has captured two pallid sturgeon in conjunction with the downstream bars along the channel side of Chevron structures in the channel border, one in the upper end of the Hamburg Chute and another in an outside bend revetment "Scallop". Additionally, during a unique opportunity of lower flows, over 900 plains minnows were seined from an outside bend revetment scallop. This effort accounted for approximately 80% of all plains minnows sampled in this river segment.

Sand shiner (95 fish) were collected primarily in "Bar" mesohabitats (<1.2 meter depths) in inside bends.

All nine representative native Missouri River species identified in the population assessment program were collected in inside bends. Sauger, bigmouth buffalo, plains minnow, sand shiner and the speckled chub were sampled in water less than 1.2 meters deep. The shallow water habitat efforts are increasing the quantity of bar and channel border mesohabitats where all of the pallid sturgeon were sampled as well as the majority of the shovelnose sturgeon, blue sucker, sicklefin chub and sturgeon chub.

III. DESCRIPTION OF ACTIVITY AND ESTIMATED ACREAGES

1. Corps capabilities

The Corps used two authorities for complying with the BiOp and Amended BiOp in 2004—Operations and Maintenance (O&M) and BSNP Fish and Wildlife Mitigation (Mitigation). O&M funds are appropriated funds used for the operations and maintenance of existing completed projects. Mitigation funds were authorized by the 1986 WRDA, where the purpose of the project is to mitigate losses of fish and wildlife resources resulting from construction and operation of the BSNP, which extends from Sioux City, Iowa to the mouth of the Missouri River near St. Louis, Missouri. Both construction and operation of the project are at 100 percent Federal cost. Mitigation funding this year was used to enhance SWH as much as possible both in planning and necessary land acquisitions for futre work.

Kansas City District in-house work crews under the direction of the Napoleon Area Office constructed Diana Bend and Franklin Island projects. These projects were constructed using a combination of government owned and rented land-based equipment. In general, the land-based equipment consisted of D-7 and D-8 bulldozers and 345 backhoes. Equipment operators on-site ranged from four up to eight government employees. This work was performed between February and June.

In addition to the land-based construction capability, the Kansas City District also has floating plant consisting of two tow boats, one spud barge with associated dragline, and numerous rock deck barges. On-site crews averaged approximately 3 to 4 government employees. This crew was utilized cutting dike and revetment notches from floating plant during of the months of May and June. Most of their work was between river miles 130 and river miles 200.

The Kansas City District contracted with the W.A Ellis construction company to cut notches from floating plant and to construct seven of the site-specific projects. Four other site-specific projects were contracted to two companies under an Omaha District Indefinite Delivery-Indefinite Quanitity Contract (IDIQ) contract. The notice-to-proceed on the Ellis notching contract was issued March 10 and the notice-to-proceed for the seven site-specific projects also constructed under the Ellis contract was issued April 23. The IDIQ notice-to-proceed was issued May 3. The IDIQ contract was also used by the Omaha District for the dredging and major dike modification work.

The Kansas City District also staffs two full time river survey crews with the capability of structure layout and bathymetric data collection. These crews have been engaged full time during the months of March through June either laying out construction work or engaged in pre and post construction data collection.

Omaha District has a River and Structural Maintenance Team, that consist of a foreman, two Pilots, one heavy equipment operator, two motor vehicle operators and a heavy equipment mechanic all located in Omaha, NE. Omaha District Missouri River floating plant consisting of two tow boats, two equipment barges and 5 rock barges. The land based equipment includes, D-7, D-6 and D-4 dozers, John Deere 755B crawler loader, JD motor grader, 55 ton tracked crane, 400LC-6 tracked excavator, two dump trucks along with all the associated support equipment. The District has the capability to lease almost any land based equipment needed to perform the mission, for example leasing a 400LC-6 tracked excavator for two months this tyear to help in the dike notching for the SWH effort.

The Omaha District issued three task orders against the IDIQ Contract, two for dredging projects and one for major dike modifications. The Omaha District also contracted for data collection.

2. Activity description and acreage analysis

a. Notching

BANK NOTCHES: These are 75' notches excavated to –5 CRP constructed entirely landward of the high bank. These notches are constructed in straight out dikes or L-head dikes using land-based equipment. Pre-construction consists of clearing and grubbing an area of the overbank sufficient to construct the notch. The cleared vegetation is placed downstream of the notch and riverward of the high bank. After a site is cleared, the overbank and buried dike are excavated so that water will flow freely through the notch. In general, approximately 15,000 cubic yards of bank material are removed for each bank notch. The excavated bank material is pushed riverward of the high bank.

Bank notches were constructed at Monkey Mountain, Worthwine Island, Benedictine Bottoms, Baltimore Bend, Grand Pass, Franklin Island, Diana Bend, Eagle Bluffs, Marion Bottoms, and Smokey Waters. At these locations the landowners can tolerate a high degree of bank erosion and land disturbance. They are constructed on every dike in a particular reach of river so that the effects of the notch are greatly multiplied. Bank notches have numerous immediate and long-term benefits for the pallid sturgeon.

The immediate benefits include the creation of a secondary channel adjacent to the high bank. Water enters the upstream notch and flows along the bank through the downstream bank notches. Deposition will occur riverward of the secondary channel resulting in sandbar formation and shallowing of the area between the dikes. The resulting habitat has greater depth and velocity variation than the pre-notch condition. In addition, the excavated overbank will erode and create a more dynamic alluvial process within the dike field. Also, the cleared vegetation disposed of in the river during construction, along with trees falling into the river as the bank erodes, will provide structure for benthic organisms.

The long-term benefits are fairly rapid erosion of the high bank and widening of the top-width of the river. As the river widens, the total amount of aquatic habitat available is increased and sandbar formation within the dike field increases in a riverward direction.

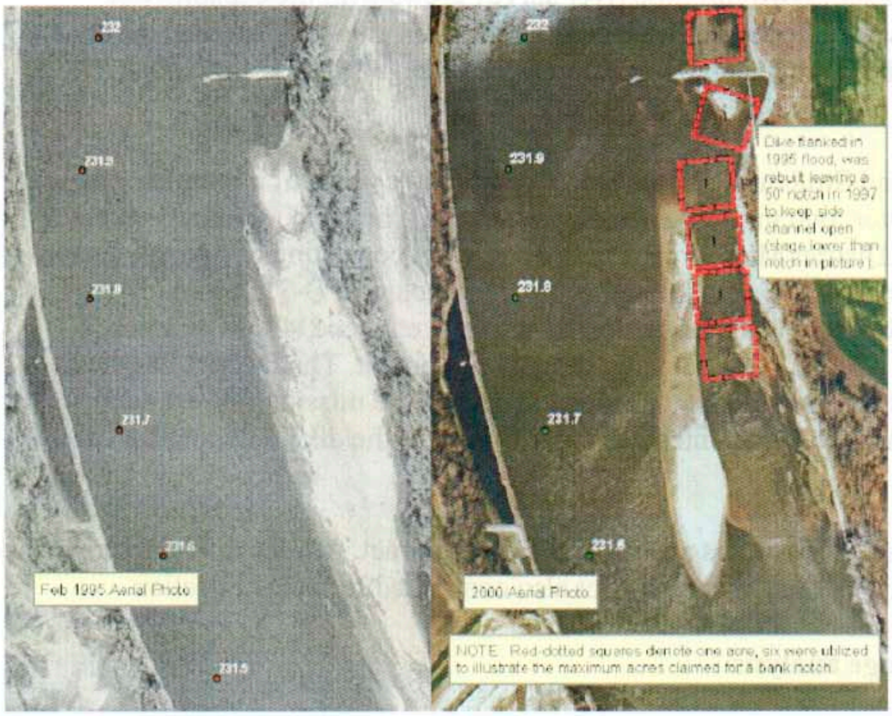


Figure 7: This figure illustrates the effect a dike that became detached from the bank as a result of high water. Bank notches will have similar effects as the water from the bank notch flows along the high bank.

Photograph 1: This photo illustrates the erosion that will occur downstream of a bank notch.

Based on analysis of past and current bank notching efforts including the data in Appendix D, one bank notch will create between 4 and 6 acres of diverse shallow water habitat. Seventy-five bank notches were constructed creating between 300 and 450 acres of diverse shallow water habitat.

Site	River Miles	# of Bank Notches	Min. Acres/Notch	Max. Acres/Notch	Min. SWH Acres	Max. SWH Acres
Monkey Mountain	466-464	5	4	6	20	30
Worthwine Island	459-456	11	4	6	44	66
Benedictine Bottoms	428-424	9	4	6	36	54
Weston Bend SP	403-402	0	4	6	0	0
Liberty Bend	352-351	0	4	6	0	0
Baltimore Bend	300-296	8	4	6	32	48
Grand Pass	272-267	5	4	6	20	30
Lisbon-Jameson	218-210	0	4	6	0	0
Franklin Island	195-192	9	4	6	36	54
Diana Bend	189-187	2	4	6	8	12
Eagle Bluffs	176-171	12	4	6	48	72
Marion Bottoms	164-158	9	4	6	36	54
Smokey Waters	134-131	5	4	6	20	30
Total SWH Acres	**300**	**to**	**450**			

Table 3: Number and location of bank notches excavated and the amount of SWH developed.

DIKE NOTCHES: These notches range in width between 50' to 100' and are excavated to either –4 or –5 CRP. These notches are excavated entirely riverward of the high bank between the high bank and no more than half-way out on the dike.

As with a bank notch, dike notches have immediate benefits. These notches improve the depth and velocity diversity upstream and downstream of the dike by allowing a portion of the river flow to flow within the dike field. As the flow spreads out downstream and riverward of a notch, the velocity slows down creating a high degree of velocity variability. In addition to the increased velocity diversity, a deep scour hole will form immediately downstream of a notch and deposition will generally occur further downstream and riverward from the notch increasing the depth diversity. The result is an area with a high degree of depth and velocity diversity upstream and downstream of the notch.

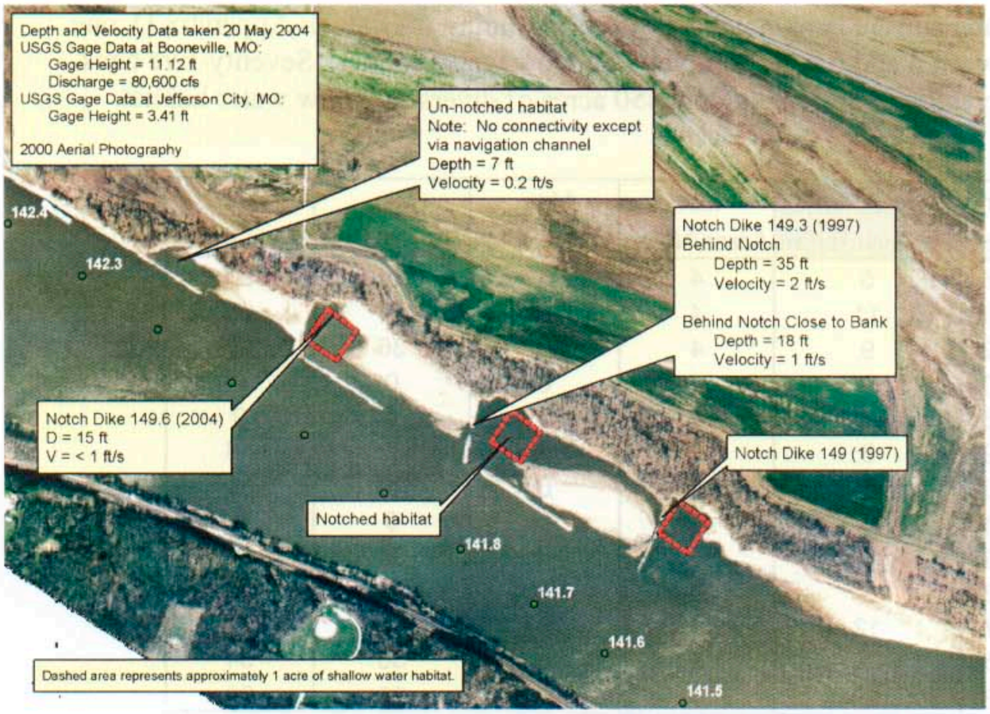


Figure 8: This figure compares the habitat downstream from two dikes with existing 50' notches and downstream from a dike without a notch. Note the secondary side channel and the more diverse habitat as a result of the notches. Red squares represent one acre. Velocities and depth data was collected May 2004 at low navigation stages.

Photograph 2: Sediment sample taken 100 yards downstream of notch at dike 149.3. Note sandy consistency.

Photograph 3: Sediment sample taken within un-notched area on left bank behind revetment at river mile 142.2. Note silty consistency.

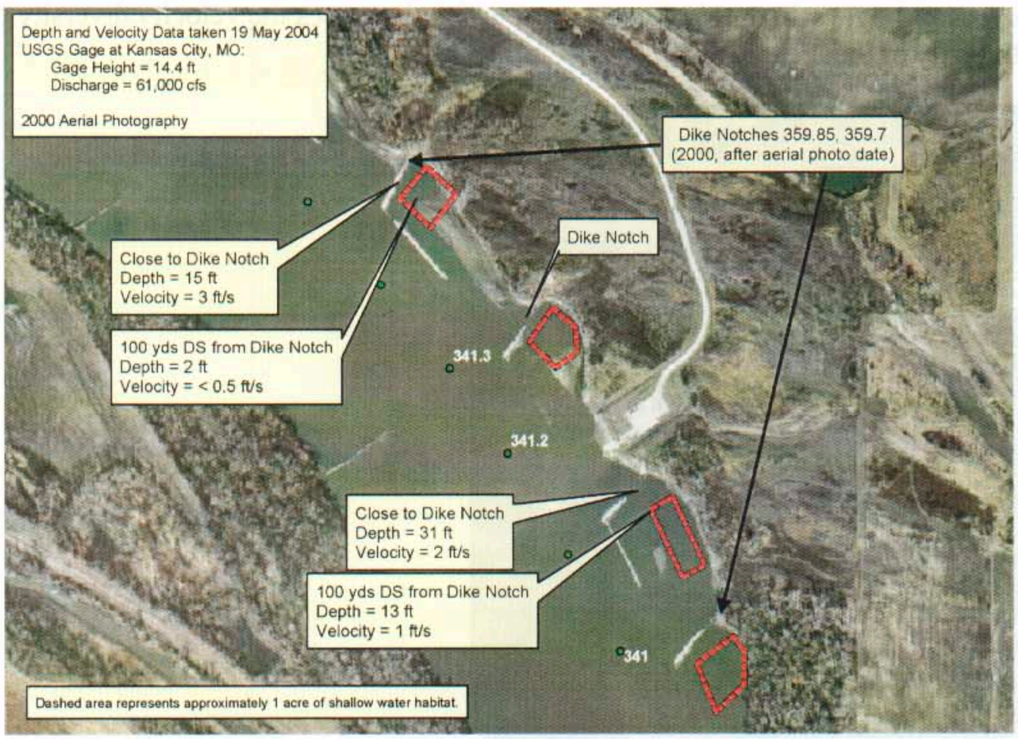


Figure 9: Notches at Cooley Lake. This figure illustrates the depth and velocity diversity resulting from a series of notches constructed in dikes by Cooley Lake. Depth and velocity data was collected May 2004 at low navigation stages. Red squares represent one acre.

Based on analysis of past and current notching, a 50' dike notch will create one acre of diverse shallow water habitat and a 100' notch will create two acres of diverse shallow water habitat.

	50'	60'	75'	100'	150'
Dike Notches	302	47	45	33	0
SWHAcres/Notch	1	1.2	1.5	2	3
SWH Created	302	56.4	67.5	66	0
Total SWH Acres			**491.9**		

Table 4: Number and size of dike notches excavated and the total amount of SWH developed.

REVETMENT NOTCHES: These notches are cut in stone fill revetments at locations where a slack water pool is separated from the main channel by a stone fill revetment. Without notches in the revetment, these aquatic areas are poorly connected to the main channel at normal summer flows, and therefore have little to no flow, and no velocity diversity. These notches range in width between 50' to 100' and were excavated to either –4 or –5 CRP. In most cases notches were cut at the upstream and downstream end of the pool to maximize the effects of the notches.

A revetment notch increases the connectivity of the slack water pool with the main channel. The increased connectivity increases the flow in the slack water area which increases the velocity diversity and increases the depth diversity of the area.

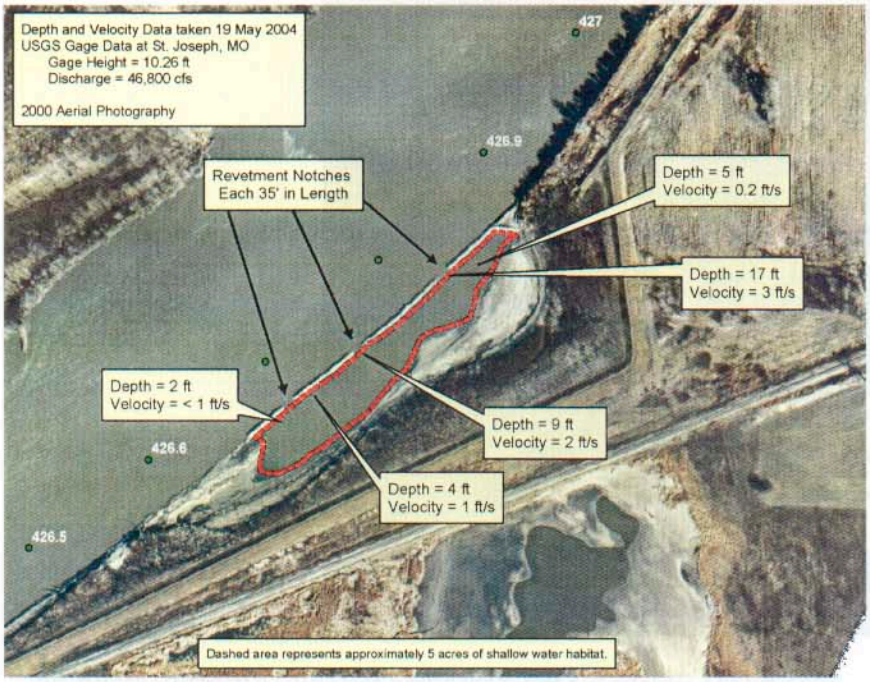


Figure 10: Revetment Notching. This figure illustrates the increased connectivity and depth and velocity diversity that results from revetment notches. Depth and velocity data were collected during May 2004 at low navigation stages.

Based on analysis of past and current revetment notching efforts, a 50' revetment notch will create one acre of diverse shallow water habitat and a 100' revetment notch will create two acres of diverse shallow water habitat.

	50'	75'	100'
Revetment Notches	56	16	19
SWHAcres/Notch	1	1.5	2
SWH Created	56	24	38
Total SWH Acres		118	

Table 5: Number and size of revetment notches excavated and total amount of SWH developed.

	Complete					Complete	
	50'	60'	75'	100'	150'	Totals	Totals
Dike Notches	236	34	22	21	0	313	427
Revetment Notches	56	-	9	17	-	82	91
Bank Notches	-	-	50	-	-	50	75

	Estimated to be complete by 30 June					To Be
	50'	60'	75'	100'	150'	Totals
Dike Notches	66	13	23	12	0	114
Revetment Notches	0	-	7	2	-	9
Bank Notches	-	-	25	-	-	25

Table 6: Notches completed as of June 4 and estimated to be completed by June 30 between the Osage River and Rulo Nebraska.

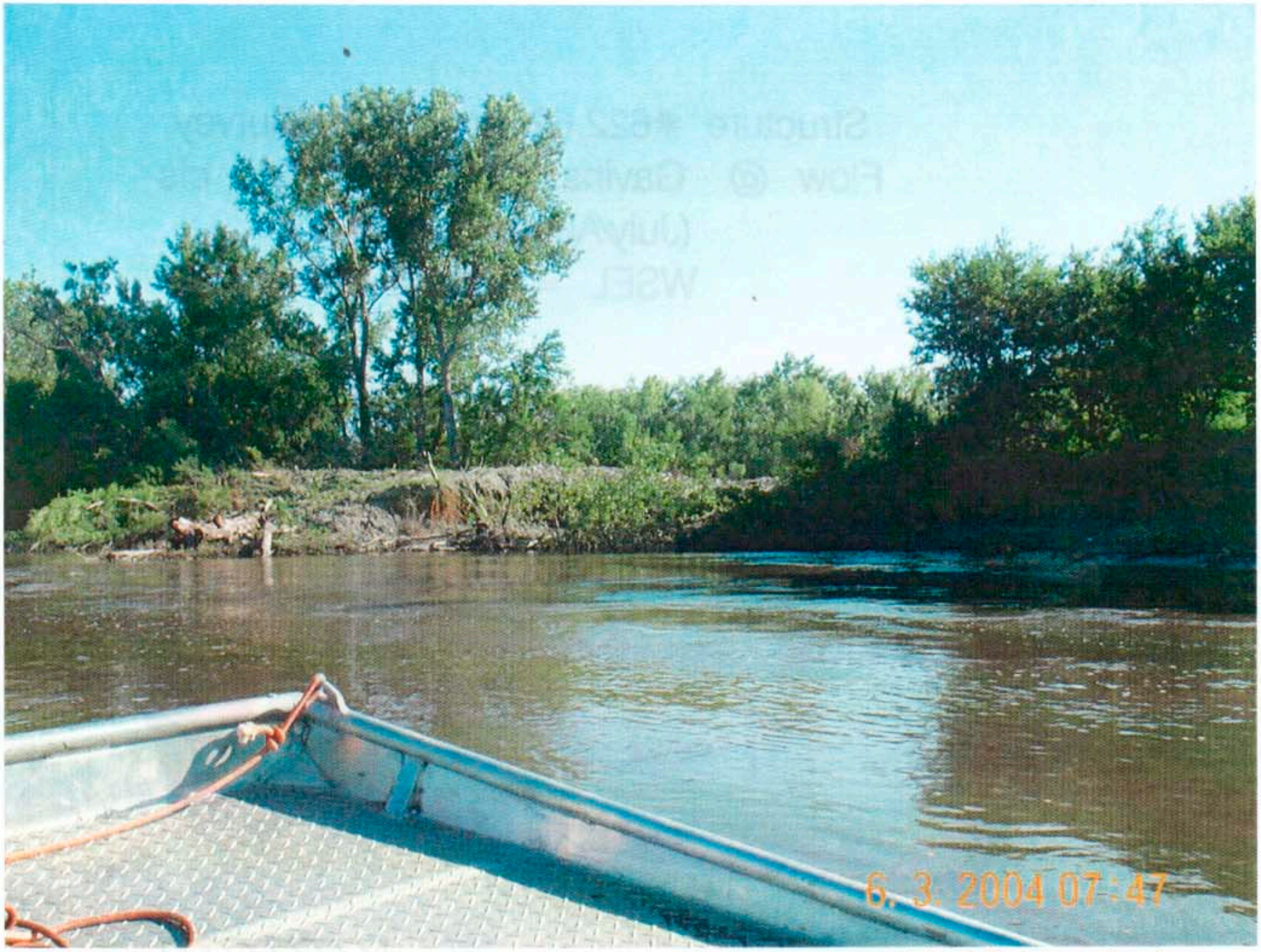
TYPE B NOTCH: Type B notches were constructed in the reach from Sioux City, Iowa to Rulo, Nebraska (2000 BiOp Segments 12 and 13). Type B notches were constructed in a total of 48 dikes (6 bends) in Segment 12, and a total of 75 dikes (6 bends) in Segment 13. Table 3 below summarizes the number and location of the notched dikes. For a complete listing of dikes refer to Appendix E. Type B notches were monitored both qualitatively and quantitatively. The qualitative assessments were conducted during the joint inspections outlined in Table 2.

During these inspections erosion was observed, trapping of large woody debris was noted and the change in surface flow patterns between modified and unmodified dikes was clear to see. The extent of the effect ranged from one notch width to several notch widths in the downstream direction, depending on the length of the exposed dike and the angle of the dike to the direction of flow. The observed effects upstream of the notched dike were very local and are considered insignificant at this time. Quantitative assessments were made using pre-and post construction surveys as described in Section II.c. Detailed results from these surveys are provided in Appendix D. Survey data indicate changes in shallow water (0-5 feet) were minimal. However the data show a significant change in the diversity of depths in the channel adjacent to the notched dike. Depth diversity and bankline irregularity were increased over an area of roughly two acres per notch. It is important to note that the diversity changes extended to the limits of the survey, so it is reasonable to assume that the changes extend beyond the surveyed area. Figures 4a and 4b show typical depth diveristy in the vicinity of a type B notch. Considering the above information, and information contained in the 2003 Amended Biological it is likely that each type B notch would provide 1-2 acres of SWH.

Type B Notch Summary					
Project Site	River Miles	River Bank	Number of Notches	Acres of SWH/Notch	Total Acres of SWH
Lower Dakota Bend	722.5 – 722.1	Right	5	1-2	5-10
Lower Monona Bend	700.8 – 699.6	Right	10	1-2	10-20
Upper Blenco Bend	679.6 – 678.9	Left	6	1-2	6-12
Sandy Point Bend	657.4 – 656.5	Right	7	1-2	7-14
Lower Little Sioux Reach	672.4 – 670.5	Left	14	1-2	14-28
Tyson Bend	655.4 – 531.1	Left	7	1-2	7-14
Nottleman Island	584.8 – 582.8	Left	15	1-2	15-30
Aulden Bar	578.7 – 576.8	Left	13	1-2	13-26
Copeland Bend	569.2 – 565.4	Left	21	1-2	21-42
Nebraska Bend	562.7 – 561.5	Left	8	1-2	8-16
U/L Deroin and Indain Cave B.	519.7 – 516.3	Left/Right	17	1-2	17-34
Cottier Bend	508.4	Left	1	1-2	1-2
		Totals	**124**		**124-248**

Table 7: Type B Notch Summary

Photograph 4: Typical Type B Notches (Lower Monona Bend)



Photograph 5: Dike 626.82 (Nottleman Island), notice the woody debris falling into the river.

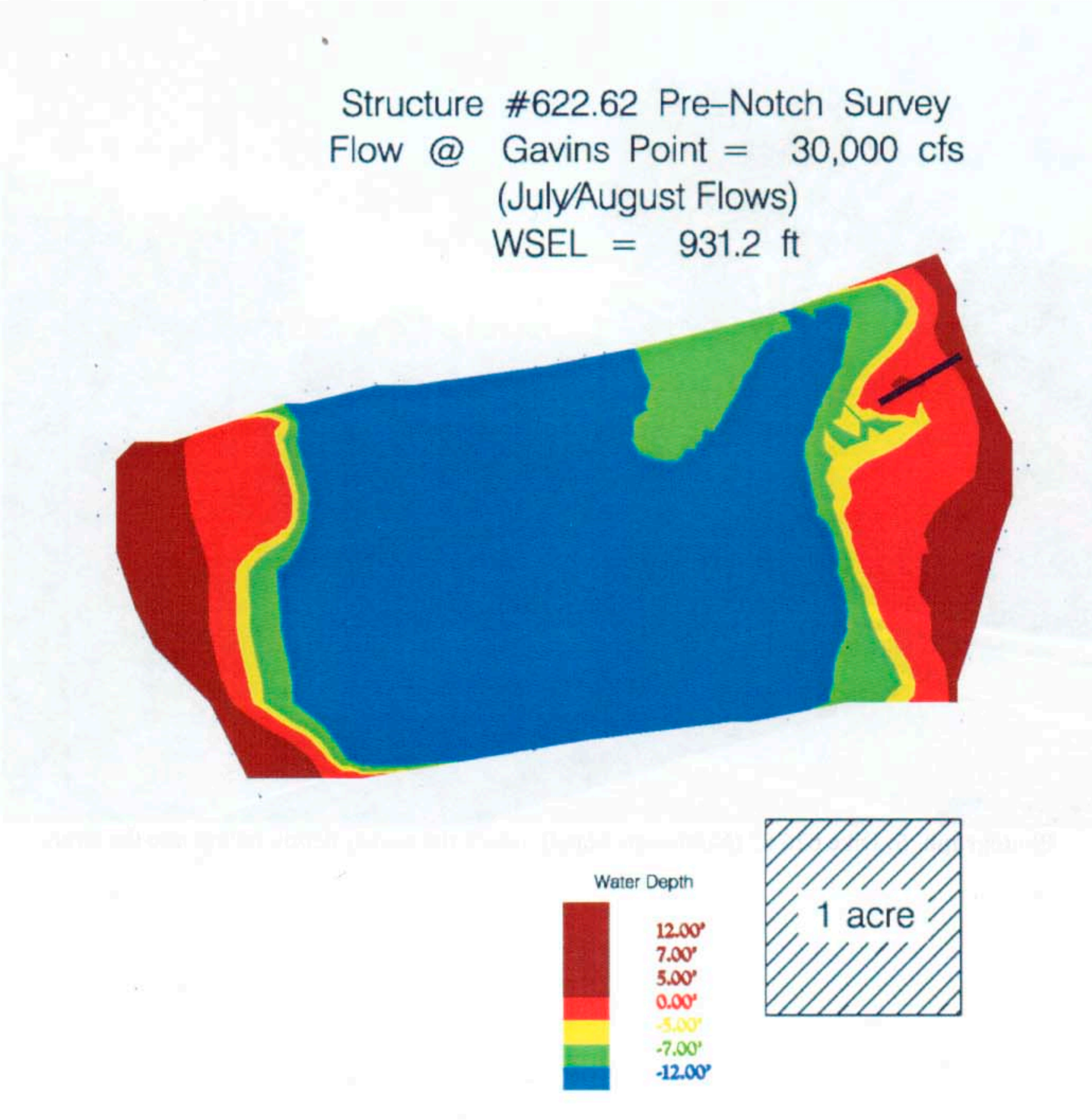


Figure 11a. Typical Pre-construction Depth Diversity in the Vicinity of a Type B Notch.

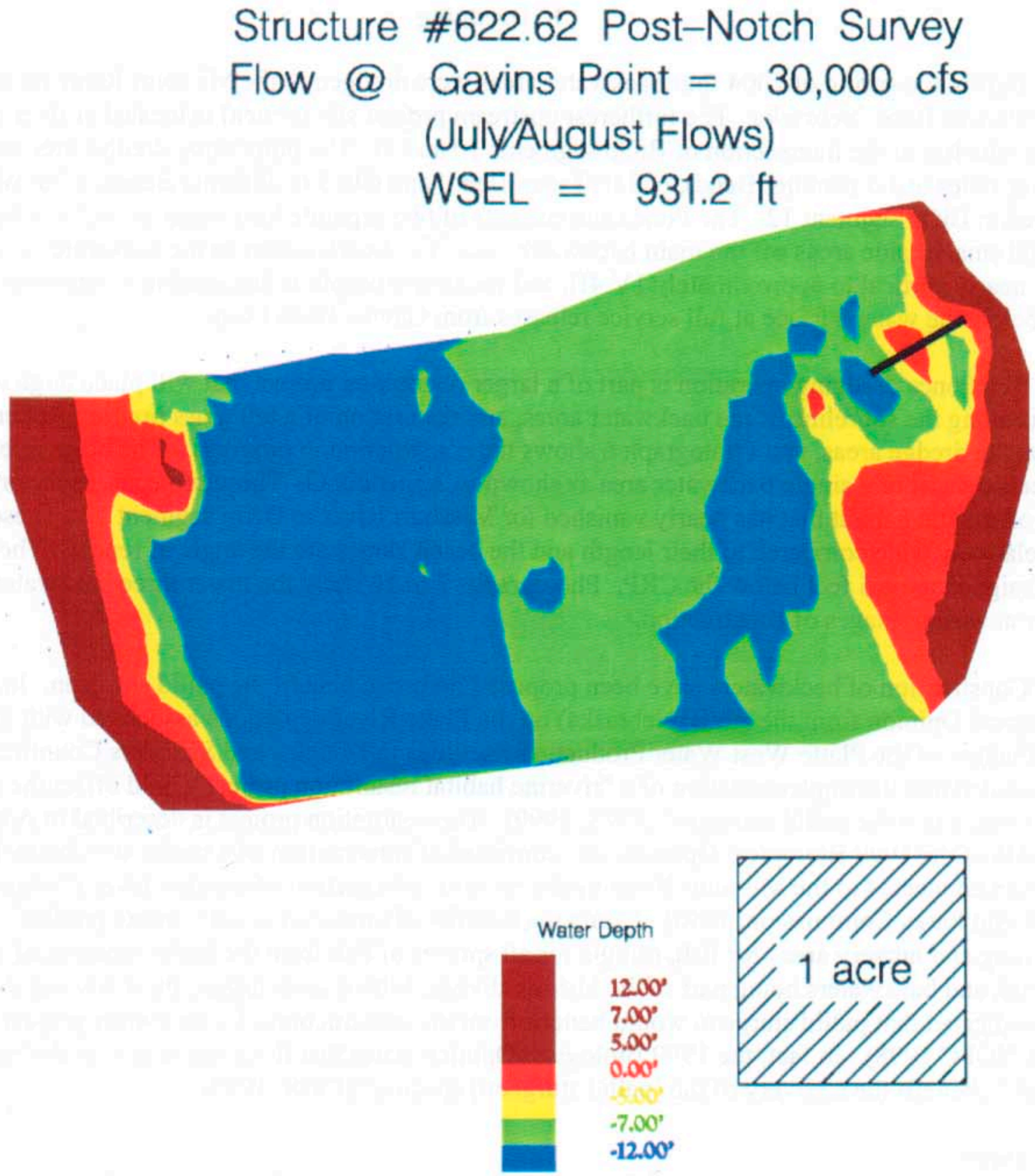


Figure 11b. Typical Post Construction Depth Diveristy in the Vicinity of a Type B Notch.

b. Dredging

During the spring of 2004 four backwater areas were dredged in the Missouri River from Ponca State Park to Blair, Nebraska. The furtherest upstream project site (Ponca) is located at river mile 754.0 which is at the intersection of BiOp segments 10 and 11. The other three dredge sites are located at river miles 661.5 (Soldier Bend), 653.0 (Tyson Bend) and 649.5 (California Bend), all of which are located in BiOp segment 12. The Ponca site consists of two separate backwater areas, each having several smaller side areas off the main backwater area. The beach slopes in the backwater areas ran from nearly vertical to approximately 1V:4H, and the bottom depth is designed to be approximately 5 feet below the water surface at full service releases from Gavins Point Dam.

The Ponca dredging operation is part of a larger restoration project that will place large woody debris along the shoreline of the backwater areas, and restoration of a tall grass prairie. Appendix G shows the dredge areas, and Photograph 6 shows the construction in progress. The other three projects consist of a single backwater area as shown in Appendix G. These projects are restoring a type of aquatic habitat that has nearly vanished for Missouri River in BiOp segment 12. These areas are relatively wide compared to their length and the beach slopes are the angle of repose. The depths are designed to be 5 feet below the CRP. Photographs 7 to 10 show the lower three backwater areas under at various stages of construction.

Construction of backwaters have been proposed before to benefit the pallid sturgeon. In the 1999 Biological Opinion from the FWS (Nebraska) on the Platte River depletions associated with the construction of the Platte West Water Production Facilities in Douglas and Saunders Counties, the FWS stated that the implementation of a "riverine habitat restoration project would offset the impacts of the project on the pallid sturgeon" (FWS, 1999). The restoration project is described in Appendices A and B of the 1999 Biological Opinion, and consisted of construction of a backwater channel complex connected to the Missouri River by the removal of a section of existing levee (Nebraska Game and Parks Commission, 1998). Citing the benefits of increased aquatic insect production, spawning and nursery areas for fish, refugia for all species of fish from the high velocities of the main channel, and backwaters being part of the historic diverse habitat assemblage, the FWS and the NGPC both indicated that pallid sturgeon would benefit from the construction of a backwater project (FWS, 1999; NGPC 1998). In fact, the 1999 Biological Opinion states that the construction of the backwater would "...benefit the recovery of the [pallid sturgeon] species," (FWS, 1999).

References:

U.S. Fish and Wildlife Service, 1999. Letter report to Ms. Candace Gorton of the Corps including the FWS's biological opinion for impacts to federally listed....species in Nebraska from the Metropolitan Utilities District...proposed project dated February 22, 1999, in Burns & McDonnell Engineering Company, 2002, Final Environmental Impact Statement for the Platte West Water Production Facilities, Douglas and Saunders Counties, Nebraska. Prepared for the U.S. Army Corps of Engineers, Omaha District and the Metropolitan Utillities District, Omaha, NE, Project Number 20383, March 2002.

Nebraska Game and Parks Commission, 1998. Letter to Bob Nebel of the Corps describing the proposed restoration project, in Appendix A of the U.S. Fish and Wildlife Service's Biological Opinion dated February 22, 1999.

The dredged areas will not be physically monitored beyond that specified in the construction contract, though they will be part of the future biological monitoring plan. Minor fluctuations in water surface elevations will cause water to circulate into and out of these backwater areas. This has been observed on numerous occasions at Hidden Lake near Bellevue, Nebraska and at several pump inlet channels along the Missouri River in BiOp segment 12 and 13. This was most recently observed at the Ponca site on May 12, 2004, where surface currents were noticed in the backwater as flows from Gavins Point Dam were being dropped. The amount of circulation will depend in the size and shape of the backwater area, and amount of direct access to flowing water. Ponca will have the least amount of circulation and California Bend will have the most.

All of the backwater dredge areas are under construction and will be completed by July 1, 2004, and when completed each will provide an increase in the amount and quality of "Secondary Channel-Non Connected Habitat," as described in Appendix B. Table 7 shows the expected range of acres of SWH that each site will contribute to the system through the construction alone. At Soldier and California Bends the dredging operations will connect existing shallow water areas to the main channel that were previously isolated. Until construction is complete the total amount of additional acres cannot be determined, but a conservative estimate would be an increase of 75% at each site for a total of additional 28 acres. Also, the Tyson Bend dredge area will intersect with a flowing side channel. This will not increase the amount of SWH acres but it will provide greater circulation within the dredged area.

Habitats created from dredging operations fall into two primary categories. Dredging in Chute habitats (Secondary Channel Connected) such as the projects at California Bend, Soldier Bend and Tyson Bend result in channel widening; whereas the dredging operations at sites such as Ponca results in the formation of a backwater (Secondary Channel Non-Connected) habitat or re-connects a backwater habitat restoring connectivity back to the river.

Biological benefits of channel widening (chutes) include the enhancement of a range of depths and velocities available to native river species, provides connectivity to the floodplain, provides off-channel habitat for spawning and promotes the erosive processes (i.e., sediment and woody debris) resulting in enhanced ecosystem diversity and function.

Backwater (Secondary channel non-connected) areas developed through dredging such as the Ponca Project increase connectivity to the floodplain, provide diversity in temperature, velocity, increased nutrient load resulting in increased energy necessary for invertebrates and native fish species while restoring functionality to the ecosystem.

Dredging Summary				
Project Site	River Mile	Bank	Constructed Acres	Acres of SWH at Minimum Service
Ponca	754.0	Right	80	60
Tieville-Middle Decatur Bend	691.0	Left	10	10
Soldier Bend	661.5	Left	25	25
Tyson Bend	653.0	Left	25	25
California Bend	649.5	Left	15	15
		Totals	155	135

Table 8: Dredging Summary

Photograph 6: Ponca Project looking SW at the dredge area and the emergent sandbar being created.

Photograph 7: Soldier Bend dredging, looking upstream. Dredging is approximately 60 percent complete. Additional acres are shown in the upper center portion of the picture.

Photograph 8: Tyson Bend Dredge Area. The approximate area to be dredged is outlined in red.

Photograph 9: California Bend Dredging, looking downstream. Dredging is nearly complete.

Photograph 10: California Bend Dredging, looking upstream. The additional acres are located in the upper left protion of the picture.

c. Pilot Channels

Pilot channels are trenches excavated immediately landward of a stone fill revetment. The trenches are connected to the river by notches in the adjacent revetment. Pilot channels have at least a 50' bottom width and range between 1000' and 2400' in length. Approximately 40 cubic yards of bank material is excavated per foot of channel. Cleared vegetation and excavated bank material is placed riverward of the adjacent revetment. Pilot channels were constructed at Eagle Bluffs, Diana Bend, Liberty Bend, Weston Bend, Benedictine, Worthwine Island, and Monkey Mountain.

By excavating the overbank, pilot channels have the immediate effect of increasing the amount of available shallow aquatic habitat. This desirable habitat will be immediately adjacent to and highly connected to the main channel. In addition, the excavated overbank and woody debris disposed of on the riverside of the revetment will provide additional habitat as the organic matter is washed into the river. It is also expected that the aquatic habitat in the dike field across the river from the pilot channel will experience some deposition due to the redirection of water out of the main channel.
Pilot channels are in general located upstream of slack water off-channel pools so that the flow through the pilot channel will flow into the pool and diversify the habitat of the pool.

It is expected that by the first of July, the pilot channels will erode to a topwidth of 100'. The result will be 2.3 acres of aquatic habitat per 1000' of pilot channel. In addition, the increased diversity of the pool area downstream of a pilot channel and the deposition in the dike field across the river will result in an additional 1.7 acres of aquatic habitat per 1000' of pilot channel. The net effect is the creation of 4 acres of shallow water habitat per 1000' of pilot channel.

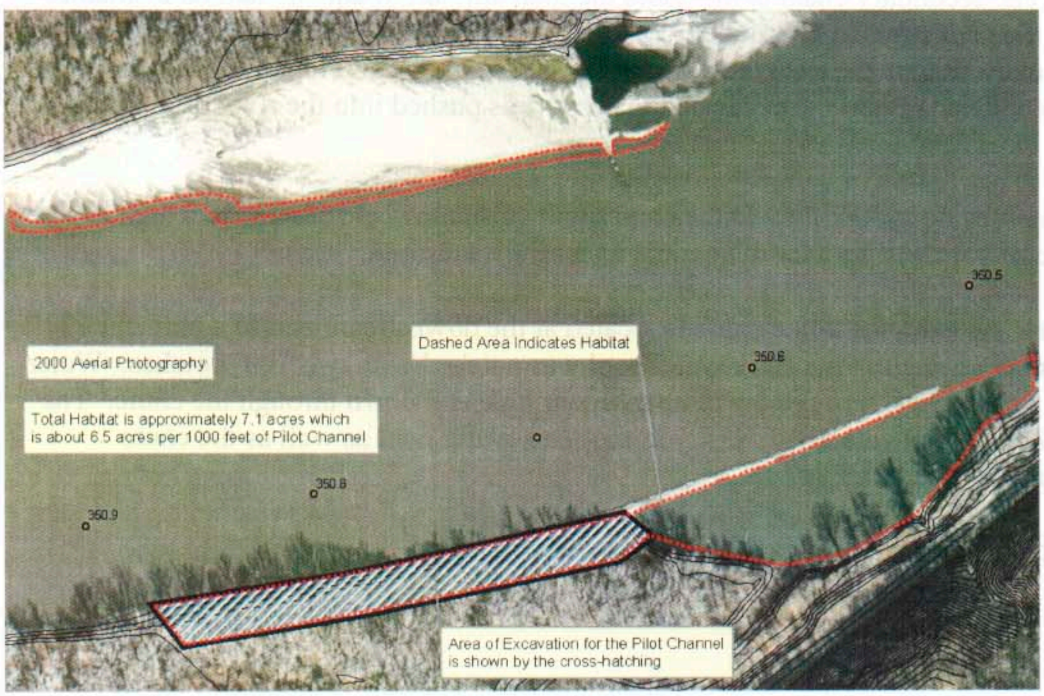


FIGURE 12: Area of improved aquatic habitat as a result of pilot channel construction at Liberty Bend near river mile 350.

Site	River Miles	Length	Local Acres/1000'	Downstream Acres/1000'	Local SWH Acres	Downstream SWH Acres	SWH Acres Created
Monkey Mountain	466-464	2500	2.3	1.7	5.75	4.25	10
Worthwine Island	459-456	2750	2.3	1.7	6.325	4.675	11
Benedictine Bottoms	428-424	2000	2.3	1.7	4.6	3.4	8
Weston Bend SP	403-402	1250	2.3	1.7	2.875	2.125	5
Liberty Bend	352-351	1100	2.3	1.7	2.53	1.87	4.4
Baltimore Bend	300-296	0	2.3	1.7	0	0	0
Grand Pass	272-267	0	2.3	1.7	0	0	0
Lisbon-Jameson	218-210	0	2.3	1.7	0	0	0
Franklin Island	195-192	0	2.3	1.7	0	0	0
Diana Bend	189-187	1000	2.3	1.7	2.3	1.7	4
Eagle Bluffs	176-171	300	2.3	1.7	0.69	0.51	1.2
Marion Bottoms	164-158	0	2.3	1.7	0	0	0
Smokey Waters	134-131	0	2.3	1.7	0	0	0
Total SWH Acres				43.6			

Table 9: Length and location of pilot channel excavated and the amount of SWH developed.

d. Chutes

Chutes are trenches excavated entirely within the overbank and connected to the river at the entrance and the exit. The secondary channel increases the total amount of aquatic habitat available. One 2400' x 75' chute was constructed at Smokey Waters and one 1000' x 125' chute was constructed at Diana Bend. At Smokey Waters the excavated material was disposed of on top of the adjacent high bank of the chute while at Diana Bend the excavated material was pushed into the river or disposed of on the high bank.

During normal summer flows, the flow in the chutes will be shallow and slow with a high degree of diversity. The chute bottom will be very dynamic with a sandy substrate.

At Smokey Waters, the entrance to the chute is located at the downstream end of a remnant 1993 scour hole. The revetment separating the slack water pool was notched with two 100' notches. Water will now flow through the notches, through the remnant scour hole and down through the chute. The result will be increased depth and velocity diversity in the slack water pool as well as the chute creating 25 acres of shallow water habitat.

The Diana Bend chute will add 3 acres of shallow water habitat.

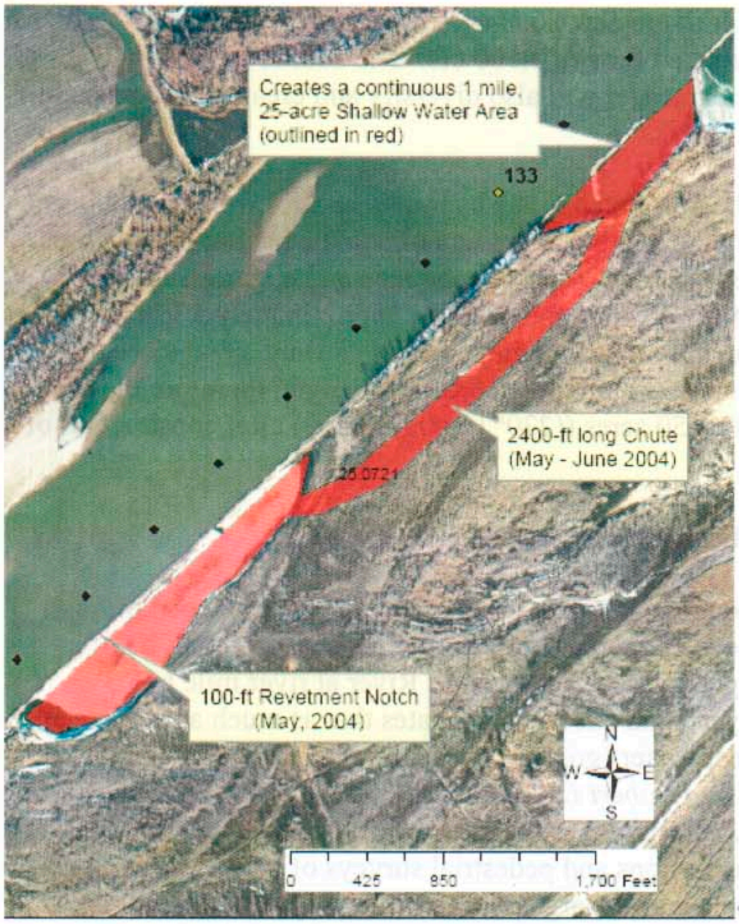


Figure 13: Area of improved aquatic habitat as a result chute construction at Smokey Waters.

Site	River Miles	Feet of Chutes	SWH Acres Created
Monkey Mountain	466-464	0	0
Worthwine Island	459-456	0	0
Benedictine Bottoms	428-424	0	0
Weston Bend SP	403-402	0	0
Liberty Bend	352-351	0	0
Baltimore Bend	300-296	0	0
Grand Pass	272-267	0	0
Lisbon-Jameson	218-210	*	50
Franklin Island	195-192	0	0
Diana Bend	189-187	1000	3
Eagle Bluffs	176-171	0	0
Marion Bottoms	164-158	0	0
Smokey Waters	134-131	2400	25
Total SWH Acres		**78**	

Table 10: Length of chutes constructed and the amount of SWH developed.

*LISBON CHUTE: Notches excavated in the revetment and hydraulic control weir at the Lisbon chute will increase the amount of flow entering the chute during normal summer stages. At normal summer stages, the increased flow in the chute as a result of the new notches is estimated to amount to approximately 1,100 cfs above the existing estimated flow of 1,500 cfs. The additional flow will increase the submerged surface area within the chute and will also diversify and create a more dynamic aquatic environment in the chute in general.

At the time of the writing of this report, the new notch in the hydraulic control weir has not been constructed so it is not possible to field quantify the additional amount of aquatic habitat that will be available as a result of the new notches. However, based on past experience and engineering judgment, the additional flow should increase flow depth in the chute by approximately 5 feet at normal summer stage. As a result, flow will begin to inundate the sandbars causing an increase in topwidth of approximately 220 feet. The chute is approximately 10,000' in length; therefore the net increase in available shallow water habitat will be 50 acres ((220*10,000)/43560) after construction of the new notches.

f. Major Dike Modifications

The initial estimates for SWH created through major dike modifications was developed through reconnaissance inspections and pedestrial surveys of similar projects, and engineering analysis of a completed chevron project located along the right bank of the Missouri River at river mile 635.3 (Boyer Bend). Engineering analysis of the Boyer Bend chevrons indicates that as much as 25 percent of the cross section could be converted from deep water (greater than 10 feet) to shallow water ($\leq$ 5 feet). This is documented in: "*Remus, John I., and Robert D. Davinroy, Use of Chevron Structures to Create Depth Diversity in the Missouri River, Proceedings of the 7th Federal Interagency Sediment Conference, March 2000*". Reconnaissance inspections and pedestrial surveys of an area along the right bank near river mile 555 indicated that removal of a large portion of two adjacent dikes coupled with the construction of a chevron structure between the dikes, initiated almost immediate erosion of the high bank and reduced depths in the hydraulic shadow of the chevron from roughly 12 feet to less than 3 feet in a matter of a few weeks. The resulting sandbar was evident for several hundred feet downstream. In addition to adding top width to the main channel of the river, the modification provided greater depth diversity to the channel riverward of the modified dikes. SWH acreage estimates at each individual site were based on engineering judgment taking into account the number and length of exposed dikes, height of the adjacent high bank, length and radius of the bend, and historic thalweg meander potential in the bend.

Major dike modifications consist of lowering a large portion of the riverward ends of the dikes (Figure 2) and construction of a chevron structure (Figure 3) between approximately every pair of lowered dikes. This type of modification was placed at 6 bends in the river as indicated on Table 6 below. For a more detailed description of the individual dike modification plans please refer to Appendix F. Four of the six sites are located in BiOp segment 12 and the other two are located in BiOp segment 13. The dike lowering will allow the high bank to erode an amount approximately equal to the amount the dike is lowered into the high bank. The chevrons will perform two functions. First, the chevrons will create an area where sediment can accumulate in and adjacent to the main channel. The second function is to force a portion of the flow against the high bank, thus facilitating the erosion process. The erosion process adds to the top width of the river, adds large woody debris to the main channel, and provides for a slight increase in the amount of sediment available for alluvial processes. The combination of these two effects leads to a greater diversity of depths and velocities through the bends. This modification results in an increase in the amount and quality of "Inside Bend Habitat," as described in Appendix B. Photographs 11 through 16 show these effects.

Qualitative analysis of these modifications indicates the erosion process leading to a greater diversity of depths and velocities can occur very quickly. During the joint inspection conducted on April 27, 2004, pre-construction depths in Snyder and Winnebago Bends were 17-20 feet. Chevrons were constructed on April 28-30. During the joint inspection conducted on May 4, 2004, depths of 2-6 feet were observed in the same area under similar discharge conditions. These changes were further verified during the joint inspection on June 2-3, 2004. This is consistent with other reconnaissance inspections conducted near river mile 555 in the fall of 2002, and with several reconnaissance inspections of the completed chevrons in Boyer Bend, river mile 635.3. Reconnaissance inspections indicate that this modification can influence the hydraulics of flow for several hundred feet downstream of each chevron.

The engineering analysis of channel geometry data indicates that the change in the number of acres of SWH was minimal as indicated in Figures 6a through 6d. A more complete synopsis of the analysis is contained in Appendix D. This analysis is inconsistent with the numerous inspections and reconnaissance surveys discussed above. However, this area has experienced relatively varying flows that have overtopped the chevrons. This has likely caused the sandbars to scour. All evidence would indicate that the sandbars will re-appear during the July-August period when the flows are expected to be at or below the tops of the chevrons. The data does show a general decline in the 7-12 foot depth range and a general increase in the 5-7 foot depths. This is adding depth diversity to the main channel. Furthermore, the fact that the sandbars are able to form and erode with changes in the hydrograph adds to the overall "natural river processes" or in other words increased alluvial dynamics.

In addition to the geometry assessment described above, a qualitative assessment of the velocity distributions was conducted. Because the velocity data was collected for the purpose of verifying a math model, the data has limited utility in assessing velocity distribution changes. However, general trends are discernable. Figures 7a through 7d show the impacts that this modification can have on the distribution of velocities within the main channel. This modifications impact the flow field locally as well as throughout the bend.

Based on the all of the information available on this type of modification the increase in SWH is 8-15 acres per mile of modification.

Photograph 11: Chevron and sandbar are near RM 635 during low winter flow.

Photograph 12: Chevron and sandbar are near RM 635 during low winter flow. Looking from the upstream end of the sandbar.

Photograph 13: Chevron and sandbar at RM 555.0 approximatly 6 weeks after construction.

Photograph 14: Chevron and SWH near RM 552,


Photograph 15: Flow Disturbance patterns of submerged chevron in Snyder Bend.


Photograph 16: Chevron and large woody debris pile in Winnebago Bend.

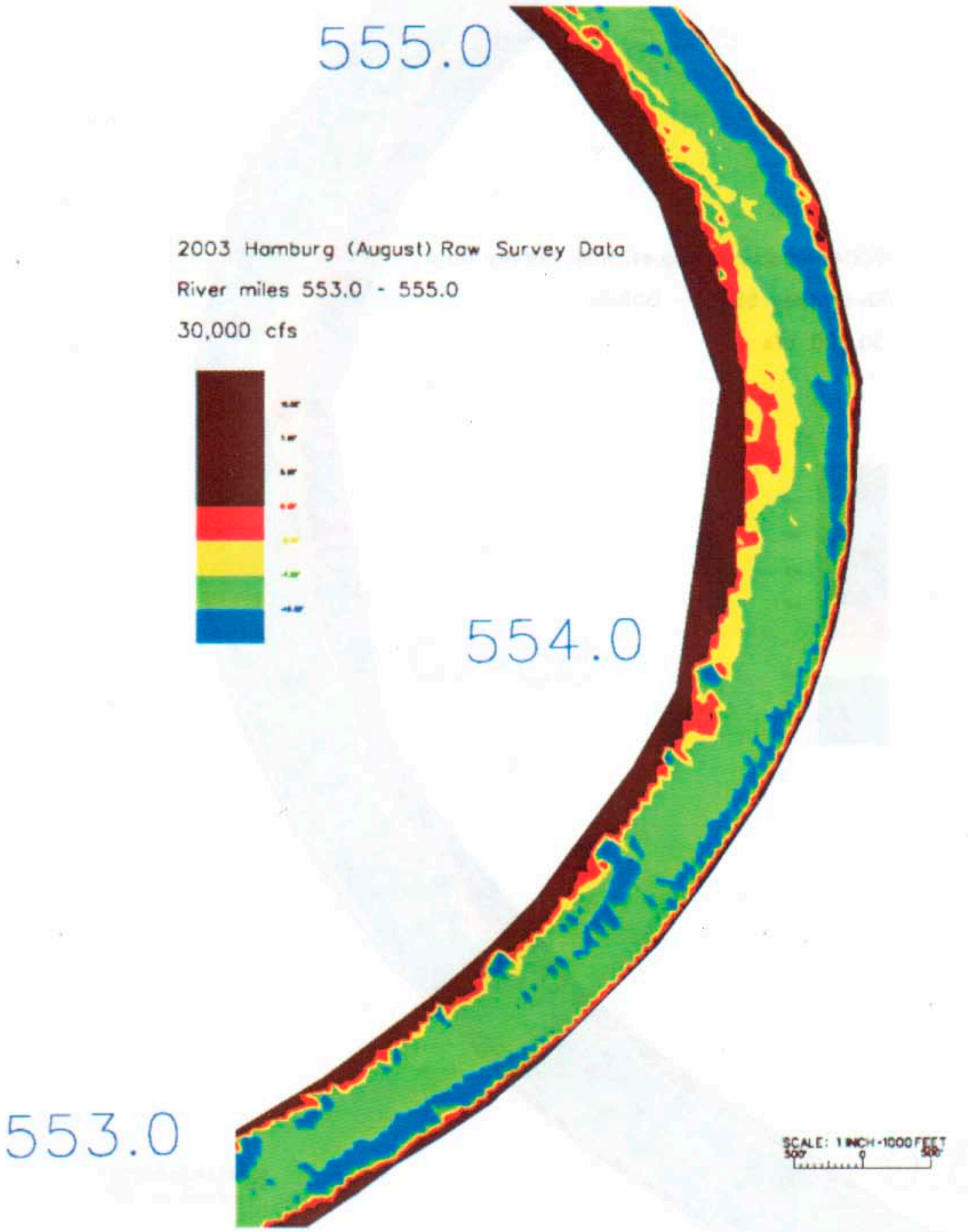


Figure 14a. Pre-construction depth distributions, Upper Hamburg Bend.

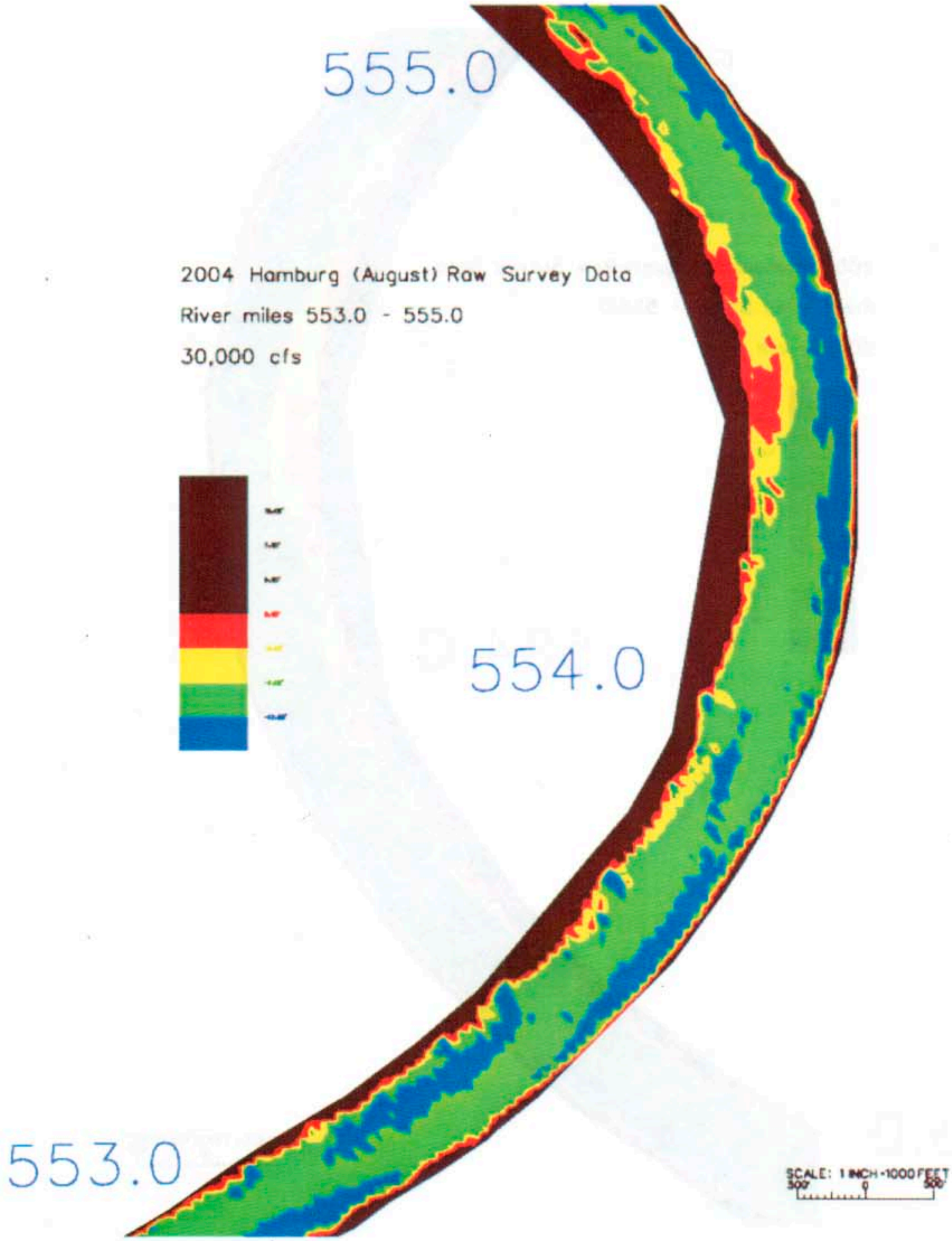


Figure 14b. Post construction depth distributions, Upper Hamburg Bend.

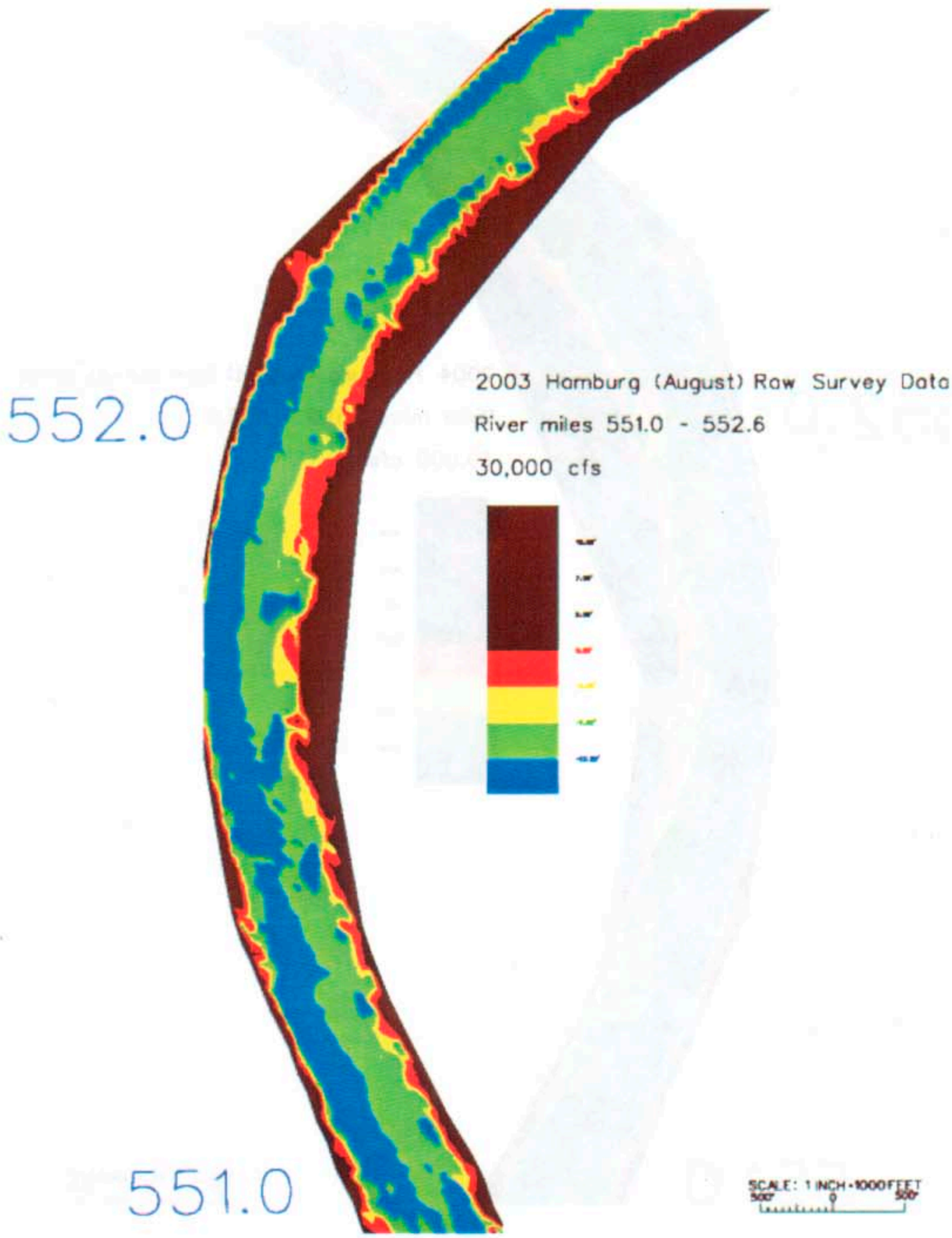


Figure 14c. Pre-construction depth distributions, Lower Hamburg Bend.

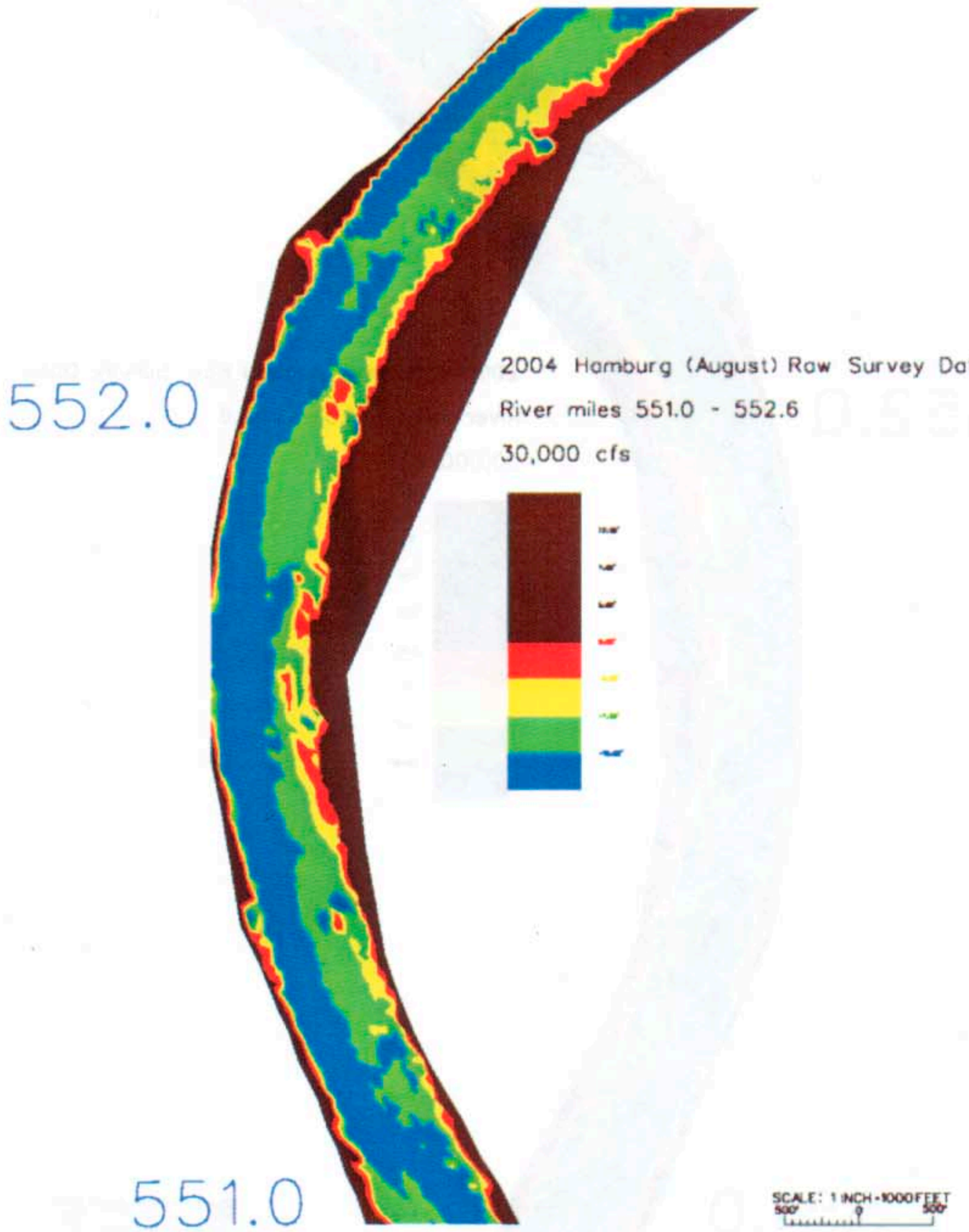


Figure 14d. Post construction depth distributions, Lower Hamburg Bend.

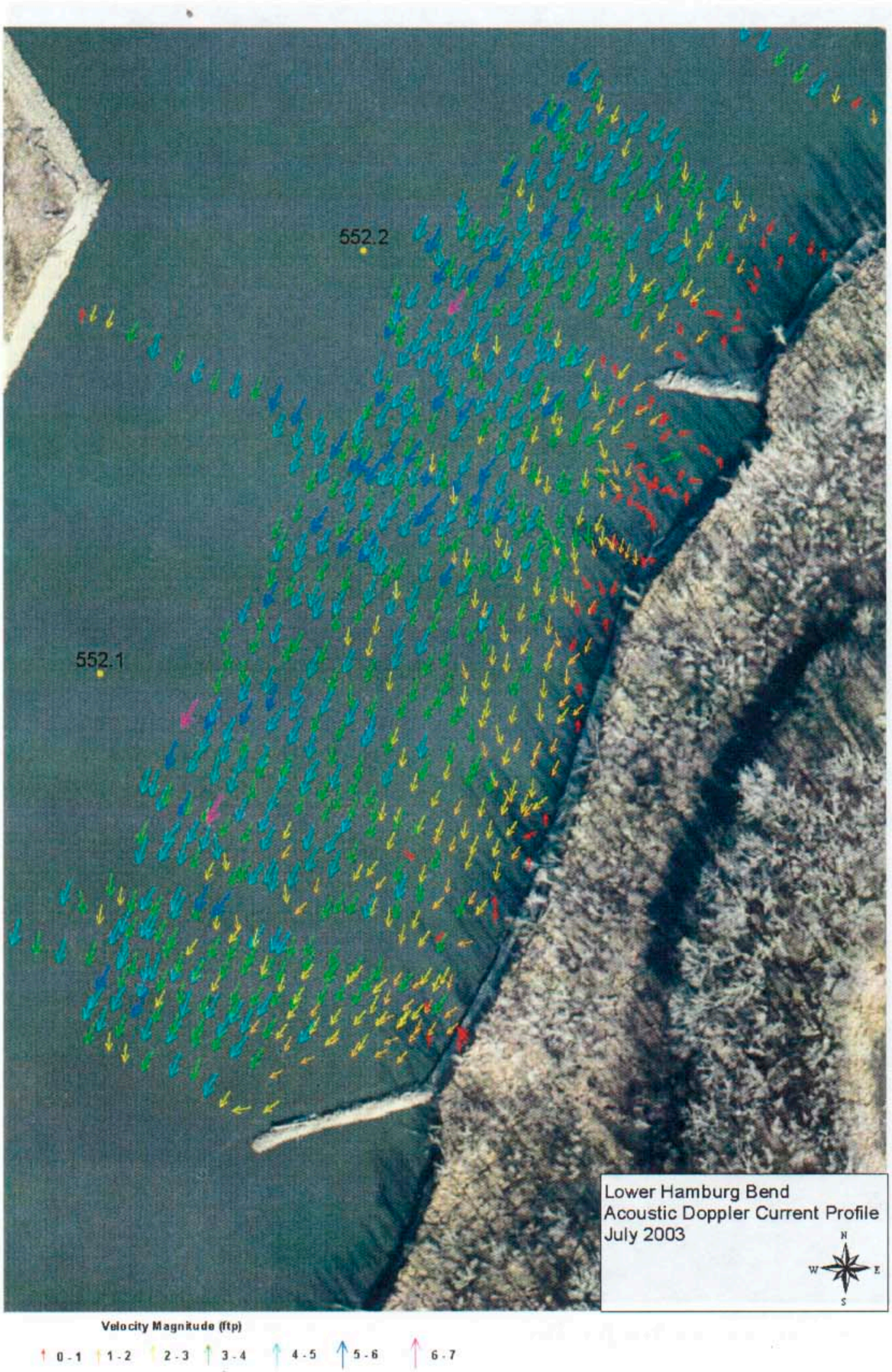


Figure 15a. Pre-construction velocity distributions, Lower Hamburg Bend.

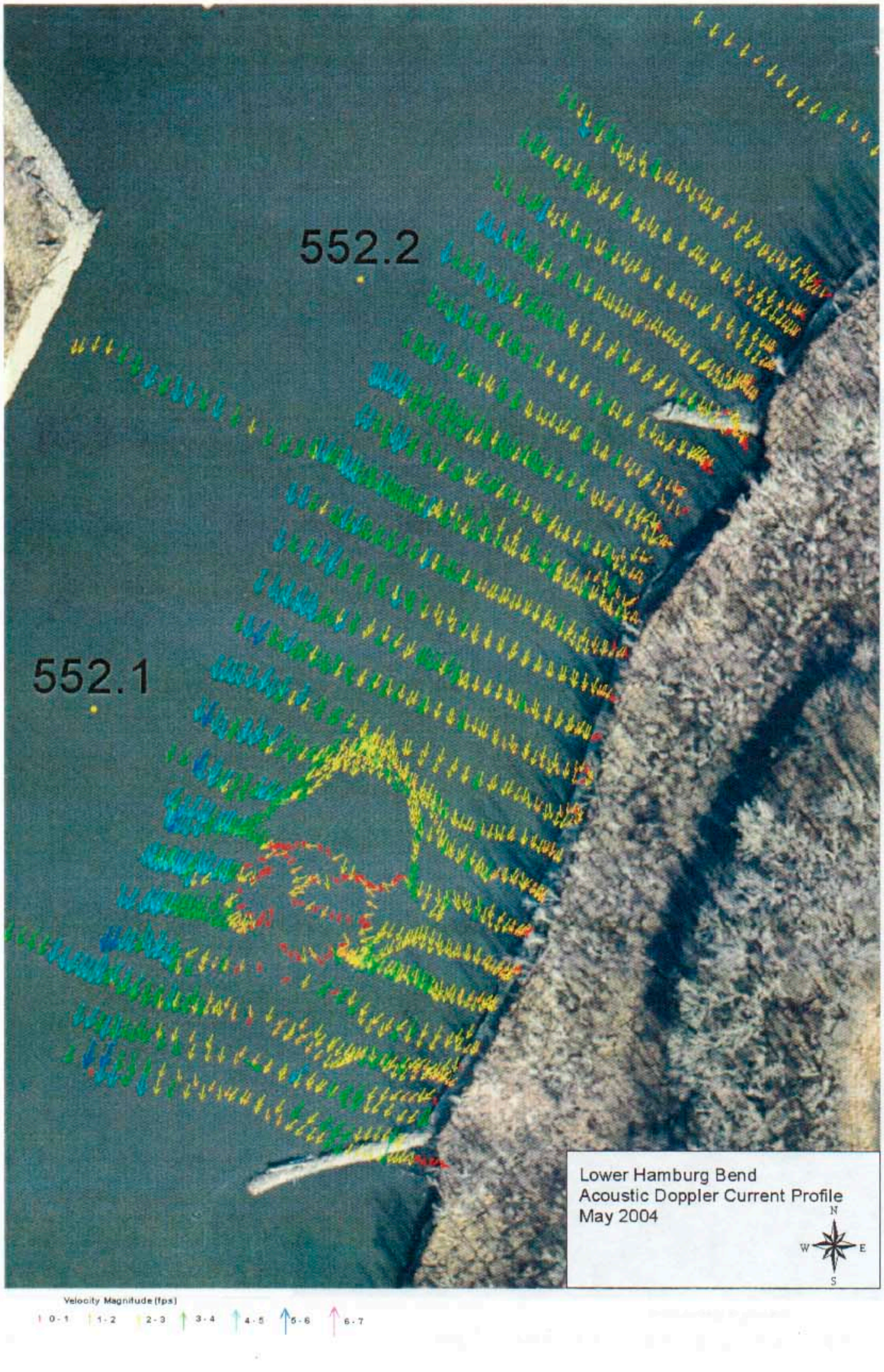


Figure 15b. Post construction velocity distributions, Lower Hamburg Bend.

Major Dike Modification Summary					
Project Site	River Miles	River Bank	Dikes Lowered	Chevrons Constructed	New SWH Acres
Snyder Bend	715.2-714.7	Left	5	3	4-8
Winnebago Bend	710.0-708.7	Left	12	5	10-19
Desoto Bend	644.0-642.0	Right	12	6	16-30
Boyer Bend	637.0-634.0	Right	20	8	24-45
Tobacco Islands (Bend) [1]	589.0-588.6 587.7-586.2	Right	9	5	15-28
	588.6-587.7		7	3	0
Upper/Lower Hamburg Bend	See Note 2				40-76
Langdon Bend	531.7-529.0	Right	20	10	21-40
		Totals	**85**	**40**	**130-246**

1 – Due to an active Bald Eagles nest in the area, the shaded area in the table will not be completed
until late July to early August 2004.

2 – This includes 3.6 miles in the Upper and Lower Hamburg Bends and 1.5 miles in Kansas Bend that was complete under the same contract.

Table 11: Major Dike Modification Summary

IV. DESCRIPTION OF CORPS 2004 SUMMER FLOW PROPOSAL

The Corps is proposing to operate this summer in accordance with the 2004 AOP dated March 19, 2004. This year's summer regulation is a steady release – flow to target operation. As identified in the 2004 AOP, the Corps had anticipated an "initial steady release from Gavins Point Dam of 28 kcfs in May and June to keep birds from nesting at low elevations, and 30 kcfs in July and August to meet flow targets as downstream tributary flows decline (see page 12)." Tributary flows were much lower than anticipated, and the Corps increased the Gavins Point Dam release to 30 kcfs in early May. Beginning in mid-May, much needed rains occurred in various parts of the lower Missouri River basin that allowed releases to be reduced.

To retain the ability to return to the higher anticipated release of 30 kcfs, the Corps elected to cycle the releases from 30 kcfs for 1 day followed by no less than 25 kcfs for 2 days, with this being repeated on a 3-day cycle. This keeps the birds nesting high enough to allow the releases to return to 30 kcfs when the tributary flows drop following the May rains. These releases are intended to provide for minimum service on the lower river while meeting the needs of listed species. Should the tributary flows drop below those experienced in early May, the Corps will consider increasing the Gavins Point Dam release to more than 30 kcfs. However, if the wet conditions persist downstream of Gavins Point Dam, releases less that 30 kcfs will be considered to meet targets and conserve water in the upstream reservoirs. The following table shows the number of years out of 100 that the specified discharge from Gavins Point Dam will meet downstream minimum service targets during the July–August time frame. This information shows the probability of what might have to be released to meet downstream targets this year during July and August.

Discharge kcfs	No. of years min. service met
21	<17
25	57
28	73
30	86

Table 12: Probability of Gavin's Point Flow Releases

The releases from Gavins Point Dam from 25 to over 30 kcfs will take advantage of the newly constructed habitat. The newly constructed habitat was designed to operate over a wide range of flows, however, these modifications will perform most effectively when the largest amount of water is diverted over/through modification. Once the modification is submerged, the effectiveness decreases. In general these modifications would operate most effectively at discharges approximately equal to or slightly higher than full service. The 30 kcfs flow is currently anticipated to be the release that will meet the minimum service requirements 86 percent of the time, based on the table above. Dropping the release to 25 kcfs reduces the anticipated minimum service to only 57 percent of the time.

1. Analysis of SWH

In order to put the construction of the 1,200 acres of new SWH into perspective with different flow scenarios, the Corps examined the net change in the amount of potential SWH from Sioux City to the Osage River. Relying on information in the Master Manual Final Environmental Impact Statement (FEIS) and the information in this report, the Corps examined differences in SWH during the summer for 25 kcfs, 28.5 kcfs and 28.5 to 34.5 kcfs as compared to 21 kcfs as identified in the 2000 BiOp.

There are three factors to be considered in this analysis. First are the estimated changes in SWH prior to construction of over 1,200 acres this spring for different flow scenarios as compared to the summer release rate of 21 kcfs. Using information from the FEIS, the Corps used the GP2028 and GP2021 flow management alternatives to estimate this change in SWH. Approximately 1,200 acres corresponds to the average annual gain in shallow water habitat that would occur in the Sioux City to the Osage River reach with a reduction in the summer Gavins Point Dam variable release under the new Water Control Plan compared to the GP 2021 alternative of 21 kcfs in the mid-July to mid-August timeframe. The variable release under the new Water Control Plan adopted in March 2004 is between 34.5 kcfs in normal to somewhat above-normal annual runoff periods and 28.5 kcfs in drought periods. A comparison of the values for the GP2028 and GP2021 alternatives provides an approach for determining the amount of habitat gained for a release of 25 kcfs, which is approximately in the middle of the 28.5 and 21 kcfs releases of the two GP options. The average annual shallow water habitat value for a release of 25 kcfs would be approximately 4,500 acres (prorated value between 4,906 for GP2021 and 4,147 acres for GP2028). The expected daily shallow water habitat in Table 13 is the result of this analysis and are the median values for shallow water habitat over the 100 years of analysis (1989 through 1997 inflow data) conducted for the Master Manual Study.

The second factor is to examine the effects of different flow scenarios on SWH that were constructed under the Missouri River Fish and Wildlife Mitigation Project and Section 1135 program. Utilizing the methodology discussed in the FEIS (see Section 7.7.7), the total acres of SWH construction under these programs would decrease as flows were lowered. The mitigation and Section 1135 site changes from GP2021 in Table 13 is the result of this analysis.

The last factor is the construction of over 1,200 of SWH this spring. These modifications will effectively operate over a wide range of flows, however, they will perform most effectively for pallid sturgeon shallow water habitat with discharges approximately equal to or slightly higher than full service

Table 13 presents the amount of potential habitat using the FEIS data on shallow water habitat. In summary, with the construction of 1,200 acres of shallow water habitat this year and the Gavins Point Dam release set at 25 kcfs or greater, a net positive change in shallow water habitat is expected this summer. This amount is estimated to be in the range of 248 to 860 acres over what would be created with a release of 21 kcfs alone.

Table 13: Shallow Water Habitat for a Range of Gavins Point Dam Releases

Gavins Point Dam Release	(kcfs)	25	28.5	28.5/34.5*
Expected Daily Shallow Water Habitat**	(acres)	4500	4147	3767
Mitigation and Section 1135 Site Changes from GP2021	(acres)	66	123	187
Total SWH without Construction of 1200 acres	(acres)	4566	4270	3954
Total SWH with Construction of 1200 acres****	(acres)	5766	5470	5154
Total Shallow Water Habitat Increase Over GP2021	(acres)	860	564	248

* New Water Control Plan has variable summer releases:
28.5 kcfs for minimum service 34.5 kcfs for full service.
** Data based on Table 7.7-8 of the Master Manual FEIS
*** GP2021 would provide 4906 acres
****Actual constructed habitat was 1420 – 1810 acres

2. Analysis of flow effect on terns and plovers

The Corps flow proposal for 2004 below Gavins Point Dam, will minimize direct impacts to least tern and piping plover eggs and chicks. The steady release should provide static habitat conditions on the reach protecting nests from inundation and chick foraging and brooding areas from being susceptible to rising waters resulting from System operational increases.

Based on fall 2003 habitat surveys, potential nesting habitat will be approximately 4.2 acres/river mile at a 30,000 cfs release from Gavins Point. Potential nesting habitat would be approximately 10 acres/river mile at 25,000 cfs, and 14.4 acres/river mile at 21,000 cfs.

Least tern and piping plover nest monitoring and near real time data management activities will allow river managers and field technicians to minimize take to eggs and chicks by coordinating water management activities throughout the System, and by moving at-risk nests and chicks to secure habitats when possible. This work will occur regardles of flows dictated by storm events.

Eight acres of emergent sandbar habitat (ESH) were created in March of 2004 by mechanical vegetation removal on a sandbar complex downstream of Fort Randall Project. A piping plover nest was discoverd on the recently cleared sandbar. A monitoring program for the sandbar is underway.

The Corps will perform vegetation removal on 200+ acres of sandbars during the summer months on Lewis and Clark Lake as well as the river reach below the dam. The Environmental Assessment (EA) is complete for the project. Vegetation removal will be accomplished utilizing a contracted helicopter spray unit applying Rodeo herbicide.

A piping plover nest was found the week of May 24, 2004, on an FY 03 test plot for the pre-emergent herbicide, Arsenal, on Lewis & Clark Lake. Monitoring programs for the project are ongoing.

At the Ponca dredging project, two 75 acre ESH islands (150 acres total) were created in the channel. These islands were constructed at navigation flow levels and will function (remain emerged) at the anticipated summer flows.

V. SUMMARY AND CONCLUSIONS

Section VII.1.b. of the Amended Biological Opinion provides that when approximately 1,200 acres of new shallow water habitat has been made available above that which currently exists between Sioux City and Omaha (approximately the amount that would be developed through flow management) the Corps, in consultation with the Service, may modify flows to take advantage of that habitat and more fully meet project purposes.

As addressed in the Corps' letters dated February 13 and March 2, 2004, the Corps believes that based on new information, it is biologically warranted for the benefit of the pallid sturgeon, to extend the geographic reach of the 1,200 acres of new shallow water habitat set forth in the 2003 Amended Biological Opinion, from Ponca State Park to the mouth of the Osage River. The information provided included engineering analysis of current shallow water habitat deficiencies, biological studies of the drifting phase of pallid sturgeon, population assessment sampling below the Platte River, and sampling within the Platte River itself. The FWS letter of March 5, 2004, evaluated the information and concurred in the modification of the geographical reach of river for habitat development in Section VII.1.b.

The Corps is developing over 1,200 acres of shallow water habitat by modification of the existing channel and bank stabilization structures from the Ponca State Park to the Osage River. As described above, this work has included bank, dike, and revetment notches, dredging to widen the existing channel and to connect backwater areas, creation of pilot channels and chutes, and major dike modifications. These modifications will effectively operate over a wide range of flows, however, they will perform most effectively for pallid sturgeon shallow water habitat with discharges approximately equal to or slightly higher than full service.

The Corps' technical engineering studies conservatively estimate that as of July 1, 2004, between 1420 and 1810 acres of shallow water habitat will have been created since the issuance of the 2003 Amended Biological Opinion. Table 14 summarizes total amount of SWH developed by construction method.

Summary Table SWH Acres		
Structure Type	Minimum Acres	Maximum Acres
Bank Notches	300	450
Dike Notches	492	492
Revetment Notches	118	118
Type B Notches	124	248
Dredging	135	135
Pilot Channels	43	43
Chutes	78	78
Dike Modifications	130	246
TOTAL SWH ACRES	1420 Minimum	1810 Maximum

Table 14: Amount of SWH developed by construction method.

Table 15 is a summary of where all the work has occurred and the range of acreages of SWH to be expected.

Shallow Water Habitat Site	Approximate River Mile	Low Range of Acres	High Range of Acres
Bank Notching		**300**	**450**
Monkey Mountain	465	20	30
Worthwine Island	460	44	66
Benedictine Bottoms	428	36	54
Baltimore Bend	300	32	48
Grand Pass	270	20	30
Franklin Island	194	36	54
Diana Bend	192	8	12
Eagle Bluffs	170	48	72
Marion Bottoms	158	36	54
Smokey Waters	130	20	30
Dike Notches			
NWK Dike Notches	130 - 466	**492**	**492**
Revetment Notches			
NWK Revetment Notches	130 - 466	**118**	**118**
Type B Notches		**124**	**248**
Lower Dakota Bend	722	5	10
Lower Monona Bend	700	10	20
Upper Blenco Bend	679	6	12
Sandy Point Bend	657	7	14
Lower Little Sioux Reach	671	14	28
Tyson Bend	655	7	14
Nottlemen Island	585	15	30
Aulden Bar	577	13	26
Copeland Bend	567	21	42
Nebraska Bend	562	8	16
Upper & Lower Deroin Bend	518	17	34
Cottier Bend	508	1	2
Dredging		**135**	**155**

Ponca	754	60	80
Tieville-Middle Decatur Bend	693	10	10
Soldier Bend	663	25	25
Tyson Bend	654	25	25
California Bend	650	15	15
Pilot Channel		**44**	**44**
Monkey Mountain	465	10	10
Worthwine Island	457	11	11
Benedictine Bottoms	426	8	8
Weston Bend SP	402	5	5
Liberty Bend	351	4	4
Diana Bend	188	4	4
Eagle Bluffs	175	2	2
Chutes		**78**	**78**
Lisbon-Jameson	215	50	50
Diana Bend	188	3	3
Smokey Waters	133	25	25
Major Dike Modifications		**130**	**246**
Snyder Bend	715	4	8
Winnebago Bend	709	10	19
Desoto Bend Dikes	644	16	30
Boyer Bend	637	24	45
Tobacco Bend	589	15	28
Upper/Lower Hamburg Bend	556	40	76
Langdon Bend	532	21	40
TOTAL		**1420**	**1810**

Table 15: Site and Acreage Summary of SWH.

This shallow water habitat meets the criteria discussed in the 2003 Amended Biological Opinion and further described in the FWS March 5, 2004, letter to the Corps. Over time, flows that meet all project purposes are expected to increase the effectiveness of these structural modifications and further expand the amount of shallow water habitat already created as well as increase the biological productivity of these sites.

The Corps is proposing to operate in accordance with the 2004 AOP dated March 19, 2004, based on meeting the provisions of Section VII.1.b. of the 2003 Amended Biological Opinion. The AOP provides for releases of 30,000 cfs in July and August to meet flow targets as downstream tributary flows decline, but as noted in the AOP, actual releases will be dependent on the hydrologic conditions existing at that time. Should the tributary flows drop below the high run-off flows experienced in early May, the Corps will consider increasing the Gavins Point Dam releases to more than 30,000 cfs. However, if wet conditions persist downstream of Gavins Point Dam, releases less that 30,000 cfs will be considered to meet service levels and to conserve water in the upstream reservoirs. As stated above, the releases above those described in Section VII 1.a., are intended to optimize the newly created shallow water habitat maximizing benefits to pallid sturgeon while providing for authorized purposes on the lower river.

VI. APPENDIX

Appendix A: Location Maps
Appendix B: Coordination Letters
Appendix C: Weekly Situation Reports
Appendix D: SWH Monitoring Data
Appendix E: Dike Notching Summary
Appendix F: Major Dike Modification Designs
Appendix G: Backwater Dredging Designs
Appendix H: Individual Project Designs

APPENDIX A

LOCATION MAPS

Legend

N

● 1960 River Miles

Proposed SWH Development Sites

Ponca

River Mile 754.0

500 0 500 1000 1500 2000 Feet

Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed, or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Produced By:
Lloyd Schultz

Production Date:
2 June 2004

Revised By:
-

Revision Date:
-

US Army Corps of Engineers
Omaha District

File Location:
Ponca

Sources: 2000 1 Foot Orthophotography and 1960 River Miles

Legend

1960 River Miles

Proposed SWH Development Sites

Winnabago/Snyder

River Mile 715.0 to 708.0

N

700 0 700 1400 2100 2800 Feet

Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed, or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.

Surveys, Mapping, and GIS Section
CENWD-ED-GD

Produced By: Scott Zessin
Production Date: 3 June 04
Revised By: -
Revision Date: -

US Army Corps of Engineers ®
Omaha District

File Location: Winnabago/Snyder

Sources: 2000 1 Foot Orthophotography and 1960 River Miles

Legend

Proposed SWH Development Sites

Tieville-Middle Decatur Bend

River Mile 693.5 to 687.5

N

700 0 700 1400 2100 2800 Feet

1960 River Miles

Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed, or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Produced By: Scott Zessin
Production Date: 2 June 04
Revised By: -
Revision Date: -

US Army Corps of Engineers ®
Omaha District

File Location: Tieville-Middle Decatur Bend

Sources: 2000 1 Foot Orthophotography and 1960 River Miles

Legend

1960 River Miles

Proposed SWH Development Sites

Soldier Bend

River Mile 663.0 to 661.0

N

700 0 700 1400 2100 2800 Feet

Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed, or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Produced By: Scott Zessin

Production Date: 3 June 04

Reviewed By: -

Revision Date: -

US Army Corps of Engineers ®
Omaha District

File Location: Soldier Bend

Sources: 2000 1 Foot Orthophotography and 1960 River Miles

Legend

Proposed SWH Development Sites

Tyson Bend

River Mile 654.5 to 653.0

N

700 0 700 1400 2100 2800 Feet

1960 River Miles

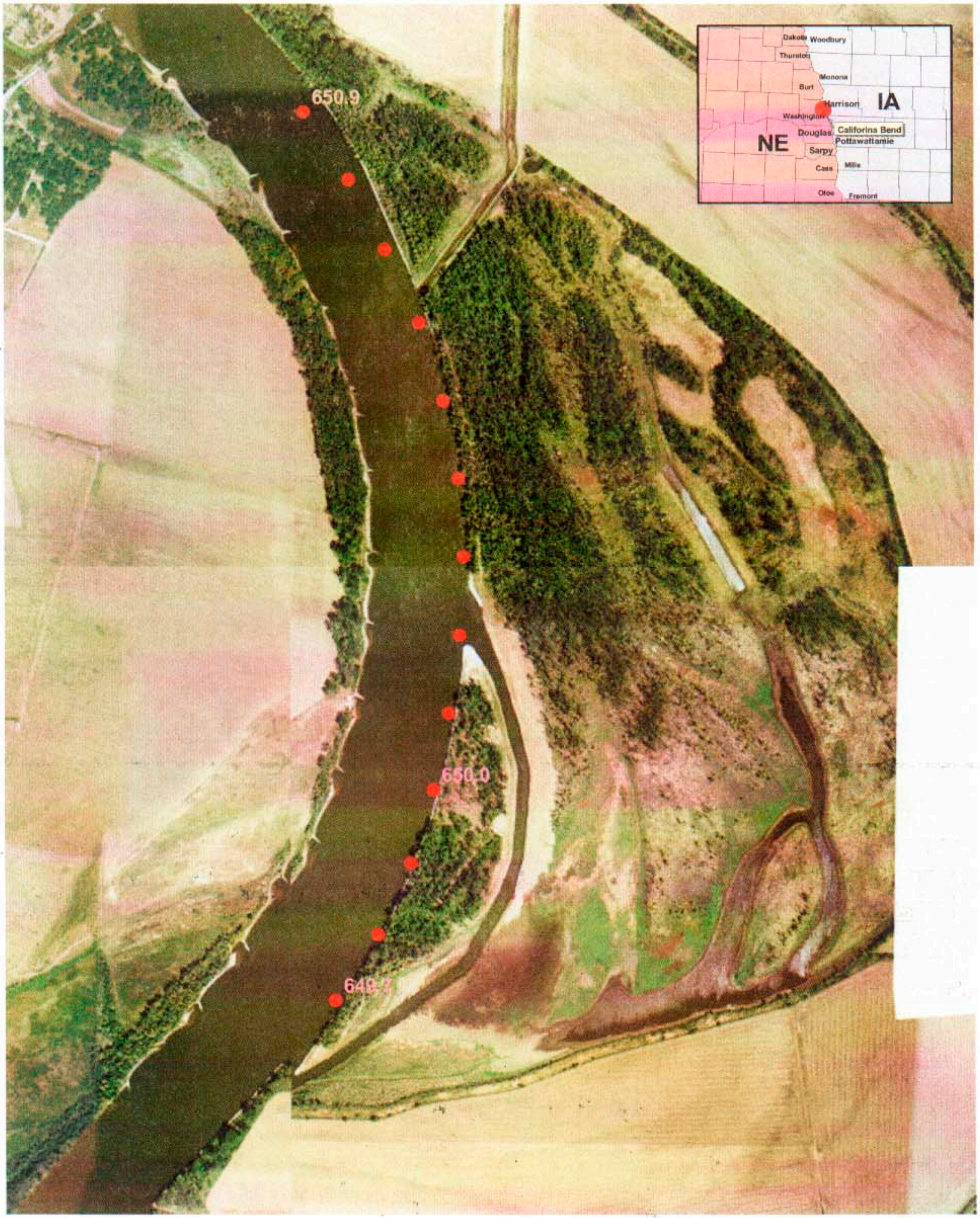
Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed, or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Produced By: Scott Zessin
Production Date: 3 June 04
Revised By: -
Revision Date: -
File Location: Tyson Bend

US Army Corps of Engineers ®
Omaha District

Sources: 2000 1 Foot Orthophotography and 1960 River Miles



Legend

1960 River Miles

Proposed SWH Development Sites

California Bend

River Mile 650.9 to 649.7

N

400 0 400 800 1200 1600 Feet

Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed, or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Produced By
Scott Zessin

Production Date
3 June 04

Revised By
-

Revision Date
-

US Army Corps of Engineers
Omaha District

File Location
California Bend

Sources: 2000 1 Foot Orthophotography and 1960 River Miles

Legend

1960 River Miles

Proposed SWH Development Sites

Desoto Bend Dike Mod

River Mile 644.0 to 642.0

N

700 0 700 1400 2100 2800 Feet

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Produced By:
Scott Zessin

Production Date:
3 June 04

Revised By:
-

Revision Date:
-

US Army Corps of Engineers
Omaha District

File Location:
Desoto Bend Dike Mod

Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed, or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.

Sources: 2000 1 Foot Orthophotography and 1960 River Miles

Legend

1960 River Miles

Proposed SWH Development Sites

Boyer Bend

River Mile 637.0 to 634.0

N

800 0 800 1600 2400 3200 Feet

Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed, or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Scott Zessin

3 June 04

-

-

US Army Corps of Engineers ®
Omaha District

Boyer Bend

Sources: 2000 1 Foot Orthophotography and 1960 River Miles

Legend

1960 River Miles

Proposed SWH Development Sites

Tobacco Bend

River Mile 589.0 to 586.0

N

700 0 700 1400 2100 2800 Feet

Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed, or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Produced By:
Scott Zessin

Production Date:
3 June 04

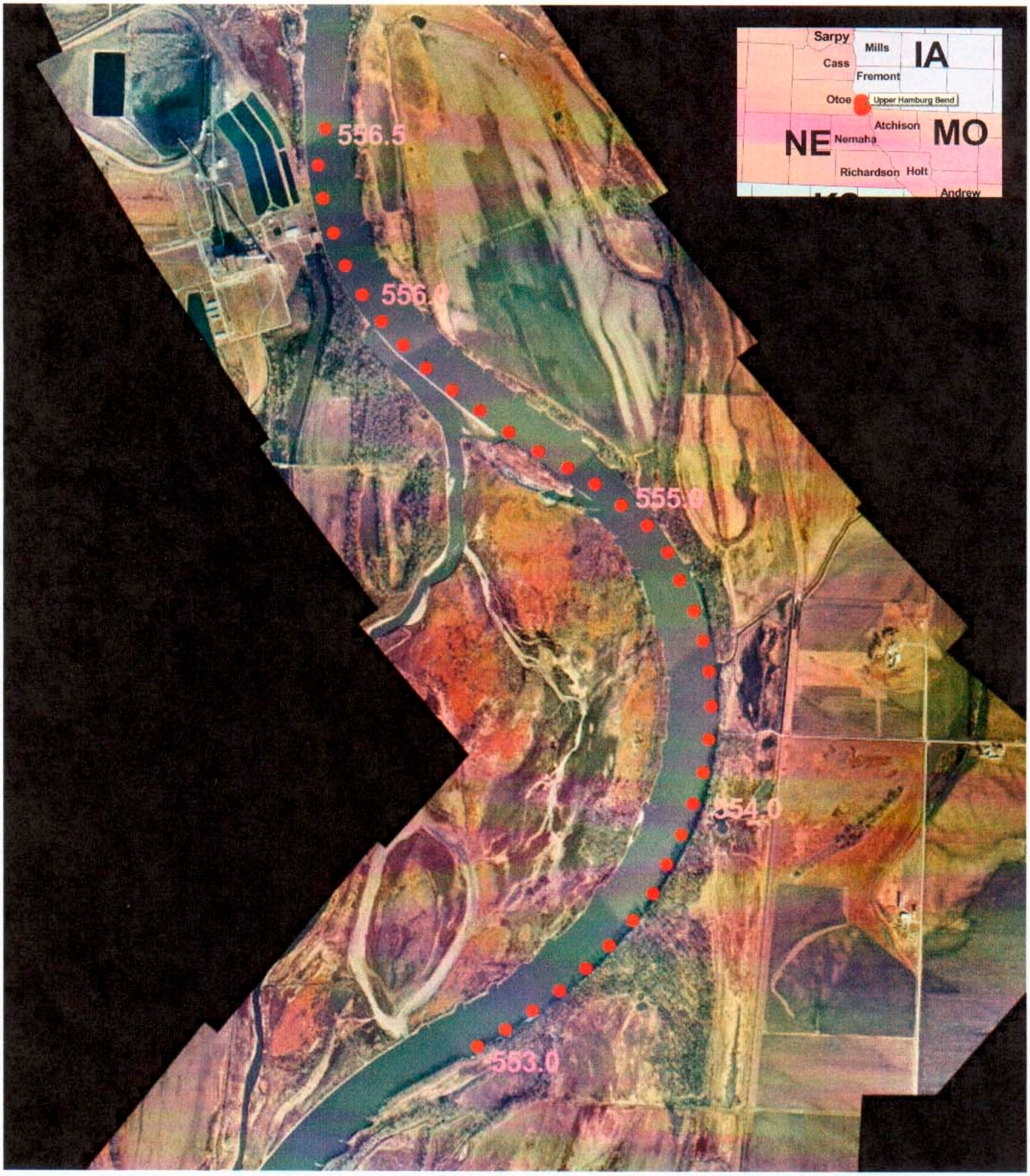
Revised By:
-

Revision Date:
-

US Army Corps of Engineers
Omaha District

File Location:
Tobacco Bend

Sources: 2000 1 Foot Orthophotography and 1960 River Miles



Legend

1960 River Miles

Proposed SWH Development Sites

Upper Hamburg Bend

River Mile 556.5 to 553.0

N

600 0 600 1200 1800 2400 Feet

Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed, or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Produced By: Scott Zessin

Production Date: 3 June 04

Revised By: -

Revision Date: -

File Location: Upper Hamburg Bend

US Army Corps of Engineers ®
Omaha District

Sources: 2000 1 Foot Orthophotography and 1960 River Miles

Legend

1960 River Miles

Proposed SWH Development Sites

Lower Hamburg Bend

River Mile 553.0 to 551.0

N

700 0 700 1400 2100 2800 Feet

Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed, or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Produced By: Scott Zessin

Production Date: 3 June 04

Revised By: -

Revision Date: -

US Army Corps of Engineers
Omaha District

File Location: Lower Hamburg Bend

Sources: 2000 1 Foot Orthophotography and 1960 River Miles

Legend

Proposed SWH Development Sites

Langdon Bend

River Mile 530.5 to 532.0

N

700 0 700 1400 2100 2800 Feet

1960 River Miles

Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed, or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Produced By: Scott Zessin

Production Date: 3 June 04

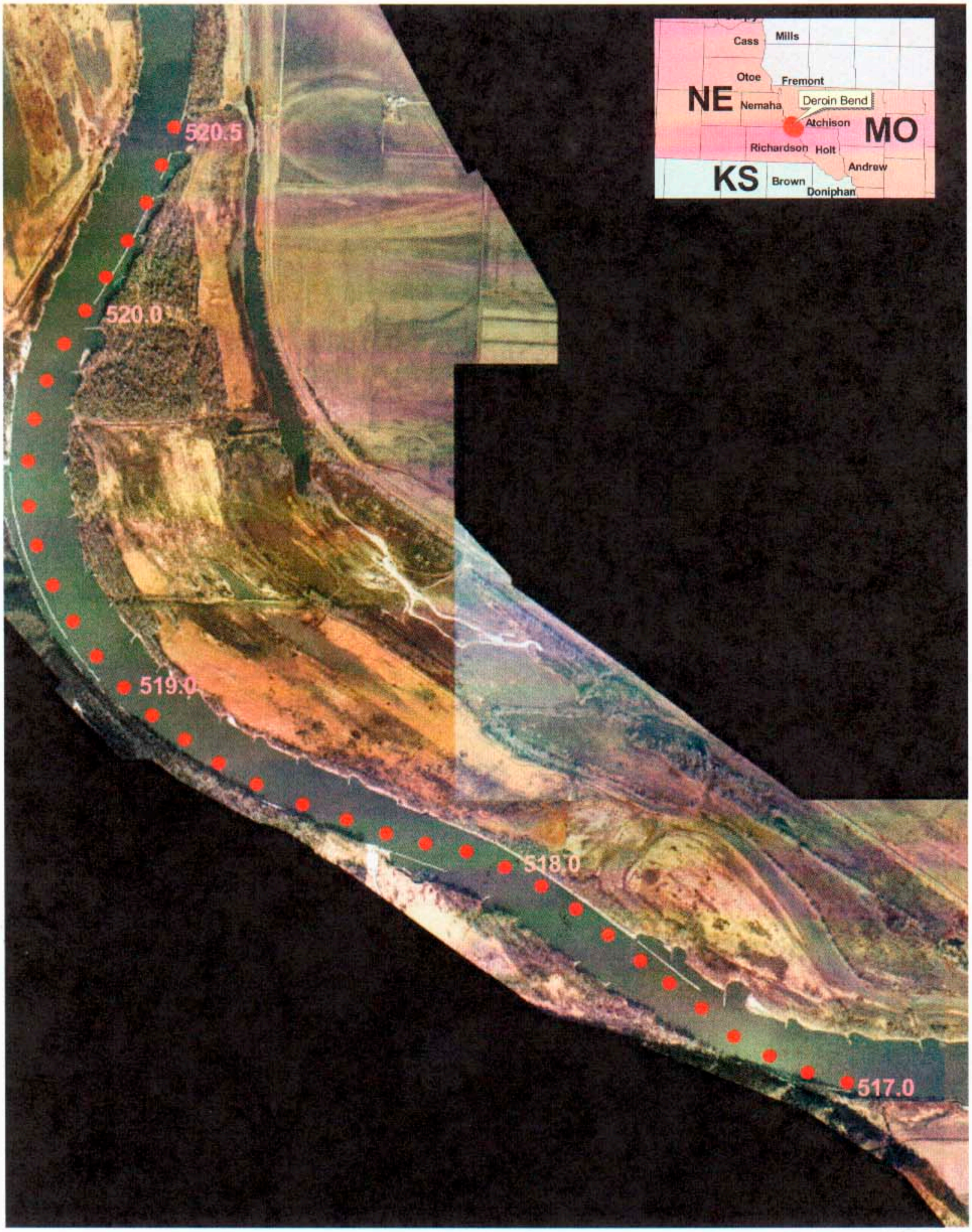
Reviewed By: -

Revised Date: -

File Location: Langdon Bend

US Army Corps of Engineers
Omaha District

Sources: 2000 1 Foot Orthophotography and 1960 River Miles



Legend

Proposed SWH Development Sites

Deroin Bend

River Mile 520.5 to 517.0

N

700 0 700 1400 2100 2800 Feet

1960 River Miles

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Prepared By: Scott Zessin

Production Date: 3 June 04

Revised By: -

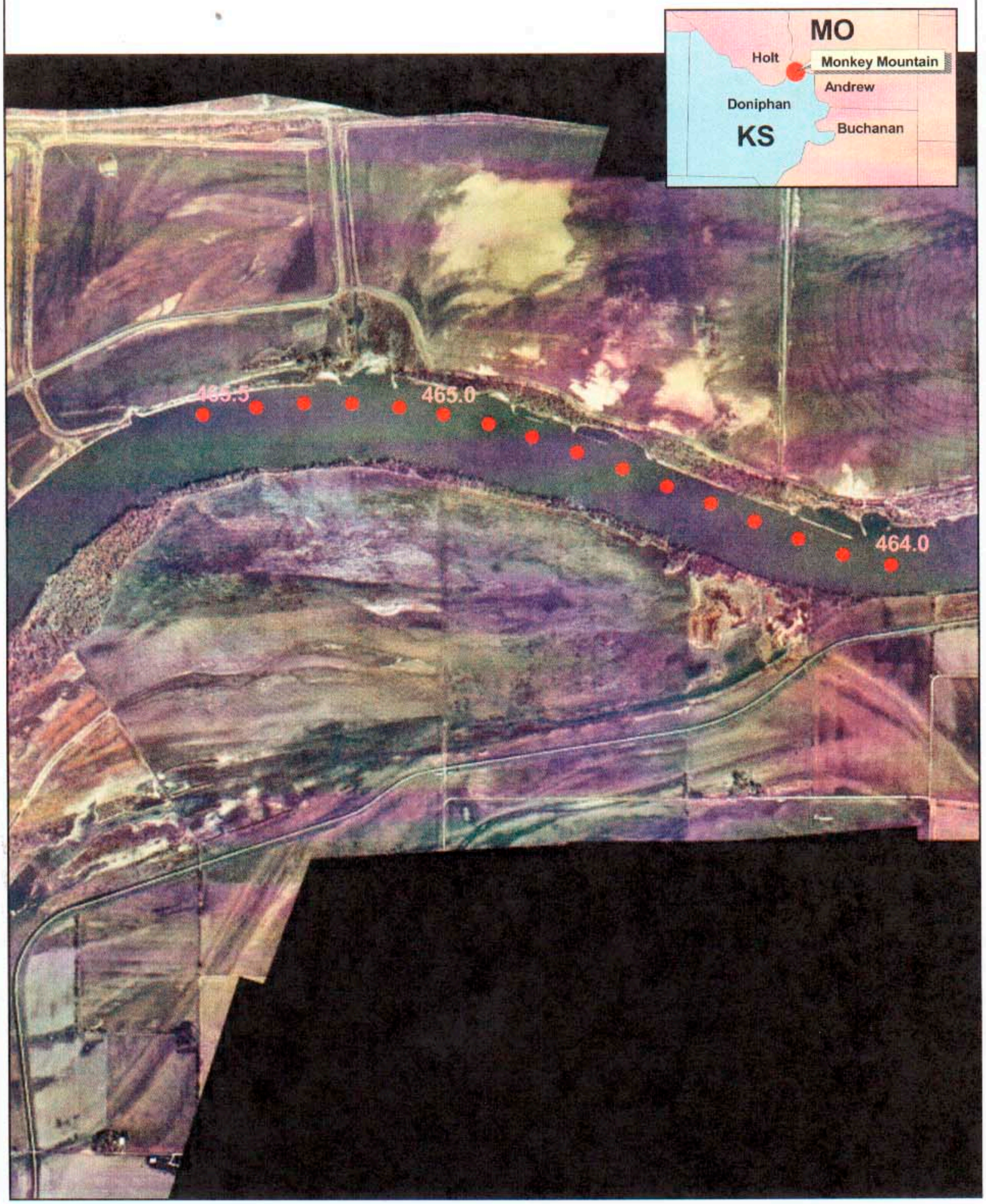
Revision Date: -

US Army Corps of Engineers
Omaha District

File Location: Deroin Bend

Sources: 2000 1 Foot Orthophotography and 1960 River Miles

Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.



Legend

N

1960 River Miles

Proposed SWH Development Sites

Monkey Mountain

River Mile 465.5 to 464.0

500 0 500 1000 1500 2000 Feet

Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed, or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Produced By:
Lloyd Schultz

Production Date:
2 June 2004

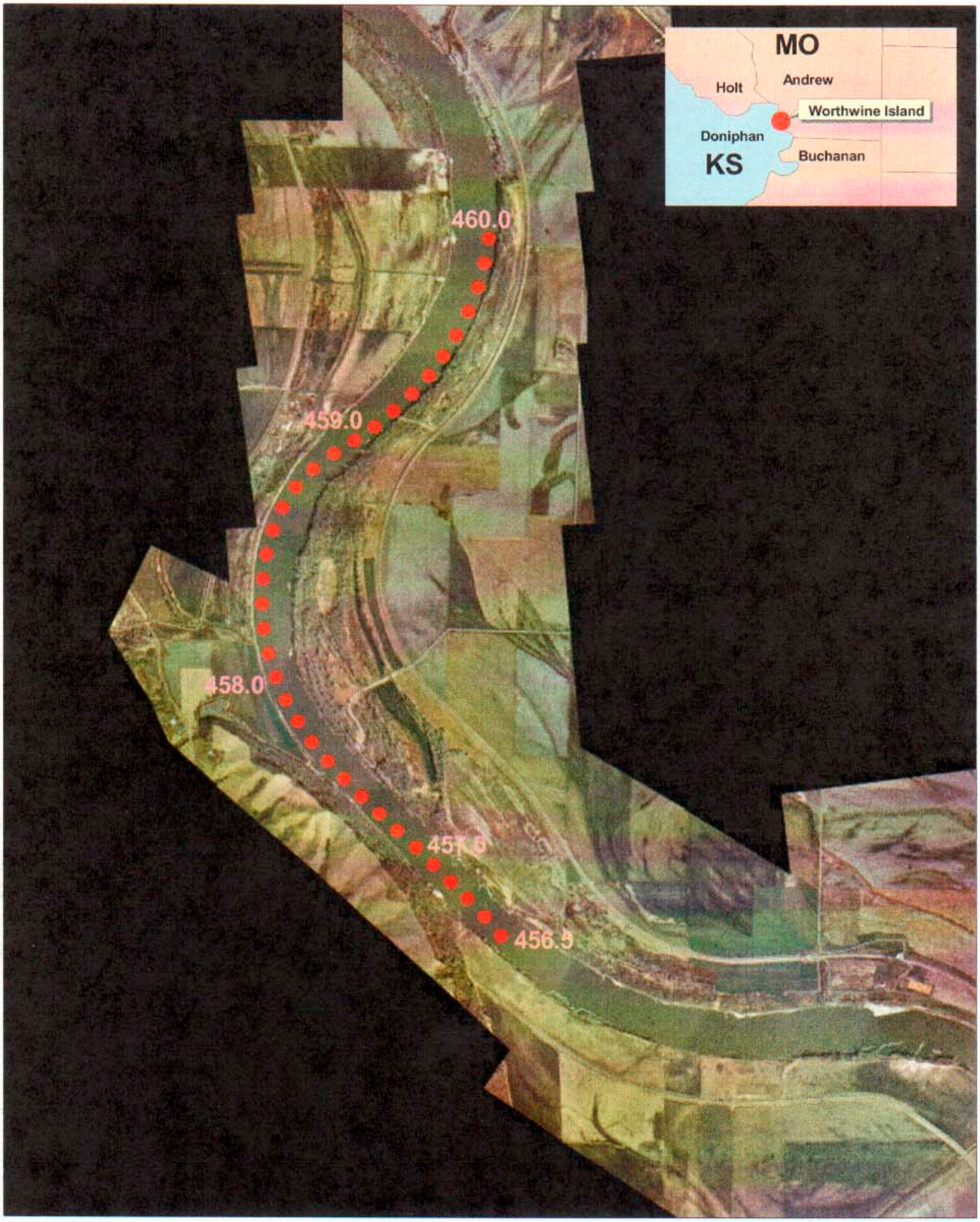
Revised By:
-

Revision Date:
-

US Army Corps
of Engineers
Omaha District

File Location:
Monkey Mountain

Sources: 2000 1 Foot Orthophotography
and 1960 River Miles



Legend

N

1960 River Miles

Proposed SWH Development Sites

Worthwine Island

River Mile 460.0 to 456.5

1000 0 1000 2000 3000 4000 Feet

Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed, or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Produced By
Lloyd Schultz

Production Date
28 May 2004

Reviewed By
-

Revision Date
-

US Army Corps of Engineers ®
Omaha District

File Location
Worthwine Island

Sources: 2000 1 Foot Orthophotography and 1960 River Miles

Legend

1960 River Miles

N

Proposed SWH Development Sites

Benedictine Bottoms

River Mile 428.5 to 425.0

1000 0 1000 2000 3000 4000 Feet

Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed, or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Produced By: Lloyd Schultz

Production Date: 28 May 2004

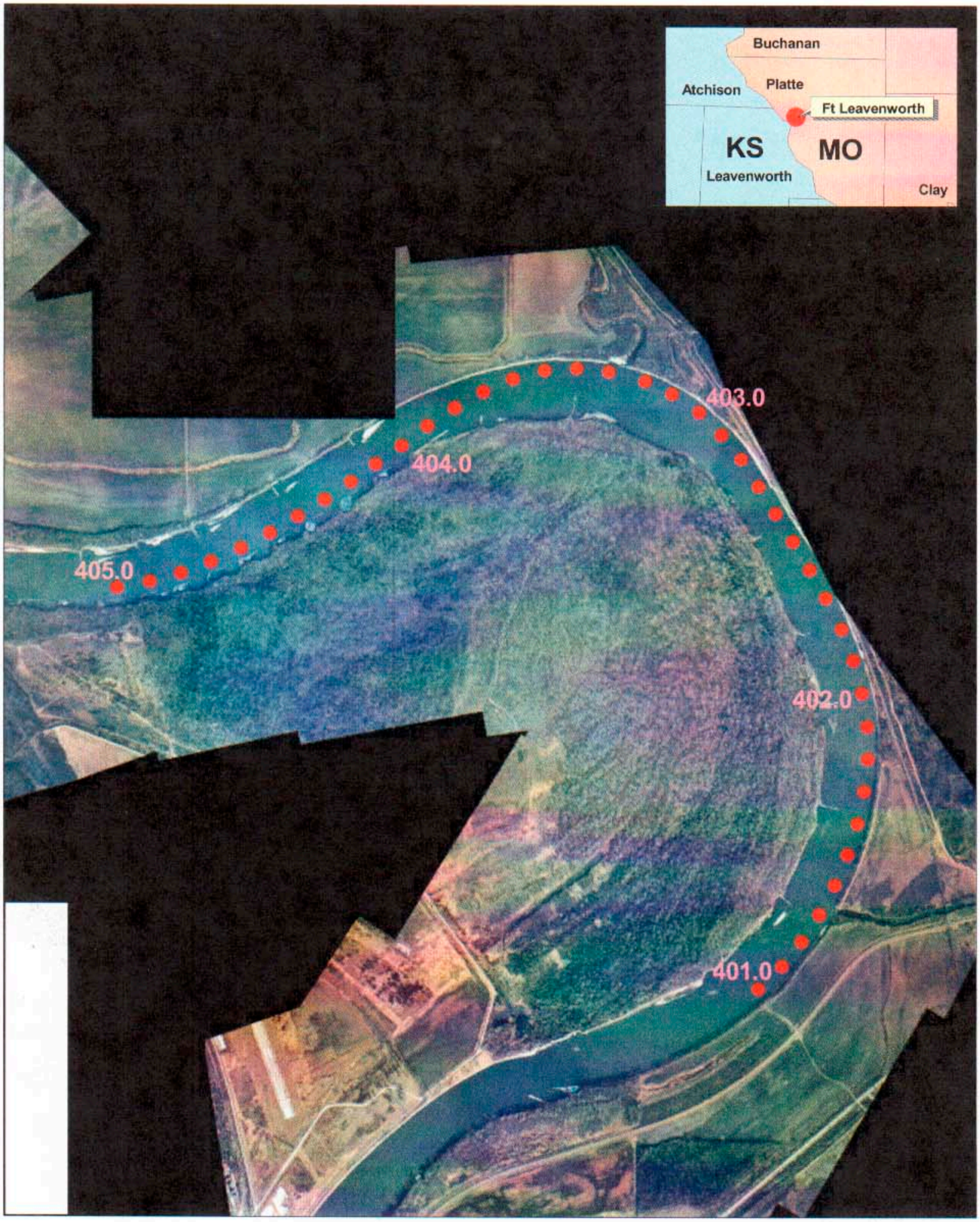
Reviewed By: -

Revision Date: -

File Location: Benedictine Bottoms

US Army Corps of Engineers ®
Omaha District

Sources: 2000 1 Foot Orthophotography and 1960 River Miles



Legend

N

1960 River Miles

Proposed SWH Development Sites

Ft Leavenworth

River Mile 405.0 to 401.0

1000 0 1000 2000 3000 Feet

Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed, or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Produced By
Lloyd Schultz

Production Date
2 June 2004

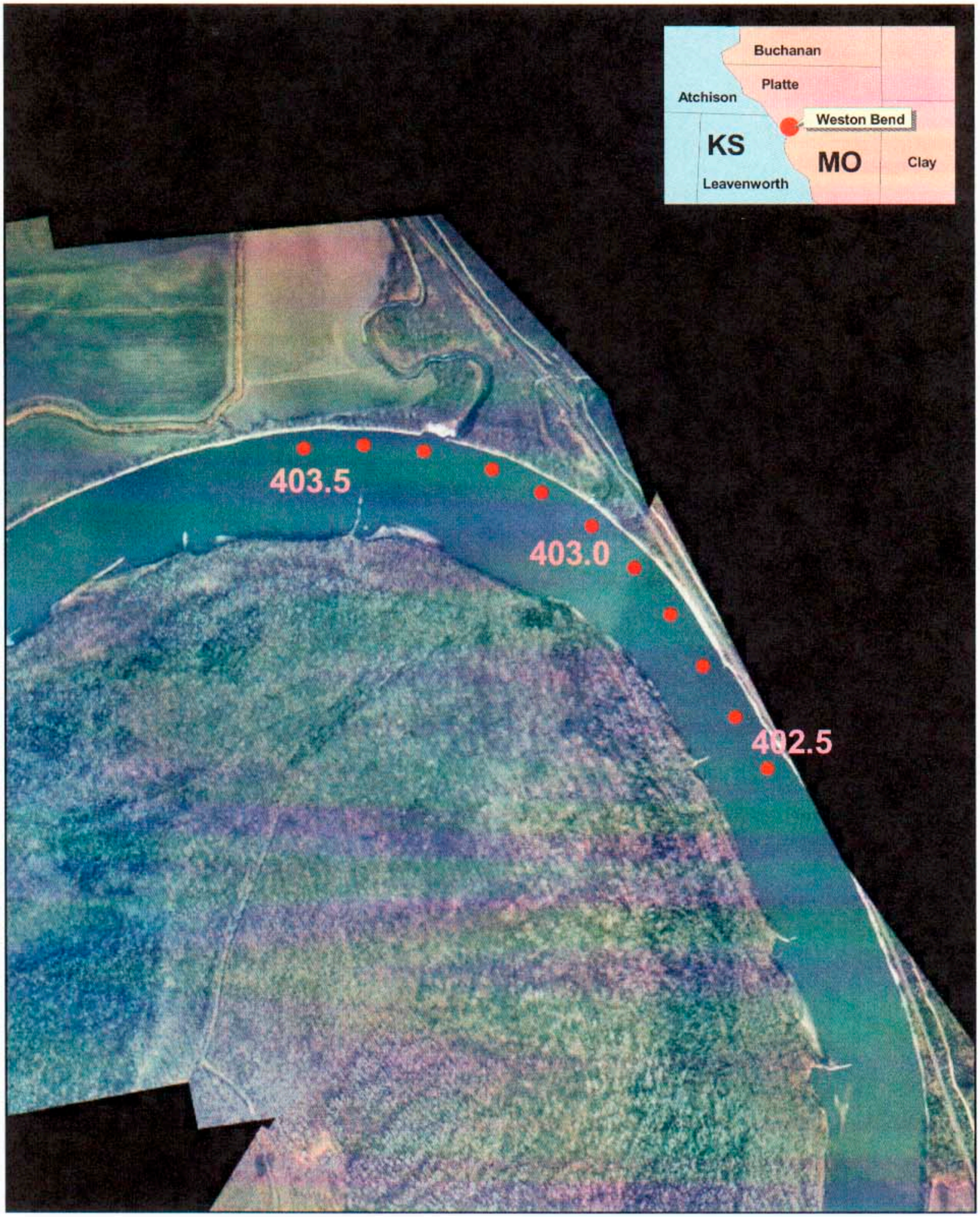
Revised By
-

Revision Date
-

US Army Corps of Engineers
Omaha District

File Location
Ft Leavenworth

Sources: 2000 1 Foot Orthophotography and 1960 River Miles



Legend

N

1960 River Miles

Proposed SWH Development Sites

Weston Bend

River Mile 403.5 to 402.5

300 0 300 600 900 1200 Feet

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Produced By
Lloyd Schultz

Production Date
28 May 2004

Revised By
-

Revision Date
-

US Army Corps of Engineers
Omaha District

File
Weston Bend

Sources: 2000 1 Foot Orthophotography and 1960 River Miles

Legend

N

1960 River Miles

Proposed SWH Development Sites

Liberty Bend CA

River Mile 351.4 to 350.6

400 0 400 800 1200 1600 Feet

Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed, or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Produced By:
Lloyd Schultz

Production Date:
28 May 2004

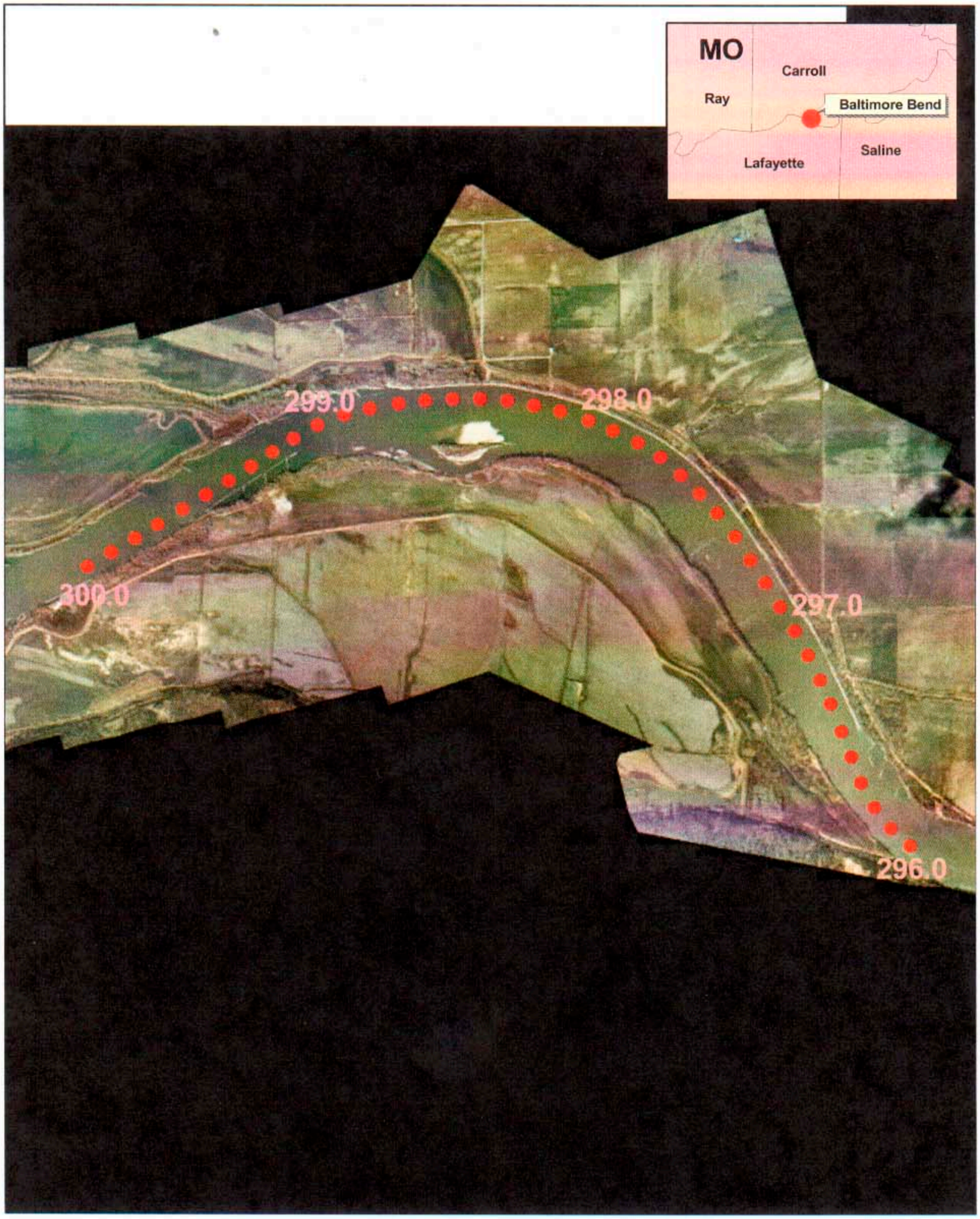
Revised By:
-

Revision Date:
-

US Army Corps of Engineers
Omaha District

File Location:
Liberty Bend CA

Sources: 2000 1 Foot Orthophotography and 1960 River Miles



Legend

N

● 1960 River Miles

Proposed SWH Development Sites

Baltimore Bend

River Mile 300.0 to 296.0

900 0 900 1800 2700 3600 Feet

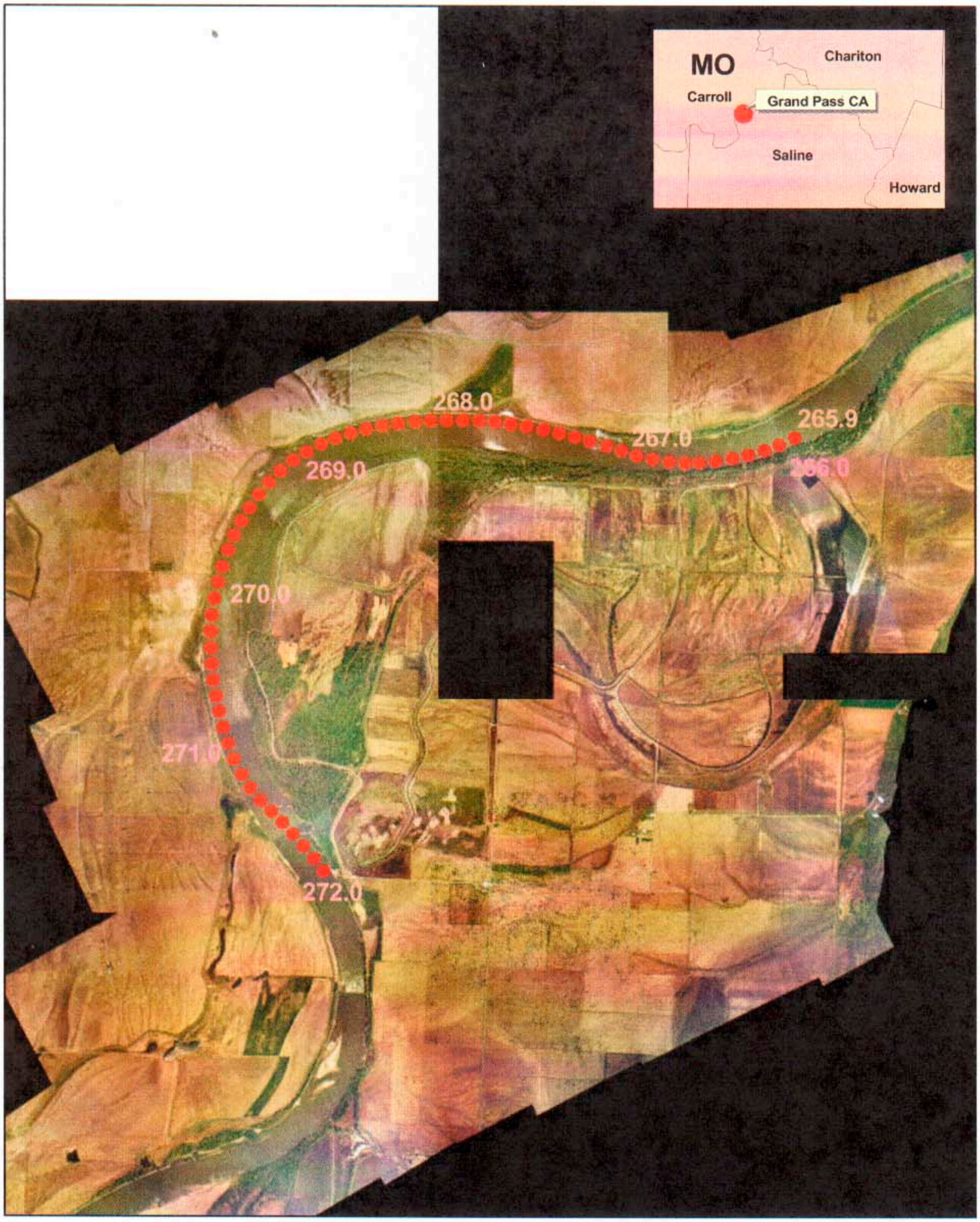
Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed or implied, concerning the accuracy, completeness, reliability, usability or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Produced By: Lloyd Schultz
Production Date: 2 June 2004
Revised By: -
Revision Date: -
File Location: Baltimore Bend

US Army Corps of Engineers
Omaha District

Sources: 2000 1 Foot Orthophotography and 1960 River Miles



Legend

N

● 1960 River Miles

Proposed SWH Development Sites

Grand Pass CA

River Mile 272.0 to 265.9

0.2 0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 Miles

Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Produced By: Lloyd Schultz

Production Date: 28 May 2004

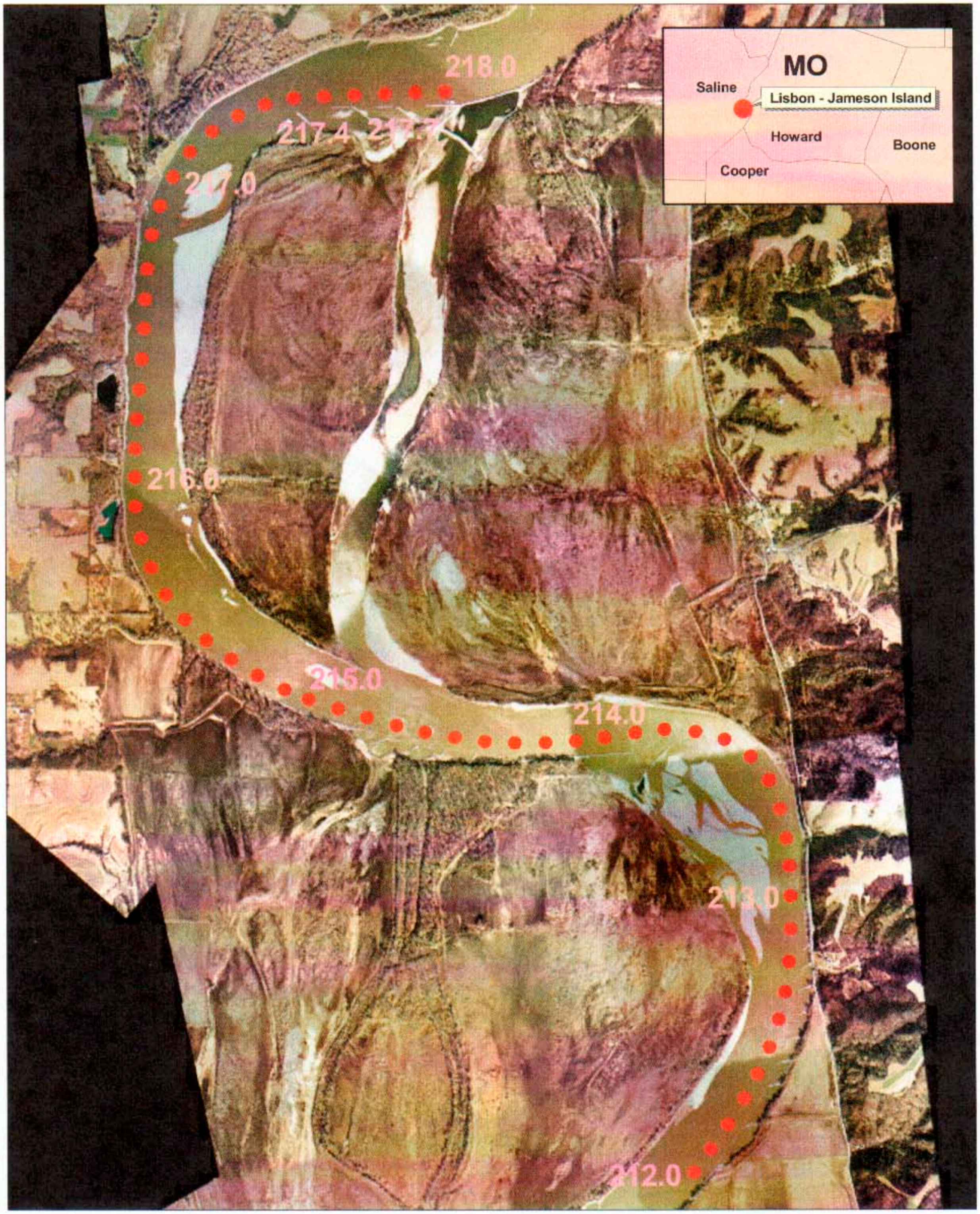
Revised By: -

Revision Date: -

File Location: Grand Pass CA

US Army Corps of Engineers ®
Omaha District

Sources: 2000 1 Foot Orthophotography and 1960 River Miles



Legend

N

● 1960 River Miles

Proposed SWH Development Sites

Lisbon - Jameson Island

River Mile 218.0 to 212.0

800 0 800 1600 2400 3200 Feet

Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed, or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Produced By:
Lloyd Schultz

Production Date:
2 June 2004

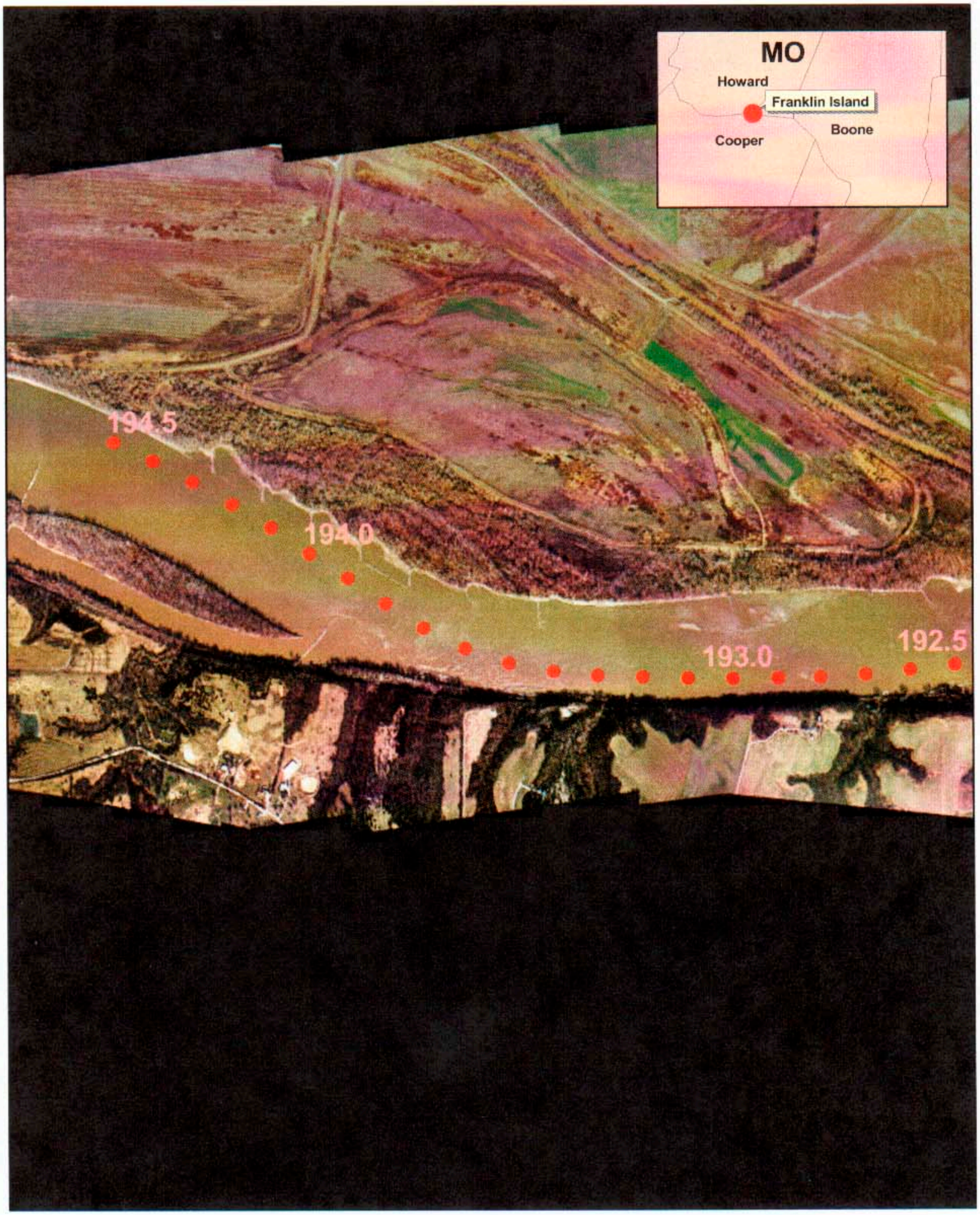
Reviewed By:
-

Revision Date:
-

US Army Corps of Engineers
Omaha District

File Location:
Lisbon-Jameson Island

Sources: 2000 1 Foot Orthophotography and 1960 River Miles



Legend

N

1960 River Miles

Proposed SWH Development Sites

Franklin Island

River Mile 194.5 to 192.5

500 0 500 1000 1500 2000 Feet

Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed, or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof.
Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Produced By: Lloyd Schultz

Production Date: 2 June 2004

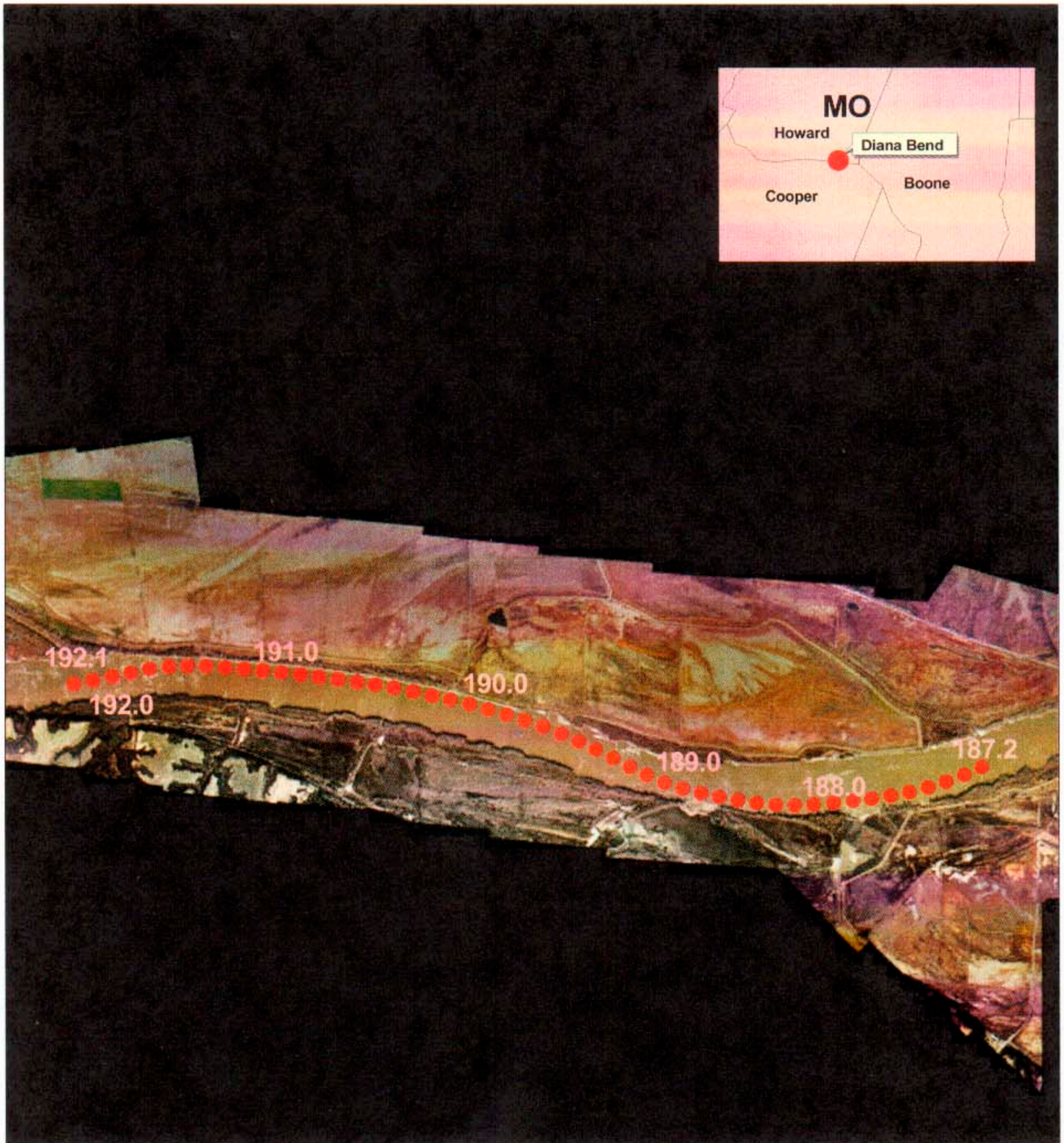
Revised By: -

Revision Date: -

File Location: Franklin Island

US Army Corps of Engineers
Omaha District

Sources: 2000 1 Foot Orthophotography and 1960 River Miles



Legend

N

● 1960 River Miles

Proposed SWH Development Sites

Diana Bend

River Mile 192.1 to 187.2

1000 0 1000 2000 3000 4000 Feet

Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed, or implied concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Lloyd Schultz

2 June 2004

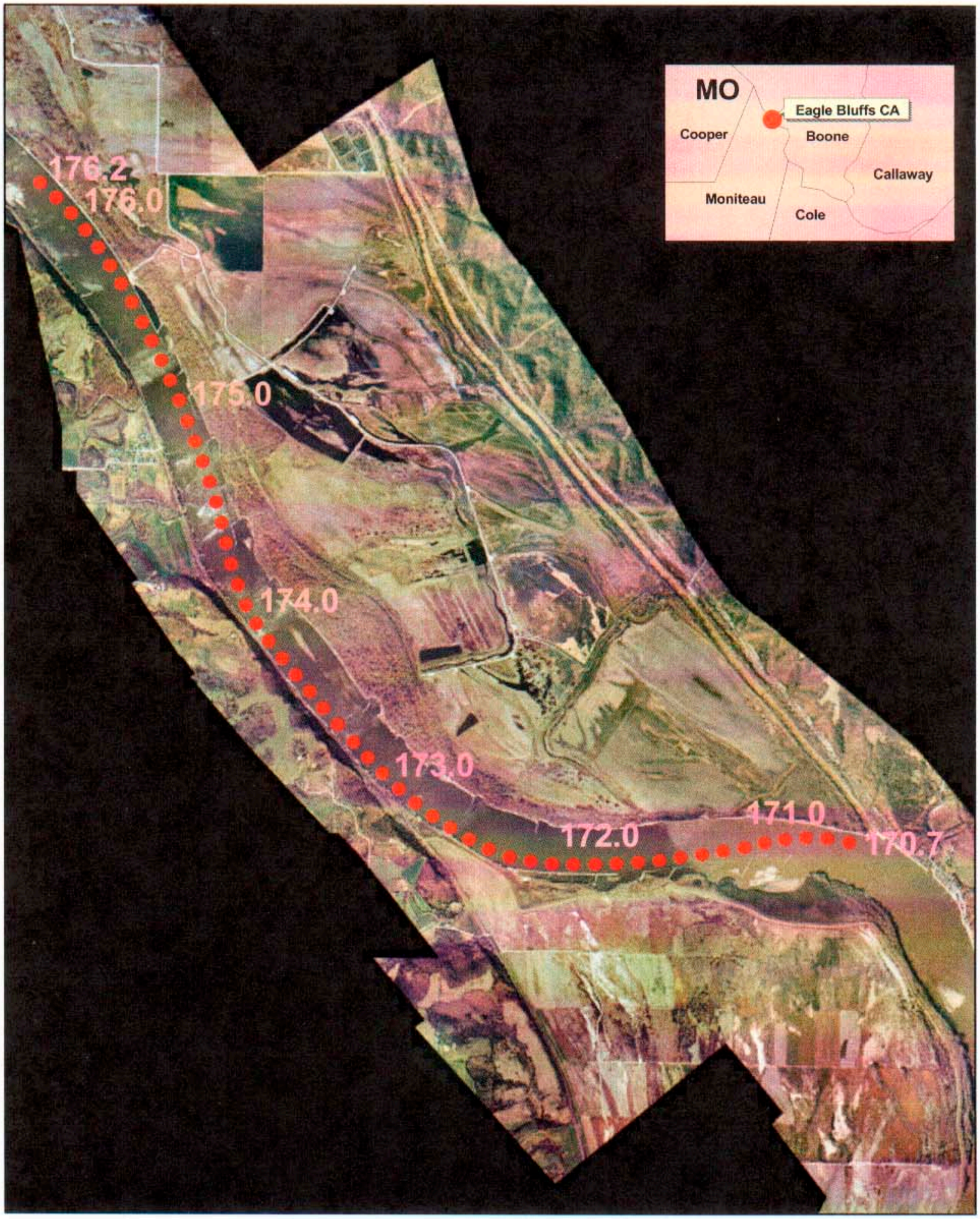
-

-

US Army Corps of Engineers ®
Omaha District

Diana Bend

Sources: 2000 1 Foot Orthophotography and 1960 River Miles



Proposed SWH Development Sites

Eagle Bluffs CA

River Mile 176.2 to 170.7

Legend

N

● 1960 River Miles

1000 0 1000 2000 3000 4000 Feet

Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed, or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Produced By: Lloyd Schultz

Production Date: 2 June 2004

Reviewed By: -

Revision Date: -

File Location: Eagle Bluffs CA

US Army Corps of Engineers
Omaha District

Sources: 2000 1 Foot Orthophotography and 1960 River Miles

Legend

N

1960 River Miles

Proposed SWH Development Sites

Marion Bottoms

River Mile 158.7 to 155.2

600 0 600 1200 1800 2400 Feet

Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed, or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Lloyd Schultz

2 June 2004

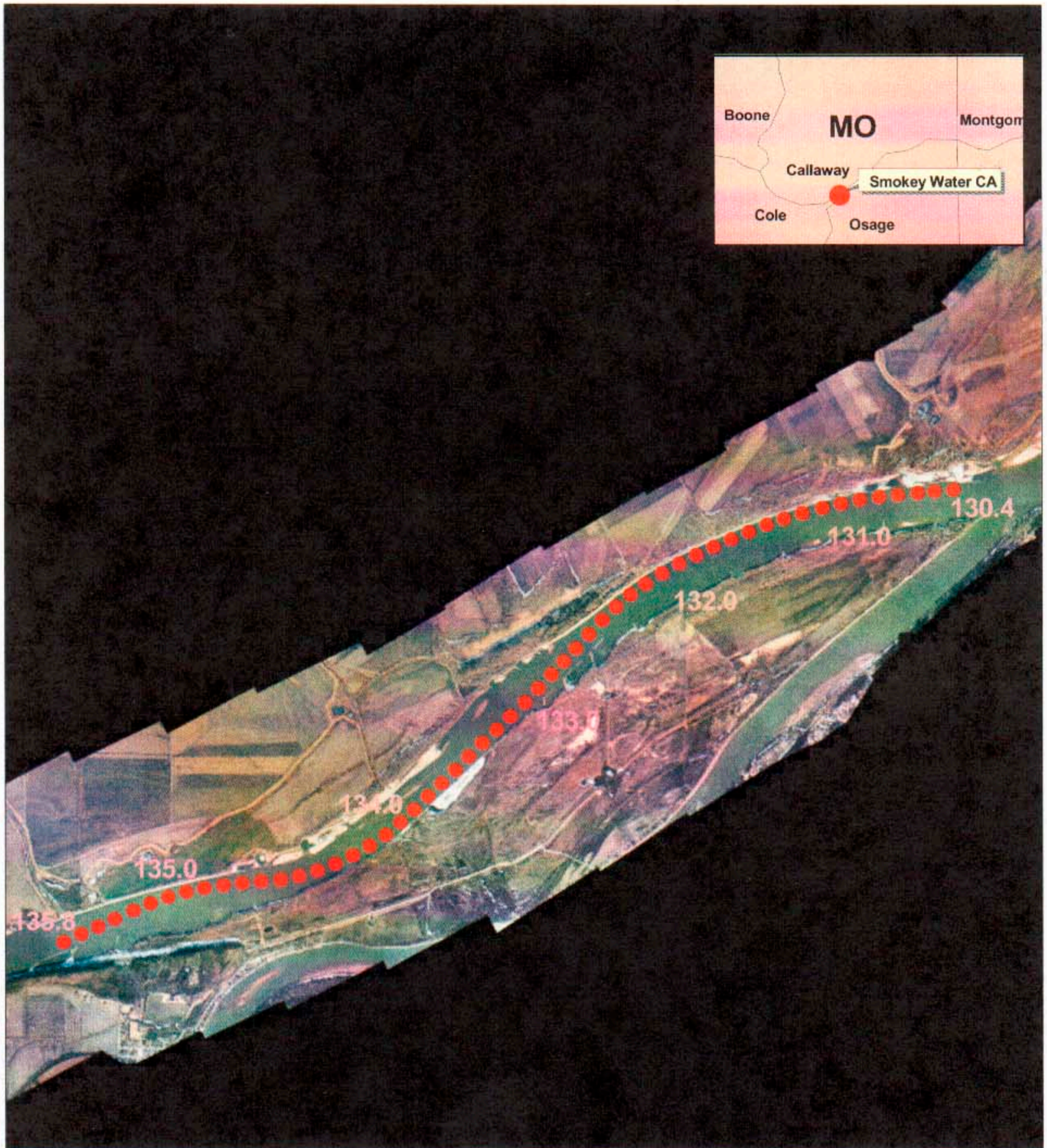
-

-

US Army Corps of Engineers ®
Omaha District

Marion Bottoms

Sources: 2000 1 Foot Orthophotography and 1960 River Miles



Legend

N

1960 River Miles

Proposed SWH Development Sites

Smokey Water CA

River Mile 135.8 to 130.4

1000 0 1000 2000 3000 4000 Feet

Disclaimer: The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed, or implied concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. Data displayed on this map are approximations derived from GIS layers and should not be used in place of survey data or legal land descriptions.

Surveys, Mapping, and GIS Section
CENWO-ED-GD

Produced By
Lloyd Schultz

Production Date
2 June 2004

Reviewed By
-

Revision Date
-

US Army Corps of Engineers ®
Omaha District

File Location
Smokey Water CA

Sources: 2000 1 Foot Orthophotography and 1960 River Miles

APPENDIX B

COORDINATION LETTERS

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NORTHWESTERN DIVISION
PO BOX 2870
PORTLAND OR 97208-2870

REPLY TO
ATTENTION OF

Planning and Policy Division

Ms. Robyn Thorson
Regional Director, Great Lakes-Big Rivers Region
U.S. Fish and Wildlife Service
Bishop Henry Whipple Federal Building
1 Federal Drive, Room 630
Fort Snelling, Minnesota 55111-4056

Dear Ms. Thorson:

This letter is a follow-up to discussions between our two agencies on January 26, 2004, in Omaha, Nebraska, regarding your 2003 Amendment to the 2000 Biological Opinion (BiOp) on the operation of the Missouri River Mainstem Reservoir System (Mainstem System), the operation and maintenance of the Missouri River Bank Stabilization and Navigation Project, and the operation of the Kansas River Reservoir System (2003 Amended BiOp). In that meeting, we discussed the Corps' plan for the creation of habitat for the threatened and endangered species along the Missouri River and selected tributaries, and the Corps' plan for the operation of the Mainstem System this summer. This letter documents the issues discussed at that meeting and further developed in subsequent discussions between the Corps and the Service.

Your 2003 Amended BiOp indicates that when 1200 acres of new shallow water habitat have been made available in the Sioux City to Omaha reach that the agencies may consult to modify flows to take advantage of that habitat and more fully meet Corps project purposes. We believe that current scientific information shows that expanding the development of these 1,200 acres of habitat beyond this reach to the entire reach of the Missouri River to be biologically warranted. We also believe that it may be biologically warranted to take actions along some of the major tributaries of the Missouri River where the pallid sturgeon is known to exist. The enclosed document presents in detail the basis for these conclusions and other issues discussed at our January 26 meeting in detail and includes references to the relevant scientific documentation.

We understand from our January 26 meeting and subsequent discussions that the Service concurs with the approach set forth in this letter and its attachment. Please confirm your concurrence with our plan for pallid sturgeon habitat development as set forth in the enclosed attachment and the Corps' flexibility to operate the system in 2004 to meet all congressionally authorized purposes.

The Corps is also pursuing implementation of the various habitat and propagation requirements and other components of the 2003 Amended BiOp in addition to the shallow water habitat creation discussed above. We are seeking authority to reprogram 2004 appropriations to construct habitat as provided for in the 2003 Amended BiOp. Both of our agencies' staffs have worked together for many years for the improvement of the health of the Missouri River ecosystem. It is timely and appropriate for our agencies to intensify and further coordinate our efforts to ensure the survival and recovery of the interior least tern, piping plover, and pallid sturgeon.

I want to take this opportunity to express my sincere appreciation for your efforts, and that of the other U.S. Fish and Wildlife staff involved, in the preparation of the 2003 Amended BiOp. I look forward to your response to this letter. Should you or your staff have any questions or need any additional information, please do not hesitate to contact me, or Mr. David Ponganis of my staff.

Sincerely,

William T. Grisoli
Brigadier General, U.S. Army
Division Engineer

Enclosure

ATTACHMENT
BIOLOGICAL AND ENGINEERING INFORMATION
2003 AMENDMENT TO THE MISSOURI RIVER 2000 BIOLOGICAL OPINION

This attachment provides biological and engineering information on the Corps' implementation of the summer habitat flows and pallid sturgeon habitat provisions of the Service's 2003 Amendment BiOp Reasonable and Prudent Alternative (RPA). It also documents other elements of the RPA that the Corps and the Service discussed at the January 26, 2004 meeting in Omaha, Nebraska.

The 2003 Amended BiOp RPA VII.1.b indicates that when 1200 acres of new shallow water habitat have been made available in the Sioux City to Omaha reach that the agencies may consult to modify flows to take advantage of that habitat and more fully meet Corps project purposes. In reviewing recent biological studies of the drifting phase of pallid sturgeon and population assessment sampling in the Missouri River (Platte River to the Kansas River), and sampling within the Platte River itself, the Corps believes that the biological needs of the pallid sturgeon are better met by not only providing habitat in the Sioux City to Omaha reach, but also providing habitat throughout the system.

Biological Benefits of Shallow Water Habitat from Sioux City to the Mouth

Studies focusing on the behavior and migration patterns of the early life stages of sturgeons (pallid and shovelnose) have been conducted as recently as 2003 and have resulted in new information on larval drift.

Immediately following hatching, pallid and shovelnose sturgeon experience a naturally occurring drifting phase. Kynard, Henyey and Horgan (Kynard) utilized both pallid and shovelnose sturgeon during laboratory testing to further understand and quantify the various behaviors during this critical life stage. Laboratory efforts conducted by Kynard indicated that pallid sturgeon fry may drift for up to 13 days post-hatch. Other than a few exceptions, the migration style of pallid and shovelnose sturgeon were similar regarding rate of drift and duration of drift. The pallid fry drifted approximately twice as long as the shovelnose, but at half the rate. Pallids were most active during the day, whereas the shovelnose were most active at night. Strong similarities between the species include the location in the water column used at a given age for each species. Prior to the age of day 7, both species utilized the lower portion of the water column and from the age of day 7 to completion of the drifting phase both species utilized the upper portions of the water column.

In July 2003, a field larval drift experiment was conducted in a secondary channel of the Missouri River in Recovery Priority Management Area #2 (near Culbertson, Montana). Due to the inability to differentiate unmarked pallid sturgeon fry (that would not be recaptured during this experiment) with any potentially naturally reproduced pallid sturgeon, Braaten, Fuller and Brandt (Braaten) utilized shovelnose sturgeon fry to conduct the field drift test. Shovelnose sturgeon fry ranging from 0-2 days of age were utilized on two separate trials within the study area. During each trial, all of the fry were released at point "0" at the head end of a secondary channel with collection locations located at four evenly dispersed sampling sites downstream (0m/Release Site, 100m, 500m, 900m, 1300m). At each site, nets were fished in tandem (top and bottom) and pulled and replaced at 30 second sampling intervals resulting in continuous sampling throughout each trial.

The laboratory studies by Kynard were well supported by the larval field drift study in relation to water column use. Eighty-seven percent of the age 0-2 fry were sampled near the river bottom and there was an increase in use of the lower portion of the water column as the fry moved downstream at each transect. Basic velocity information in river systems yields the slowest velocities near the river's bottom and the swifter velocities near the surface. As a result, the fry drifted at a rate slower than the mean column velocity but similar to the velocity data collected near the bottom of the water column. As previously mentioned, both species tend to utilize the upper portions of the water column after day 7. The drift duration of the pallid sturgeon is approximately twice that of the shovelnose; therefore, there is an increased potential for the pallid sturgeon to drift much greater distances than the shovelnose sturgeon. This statement is supported by the laboratory findings that both species tend to utilize the swifter upper portion of the water column after an age of 7 days.

To estimate larval drift rates based on conservative velocities that may be found in the Missouri River a standard figure of 0.35 m/s (bottom velocity) may be used to approximate drift distance for larvae prior to an age of 7 days. The same philosophy holds true for larvae 7 days and older by using a conservative 0.75 m/s (surface velocity). This assumption is based on Kynard's laboratory studies that these fry utilize these portions of the water column at these given ages. If pallid sturgeon spawned at the base of Gavins Point Dam (which is highly unlikely) and the hatched fry drifted for 8 days, they may travel approximately 310 Km (193 miles). Also utilizing this conservative drift rate with a total drift duration time of 13 days as supported by Kynard's laboratory studies, the fry may drift approximately 633 Km (393 miles). At the minimum drift duration, fry may complete the drifting phase at approximately the Platte River; however, the potential for these fry to drift downstream of Omaha is highly probable even based on these conservative drift rates. Additionally, Kynard references the typical behavior of sturgeon species to migrate downstream in two phases. The first phase being the drifting of the fry and the second phase is an actual downstream swimming migration once these fish become pelagic.

Kynard expanded his laboratory research efforts in 2003 to evaluate behavior of pallid sturgeon fry in relation to depth (water column height). Kynard found that the fry would swim to the water's surface in a 10 foot tube from day 6 through day 9. This current information will significantly increase larval drift rates and distances over the projections used above (Personal Communication, Dr. Boyd Kynard, USGS, January 2004).

In addition to the information related to the larval drift characteristics of the pallid sturgeon, the Nebraska Game and Parks Commission's population assessment sampling in the Missouri River (Platte River to the Kansas River), and the University of Nebraska's sampling within the Platte River itself provides data to support the significance of the Platte River regarding use by pallid sturgeon. If pallid sturgeon are spawning in or near the Platte, the same drift distances as described above would indicate that the benefits of shallow water habitat creation would be most appropriate further downstream to provide the greatest opportunity for naturally reproduced larval pallid sturgeon to drift to during this critical life stage. Shallow water habitat above the Platte River may provide multiple benefits to the river, but would likely provide little benefit to pallid sturgeon regarding their critical drifting phase in the near term.

Natural reproduction has been documented by the Columbia Fishery Resources Office (USFWS) on a couple of occasions in the late 1990's. University of Missouri (Columbia) has also captured and documented naturally reproduced young-of-the-year pallid sturgeon as recently as 2002. Although it is impossible to determine where these fish drifted from, it is highly probable that spawning may be occurring in association with the Platte River.

Although the wild populations of pallid sturgeon are severely depressed, the propagation/population augmentation efforts are intended to replace year classes due to the lack of natural reproduction and recruitment. Currently, standardized stocking sites on the Missouri include Mulberry Bend near Vermillion, South Dakota, Bellevue, Nebraska, and Booneville, Missouri. None of these stocking sites fall within the Sioux City to Omaha reach (although the Bellevue site is in close proximity to this reach). An additional basis for the creation of shallow water habitat further downstream from Omaha is that the habitat should be within the reaches that are being stocked to maximize the opportunity for these juvenile fish to survive and recruit into the population.

Increasing the habitat diversity of the Missouri River to provide the habitat elements for the species to recover hinges on the creation of shallow water habitat. Although in the long-term, shallow water habitat is essential throughout the Missouri River system, the immediate need for this component extends to the lower portion of the river.

There would be tremendous biological benefits to pallid sturgeon and other native fish species by emphasizing the creation of functional shallow water habitat from the Platte River to the mouth of the Missouri River.

Biological benefits associated with the creation of shallow water habitat in the lower Missouri River in addition to the Sioux City to Omaha reach include:

- Maximizing the opportunity for survival and recruitment during this critical life stage by providing shallow water habitats in reaches that larval sturgeon are known to inhabit (based on previous collections).
- Enhancement of invertebrate production in these shallow water habitat areas critical to the survival of early life stages of pallid sturgeon and other native species

- Increasing the abundance of other native fish species (e.g., sicklefin chub, sturgeon chub).
- Increasing the forage species (native fish species) that are believed to be a critical component to pallid sturgeon diet as they transition from an invertebrate feeder to piscivory.

Shallow Water Habitat

Since the issuance of the 2000 Biological Opinion, the Corps has been pursuing creation of shallow water habitat (SWH). The 2000 Biological Opinion did not prioritize river reaches for habitat creation. Therefore, projects were developed throughout the entire reach from Sioux City to the mouth of the Osage River where existing public lands were available and construction could be completed as quickly as possible, and where the Corps' studies estimated a loss in shallow water habitat of 1,200 acres of habitat due to flow management. Prior to the completion of the 2003 Biological Assessment, approximately 1,147 acres of shallow water habitat were developed on the Missouri River in the reach between the Platte River and Osage River. Table 9 of the Amended BiOp estimates available shallow water habitat under the current water control plan. This was the same information used in the 200 Biological Opinion. The 1,147 acres developed since 2000 are not included in Table 9 utilized in the Amended Opinion.

Another 1,045 acres are either already in place or scheduled to be completed by July 2004 with 865 of those acres located in the Sioux City to Omaha reach. The amount of new habitat either currently available, or planned to be available by July 2004, totals 2,192 acres. Table 1 identifies the location and amount of estimated shallow water habitat to be available by July 2004 and July 2005. The Corps is now prioritizing future construction in the Sioux City to Omaha reach.

Table 1. ESTIMATED SHALLOW WATER HABITAT (SWH)

Site	New Acres created by November 2003	New Acres of SWH Online by July 2004	New Acres of SWH Online by July 2005
Missouri River (Sioux City to Omaha)			
Tieville-Middle Decatur Bend	0	465	0
Desoto Bend Lake	0	400	0
Kensler Bend	0	0	50
Glovers Point Bend	0	0	40
Hole-in-the-Rock	0	0	7
Blackbird Bend	0	0	95
Soldier Bend	0	0	20
California Bend	0	0	18
Desoto Bend Dikes	0	0	30
Boyer Bend	0	0	60
Plattsmouth Bend	0	0	40
Subtotal/year	0	865	360
Cumulative	0	865	1225

Missouri River (Platte River to the Mouth)			
Tobacco Bend	55	0	See Note
Upper Hamburg Bend	55	35	See Note
Lower Hamburg bend	0	55	See Note
Kansas Bend	0	0	See Note
Langdon Bend	15	0	See Note
NWK Dike Mods	400	0	See Note
Monkey Mountain	12	0	See Note
Worthwine Island	40	0	See Note
Benedictine Bottoms	20	0	See Note
Fort Leavenworth	20	0	See Note
Weston Bend State Park	10	0	See Note
Kansas City Reach	40	0	See Note
Lisbon – Jameson Island	200	0	See Note
Franklin Island	10	30	See Note
Diana Bend	20	30	See Note
Marion Bottoms	250	30	See Note
Subtotal/year	1147	180	See Note
Cumulative	1147	1347	1347
Missouri River (Sioux City to Mouth)			
Cumulative New Acres	**1147**	**2192**	**2552**

Note: Plans for additional SWH are under development at these sites and others along the BSNP.

Each site differs in the type of work planned, the resulting habitat, and ultimately the biological output, especially for pallid sturgeon. The following paragraphs describe the categories of work that would create shallow water habitat.

- Inside Bend Habitat. These projects consist of modifying existing structures and/or building new structures that will result in diversification of existing aquatic habitat and/or increase the topwidth of the river. In general, projects along public property will both diversify existing habitat and increase the river's topwidth, while projects along private property will only diversify existing habitat. Structure modifications to increase diversity will result in greater depth and velocity distribution within a specific area, however will not necessarily result in additional shallow water habitat. Conversely, structure modifications to increase the river's topwidth will increase the total amount of aquatic habitat available. Most projects with structure modifications increasing the topwidth will diversify the existing and new habitat, resulting in increased amounts of SWH.

- Outside Bend Habitat. Projects and resulting habitat will be similar to inside bend projects except it is likely that the habitat resulting from outside bend projects will have an average depth greater than inside bend projects and will have slightly less

- velocity and depth diversity. In addition outside bend projects will likely have higher average velocities during above average and higher stages.

- Off Channel Chutes. Projects consist of excavating long, fairly narrow channels through the overbank. These projects will result in increased amounts of diverse aquatic habitat defined as SWH. When first constructed, most chutes will be of rather uniform depth and velocity with a mean average depth of between 2' and 6' during normal navigation stages. The chutes will widen and diversify over time as they mature. The end product will increase total available aquatic habitat and SWH acreage.

- Off Channel Backwaters. The work consists of excavating/dredging backwaters in areas that have historically been connected to the river. These projects will reconnect the backwaters to the river, most at the downstream end. Depths generally range from 2-6 feet below the water surface at normal navigation stages. Some areas are designed with deep holes (7-12 feet deep) at intermittent locations in the backwater. The side/beach slopes along the perimeter of the backwaters are vary between 1:2 to 1:10.

The individual projects at each site may contain one or more of the above actions, which would result in different types of habitat. A standardized hierarchical habitat classification system has been developed by a team of Missouri River biologists and scientists to classify the habitats of the riverine segments of the Missouri River from Fort Peck Dam to the mouth near St. Louis. Macrohabitats are broad categories describing the various habitats throughout the river system. All of the shallow water habitat projects fall into four of these macrohabitat types.

- **Main Channel Inside Bend:** The inside bend is the convex side of a river bend.

- **Main Channel Outside Bend:** The outside bend of the river is the concave side of a river bend.

- **Secondary Channel-Connected:** Secondary connected channels are open on both ends and have flowing water but carry less flow than the main channel.

- **Secondary Channel-Non Connected:** Secondary channel non-connected are channels that are blocked at one end.

The diversity of the macrohabitats can be further defined by additional descriptors, mesohabitats. It should be noted that the secondary channel-non-connected are not further broken down into mesohabitats because of the lack of additional diversified habitat features (e.g. flow velocities). This is consistent with the Pallid Sturgeon Population Assessment Protocols. The following describe the different features of these mesohabitats.

- **Bars:** Sand bar/shallow bankline mesohabitats are the terrestrial/aquatic interface area of deposited sediment where water depth is < 1.2 meters.

- **Pools:** Pool mesohabitats are areas immediately downstream from sandbars, dikes, snag-piles or other obstructions that have formed a scour hole > 1.2 meters.

- **Channel border:** The channel border mesohabitat lies along a bankline or a sandbar area between the thalweg and the 1.2 m depth interval in the channelized river.

- **Thalweg:** The deepest part of the main channel between the channel borders conveying the majority of the flow . Thalweg does not apply to the inside bend macrohabitat.

- **Island Tip:** The island tip is the area immediately downstream of a sand bar or island where two channels converge and water depth is > 1.2 meters. Only found in conjunction with secondary channel-connected macrohabitat.

Biological Benefits

The biological benefits associated with the four macrohabitat types described above of shallow water habitat are discussed below.

1. Main Channel Inside Bends: Inside bend modifications provide an increase in the mesohabitats as described above. The widening of the top-width via dike-notching and associated activities increases the erosion along the inside bend shoreline providing:

- Increased habitat available for native chub species believed to be critical to the pallid sturgeon's foraging requirements as they convert from invertebrate feeders to piscivory
    - In 2002, 90% of all of the *Macrohybopsis* species sampled by the Nebraska Game and Parks Commission were collected in the inside bend (Steffensen, 2003).
- access for larval pallid sturgeon and other native species to passively drift into these areas and utilize diverse mesohabitats critical for survival and recruitment
- an increase in the organic matter that enters the river which serves to energize the system via increasing invertebrate production serving as forage for pallid sturgeon juveniles and other native species
- an increase in structure in the river through the erosive processes (e.g., trees, woody debris)
- in-channel bar formation providing areas of refuge from swift velocities and feeding areas (nursery areas) for various life stages of pallid sturgeon and other native fish species
    - In 2003, the Great Plains Fish & Wildlife Management Assistance Office sampled 72 pallid sturgeon (Fort Randall Reach). Of the 46 entered into the database, 11 were sampled in inside bends.

- benefits to the ecosystem

2. **Main Channel Outside Bend:** Modifications to the outside bends will provide similar results as the modifications to the inside bends facilitating an increase in the erosion along the shoreline providing:
   - Increased habitat available for native chub species believed to be critical to the pallid sturgeon's foraging requirements as they convert from invertebrate feeders to piscivory
   - access for larval pallid sturgeon and other native species to passively drift into these areas and utilize diverse mesohabitats critical for survival and recruitment
   - an increase in the organic matter that enters the river which serves to energize the system via increasing invertebrate production serving as forage for pallid sturgeon juveniles and other native species
   - an increase in structure in the river through the erosive processes (e.g., trees, woody debris)
   - in-channel bar formation providing areas of refuge from swift velocities and feeding areas (nursery areas) for various life stages of pallid sturgeon and other native fish species
   - benefits to the ecosystem
     - In 2003, the Great Plains Fish & Wildlife Management Assistance Office sampled 72 pallid sturgeon (Fort Randall Reach). Of the 46 entered into the database, 23 were sampled in outside bend macrohabitats.

3. **Secondary Channel-Connected:** Secondary channels that are connected to the river at both ends provide:
   - Increased habitat available for native chub species believed to be critical to the pallid sturgeon's foraging requirements as they convert from invertebrate feeders to piscivory
     - In 2002, approximately 10% of all of the *Macrohybopsis* species sampled by the Nebraska Game and Parks Commission were collected in the Hamburg chute (Steffensen, 2003)
   - access for larval pallid sturgeon and other native species to passively drift into these areas and utilize diverse mesohabitats critical for survival and recruitment
   - potential spawning areas for native species including the pallid sturgeon
   - an increase in the organic matter that enters the river which serves to energize the system via increasing invertebrate production facilitating foraging
   - an increase in structure in the river through the erosive processes (e.g., trees, woody debris, etc.)
   - connectivity to the floodplain
   - unique mesohabitats that have been identified as areas inhabited by pallid sturgeon (e.g., downstream island tip where the secondary channel discharges back into the main river channel)
     - In 2002, the Columbia Fishery Resources Office sample 12 pallid sturgeon of which 3 were associated with secondary channel-connected (island tips).

- In 2003, one of the three pallid sturgeon sampled by the Nebraska Game and Parks Commission was collected in the upper portion of the Hamburg Chute.
- In 2003, the Great Plains Fish & Wildlife Management Assistance Office sampled 72 pallid sturgeon (Fort Randall Reach). Of the 46 entered into the database, 8 were collected in association with secondary channel-connected (1-island tip, 7-channel border).

- benefits to the ecosystem

4. Secondary Channel-Non Connected: Secondary channels that are connected to the river at only one end (either the top or bottom) provide:

- areas of warmer water serving as nursery areas for young-of-the-year native fishes and (e.g., chubs, minnows) and juvenile pallid sturgeon
- refuge from velocities
- connectivity to the floodplain
- potential spawning areas for native species
- areas of increased organic matter (e.g., leaves) energizing these backwater habitats to provide for increased invertebrate production and foraging areas
- benefits to the ecosystem

Table 2 describes the expected macrohabitat type of SWH for each proposed site.

Table 2. Shallow Water Habitat Development Sites and their Respective Habitat Type

Proposed SWH Site	**Macrohabitat Type (s)**
Kensler's Bend Reach	Inside Bend
Glovers Point Bend	Secondary Channel-Connected & Inside Bend
Hole-in-the-Rock	Secondary Channel-Non Connected
Blackbird Bend	Secondary Channel-Connected & Inside Bend
Tieville-Middle Decatur Bend	Secondary Channel-Non Connected
Soldier Bend	Secondary Channel- Non Connected
California Bend	Inside Bend
Desoto Bend Dike Mod	Inside Bend
Desoto Bend Lake	Secondary Channel-Connected
Boyer Bend	Inside Bend
Plattsmouth Bend	Inside Bend
Tobacco Bend	Inside Bend
Upper Hamburg Bend	Secondary Channel-Connected & Inside Bend
Lower Hamburg Bend	Secondary Channel-Connected & Inside Bend
Kansas Bend	Secondary Channel-Connected & Inside Bend
Langdon Bend	Secondary Channel-Connected & Inside Bend
NWK Dike Modifications	Inside Bend
Monkey Mountain	Outside Bend
Worthwine Island	Inside Bend

Benedictine Bottoms	Secondary Channel-Connected & Inside Bend
Fort Leavenworth	Inside Bend
Weston Bend State Park	Outside Bend
Kansas City Reach	Inside Bend & Outside Bend
Lisbon—Jameson Island	Secondary Channel-Connected & Inside Bend
Franklin Island	Inside Bend & Outside Bend
Diana Bend	Outside Bend
Marion Bottoms	Inside Bend

Conclusions Regarding 2003 Amended BiOp RPA VII.1.b

As stated above, current biological information on larval drift, the importance of the use of the Platte River as a spawning area, and optimizing development of habitat at priority stocking sites indicate that shallow water habitat below the Platte River will benefit the survival and recovery of the pallid sturgeon. Since the 2000 Biological Opinion, approximately 2,192 acres of new shallow water habitat have either been constructed or are scheduled to be in place by July 2004. Of the total amount, 865 acres are located in the Sioux City to Omaha reach. The Corps is now prioritizing next year's efforts for the Sioux City to Omaha reach but will continue to evaluate other opportunities in the lower river.

We therefore believe that the totality of the Corps' habitat creation efforts are applicable to the implementation of the pallid sturgeon RPA in the 2003 Amended BiOp, thus providing for the Corps' operation of the Mainstem Reservoir System for all project purposes including navigation in July 2004.

Conclusions on other elements of 2003 Amended BiOp RPA

Also discussed at the January 26, 2004, meeting were other elements of the 2003 Amended BiOp RPA. The following elements were discussed:

- Pallid Sturgeon RPA VII.1.b. With the Corps implementation of shallow water habitat described above and operation of the system for all project purposes in 2004, the other provision of the element addressing navigation season suspension is no longer applicable.

- Pallid Sturgeon RPA VII.1.d. This part of the RPA discusses utilizing an experimental spring pulse as information is available to establish an acceptable flow management plan and if hydrologic conditions are suitable in 2004 or 2005 to inform the process for establishing a long-term flow plan. The Corps intends to implement a comprehensive pallid sturgeon research program to inform the process for developing the long term flow plan that would include focused research in reaches where there are existing spring pulses from tributaries. Since additional scientific information will be gather in other reaches of the river, an experimental spring pulse from Gavins Point is not anticipated to be implemented in 2004 or 2005.

- Incidental Take Statement for Terns and Plovers. The fledge ratio to be used for interior least terns is 0.94 rather than the 0.70 referenced elsewhere in the 2003 Amended BiOp. The Corps also intends to review the "Contingency Plan for Protection of Least Tern and Piping Plover Nest and Chicks" prior to this season. This should result in the Corps continued operation to move tern and plover nest/eggs to higher elevation on the sandbars in accordance with the protocols in the referenced contingency plan.

2003 Amended BiOp Conservation Recommendation
Fish Passage at Intake Diversion Dam

A Water Diversion Structure at Intake, Montana (Intake Diversion Dam) is located at river mile 71.1 on the Yellowstone River near Glendive, Montana. Under its current operation and function, the diversion dam draws water from the Yellowstone River primarily facilitating irrigation. The existing structure and rock weir inhibit upstream migration of pallid sturgeon and other native species during most of the year. There may also be entrainment issues of native fish including pallid sturgeon in the event that fish are able to migrate above this Intake structure during spawning migrations.

As part of the 2003 Amendment to the 2000 Missouri river Biological Opinion, there is a Conservation Recommendation concerning the Intake Diversion Dam on the Yellowstone River operated by the Bureau of Reclamation. The Conservation Recommendation is that the Department of the Army is encouraged to work with the Department of the Interior to implement existing plans for reconstruction of this facility to include pallid sturgeon passage facilities. Although this is a discretionary action, the Corps is committed to work with the Department of Interior and its respective agencies to assist them in providing for pallid sturgeon passage at this location.

Renovation of this structure to include fish passage (via Obermeyer Weir) would provide multiple benefits to native fish species including the pallid sturgeon. The Cartersville Dam is the next structure on the Yellowstone River that would inhibit fish passage. This structure is located at river mile 237.4; therefore, renovation of the Diversion Dam structure facilitating fish passage would provide an additional 166 miles of river that is rarely available to native fish at the present time. This would benefit the sub-population of pallid sturgeon in this reach that is separate from the sub-population below Gavins Point Dam. Although spawning of pallid sturgeon has been suspected in Yellowstone River below Intake Diversion Dam, it has never been officially documented. If pallid sturgeon are spawning in the lower Yellowstone River (below Intake Diversion Dam), there may not be adequate downstream area to accommodate the larval drift before reaching the headwaters of Lake Sakakawea. The biological benefits with this modification would include:

- Expanded access to portions of the Yellowstone River for pallid sturgeon and other native fish species that are not available under current conditions and may

- provide increased success of spawning and recruitment of native species and the pallid sturgeon.
- Adding 166 available miles of the Yellowstone River would increase the total river availability to native fishes and the pallid sturgeon by approximately 38% within Recovery Priority Management Area #2 (Including the Missouri River).
- Additional length of river that may be an essential component for natural recruitment to occur regarding the larval drift characteristics of the endangered pallid sturgeon, shovelnose sturgeon, paddlefish and many other native species.

Planning and Policy Division

Ms. Robyn Thorson
Regional Director, Great Lakes-Big Rivers Region
U.S. Fish and Wildlife Service
Bishop Henry Whipple Federal Building
1 Federal Drive, Room 630
Fort Snelling, Minnesota 55111-4056

Dear Ms. Thorson:

This letter is a follow-up to our letter of February 13, 2004, and continued discussions between our two agencies in January and February regarding development of new shallow water habitat and implementation of Reasonable and Prudent Alternatives (RPA) III.a and VII.1.b of the U.S. Fish and Wildlife Service's (Service) 2003 Amendment to the 2000 Biological Opinion (BiOp) on the operation of the Missouri River Mainstem Reservoir System (Mainstem System), the operation and maintenance of the Missouri River Bank Stabilization and Navigation Project, and the operation of the Kansas River Reservoir System (2003 Amended BiOp).

The 2003 Amended BiOp RPA VII.1.b. states that when 1200 acres of new shallow water habitat have been made available, our agencies may consult to modify flows to take advantage of that habitat and more fully meet Corps project purposes. We are committed to implement this RPA element by July 1, 2004, to aggressively address biological needs for pallid sturgeon and to avoid interruption in the navigation season. We understand that only shallow water habitat suitable for the various life stages of young pallid sturgeon constructed since November 2003 can be credited toward implementation of RPA VII.1.b. consistent with the environmental baseline in the 2003 Amended BiOp.

The Corps requests technical assistance from the Service regarding sites we have identified in the enclosure to this letter, in order to make certain that the listed projects provide biological benefits for pallid sturgeon. The sites extend from Ponca to the Osage River, an expansion of the reach in the 2003 Amended BiOp (of Sioux City to the Platte) as explained in our February 13 letter. We ask the Service's concurrence in this modification of the river reach for the 1200 acres of shallow water habitat.

Our staffs worked together with the States of Iowa, Kansas, Missouri and Nebraska to identify sites for development of new shallow water habitat from Ponca to the Osage River. Jointly, we have identified a range of acres for each project that add up to a minimum of 1200 acres of new shallow water habitat that could be constructed between now and July 1, 2004. A foremost tool to construct this habitat is an aggressive program of notching of wing dikes, pursuant to technical assistance from the Service indicating the value of this approach. Notching wing dikes with different notch sizes and depths will make a broad range of new habitat immediately available to pallid sturgeon and other riverine species over a range of flows. The notched wing dikes, located throughout the river, will make the resulting habitat available to young fish that have hatched at different locations with varying larval drift distances. The enclosed document lists sites identified to date and their expected biological responses. This list may expand as we identify additional sites for development before July 1 or for our ongoing effort for shallow water habitat creation, restoration and development, and we will continue to work closely with you on the list and priorities. We have reprogrammed our fiscal year 2004 appropriations to construct this new shallow water habitat as well as to provide for other measures identified in the 2003 Amended BiOp. Please verify that the projects listed in the enclosure address the requirements of RPA VII.1.b.

We appreciate the Service's agreement to assist the Corps to achieve our goal of providing the habitat identified in RPA VII.1.b. This will enable the Corps and Service to consult on the operation of the Mainstem System and provide for all congressionally authorized purposes this summer. We appreciate your reply by March 4, 2004, so that the Corps' plans for pallid sturgeon habitat development can proceed immediately and succeed by July 1, 2004.

As we implement the conditions of the 2003 Amended BiOp, it is important that we continue to seek the input of basin states, tribes and stakeholders. An example of the benefits of this coordination is our joint discussions this last week with the states, where the Corps and the Service identified additional sites available for development of shallow water habitat this year. I believe that this cooperative approach optimizes our shared capabilities to help the survival and recovery of the pallid sturgeon, interior least tern and piping plover. Should you or your staff have any questions or need any additional information, please do not hesitate to contact me, or Mr. David Ponganis of my staff.

Sincerely,

William T. Grisoli
Brigadier General, U.S. Army
Division Engineer

Enclosure

ENCLOSURE
BIOLOGICAL AND ENGINEERING INFORMATION
2003 AMENDMENT TO THE MISSOURI RIVER 2000 BIOLOGICAL OPINION

The 2003 Amended BiOp RPA VII.1.b indicates that when 1,200 acres of new shallow water habitat have been made available that the agencies may consult to modify flows to take advantage of that habitat and more fully meet Corps project purposes. The information below provides site-specific information on the proposed development of over 1,200 acres of new shallow water habitat. Based on biological information in the Corps letter of February 13, 2004, and subsequent discussions, it is the Corps understanding that the U.S. Fish and Wildlife Service (Service) concurs that providing habitat in the Ponca to Osage River reach of the Missouri River is biologically warranted for implementing RPA VII.1.b.

Shallow Water Habitat

Based on recent discussions with the States of Iowa, Kansas, Missouri and Nebraska, the Corps and the Service have jointly identified approximately 1,235 to 1,914 acres of new shallow water habitat (SWH) to be constructed from November 2003 to July 1, 2004. Table 1 identifies the location and range of estimated shallow water habitat to be available by July 1, 2004.

Site	New Acres of SWH Online between November 2003 to July 1, 2004
Ponca	40-80
Winnebago/Snyder	20-25
Tieville-Middle Decatur Bend	10-308
Soldier Bend	20-25
Tyson Bend	20-25
Desoto Bend Dikes	25-30
Tobacco Bend	15-20
Upper Hamburg Bend	35-40
Lower Hamburg Bend	50-55
Langdon Bend	15-18
Deroin Bend	25-30
Rush Bottoms	5
NWO Dike Notching	120-145
NWK Dike Notching	300-400
Bob Brown	5
Monkey Mountain	40-60
Worthwine Island	32-48
French Bottoms	5
Benedictine Bottoms	40-60
Fort Leavenworth	28-35
Weston Bend State Park	30-40

Kansas City Reach	100
Liberty Bend	20-30
Baltimore Bend	20
Grand Pass	20-30
Lisbon – Jameson Island	40-60
Franklin Island	25-35
Diana Bend	25-35
Overton Bottoms South	20
Eagle Bluffs	50-80
Marion Bottoms	25-35
Smokey Waters	10
TOTAL	**1235-1914**

Each site differs in the type of work planned, the resulting habitat, and ultimately the biological output, especially for pallid sturgeon. A variety of biological benefits will be provided as a result of the Corps shallow water habitat development resulting from dike notching efforts. Top-width widening in conjunction with inside bend macrohabitats will provide diversity in both depth and velocity at various river stages as well as facilitate the natural erosive processes along the river's banks increasing the amount of sediment, organic matter and woody debris available to the river. Varying notch sizes (depending upon the availability of land) will provide diversified habitat downstream of each notch.

Each dike notch will result in the formation of a variety of mesohabitats within the inside bend. A scour hole or pool will be created providing a range of both depth and velocities available to pallid sturgeon at various life stages. The channel border area will become more diversified resulting in a mosaic of depths and velocities. The minimal existing bar habitat (<1.2 meters) will be increased along with a range of velocities and intermixing of sediments through the erosive processes. The combination of these habitats provides a variety of available habitat for young-of-the-year, juvenile and adult pallid sturgeon.

The flow through the notches provides benefits in flushing the adjacent area by maintain clean sand substrates typically utilized by pallid sturgeon. Strategically placed notches adjacent to islands can be utilized to improve flows and fish movement in existing secondary connected channels that currently lack adequate flows. These efforts will help restore much of the dynamic processes to the river that have been lacking from the channelized river. Active sediment transport, formation of submerged sand bar (dune), depth and velocities that mimic the historical river will result from the notching efforts providing diversity beneficial for the pallid sturgeon and native fish community.

Further detailed information on other types of work and resulting biological output was provided in the Corps' letter to the Service dated February 13, 2004.

Table 2 describes the expected macrohabitat type of SWH for each proposed site.

Table 2. Shallow Water Habitat Development Sites and their Respective Habitat Type	
Proposed SWH Site	**Macrohabitat Type (s)**
Ponca	Inside Bend
Winnabago/Synder	Inside Bend
Tieville-Middle Decatur Bend	Secondary Channel-Non Connected
Soldier Bend	Secondary Channel- Non Connected
Tyson Bend	Secondary Channel- Non Connected
Desoto Bend Dike Mod	Inside Bend
Tobacco Bend	Inside Bend
Upper Hamburg Bend	Secondary Channel-Connected & Inside Bend
Lower Hamburg Bend	Secondary Channel-Connected & Inside Bend
Langdon Bend	Secondary Channel-Connected & Inside Bend
Deroin Bend	Inside Bend
Rush Bottoms	Inside Bend
NWO Dike Modifications	Inside Bend & Outside Bend
NWK Dike Modifications	Inside Bend & Outside Bend
Bob Brown	Inside Bend
Monkey Mountain	Outside Bend
Worthwine Island	Inside Bend
French Bottoms	Outside Bend
Benedictine Bottoms	Secondary Channel-Connected & Inside Bend
Fort Leavenworth	Inside Bend
Weston Bend State Park	Outside Bend
Kansas City Reach	Inside Bend & Outside Bend
Liberty Bend	Outside Bend
Baltimore Bend	Inside & Outside Bend
Grand Pass	Inside & Outside Bend
Lisbon—Jameson Island	Secondary Channel-Connected & Inside Bend
Franklin Island	Inside Bend & Outside Bend
Diana Bend	Outside Bend
Overton South	Inside Bend & Secondary Channel- Connected
Eagle Bluffs	Inside Bend
Marion Bottoms	Inside Bend
Smokey Waters	Inside Bend

FWS/RD

March 5, 2004

Brig. General William T. Grisoli
Corps of Engineers
Northwestern Division
P.O. Box 2870
Portland, Oregon 97208-2870

Dear General Grisoli:

The U.S. Fish and Wildlife Service (Service) has received your letters of February 13 and March 2, 2004, regarding development of new shallow water habitat and implementation of Reasonable and Prudent Alternatives (RPA) elements III.a. and VII.1.b. of the Service's 2003 Amendment to the 2000 Biological Opinion on the Operation of the Missouri River Mainstem Reservoir System, the Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project and the Operation of the Kansas River Reservoir System. Your letters reflect the continued discussions between our agencies in January, February and this week.

Your letter correctly cites the 2003 Biological Opinion RPA element VII.1.b., that states that when 1200 acres of shallow water habitat have been made available, our agencies may consult to modify flows to take advantage of that habitat and more fully meet Corps' project purposes. On January 26, 2004, the Service and the Corps met in Omaha, Nebraska to discuss the Corps' commitment to implement this RPA element by July 1, 2004. This schedule is the prerogative of the Corps. The Service supports this decision because aggressive implementation of RPA element VII.1.b. and acceleration of shallow water habitat development both address an immediate need for survival and recovery of the pallid sturgeon. The Service will continue to provide technical assistance and cooperation to help this effort succeed, in addition to assistance to address all aspects of the 2000 Biological Opinion and 2003 Amended Biological Opinion.

As discussed in Omaha and reflected in your letter of February 13, 2004, the Corps has provided new information to support a request that RPA element VII.1.b. be applied from Ponca State Park to the mouth of the Osage River, and not be limited to the Sioux City to Platte River reach identified in the 2003 Amended Biological Opinion. We evaluated this request and we concur. Comments supporting our concurrence are in the enclosure. This concurrence will change our Amended Biological Opinion, and the appropriate process for change is reinitiation of consultation. Therefore, the Service will provide full documentation supporting our concurrence in mid-June when the Corps reinitiates consultation in association with a request for flow modification. The amendment at that time will be consistent with this concurrence.

The projects listed in your letter of March 2, 2004, reflect work by the Corps, the Service, and state partners to identify potential sites generally suitable for the purpose of implementing RPA element VII.1.b. The list of projects can change as new information becomes available, additional opportunities arise, or circumstances change, and we agree to work with you and partners to continue identifying habitat project sites and revising the list of potential projects. It is our opinion that the list in the attachment to your March 2, 2004, letter identifies a sufficient number of sites that could satisfy RPA element VII.1.b. by July 1, 2004.

The Service will work with the Corps to evaluate progress and acreage for each habitat project as it is accomplished; consultation for a flow change will take into account the accumulated habitat modifications and their biological support for a flow proposal. Habitat projects should be constructed at elevations for the summer flow level that you will be proposing, to ensure habitat will be available to young pallid sturgeon as required in RPA element VII.1.b.

In addition to the immediate gain in habitat for pallid sturgeon, the Service also supports aggressive habitat development by the Corps to address RPA element VII.1.b. because it provides an outstanding opportunity to implement adaptive management, as required in the 2003 Amended Biological Opinion. For example, the substantial number of dike notchings in the coming months provides an opportunity to evaluate aspects of these habitat modification measures. The Service recommends that the Corps use research and monitoring resources identified for 2004 to help inform and improve subsequent habitat development. We encourage the Corps to work with the Service, states, tribes and the U.S. Geological Survey to direct biological monitoring to these locations.

Along with the efforts of Corps and Service staff to address implementation, I particularly appreciate the expertise and energy contributed by the states of Iowa, Nebraska, Kansas and Missouri to help identify projects for shallow water habitat development. The U.S. Department of Agriculture, Natural Resource Conservation Service (NRCS), has also joined this effort, providing an opportunity for private landowners to join local, state and federal governments in conservation along the Missouri River. Our thanks to these partners is profound, and the Service joins the Corps in the commitment to maintenance of these relationships and responsiveness to partner concerns as we move forward with implementation.

Our focus in the past two months has been identification of shallow water habitat projects in order to address RPA element VII.1.b., and there has been significant progress toward the Corps' goal of implementation of this element by July 1. We are also committed to providing technical assistance to the Corps to address all the other elements of the RPA, and reasonable and prudent measures for birds. Implementation of the 2003 Amended Biological Opinion is a goal we can jointly address, and we lend our full cooperation to that effort.

Sincerely

/s/

Robyn Thorson
Regional Director

Enclosure

Enclosure

U.S. Fish and Wildlife Service
2000 Biological Opinion and 2003 Amended Biological Opinion
Missouri River

Technical Assistance, Corrections and Changes
March 5, 2004

The following information is provided in association with the 2000 Biological Opinion and 2003 Amended Biological Opinion. Technical assistance is provided to help the Corps with implementation of the Opinions. Changes and corrections to the 2003 Amended Biological Opinion are noted, and these constitute official modifications that will be finalized when the Service and Corps enter into formal consultation on proposed changes in flows.

<u>Shallow Water Habitat Project Characteristics (technical assistance)</u>
The Service e-mailed guidance to the Corps on February 13, 2004, to assist engineers and biologists working together to identify habitat projects. This guidance was targeted at restoration of cutoff channel areas, and the information is reiterated here as technical assistance to the Corps:

Restoration of cutoff channel habitats for shallow water classification needs to incorporate an active bed transport that functions much like secondary or main channels, that is sustainable over the long term. Flows need to be sufficient to create a mosaic of shallow, submerged sand bar (sand dune) habitats that mimic the historical frequency distribution of depths and velocities. These shallow sandbar habits that are closely associated with a thalweg are typically where pallid sturgeon juveniles and young of the year shovelnose sturgeon are found. These habitats provide the fish access to the variety of depths and flows dependant on activity and life stage. Connectivity with the main channel needs to be maintained in order to allow movement of fish among these habitats under a variety of flow conditions, seasons and species' needs over all life stages.

Pallid sturgeon prefers areas where flows converge (e.g., main channel and side channel, island tips, tributary mouths). Ideally, habitat should be available over a wide range of flows. An area may provide more than one type of habitat for various life stages as the depths and velocities in that area change in response to river discharge. Thus variable river flow is as large a factor in abundance, location, and longevity of suitable habitat as the geomorphology that underlies it.

Preferred shallow water habitats should be in channel with the above mentioned characteristics.

Existing examples of secondary channels that have experienced success are the Lisbon Bottoms prior to modification in 2000 and Hamburg Bend. There is both biological and physical information from those areas, as well as some historic *geomorphic data on DeSoto Bend (as the river), to explore potential future pallid sturgeon habitat restoration opportunities in that area. While feasible, such efforts would require considerable technical coordination, modeling, monitoring and assessment to adequately implement a project.*

Modeling to help inform the design process and describe project outputs is critical.

The list of projects in the attachment to the March 2, 2004 letter from the Corps includes a substantial amount of dike modification work; the Service strongly supports these projects. The Service e-mailed the Corps on March 1, 2004, with information on the benefits of dike modifications, and that information is reiterated here as technical assistance to the Corps:

The Service supports notching as an effective tool to contribute to pallid sturgeon habitat in the main channel of the river by diversifying aquatic habitat downstream of the notches. Based on discussions with the Corps regarding their most recent proposal, notches would be between 50' and 75' wide with a minimum depth of - 4' CRP. The size of the notch would depend, to a large extent, on adjacent land ownership (i.e., larger more landward notches on public lands). The results would depend on the specific location and size, but in general notches would develop a scour downstream and an associated shoal or shallower area downstream of that. The notches would also favorably modify velocities in the area around the notches. Notches in L-dikes can help flush the surrounding area, maintaining clean sand substrates. Notches in dikes at the ends of islands can improve flows and fish movement to the existing side channels.

The Service's Fisheries Management Office in Columbia, Missouri, (CMFRO) has documented sturgeon associated with various types of notches and believe the notches improve habitat for a number of native river species. While the true value of larger notches will likely be realized with higher flows, notches can begin responding immediately, and a variety of notch sizes and depths should help take advantage of varying habitat over a range of flows. Located throughout the lower river, the resulting habitat would also be available to young fish that hatched at different locations, and experienced varying larval drift distances. Modifications of these dikes can be accomplished this winter and spring and meet the Corps' goal of 1200 new acres of shallow water habitat available to sturgeon by July 1, 2004.

<u>Shallow Water Habitat Project List (technical assistance)</u>
The projects listed by the Corps in the attachment to the March 2, 2004, letter identify potential sites generally suitable for the purpose of implementing RPA element VII.1.b. The Service does not consider this list as exclusive, because new projects can be identified as partners continue to work with the Corps and the Service to address habitat needs for pallid sturgeon survival and recovery. There are a few projects on the list that may prove to be infeasible in 2004 (due to ownership issues, intended uses, required processes, logistics, or other obstacles) but would be viable in future years as ongoing habitat development requirements (from the 2000 Biological Opinion) are addressed.

<u>Reach of River for Shallow Water Habitat Projects (future amendment)</u>

In a meeting with the Corps in Omaha, Nebraska, on January 26, 2004 the Service agreed to evaluate information regarding the Corps' request to extend the geographic scope for implementing RPA element VII.1.b. The RPA had identified the river reach from Sioux City to Omaha as the exclusive area for developing 1200 acres of shallow water habitat available to sturgeon. The letter from the Corps to the Service dated February 13, 2004, requested extending that from Sioux City to the mouth of the Missouri River, but immediately thereafter the Corps modified the request, shortening it to include only the river reaches from just above Sioux City (Ponca State Park) to the confluence with the Osage River. This request is documented in the Corps' letter of March 2, 2004.

The Service evaluated the materials from the Corps' February 13 letter, along with our administrative record and with the new information about the Corps' commitment to an accelerated pace for accomplishing the 1200 acres of habitat development. The Corps also proposed to continue to focus priority in the Sioux City to Omaha reach in 2005. Based on this evaluation, as documented below, it is the opinion of the Service that there is sufficient justification to modify RPA element VII.1.b. to include the Missouri River reaches from Ponca State Park to the mouth of the Osage River.

The Corps analysis conducted for the 2001 Revised Draft EIS for the Master Water Control Manual indicated that approximately 1200 acres of habitat would be lost in the Sioux City to the Osage River reach of the river by not implementing the summer low flow RPA element of the 2000 Biological Opinion. The Corps proposed to create this 1200 acres of habitat through mechanical means instead of through flow manipulation. The Service utilized this analysis, in part, to establish the 1,200 acre requirement in RPA element VII.1.b. The Service did not object to mechanically creating the habitat because habitat is a limiting factor for sturgeon. In formulating the RPAs the Service concluded that mechanically created habitat should be accomplished where pallid sturgeon shallow water habitat is least available.

Larval drift is imprecise but an important factor in considering habitat development priority areas. Information provided indicates that larval and post-larval fish exhibit different drifting and migration strategies. Once larval fish "fall out" of the stream flow and their yolk sac has been absorbed they must be in suitable habitat that provides food and shelter immediately. As larval fish transition into a post-larval stage they may likely move or be transported further to different areas. Without suitable habitat, there is no recruitment into the population. Since larvae and post-larval fish will have a wide distribution, making habitat available where it currently does not exist and providing a wide distribution of potential habitat is a biologically appropriate strategy.

The next issue is location of that habitat. The available science and recent developments related to pallid sturgeon larval drift indicates the need to have larval/juvenile habitat distributed throughout the river in order to take advantage of spawning events. Recent research below Fort Peck Dam confirm the fact that pallid sturgeon exhibit a drifting behavior geared toward distributing individuals throughout the river system. Thus, when spawning occurs below Gavin's Point Dam, studies suggest that larvae would eventually be distributed throughout the lower river from the dam to the mouth. In two reaches of the river below Gavin's Point Dam, a critical mass of diverse aquatic habitat already exists (Gavin's Point to Ponca State Park, and the Osage River to the mouth). In between Ponca and the Osage there is evidence of spawning upstream, but these river miles provide limited or no suitable habitat for larval fish. That is why these reaches are the target for habitat development.

The reaches above the Platte (Ponca to Omaha) and below the Platte (Omaha to the Osage) are both valuable for pallid sturgeon. The reach above the Platte was identified as the highest priority area for habitat projects because it has the least suitable habitat for pallid sturgeon at this time, and developing it would provide another significant additional larval and juvenile habitat area (by making it available to young pallid sturgeon). The Platte River is suspected to provide pallid sturgeon spawning areas. Therefore, areas below the Platte are essential for habitat development based on the likelihood of use and benefit. But biologically the reaches above and below the Platte are comparable, and in the interest of establishing as much usable habitat as possible where there is high potential for use, both areas merit emphasis

When the 2003 Amended Biological Opinion was written, the Service did not anticipate that the Corps would implement RPA element VII.1.b. within six months of the issuance of that Opinion. This accelerated pace for implementation is advantageous for addressing habitat needs for pallid sturgeon because of the dire status of the sturgeon population, and limiting that to Sioux City to Omaha is no longer prudent. We continue to emphasize the value of the reach above the Platte River for long-term survival of the species, but given the short-term habitat accomplishments planned by the Corps before this summer, the larger reach (Ponca to Osage) affords higher potential for short-term benefits to the sturgeon, without undermining long-term benefits.

In examining this matter, the Service has utilized the same data that we used in formulating the 2003 Amended Biological Opinion. We are in agreement with the Corps to modify the geographic reach of river for habitat development in RPA element VII.1.b. As discussed earlier, when the Corps proposes a change in operational flow for this summer based on the biological relationship between the flow and the habitat that has been developed, we will formally consult and formalize this modification to the 2003 Amended Biological Opinion, consistent with this conclusion, by mid-June.

<u>Adaptive Management (technical assistance)</u>
As noted in the 2003 Biological Assessment provided by the Corps in November, adaptive management is an essential part of the Corps' approach to conservation responsibilities. The Service believes that the Corps' habitat restoration program this year will yield substantial biological benefits, along with new information and questions. The Service is prepared to assist the Corps in developing hypotheses to be tested through an adaptive management framework. We recommend that the Corps meet with the Service and U.S. Geological Survey as soon as practicable to identify research resources for monitoring and evaluating this new habitat. New information can be used to inform and support subsequent decisions.

Spring experimental pulse (clarification)

In the 2003 Amended Biological Opinion the Service stated that a spring pulse is not required in 2004 or 2005; we encouraged the Corps to conduct an experimental spring pulse as part of adaptive management. This experiment could yield biological information valuable to other flow management plan processes outlined in other elements of the RPA. A controlled test could help inform the Corps and stakeholders of issues (if any) that need to be specifically addressed, and a test could beneficially assist in conditioning habitat for the listed birds and the sturgeon. This is not a requirement, and although monitoring and evaluative protocols are not likely to be ready for 2004, we encourage consideration of the benefits of implementing an experimental spring pulse in 2005 as an adaptive management measure.

Fledge Ratio (correction)

The Incidental Take Statement for the least tern has two anticipated levels of incidental take. One level deals with anticipated take resulting from flooding of nests - the anticipated level is 60 eggs per year or no more than 180 over 3 consecutive years. The other level in the 2003 Amended Biological Opinion is associated with incidental take other than flooding that is influenced by (but not directly attributable to) Corps operations. It was determined that the best index to measure this level of anticipated take was a fledge ratio. Using data from the past 10 years of tern monitoring by the Corps yields the average fledge ratio. A fledge ratio of 0.94 chicks per pair over a 5 year running average is the threshold for this form of incidental take.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Bishop Henry Whipple Federal Building
1 Federal Drive
Fort Snelling, MN 55111-4056

IN REPLY REFER TO:
FWS/AES

May 13, 2004

Ms. Karen Durham-Aguilera
Northwestern Division
U.S. Army Corps of Engineers
P.O. Box 2870
Portland, Oregon 97208-2870

Dear Ms. Durham-Aguilera:

This letter is a follow-up to our agencies' April 20, 2004, meeting in our Regional Office in Fort Snelling, Minnesota, to discuss progress on shallow-water habitat development pursuant to the 2003 Amended Biological Opinion (BO) on Missouri River operations. As our agencies continue to collaborate on implementation of the BO, periodic meetings are serving an important role in information exchange, agency understanding, and future direction. As a result of the April 20th meeting, the Corps of Engineers (Corps) agreed to provide the Fish and Wildlife Service (Service) with information on three key dates: an outline of the proposed shallow water habitat development projects by May 1, 2004, preliminary information on the Corps' progress in creating shallow-water habitat that meets the criteria for pallid sturgeon use by May 17, 2004, and a final report by June 7, 2004. This final report will contain the information/rationale the Service will rely on to evaluate the effects of recent shallow water habitat construction efforts towards the 1,200-acre goal in RPAVII.1(b) of the BO. Pursuant to this portion of the RPA, if the Corps constructs approximately 1,200 acres of suitable, available pallid sturgeon habitat that meets the BO criteria, the Service would use this information to consider any proposal that the Corps may make to implement alternative summer flows greater than 25,000 cubic feet per second from Gavins Point Dam.

During the April 20th meeting, our agencies outlined the process for monitoring and evaluating sites, exchange of information, and evaluation of compliance with the BO.

Our agencies agreed to two physical habitat monitoring approaches that would be used by the Corps' Omaha and Kansas City Districts, respectively, for this summer's habitat construction work. We were encouraged to hear from the Corps that the weather has not affected the construction schedule. Of immediate interest is the review of your data related to the physical habitat monitoring that has been or will be conducted; however, we are also looking forward to reviewing your outline for future biological monitoring of these sites.

Received May-13-04 01:10pm From-612 713 5292 To-CENWD-CM Page 002

Ms. Karen Durham-Aguilera

To ensure the most efficient coordination process possible, we are reiterating the type of information the Service needs to conduct its evaluation. The final report due to the Service no later than June 7, 2004, should include all of the items discussed during the April 20th meeting:

1.) Specific information for each shallow water habitat construction location, including: the type of construction; pre- and post-construction monitoring information, if surveyed, and any underlying assumptions (e.g., based on monitoring of other areas or mutually agreed upon historical information) of acreage estimates if a particular site was not surveyed; and an estimate of the range of shallow water acres created. As a reminder, the two agencies have agreed that the initial acreages identified in the Corps' letter to the Service dated February 13, 2004, were estimates based on existing survey information and reconnaissance level investigations.

2.) Project-related changes (i.e., increases or decreases) in shallow water acres as defined by the criteria set forth in the BO and Regional Director Robyn Thorson's March 5, 2004, letter, that will be available to pallid sturgeon for flow levels at which the Corps proposes to operate Gavins Point Dam during the month of July.

3.) Detailed information on the physical monitoring plan, including: number of construction sites monitored; the list of all assumptions related to sampling methods, water elevations or river stages, and post-processing of survey data; and assumptions regarding the applicability of this data to unmonitored sites.

4.) Any additional information/expectations of project performance over the near-term, or long-term considerations that will affect habitat value/availability.

5.) Proposed biological monitoring plan(s) for these sites.

Both our agencies' representatives agreed at the April 20th meeting that this information is critical to adequately evaluate our efforts as we move forward with long-term ecological restoration in the lower Missouri River. It is especially important for the Corps to provide the type and quality of information that was agreed to, by the dates agreed to, so that the Service is able to conduct its evaluation and provide you with our responses.

The Service expects the Corps' analysis to be of sufficient breadth to determine: 1) whether the habitat constructed by the Corps will benefit pallid sturgeon as contemplated in our BO and, 2) whether, in the light of these benefits, any proposed changes to the summer flow regime affect the viability of the RPA. The information you provide will be a supplement to your earlier Biological Assessment (and associated data submittals) and may have the practical effect of reinitiating consultation pursuant to 50 CFR 402.16. Accordingly, the Service may use your data submittal to modify, amend, and/or supplement our BO, as appropriate.

Received May-13-04 01:18pm From-612 713 5292 To-CENWD-CM Page 003

Thank you for the participation of Corps staff members at the meeting and for their excellent assistance in helping us with the design of potential monitoring approaches for these recent construction efforts. If you have any questions or concerns regarding this letter, please do not hesitate to call.

Sincerely,

Lynn M. Lewis

for Charles M. Wooley
Deputy Regional Director
Region 3, Fort Snelling, MN

Lynn M. Lewis

for Mary Henry
Assistant Regional Director
Ecological Services
Region 6, Lakewood, CO

Received May-18-04 01:18pm From-612 713 5292 To-CENWD-CM Page 004

APPENDIX C

SITUATION REPORTS

SIT-REP
Biological Opinion Missouri River
Weeks
March 22 – 26, 2004
and
March 29 – April 03, 2004

Funding:
April reprogramming was completed with funds received on April 2. For April work NWK total was $3.5M and NWO total was $5.3M. Mike George is preparing a justification showing committed funds in addition to expenditures and obligations.

Enhanced Shallow Water Habitat:

NWK
1. Dike notching: Contractor has 70 notches excavated. River stages are currently ideal for this type of work. However, without additional rain in the next week, stages will drop, which could slow progress.

2. 13 Site-Specific Projects:

a. Two sites scheduled to be constructed by FO-MO. The first site has been under construction for a few months the second site will be constructed after the first.

b. Four sites will be constructed under an Omaha MATOC. RFP'S went out yesterday with bid opening scheduled for April 7.

c. Seven sites will be constructed under the existing river contract (Ellis). Site designs are complete, site visits by contractor have been conducted. Bid opening is April 9.

d. The plan is to have NTP for MATOC and Ellis on April 15.

e. NEPA documentation will be completed April 14.

3. Potential impediments to implementing NWK program: a. Contract prices come back more than 125% of government estimate. b. Division must have sufficient funds to cover the contract prices.

4. This work is estimated to result in 830 to 940 acres of SWH.

NWO
Design Work complete for notching, major dike modifications and dredging. NEPA compliance/Section 10/404 is complete for the dike notching and dike mod work. RFPs have been sent to the contractors for the dike mods and dredging, with a target award date

of 15 April for the dike mods and 1 May for the dredging. The Hired labor is proceeding with the notching plan and is completing 3-4 notches per day. The Ponca project was awarded on April 2. This may be problematic, see below.

SWH Monitoring/Verification:

1. The following Corps/FWS inspection schedule has been arranged. An additional inspection will be scheduled in June.

13, 14 and 15 April. Mike Chapman will lead an inspection of selected construction sites within the KCD. JoAnne Grady will represent the FWS. Other team members for both agencies may be included, but the intent is to have a very small group that can travel on either a small boat or by vehicle from site to site.

20 and 21 April. The Corps will conduct an aerial inspection of the Missouri River from Gavins Point Dam to the Mouth. Future aerial inspections will be problematic as there are no common DA/DOI approved vendors. This leaves only the National Guard as a common carrier, and the ability for the NG to support this work is limited at this time. A second aerial inspection will be scheduled in July after the work is done. This inspection will include a digital video record.

27 and 28 April. John Remus will lead an inspection of selected construction sites in the Omaha District. Steve Lydick will represent the FWS. Other team members for both agencies may be included, but the intent is to have a very small group that can travel on either a small boat or by vehicle from site to site.

18 and 19 May John Remus will lead an inspection of selected construction sites in the Omaha District. Steve Lydick will represent the FWS. The itinerary for this trip will be developed by the John Remus and Steve Lydick.

26, 27 and 28 May. Mike Chapman will lead an inspection of selected construction sites in the KCD. JoAnne Grady will represent the FWS. The inspection will follow the Missouri River Natural Resources Conference. The itinerary for this trip will be developed by the Mike Chapman and JoAnne Grady.

2. A draft survey plan was for the modification sites upstream of Rulo was sent to the FWS. The final details for this plan were agreed to by Corps/FWS staff during a conference call in April 1st. John Remus will revise the plan accordingly and redistribute to the team. Mike Chapman will provide a draft plan for the sites below Rulo, and the FWS and the Corps will refine the process on a future conference call.

Issues:

1. The field staff at the FWS have some concerns about the backwater projects at Ponca, Soldier Bend and Tyson Bend. They have promised an official response

by 2 April. The concern are the lack of alluvial processes and river access. This issue is being worked by Dave Ponganis.

Pallid Sturgeon Augmentation Support

Nothing new to report.

Comprehensive Pallid Sturgeon USGS Research Proposal

Nothing new to report.

Emergent Sandbar Habitat

On 22-23 March Fort Randall project personnel conducted several experimental vegetation removal processes utilizing mechanical means. Vegetation removal was conducted on 8-10 acres of a sandbar at river mile 866.6. A post project monitoring program has been established to track success/failures of the methodology used. An after action report will be prepared.

Planning continues to work on the Programmatic EA as well as the site specific EA for the three islands below Gavins Point and the five islands below Fort Randall. Engineering Division designers and T&E Section habitat analysts are scheduling site visits for below Garrison and Fort Randall reaches for April so design can begin on projects in these reaches.

A meeting was held on Thursday, 01 April with the National Park Service (NPS) regarding construction methods of the Ponca project and the possible need for additional Section 7 consultation of their Wild and Scenic Rivers Act (WSRA). The construction contractor in his bid package will not start dredging before May 1. This will be after the river stage is up and the contractor does not anticipate needing to dredge a channel to get to the site. This allayed the NPS concerns and our Section 7 certification is still valid.

Missouri River Recovery Implementation Program (MRRIP)

MRRIP Interagency meeting was held in Denver on March 31 with 22 participants. More info concerning outputs from this meeting will be coming from the contract facilitator. Mary Roth is p.o.c. on this action.

SIT-REP
Biological Opinion Missouri River

April 5 - 9, 2004

Funding:
Enclosed is the spread sheet showing SWH acreages and estimated costs and awards. Agenda and itinerary for the HQ RIT site inspection is completed and is being provided to the participants.

Enhanced Shallow Water Habitat:

NWD
Dave Ponganis is working with Charlie Wooley, FWS, to develop the acreage verification process with a meeting scheduled next week with key COE and FWS personnel to finalize the process.

FWS and COE In-Progress Review is set for April 20 in Minneapolis.

NWK
1. Dike notching: By the end of today, contractor will have 125 notches excavated. River stages are slightly below ideal for this type of work. Without additional rain in the next week, stages will drop which might slow progress.

2. 13 Site-Specific Projects:

a. Two sites scheduled to be constructed by in-house labor force (FO-MO). The first site has been under construction for a few months the second site will be constructed after the first is complete.

b. Four sites will be constructed under an Omaha MATOC. Bids were due April 7. Low bid is $932,000 which is below GE. Award and NTP are expected next week.

c. Seven sites will be constructed under the existing river contract (Ellis). Site designs are complete, site visits by contractor have been conducted. Contractor has submitted bid and negotiations are scheduled for Monday. Also expect award and NTP next week.

3. NEPA documentation will be completed April 14.

4. This work is estimated to result in 830 to 940 acres of SWH.

NWO
The Task Order for River Control Structures was awarded under the MATOC on April 9 (one week ahead of schedule) for $1,022,500. This is considerably under the initial

government estimates but cost over-runs are anticipated due to the quantity estimates not being as refined in the specifications as normal. This was due to the short suspense on getting these contracts awarded. This for work at: Winnebago/Syder; Desoto Bend Dikes; Boyer Bend; Tobacco Bend; Langdon Bend; and Deroin Bend and represents 125 – 153 acres of in-channel SWH.

The NWO work effort is estimated to result in 440 to 856 acres of SWH (of the higher number, 308 acres is unlikely unless FWS and COE agree on acreages at Tieville-Middle Decatur Bend) .

Pallid Sturgeon Augmentation Support

Missouri Dept. of Conservation/Blind Pony Hatchery contract $2.03M is ready and expecting an April 23 award.

Comprehensive Pallid Sturgeon USGS Research Proposal

A workshop with pallid sturgeon experts to identify critical elements for sturgeon survival and recovery and what role management action have on those elements is in the planning stages. Workshop attendees have been invited. The William D. Ruckelshous institute at the University if Wyoming will facilitate the workshop.

USGS is in the initial stages of conducting sturgeon reproductive studies for this years spring rises or lack of spring rises depending on the study reach and developing laboratory procedures for characterization of reproductive condition of sturgeon.

Emergent Sandbar Habitat

Planning is preparing a Scope of Work and Government Estimate to issue a task order to an existing IDIQ contract for the preparation of a Programmatic EA for the non-Rec River ESH projects. The ESH projects within the Rec River stretch will not be able to be addressed programmatically because of the site specific nature of Section 7 of the Wild and Scenic Rivers Act (WSRA). A Section 7 determination is required for each project proposed within the Rec River.

Plans are complete and specifications are being finalized for the construction of three sandbar complexes below Gavins Point July through September. A delivery order will be issued on an existing IDIQ contract as soon as the Section 7 of the (WSRA) determinations are received from the National Park Service.

An ESH PDT meeting will be held in conjunction with the Tern & Plover Habitat Conference the week of 12 April in South Sioux City, Nebraska.

Missouri River Recovery Implementation Program (MRRIP)

The MRRIP Interagency meeting contract facilitator provided his report (enclosed) the following is from the report summary:

"It was clear from the discussions -- which were generally cordial and productive -- that the level of conflict and polarization and lack of trust among key groups in the Basin require care in developing a MRRIC that can ensure buy-in and create a sense of hope that the Basin can move beyond its conflict-laden past. Participants viewed the process of developing and carrying out MRRIC as critical to its ability to promote healing and effective decision making in the Basin. Indeed, some suggested that the process had to be different enough from "business as usual" to signal a real shift in management style and direction. They felt that creating such a process was necessary to create an incentive for stakeholders to participate in good faith."

MEETING REPORT
PRELIMINARY DISCUSSION OF MISSOURI RIVER RECOVERY IMPLEMENTATION COMMITTEE AND PROCESS, MARCH 31, 2004

At a meeting held at the EPA Conference Center in Denver, twenty-two governmental and nongovernmental representatives met for an initial conversation about how the Missouri River Recovery Implementation Committee, and the process it will oversee, will be developed. Because of the timing of the meeting, not all stakeholder groups and agencies were represented. Nevertheless, the group included a rough cross-section of affected interests, including four federal agencies, two Indian tribes or tribal associations, two states or state associations, navigation, farming, and environmental groups (See attachment for attendance list.) The meeting was facilitated by Dr. Steven Yaffee and Todd Bryan from the University of Michigan, and was convened and organized by Mary Roth, U.S. Army Corps of Engineers, Omaha District.

The meeting covered five broad topics: criteria for an effective MRRIC; issues that need to be resolved in designing and managing MRRIC; lessons from comparable adaptive management projects elsewhere in the nation; overview of related efforts ongoing in the Basin; and discussion of specific action items to advance toward MRRIC.

Summary and Action Items

It was clear from the discussions -- which were generally cordial and productive -- that the level of conflict and polarization and lack of trust among key groups in the Basin require care in developing a MRRIC that can ensure buy-in and create a sense of hope that the Basin can move beyond its conflict-laden past. Participants viewed the *process* of developing and carrying out MRRIC as critical to its ability to promote healing and effective decision making in the Basin. Indeed, some suggested that the process had to be different enough from "business as usual" to signal a real shift in management style and direction. They felt that creating such a process was necessary to create an incentive for stakeholders to participate in good faith.

There was broad agreement that the MRRIC process should be:

- Inclusive and representative of all relevant interests in the Basin;
- Basin-wide in scope, but effectively linked to local level and community-based restoration activities;
- Transparent and open, with effective communication with constituent groups, political officials and the general public;
- Consensus-seeking, working toward balance and equity among participating interests;
- Grounded in credible science, including opportunities for independent science and independent science review;
- Structured in a way that promotes learning and adaptive management.

There was also broad agreement that the MRRIC process should focus on two sets of interconnected and interdependent objectives:

- Recovery of the three federally-listed species (the immediate problem);
- Recovery of the broader Missouri River ecosystem (the underlying problem).

Meeting notes were developed by Dr. Steven Yaffee (yaffee@umich.edu) and Todd Bryan (tbryan@umich.edu), School of Natural Resources & Environment, University of Michigan, Ann Arbor MI 48109-1115.

MRRIC needs to ensure that endangered species recovery takes place, but its objectives should encompass the larger recovery effort, in order to ensure that: the underlying problems causing endangerment are solved; and stakeholders and political leaders support and buy-in to the process, by considering a broad set of ecological and socioeconomic strategies that together can promote ecosystem recovery.

Participants in the meeting all agreed that MRRIC should be a carefully designed process but differed on how much time this would take. Some felt that significant time should be allowed to design MRRIC to ensure that it is as effective as possible; others felt that funding and needed short-term restoration activities demanded a faster pace. All acknowledged the backdrop of court-ordered and administrative decisions that create a broad set of deadlines for action.

Following presentations by EPA and MRBA staff, a set of specific actions were discussed in order to develop a process to create MRRIC and get recovery actions underway. These included:

1. Expose others in the Basin to restoration models and successes from elsewhere in the country. A set of experiments in ecosystem-scale restoration is underway, ranging from the Glen Canyon Adaptive Management Program in Arizona to the Everglades Restoration in Florida. While none may be at the geographic scale of the Missouri River Basin, all have lessons for an effective structure and process of MRRIC. Holding several workshops where case presenters from these other programs describe their lessons for Missouri Basin stakeholders may help inform the structure of MRRIC and provide a basis for discussion among stakeholders.
2. Recognize and expand ongoing activities to communicate with stakeholders in the Basin. Considerable discussion focused on the role of MRBA, which is planning stakeholder meetings on recovery this summer. Some thought broadening the hosting of the meetings to include USACE, USFWS, MRNRC and others (as well as broadening their number and location) would broaden participation of diverse groups and expand the credibility of the discussions. Others felt that attendance at past MRBA-convened meetings was not fully representative of the range of stakeholders in the Basin, and hence was a helpful but not sufficient way to record stakeholder opinion on the structure of MRRIC.
3. Recognize and expand ongoing experimentation with adaptive management efforts in the Basin. Meeting participants cited a number of ongoing efforts to conduct restoration and implement adaptive management at the community-scale. Providing a mechanism to track the results of these efforts would help to define the outlines of MRRIC and inform its ultimate decision making. Encouraging these experiments with seed funding from existing recovery appropriations might advance the cause of adaptive restoration even before MRRIC is put into place. This recognizes that funding is already available, there is a need to show progress, and that examples of success would be highly motivating to the larger scale effort.
4. Select an independent set of experts to develop a draft design for MRRIC. Hiring a third-party to conduct a situation assessment and process design independent of USACE or USFWS would help to create the credibility needed for MRRIC.
    a. Such an assessment would include interviewing key stakeholders and decision makers affecting Missouri River Recovery and reviewing comparable adaptive management and ecosystem management programs across the nation, and, given the complexity of the

MRRIC situation, may take as long six months to complete. The contractor would need skills in situation assessment, facilitation, process design, and ad hoc organizational structure, and would need knowledge of adaptive management and ecosystem/watershed management and restoration.

b. Advice on how to find such a contractor is available from the U.S. Institute on Environmental Conflict Resolution and the U.S. Environmental Protection Agency's Dispute Resolution Office, though it was cautioned that the contractor not just be cognizant of process design but be knowledgeable about adaptive management and ecosystem restoration. It was strongly felt that the way the contractor was hired would send signals about the level of transparency of the recovery process. A competitive bidding process may be necessary depending on the magnitude of the cost of these tasks.

5. Establish an interim structure for "steering" the development of MRRIC while the long term structure is developed. Some participants felt that an interim MRRIC should be created which would evolve "adaptively" into a longer-term structure. Others felt that it was important to undertake process design in as transparent and inclusive a process as possible.

   a. A compromise among perspectives was to create a Steering Committee for development of MRRIC. Such a group would develop a scope of work for the independent situation assessment and process design contractor and a Charter for MRRIC. It was thought that participants in the preliminary meeting could serve as an *interim* Steering Committee, which would need to be expanded to include other stakeholder groups that could not attend the March 31st meeting.

   b. Some felt it important to hold a second meeting of this broader set of interests to firm up a Steering Committee, and continue to discuss process design issues, the scope of work for the contractor, and initial ideas about a MRRIC Charter and structure. It was agreed that at minimum a teleconference would be held and all parties would have the ability to comment on the contractor selection process.

   c. It was seen as critical that this Steering Committee and its associated organizational and agency members be developed as a "political nexus" for the recovery program and committee. Ultimately, it will be necessary to solicit funding and political support for MRRIC, and a Steering Committee structure that is broadly representative of stakeholder, agency and political interests would be more likely to be persuasive. MRRIC must have the support of agency and political leaders in order to have a chance of successfully launching an adaptive restoration program.

   d. The Steering Committee could also begin to track ongoing restoration activities in the Basin and create a seed fund mechanism to encourage experimentation and build a basis for cooperation among the Steering Committee members.

6. Develop a Charter for MRRIC. While the groups who are organized into a MRRIC should have considerable ability to shape the recovery efforts, a broad, well-supported Charter for its efforts should be developed. It should identify the scope of recovery, and the overall operating procedures for Committee process. The Steering Committee (listed in #5) could develop this Charter in consultation with agency leaders and the independent contractor.

Meeting notes were developed by Dr. Steven Yaffee (yaffee@umich.edu) and Todd Bryan (tbryan@umich.edu), School of Natural Resources & Environment, University of Michigan, Ann Arbor MI 48109-1115.

Additional Detailed Meeting Notes

Overall vision of MRRIC process

In introducing themselves, participants described key criteria for an effective MRRIC process. In their view, it should:

- Be inclusive
- Be a "process of the people"
- Be open and transparent
- Promote fairness and equality among participants

- Recognize the multiple tribes in the Basin and their diverse views
- Be inclusive to tribal views and needs

- Include consensus on all issues. Consensus can mean "agree to disagree."

- Emphasize communication
- Be an educational process

- Be a way to move forward and heal scars among participants
- Promote development of trust

- Promote balance between competing needs, diverse interests and viewpoints

- Be broad enough to provide an umbrella over a full range of stakeholders but small enough to get things done
- Be useful and adequate to make a difference

- Focus on recovery of MR ecosystem
- Make ecological and social sense

- Be adaptive; involve learning

- Be future-oriented and involve "out of box" thinking

- Focus on developing information and tools that people can share, so that they are operating from the same sheet of music

Meeting notes were developed by Dr. Steven Yaffee (yaffee@umich.edu) and Todd Bryan (tbryan@umich.edu), School of Natural Resources & Environment, University of Michigan, Ann Arbor MI 48109-1115.

Process design issues

Participants identified a common set of issues that needed to be resolved in designing MRRIC. These included answers to the following questions:

- What is the scope of recovery? What is the vision of MRRIC? What is the need for it?
- How connect MRRIC to agency decision making processes? ACE, NEPA/EIS, triggers
- How should process be funded? Who will advocate for the funding?
- How ensure tribal trust responsibilities are effectively carried out by MRRIC, and that cultural resources are considered in MRRIC decisions and strategies?
- How ensure ongoing adaptation – that MRRIC is a "living process"?
- How create a "good faith" (trusted) process to motivate stakeholders? How ensure that MRRIC has impact on agency decisions? What should be its ground rules and connections to the political process?
- How should the MRRIC process be structured?
- What should be MRRIC's decision making norms? Consensus?
- Can we consider "out of box" approaches, such as more organic alternatives to USACE control and a shift in focus from species to ecosystem?
- Who should be represented on MRRIC? People or organizations/agencies?
- Who oversees facilitation of the process and how ensure their neutrality?
- How ensure agency leaders are committed to the process?
- How ensure that legal sideboards are defined and integrated?
- Can we create a process (group) to develop a process (MRRIC)? What is the role of USFWS, USACE and the 3rd party?
- How large/small a committee?
- How promote a sense of imagination and hope – that there is another way?
- How include wisdom of National Academy of Sciences committee – its panel members or ideas?
- How ensure MRRIC is well integrated into USACE organization and decisions?
- How capture the benefits of independent science – its credibility and breadth? Could actions taken to develop shallow water habitat test out independent science procedures?
- How does the Federal Advisory Committee Act provisions relate to MRRIC?
- How can MRRIC be structured to satisfy both short term and long term needs?

Representation: Who should be involved?

Considerable discussion focused on the questions of participation and representation. Some highlights of this conversation include:

- Some felt that positions were so strongly held and people were almost too entrenched to participate in the process. Others felt that some stakeholder groups would not participate responsibly and in good faith. Others raised the concern that participation in the process would require considerable commitment on the part of stakeholder representatives. It was felt that the structure of the process could address some of these problems, and that groups would opt in or out based on their level of interest. The process needs to be designed to take advantage of the input provided by groups interested in specific issues but not the entire set of MRRIC concerns.
- The geographic scale of the Basin was seen as a tough issue to resolve in designing a process that was inclusive. Both a Basin-wide perspective and community-based input and implementation should be provided. One way to deal with this is to include a structure that both operates at the Basin-scale and community- or river reach-level. At the same time, participants felt that it was important to get stakeholders to cross "geo-ideologic barriers" and that representation not simply be based on specific chunks of geography or interest.
- Given the barriers provided by travel time across the Basin, it was felt important that meeting locations be distributed across the Basin, held at times convenient to nongovernmental personnel and that provisions be made to reimburse private citizens for travel expenses for participating in MRRIC meetings. Another was to bridge the distances was to use teleconferencing and other electronic means of tying people together.
- To get people involved, many felt that it was important to invite everyone into the process and then require constituent groups to select representatives. Others felt that just key stakeholder groups should be provided seats at the table. One participant argued that "real people" should be invited, not just representatives of interest groups. The roles of out-of-Basin parties were not defined, though several participants indicated that decisions should be made in the Basin. Many seemed to agree that "local ownership" of the process was critical.
- Given the number of groups with stakes in the outcome of MRRIC, it was seen as a particular challenge in finding an effective structure that involved all stakeholders without being overly burdened by a huge number of representatives. The solution lies in organizing these clusters of interests and ensuring that they maintain communication with their constituent groups.

Consensus decision making

- Participants indicated that consensus should be the norm for decision making, recognizing that it can be designed into the process in different ways. One participant noted that MRRIC should try for "consensus" but shoot for "acceptance. I can live with the decision."
- It was seen as important that the MRRIC process include significant opportunities for committee members and the public to learn collaboratively through field experiences, and that the process be grounded in an understanding of the ecology and social realities of the region. Hence, education was seen as important to getting to consensus.

Role and value of independent science

Considerable discussion focused on the need to include an "independent science" component to ensure the credibility of MRRIC. All parties need to trust the information that is being generated and used for management decisions. Some felt that the Universities within the Basin could do more in helping create this science base and that University scientists might be convened to discuss ways to move this forward. The discussion also noted the need to:

- Have independent science undertaken on the River, along with independent scientific peer review of the research.
- Have independent credible assessments of engineering and management decisions, not just the scientific information that goes into them.
- Ensure that stakeholders have input into the choice of scientists or reviewers to ensure that they are perceived as credible by all sides.
- Ensure that management proceeds as a set of experiments that are well designed and tested in an adaptive process.
- Ensure that the process of setting research priorities is well linked to the adaptive management process overseen by MRRIC.
- Include both "hard science" and "soft science" in the research and adaptive management process. This argues for including socioeconomic questions as legitimate research within the MRRIC process, and ensuring that it is integrated with the biological/physical science.

Overall scope of effort

- Meeting participants highlighted the need to define "recovery." What is recovery in each context? What will recovery look like when it is achieved? Many agreed that the effort needs to deal with endangered species recovery while simultaneously dealing with a broader effort to restore ecosystems and built sustainability.
- Some highlighted the fact that the agency "driver" of the process is the environmental impact statement and ACE record of decision. In their view, MRRIC should not lose track of what is driving this. At present, funding is specific to endangered species recovery.
- Others asked whether the pallid sturgeon was a keystone/indicator of ecosystem health. If it is an effective ecosystem indicator, it would help to assure the survival of other species in the River ecosystem and keep others off the endangered or threatened lists.
- The bottom line on this discussion was the need to think about both short-term and long-term goals, and ensure that they are well linked and pursued simultaneously through the MRRIC process.

Meeting notes were developed by Dr. Steven Yaffee (yaffee@umich.edu) and Todd Bryan (tbryan@umich.edu), School of Natural Resources & Environment, University of Michigan, Ann Arbor MI 48109-1115.

Connection to decision-makers

Meeting participants felt that the MRRIC process should be well-linked to decision makers in the Basin. That included:

- Defining the specific decision points that affect management, along with the layers of decision makers, and providing linkages between MRRIC and those decision points.
- Ensuring commitment from decision makers for the process. This would include outreach efforts to ensure that elected officials and agency leaders were well connected and apprised of the purposes, process and activities of MRRIC. Some proposed an annual visit to Washington D.C. where diverse stakeholders would "go hand-in-hand across ideological boundaries" to explain and build support for the effort with legislative and administrative officials. Some felt decision makers needed to understand the biology of the system better, and not just be focused on the legal and administrative aspects.
- Ensuring that stakeholders felt empowered to prevent "end runs" around the process.
- Building brand new funding streams for the recovery effort.

Meeting notes were developed by Dr. Steven Yaffee (yaffee@umich.edu) and Todd Bryan (tbryan@umich.edu), School of Natural Resources & Environment, University of Michigan, Ann Arbor MI 48109-1115.

Attachment #1

List of Attendees at Meeting for Preliminary Discussion of MRRIC, March 31, 2004

Name	Affiliation
Jim Berkley	U.S. Environmental Protection Agency
Bill Bicknell	U.S. Fish and Wildlife Service
Bill Beacom	Navigation
Todd Bryan	University of Michigan
Gary Collins	Mni Sose
David Combs	U.S. Army Corps of Engineers
Joe Cothern	U.S. Environmental Protection Agency
Mike George	U.S. Army Corps of Engineers
Paul Johnston	U.S. Army Corps of Engineers
Mike LeValley	MRNRC
Buzz Mattelin	LMCRM
Roy McAllister	U.S. Army Corps of Engineers
Ken McDonald	Montana Fish, Wildlife and Parks, MRNRC
Lanny Meng	Farmer
Mike Olsen	U.S. Fish and Wildlife Service
Richard Opper	MRBA
James Picotte	Cheyenne River Sioux Tribe – THPO
Mary Roth	U.S. Army Corps of Engineers
Jason Skold	The Nature Conservancy
Wayne Werkmeister	U.S. National Park Service
Chris White	U.S. Army Corps of Engineers
Steven Yaffee	University of Michigan

Meeting notes were developed by Dr. Steven Yaffee (yaffee@umich.edu) and Todd Bryan (tbryan@umich.edu), School of Natural Resources & Environment, University of Michigan, Ann Arbor MI 48109-1115.

Attachment #2

Missouri River Recovery Implementation Committee
Preliminary Discussion of Process
EPA Conference Center
Denver, Colorado

March 31, 2004

AGENDA

9:00	**Welcome and Introductions –** Mary Roth, USACE
9:15	**Background of MRRIC –** Mary Roth, USACE
9:45	**Required Elements of MRRIC –** Facilitated Brainstorming Session – Steve Yaffee
11:15	**BREAK**
11:30	**USGS / EPA Paper on Adaptive Management –** Jim Berkley
12:00	**LUNCH**
1:00	**Role of MRBA –** Richard Opper
1:20	**EPA Pilot Project on Adaptive Management –** Jim Berkley
1:40	**Action Items – Specific Next Steps –** Steve Yaffee
2:30	**BREAK**
2:45	**Discussion of Attributes of Vendor to Facilitate MRRIC –** Steve Yaffee - **Facilitation** - **Organization** - **Administration** - **Record-keeping**
3:15	**Open Discussion / Other Topics**
3:30	**Adjourn**

Shallow Water Habitat Construction
Tracking Sheet
Missouri River

Shallow Water Habitat Site	Date Started	Date Completed	# Notches River and Bank 2/	Low Range of Acres	High Range of Acres	Macro Habitat Type	Date Inspected by USFWS	Acres Verified	Contract Funds Obligated 1/	Date Funds Obligated	Date Funds Expended	Potential for Additional Acres / Remarks
Ponca	5-Apr		dredge	40	80	Inside Bend			$1,900,000	4/2/2004		Task Order Awarded 2 April
Winnebago/Snyder	9-Apr		dike mod	20	25	Inside Bend			$1,022,500	4/9/2004		Task Order Awarded 2 April
Tieville-Middle Decatur Bend		completed		10	308	Secondary Channel non-connected						Acreage to be decided by COE and FWS
Soldier Bend			dredge	20	25	Secondary Channel non-connected			$600,000			Task Order Award 22 April
Tyson Bend			dredge	20	25	Secondary Channel non-connected			$600,000			Task Order Award 22 April
California Bend			dredge	20	25	Secondary Channel non-connected			$600,000			Task Order Award 22 April
Desoto Bend Dikes			dike mod	25	30	Inside Bend			*	4/9/2004		Contract to be awarded 12 April
Boyer Bend			dike mod	20	30	Inside Benmd			*	4/9/2004		Contract to be awarded 12 April
Tobacco Bend			dike mod	20	20	Inside Bend			*	4/9/2004		Contract to be awarded 12 April
Upper Hamburg Bend		12-Mar	dike mod	35	40	Inside Bend	Inspected					Acreage pending via ERDC survey
Lower Hamburg Bend		12-Mar	dike mod	50	55	Inside Bend	Inspected					Acreage pending via ERDC survey
Langdon Bend			dike mod	15	18	Inside Bend			*	4/9/2004		Contract to be awarded 12 April
Deroin Bend			3 bank	25	30	Inside Bend			*	4/9/2004		Contract to be awarded 12 April
Rush Bottoms	postponed			0	0							real estate issues
NWO Dike Notching	30-Mar		120 river	120	145	Inside & Outside Bend			in-house			25 notches to date (9 April) by hired labor
NWK Dike Notching	11-Mar		300 river	300	300	Inside & Outside Bend			$2,500,000			90 notches to date (9 April) by hired labor
Bob Brown	Deleted			0	0							To close to levee
Monkey Mountain			5 bank	20	38	Outside Bend			$932,000			To be awarded 12 April
Worthwine Island			8 bank	32	48	Inside Bend			**			To be awarded 12 April
French Bottoms	Deleted			0	0							Too close to levee
Benedictine Bottoms			9 bank	36	54	Secondary Channel connected			**			To be awarded 12 April
Fort Leavenworth	10-Mar		20 river	20	20	Inside Bend			$100,000			Dike Notch by existing Contractor (Ellis)
Weston Bend State Park			3 bank	17	23	Outside Bend			**			To be awarded 12 April
Kansas City Reach	10-Mar		100 river	100	100	Inside & Outside Bend			$500,000			Dike Notch by Contract
Liberty Bend			2 bank	13	17	Outside Bend			$189,000			RFP from contractor due 9 April
Baltimore Bend			8 bank	32	40	Inside & Outside Bend			$282,000			RFP from contractor due 9 April

Grand Pass			5 bank	20	30	Inside & Outside Bend			$195,000			RFP from contractor due 9 April
Lisbon Bottoms			dredge	30	30	Secondary Channel connected			$150,000			RFP from contractor due 9 April
Franklin Island	15-Feb		7 bank	56	70	Inside & Outside Bend			in-house			Hired Labor in progress
Diana Bend			2 bank	17	21	Outside Bend			in-house			Hired labor to start approx 1 May
Overton Bottoms South	postponed			0	0							Real Estate issues preclude work this year
Eagle Bluffs			12 bank	52	76	Inside Bend			$909,000			RFP from contractor due 9 April
Marion Bottoms				25	35	Inside Bend			$300,000			RFP from contractor due 9 April
Smokey Waters				10	10	Inside Bend			$738,000			RFP from contractor due 9 April *
TOTAL				**1220**	**1768**			**0**	**$11,517,500**			

1/ Blue is actual; Black is Government Estimate
2/ River notch = 1acre/notch
Bank notch = 4-6 acres/notch and 4 acres/1000' of chute
* = part of total $1,022,500 award
** = part of total $932,000 award

SIT-REP
Biological Opinion Missouri River

April 12 - 16, 2004

Funding:
Enclosed is the spread sheet showing funding, obligations, expenditures and commitments through April 16, 2004. Members from the RIT will be in NWO and NWK April 20 – 23 for a program inspection.

Enhanced Shallow Water Habitat:

NWD
FWS and COE meeting is set for April 20 in Minneapolis to finalize SWH acreage verification process.

NWK
1. Dike notching: Contractor has cut 160 notches by the end of Thursday. NWK's in-house river fleet has been redirected from critical maintenance work on the lower river to begin notching above the mouth of the Osage River. Crew should begin notching Monday morning. Low river stages are slowing notching progress due to inability of floating plant to access all dikes.

2. 13 Site-Specific Projects:

a. Two sites scheduled to be constructed by FO-MO. The first site has been under construction for a few months the second site will be constructed after the first.

b. Four sites will be constructed under an Omaha MATOC. Bids were due April 7. Low bid is $932,000 which is below GE. Award and NTP are expected this week.

c. Seven sites will be constructed under the existing river contract (Ellis). Site designs are complete, site visits by contractor have been conducted. Contractor has submitted proposal and negotiations are in progress. Contractor's proposal is over 125% of GE. Award is not possible unless GE and contractor's proposal are within 125%.

3. NEPA documentation was completed April 14.

4. This work is estimated to result in 830 to 940 acres of SWH.

NWO
Contractor is moving dredge from New Orleans up the river to begin work on Ponca project around May 1. River levels are a concern. If the river is not up by that date for the birds may need to put a water release order in or delay the contractor.

River notches are at 40 notches completed by hired labor to date.

The NWO work effort is estimated to result in 440 to 856 acres of SWH (of the higher number, 308 acres is unlikely unless FWS and COE agree on acreages at Tieville-Middle Decatur Bend) .

Pallid Sturgeon Augmentation Support

Missouri Dept. of Conservation/Blind Pony Hatchery contract $2.03M is ready and expecting an April 15 award. This award has been delayed 10 days to April 26 due to some minor changes that need to go back and forth between the Corps and MDC.

Comprehensive Pallid Sturgeon USGS Research Proposal

The steering committee has been finalizing the details of the upcoming workshop to be held on May 18/19. Approximately 41 technical experts have been identified and invited. The Corps is represented by Dr. Jack Kilgore from ERDC and Mark Drobish from Gavins Point. Six "process observers" will be invited in the next day. 3 of these are from the Corps, Glenn Covington from Kansas City District, Maryetta Smith from MVD, and Tom Keevin from St. Louis District. An open question about involvement of stakeholder groups remains. The Ruckelshaus Institute (our contract facilitator) has received input from an outside adaptive management expert that suggested the addition of more active stakeholder participation than what is currently envisioned for the science workshop. Currently a 3rd day is set aside to have stakeholder information exchange. The steering committee is contemplating opening up the process observer group to any interested stakeholder group or possibly representatives of stakeholder groups. It is apparent to the steering committee that this "science research" group and process and the "MRIC" are intimately related. The Ruckelshaus Institute has suggested we prepare a strategic plan to develop a process for stakeholder input in the "science questions" and future management tests. They have examples of Institutes and agencies that do this type of process formulation. This information has been made available to the MRIC team.

Emergent Sandbar Habitat

The schedule is slipping by 60 days due to National Park Service delays in Section 7 review under the Wild and Scenic Rivers Act. The May reprogramming request will reflect this delay. This delay does not jeopardize the creation of this habitat for this FY as per our commitment to the FWS.

Missouri River Recovery Implementation Program (MRRIP)

No change from last week.

Shallow Water Habitat Construction
Tracking Sheet
Missouri River

Shallow Water Habitat Site	Date Started	Date Completed	# Notches River and Bank 2/	Low Range of Acres	High Range of Acres	Macro Habitat Type	Date Inspected by USFWS	Acres Verified	Contract Funds Obligated 1/	Date Funds Obligated	Date Funds Expended	Potential for Additional Acres / Remarks
Ponca	5-Apr		dredge	40	80	Inside Bend			$1,900,000	4/2/2004		Task Order Awarded 2 April
Winnebago/Snyder	9-Apr		dike mod	20	25	Inside Bend			$1,022,500	4/9/2004		Task Order Awarded 2 April
Tieville-Middle Decatur Bend		completed		10	308	Secondary Channel non-connected						Acreage to be decided by COE and FWS
Soldier Bend			dredge	20	25	Secondary Channel non-connected			$600,000			Task Order Award 22 April
Tyson Bend			dredge	20	25	Secondary Channel non-connected			$600,000			Task Order Award 22 April
California Bend			dredge	20	25	Secondary Channel non-connected			$600,000			Task Order Award 22 April
Desoto Bend Dikes			dike mod	25	30	Inside Bend			*	4/9/2004		Contract to be awarded 12 April
Boyer Bend			dike mod	20	30	Inside Benmd			*	4/9/2004		Contract to be awarded 12 April
Tobacco Bend			dike mod	20	20	Inside Bend			*	4/9/2004		Contract to be awarded 12 April
Upper Hamburg Bend		12-Mar	dike mod	35	40	Inside Bend	Inspected					Acreage pending via ERDC survey
Lower Hamburg Bend		12-Mar	dike mod	50	55	Inside Bend	Inspected					Acreage pending via ERDC survey
Langdon Bend			dike mod	15	18	Inside Bend			*	4/9/2004		Contract to be awarded 12 April
Deroin Bend			3 bank	25	30	Inside Bend			*	4/9/2004		Contract to be awarded 12 April
Rush Bottoms	postponed			0	0							real estate issues
NWO Dike Notching	30-Mar		120 river	120	145	Inside & Outside Bend			in-house			40 notches to date (16 April) by hired labor

1/ Blue is actual: Black is Government Estimate
2/ River notch = 1acre/notch
Bank notch = 4-6 acres/notch and 4 acres/1000' of chute
* = part of total $1,022,500 award
** = part of total $932,000 award

NWK Dike Notching	11-Mar		300 river	300	300	Inside & Outside Bend			$2,500,000			120 notches to date (16 April) by hired labor
Bob Brown	Deleted			0	0							To close to levee
Monkey Mountain			5 bank	20	38	Outside Bend			$932,000			To be awarded 12 April
Worthwine Island			8 bank	32	48	Inside Bend			**			To be awarded 12 April
French Bottoms	Deleted			0	0							Too close to levee
Benedictine Bottoms			9 bank	36	54	Secondary Channel connected			**			To be awarded 12 April
Fort Leavenworth	10-Mar		20 river	20	20	Inside Bend			$100,000			Dike Notch by existing Contractor (Ellis)
Weston Bend State Park			3 bank	17	23	Outside Bend			**			To be awarded 12 April
Kansas City Reach	10-Mar		100 river	100	100	Inside & Outside Bend			$500,000			Dike Notch by Contract
Liberty Bend			2 bank	13	17	Outside Bend			$189,000			RFP from contractor due 9 April
Baltimore Bend			8 bank	32	40	Inside & Outside Bend			$282,000			RFP from contractor due 9 April
Grand Pass			5 bank	20	30	Inside & Outside Bend			$195,000			RFP from contractor due 9 April
Lisbon Bottoms			dredge	30	30	Secondary Channel connected			$150,000			RFP from contractor due 9 April
Franklin Island	15-Feb		7 bank	56	70	Inside & Outside Bend			in-house			Hired Labor in progress
Diana Bend			2 bank	17	21	Outside Bend			in-house			Hired labor to start approx 1 May
Overton Bottoms South	postponed			0	0							Real Estate issues preclude work this year
Eagle Bluffs			12 bank	52	76	Inside Bend			$909,000			RFP from contractor due 9 April
Marion Bottoms				25	35	Inside Bend			$300,000			RFP from contractor due 9 April
Smokey Waters				10	10	Inside Bend			$738,000			RFP from contractor due 9 April
TOTAL				**1220**	**1768**			**0**	**$11,517,500**			

1/ Blue is actual: Black is Government Estimate
2/ River notch = 1acre/notch
Bank notch = 4-6 acres/notch and 4 acres/1000' of chute
* = part of total $1,022,500 award
** = part of total $932,000 award

Supplemental BiOp Expenditure Tracking FY04

(As of 16 April 2004)

ACTIVITY		Mar-04 ($000's)	Apr-04 ($000's)	May-04 ($000's)	Jun-04 ($000's)	Jul-04 ($000's)	Aug-04 ($000's)	Sep-04 ($000's)	Total ($000's)
SHALLOW WATER HABITAT									
NWK MR Project	PWID 000621	$ 1,500.0	$ 3,500.0						$ 5,000.0
NWO MR Project	PWID 000621	$ 2,500.0	$ 2,500.0						$ 5,000.0
Cumulative Total of Funding		**$ 4,000.0**	**$ 10,000.0**						
Obligation		$ 4,000.0	$ 7,000.0						
Commitments			$ 3,000.0						
Expenditure		$ 200.0	$ 516.0						
EMERGENT SANDBAR HABITAT									
Gavins Point	PWID 006440	$ 90.0	$ 74.0						
Fort Randall	PWID 006270	$ 30.0	$ 36.0						
Big Bend	PWID 001420	$ 10.0	$ 10.0						
Oahe	PWID 012960	$ 20.0	$ -						
Garrison	PWID 006400	$ 15.0	$ 36.0						
Fort Peck	PWID 006230	$ 30.0	$ 20.0						
Cumulative Total of Funding		**$ 195.0**	**$ 371.0**						
Obligation		$ 185.0	$ 185.0						
Commitments		$ 10.0	$ 186.0						
Expenditure		$ 17.0	$ 23.0						
PALLID STURGEON PROPAGATION SUPPORT									
NWO MR Project	PWID 000621	$ 1,677.0	$ 2,030.0						
Gavins Point	PWID 006440	$ 1,602.0							
Fort Peck	PWID 006230	$ 130.0							
Cumulative Total of Funding		**$ 3,409.0**	**$ 5,439.0**						
Obligation		$ 3,409.0	$ 3,409.0						
Commitments			$ 2,030.0						
Expenditure		$ 180.0	$ 240.0						
HABITAT MONITORING AND EVALUATION									
NWK MR Project	PWID 000621	$ -	$ -						
NWO MR Project	PWID 000621	$ -	$ -						
Gavins Point	PWID 006440	$ -	$ 100.0						
Garrison	PWID 006400	$ -	$ 30.0						
Cumulative Total of Funding		**$ -**	**$ 130.0**						
Obligation			$ -						
Commitments			$ 130.0						
Expenditure			$ -						
USGS PALLID STURGEON RESEARCH PROPOSAL									
NWO MR Project	PWID 000621	$ 400.0	$ 352.5						
Cumulative Total of Funding		**$ 400.0**	**$ 752.5**						
Obligation		$ 400.0	$ 752.5						
Commitment		$ -	$ -						
Expenditure		$ 180.0	$ 270.0						
MISSOURI RIVER RECOVERY IMPLEMENTATION PROGRAM									
NWO MR Project	PWID 000621	$ 100.0	$ -						
Gavins Point	PWID 006440	$ -	$ 100.0						
Fort Randall	PWID 006270	$ -	$ -						
Fort Peck	PWID 006230	$ -	$ -						
Cumulative Total of Funding		**$ 100.0**	**$ 200.0**						
Obligation		$ 100.0	$ 160.0						
Commitments			$ 40.0						
Expenditure		$ 40.0	$ 65.0						
PIPING PLOVER POPULATION VIABILITY ANALYSIS									
Gavins Point	PWID 006440	$ -	$ -						
Cumulative Total of Funding		**$ -**	**$ -**						
Obligation									
Commitments									
Expenditure									
FORT PECK SPRING RISE TEST									
Fort Peck	PWID 006230	$ -	$ -						
Cumulative Total of Funding		**$ -**	**$ -**						
Obligation									
Commitments									
Expenditure									
MONTHLY TOTALS									
Monthly Funding		$8,104.0	$ 8,788.5						
Cumulative Total of Funding		**$8,104.0**	**$ 16,892.5**						
Obligation		$8,094.0	$ 11,506.5						
Commitments		$10.0	$ 5,386.0						
Expenditure		$617.0	$ 1,114.0						

SIT-REP
Biological Opinion Missouri River

April 19 - 23, 2004

Funding:
May reprogramming request is being prepared.

Enhanced Shallow Water Habitat:

NWD
FWS and COE met April 20 in Minneapolis and finalized the SWH acreage verification process. NWO (George) presented their acreage verification plan (copy attached). This plan had been fully coordinated with FWS field staff and was endorsed at the meeting as an acceptable strategy to verify acreages. NWK (Chapman) outlined their strategy. Chapman will provide a written copy of the plan by April 30. As outlined by Chapman, the FWS felt the strategy was a good plan. There was considerable discussion on the secondary channel—not connected macrohabitat plans for Ponca, Tyson Bend and Soldier Bend. The Corps agreed to look at modifications to make these projects more compatible for sturgeon.

NWK
1. Dike notching: Contractor has cut 230 notches by the end of last week. NWK's in-house river fleet has been redirected from critical maintenance work on the lower river to begin notching above the mouth of the Osage River. To date they have cut 11 notches. Total notches cut is 241. Low river stages are slowing notching progress due to inability of floating plant to access all dikes.

2. 13 Site-Specific Projects:

   a. Two sites scheduled to be constructed by FO-MO. The first site has been under construction for a few months the second site will be constructed after the first.

   b. Four sites will be constructed under an Omaha MATOC. Bids were due April 7. Low bid was $932,000 which is below GE. Contract has been awarded. Construction should start this week.

   c. Seven sites will be constructed under the existing river contract (Ellis). The final price was $3.165 million. The contract has been awarded and NTP given. Construction is expected to begin this week.

3. NEPA documentation was completed April 14.

4. This work is estimated to result in 830 to 940 acres of SWH.

NWO

Dredge and support plant are at mile marker 747, 7 miles below the Ponca site for work to start May 1. NWO is coordinating with Nebraska Game and Parks for a coordinated Zebra Mussel inspection of the floating plant. Inspection will occur this week with Corps, NG&P and possible NPS staff.

River notches are at 54 notches completed by hired labor to date.

The NWO work effort is estimated to result in 440 to 856 acres of SWH (of the higher number, 308 acres is unlikely unless FWS and COE agree on acreages at Tieville-Middle Decatur Bend) .

Pallid Sturgeon Augmentation Support

Missouri Dept. of Conservation/Blind Pony Hatchery contract $2.03M is ready and expecting an April 15 award. This award has been delayed 10 days to April 26 due to some minor changes that need to go back and forth between the Corps and MDC.

Comprehensive Pallid Sturgeon USGS Research Proposal

No change.

Emergent Sandbar Habitat

Contracting advertised a task order for Emergent Sandbar Habitat construction work at River miles 761.4, 769.8, and 790, on the Missouri River in Nebraska and South Dakota on 21 April 2004. Proposals are due back on 21 May 2004. Task order will be awarded after the EA and FONSI are complete. Work will be completed by 30 September 2004.

Representatives from Engineering, Planning, Fort Randall Project Office, and the T & E Section toured the river below Fort Randall to observe recently completed emergent sandbar habitat work and to observe conditions on existing sandbars proposed for future work. Engineering will also be on the river next week below Garrison with project and T & E Section employees to identify sites for FY 05 emergent sandbar habitat work. Planning is working on Programmatic EA Scope of Work and Government Estimate to go out as a task order on an existing Indefinite Delivery Contract in the next couple weeks.

Missouri River Recovery Implementation Program (MRRIP)

This program is being worked as a phased approach with the first phase being generation of Corps expectations and expected products under MRRIC. This phasing builds on the initial workshop held with stakeholders in Denver by giving an agency structure to the ideas and concerns presented in Denver.

Major Dike Modification Projects:					
Project Site	# of Structures Lowered	Material Removed CY	# of New Chevrons	New Stone (Tons)	Completion Date
Desoto Bend	12	13008	6	5011	01-Jul-04
Boyer Bend	20	25680	8	7398	01-Jul-04
Tobacco Islands (Bend)	16	20544	8	6576	01-Jul-04
Langdon Bend	20	33965	10	7650	01-Jul-04
Snyder Bend	5	6520	3	2466	01-Jul-04
Winnebago Bend	12	15408	5	4110	01-Jul-04
Total for 2004	**85**	**115125**	**40**	**33211**	
Glovers Point Bend	32	49925	15	14914	01-Jul-05
Blackbird Bend	31	41200	15	9820	01-Jul-05
Tyson Bend	27	34668	13	10686	01-Jul-05
Van Horns Bend	8	10272	4	3288	01-Jul-05
Upper Copeland Bend	26	18361	7	7220	01-Jul-05
Upper and Lower Deroin Bend	14	16871	7	4700	01-Jul-05
Total for 2005	**138**	**171297**	**61**	**50628**	

Dike Notching					
Project Site	# of Notches	Material Removed CY			
Upper Decatur Bend	12	4800			
Lower Louisville Bend	11	4400			
Lower Little Sioux Reach	13	5200			
Tyson Bend	7	2800			
Nottleman Island	15	6000			
Aulden Bar	15	6000			
Copeland Bend	12	4800	21	8400	
Nebraska Bend	8	3200			
U/L Deroin and Indain Cave B.	17	6800			
Cottier Bend	2	800			
Total	**112**	**44800**			

Dredging		
Project Site	Acres	Material Removed CY
Tyson Bend	25	160000
Soldier Bend	25	160000
California Bend	15	96000
Totals	**65**	**416000**

Missouri River, Sioux City to Rulo, FY 2004-05 Major Dike Modification Plan									
Major Dike Modification Projects:									
Project Site	River Miles	River Bank	State	# of Structures Lowered	Material Removed CY	# of New Chevrons	New Stone (Tons)	New SWH Acres	Completion Date
Desoto Bend	644.0-642.0	Right	Nebraska	12	13008	6	5011	25-30	01-Jul-04
Boyer Bend	637.0-634.0	Right	Nebraska	20	25680	8	7398	30-60	01-Jul-04
Tobacco Islands (Bend)	589.0-586.2	Right	Nebraska	16	20544	8	6576	15-20	01-Jul-04
Langdon Bend	531.7-529.0	Right	Nebraska	20	33965	10	7650	15-18	01-Jul-04
Snyder Bend	715.2-714.7	Left	IA/NE	5	6520	3	2466	20-25	01-Jul-04
Winnebago Bend	710.0-708.7	Left	Nebraska	12	15408	5	4110		01-Jul-04
Total for 2004				**85**	**115125**	**40**	**33211**	**105-135**	
Glovers Point Bend	713.5-710.7	Right	Nebraska	32	49925	15	14914	30-60	01-Jul-05
Blackbird Bend	697.3-693-7	Left	IA/NE	31	41200	15	9820	70-95	01-Jul-05
Tyson Bend	654.6-653.0	Left	Iowa	27	34668	13	10686	15-20	01-Jul-05
Van Horns Bend	576.5-574.5	Right	Nebraska	8	10272	4	3288	15-20	01-Jul-05
Upper Copeland Bend	569.0-565.5	Left	Iowa	26	18361	7	7220	30-60	01-Jul-05
Upper and Lower Deroin Bend	519.8-516.4	Left/Right	MO/NE	14	16871	7	4700	30-60	01-Jul-05
Total for 2005				**138**	**171297**	**61**	**50628**	**190-315**	

The proposal is to select one dike-chevron-dike complex (at each of the site high lighted above) and conduct a pre-construction survey that would include both bathymetery and velocity data. After constuction, bi-monthly bathymetric surveys would be obtained at index ranges to monitor the rate at which changes are occuring. Once the site has under gone a significant amount of change a complete post construction survey will be obtain that will try to duplicate the pre-construction data collection effort. DTMs and a velocity contour maps will be developed and compared.

Missouri River, Sioux City to Rulo, FY 2004 Dike Notching Plan

Dike Notching

Project Site	River Miles	River Bank	State	Dike Number	US/DS River Mile	# of Notches	Material Removed CY	Notch Type
Upper Decatur Bend	691.0-689.3	Left	Iowa			12	4800	B
				743.89	690.9			
This bend is a relatively sharp bend with a lot of dikes spaced close together, and is representative of a number of bends that are likely to be developed in the future. This bend is also in the degradation reach between Sioux City and the Platte River. The uniformness of the bend does not require more than the two dikes to be surveyed.				743.79				
				743.75				
				743.7				
				743.68				
				743.66				
				743.64				
				743.62				
				743.54				
				743.43				
				743.36				
				743..29	689.3			
Lower Louisville Bend	683.2-681.7	Left	Iowa			11	4400	B
				734.8	682.95			
This bend is fairly flat with a lot of dikes spaced close together. While not really representative of any other bend in the reach between Sioux City and Omaha this bend is represetnative of a number of other areas/bend complexes that have potential for development (i.e. Lower Decatur Bend). The uniformness of the bend does not require more than the two dikes to be surveyed.				734.7				
				734.6				
				734.49				
				734.32				
				734.25				
				734..08				
				733.92				
				733.76				
				733.7				
				733.63	681.7			
Lower Little Sioux Reach	672.5-670.5	Left	Iowa			14	5600	B
				725.2	672.4			
This bend is average length, average radius, average dike density for this reach if the river. Data collected here is probably more transportable to other reaches and bend than the upper two bend, hence the three dikes.				725.3-B				
				724.9				
				725.3-A				
				724.46				
				724.37				
				724.2				
				724.1				
				724.05				
				724.0				

				723.8					
				723.75					
				723.6					
				723.53	670.5				
Tyson Bend	654.5-653.0	Left	Iowa			7	2800	B	
				704.0	655.4				
				703.78					
				703.68					
				702.98					
				702.88					
				702.78					
				702.65	653.1				
Nottleman Island	585.9-582.8	Left	Iowa			15	6000	B	
				628.1	584.8				
This is a long flat bend, with lots of dikes and a history of thalweg meander, indicating that the potential for change is relatively high. This bend is also representative of other potential bends (i.e. Copeland Bend).				627.87		These dikes had to be removed from the monitoring list because the construction was completed before the pre survey could be completed. Three additional dike have been identified at Copeland Bend. Copeland Bend and Nottleman are similar bend types.			
				627.82					
				627.51					
				627.45					
				627.25					
				627.15					
				626.95					
				626.9					
				626.82					
				626.75					
				626.6					
				626.37					
				626.35					
				626.33	582.8				
Aulden Bar	578.8-576.8	Left	Iowa			15	6000	B	
				632.31	578.7				
This bend is a littel shorter and sharper than average for this reach of the river, but the dike density is average and the proposed sampling would likely provide the most transportable data.				623.25					
				623.15					
				623.04					
				623.0					
				622.93					
				622.88					
				622.83					
				622.62					
				622.5					

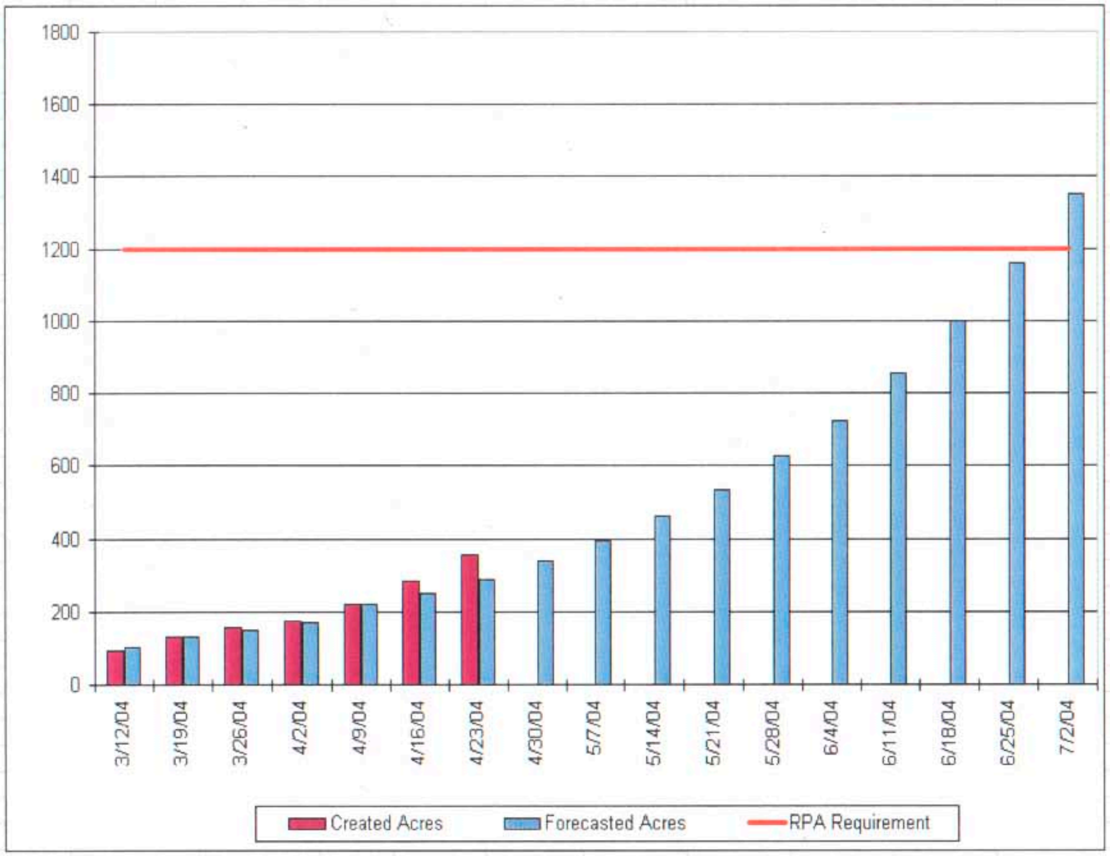
				622.3					
				622.19					
				622.15					
				622.05		Real Estate Problems may eliminate			
				621.89	576.8	these dikes from the list.			
Copeland Bend	569.2-565.3	Left	Iowa			21	8400	B	
				614.95	569.2				
				614.85					
				614.77					
				614.7-B					
				613.9					
				613.8					
				613.6					
				613.45					
				613.3					
				613.1					
				613.0					
				612.9					
				612.7					
				612.5					
				612.2					
				612.0					
				611.85					
				611.75					
				611.55					
				611.4					
				611.2	565.4				
Nebraska Bend	562.7-561.5	Left	Iowa			8	3200	B	
				608.5	562.7				
				608.3					
				608.07					
				607.92					
				607.8					
				607.69					
				607.6					
				607.4	561.5				
U/L Deroin and Indain Cave B.	519.8-516.2					17	6800	B	
		Left	Missouri	561.15	519.7				
				561.0					

These bend form a series of short flat bends which are duplicated at a number of locations in in the reach between Sioux City and Rulo. Bend complexes such as these tend to be sensitive to structure modification and therefore would indicate a greater potential for changes.				560.9					
				560.75					
				560.6					
				560.55					
				560.35					
				560.3					
				560.2					
		Right	Nebraska	559.55					
				559.5					
				559.45					
		Left	Missouri	559.0					
				558.6					
				558.45					
				558.31					
				558.2	516.3				
Cottier Bend	509.2-508.5	Left	Missouri			2	800	B	
				549.55	509.2				
				548.61	508.4				
Total						**122**	**48800**		

At each notch indicated above (high lighted in green), a series of cross sections will be obtained upstream and downstream of the dike. Cross sections will be approximately perpendicular to the general flow line of the river and will extend from high bank to high bank. The first upstream cross section will be approximately 25 feet upstream of the dike and the second and third cross sections will be spaced at 50-foot intervals further upstream. The first downstream cross section will be approximately 25 feet downstream of dike and the cross sections will be spaced at 50 feet intervals downstream for a total of 6 cross sections. The downstream spacing may be adjusted to fit field conditions as needed. Two longitudinal profiles will be obtained. The first longitudinal profile will be obtained from the most upstream cross section through the notch to the most downstream cross section. The second longitudinal profile will be approximately parallel to the first profile and will extend from the most upstream to the most downstream cross section and will be immediately riverward of the end of the dike. This survey should provide an accurate estimate of the aerial extent of river bed form changes. Velocity data will be collected at four points along each cross section. The locations are; along a line approximat

SWH Acres Construction Tracking

	3/12/04	3/19/04	3/26/04	4/2/04	4/9/04	4/16/04	4/23/04	4/30/04	5/7/04	5/14/04	5/21/04	5/28/04	6/4/04	6/11/04	6/18/04	6/25/04	7/2/04
Created Acres	92	132	155	172	220	285	355										
Forecasted Acres	100	130	150	170	220	250	290	340	395	460	535	625	725	855	1000	1160	1350
RPA Requirement	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200



SIT-REP
Biological Opinion Missouri River

April 26 - 30, 2004

Funding:
May reprogramming request is being prepared and expected to go forward on May 7. One week delay is to have the numbers for April close-out.

Enhanced Shallow Water Habitat:

NWD
Design modifications have been made for the Tyson Bend and Soldier Bend dredging projects that will make these projects top widening work (i.e. in channel) as opposed to backwaters.

NWK
1. Dike notching: Contractor has cut 264 notches by the end of last week. He has been able to cut approximately 7 notches per working day (36 working days). NWK's in-house river fleet has been redirected from critical maintenance work on the lower river to begin notching above the mouth of the Osage River. To date they have cut 22 notches. Total notches cut is 286. Our goal is 400 notches from floating plant by the end of June. Based on current rate of notches cut per day, we should reach our goal sometime in late May. It is likely we will exceed our goal by the end of June.

2. 13 Site-Specific Projects:

a. Two sites scheduled to be constructed by FO-MO. The first site has been under construction for a few months and will be completed within the next few weeks. Construction at the second site will begin immediately after completion of the first site and will be completed by the end of June.

b. Four sites will be constructed under an Omaha MATOC. Contract has been awarded. Problems with the contractors bonds have delayed NTP. It is not anticipated that this delay will prevent completion of the sites by the end of June as the contractor is mobilized and ready to begin.

c. Seven sites will be constructed under the existing river contract (Ellis). The final price was $3.165 million. The contract has been awarded and NTP given. Construction at almost every site has been started. These sites should be complete by the middle of June.

3. NEPA documentation was completed April 14.

4. This work is estimated to result in 830 to 940 acres of SWH.

NWO

Notching:

a. The Hired Labor has completed a total of 71 notches out of a possible 119. All of the notches so far have been type B (bank notches). They will finish below the Platte River early next week, and will move to Tyson Bend by the end of the week.

b. The total number of notches has been reduced from 122 to 119 due to erosion concerns on private lands. This will reduce the number of SWH acres by 6 to ten acres.

c. The State of Iowa will not allow type B notches on Upper Decatur Bend and Lower Louisville Bend. They will allow type B notches (dike notches). This will reduce the SWH acres by at least 23, maybe more.

Major Dike Mods: The contractor has degraded most of the dikes at Synder and Winnebago Bend and is beginning to construct the chevrons.

Top widening Dredging: The contract is awarded and the contractor is mobilizing. He can begin work as early as Monday. However, we do not have the 404 permit yet. The hold-up is water quality certification. Elutriate test have been sent to Iowa and Nebraska.

Monitoring: All field work for the preconstruction surveys will be complete by the end of next week. All data is scheduled to be to the district office by May 5^{th}.

Joint Inspection: The Omaha District conducted a joint inspection with the FWS in 27 and 28 April. Attendees were John Remus, Mark Drobish, Steve Lydick and Joanne Grady. The inspection included recently constructed notches, a visit to a major dike mod site, reconnaissance of backwater dredging areas, and inspection of the completed dike mods at Upper and Lower Hamburg Bend. The conversation centered around existing conditions and what might be expected to occur once the projects have the chance to mature. Number of acres were not discussed. The FWS generally agree with the types of habitat being created with the notching and dike mods, but remain opposed to the backwaters.

<u>Pallid Sturgeon Augmentation Support</u>

Missouri Dept. of Conservation/Blind Pony Hatchery contract $2.03M is ready and expecting an April 15 award. This award has been delayed to May 5.

<u>Comprehensive Pallid Sturgeon USGS Research Proposal</u>

No change.

Emergent Sandbar Habitat

Representatives from Garrison Project, Engineering Division, and the Threatened and Endangered Species Section were on the river from below Garrison to upper Oahe Reservoir identifying projects for FY 05 Emergent Sandbar Habitat work.

ESH PM met with Contracting and Construction Division to initiate a new IDIQ contract for work above Gavins Point for FY2005 and beyond. Issuing a new IDIQ contract will take approximately 24 weeks to complete.

Missouri River Recovery Implementation Program (MRRIP)

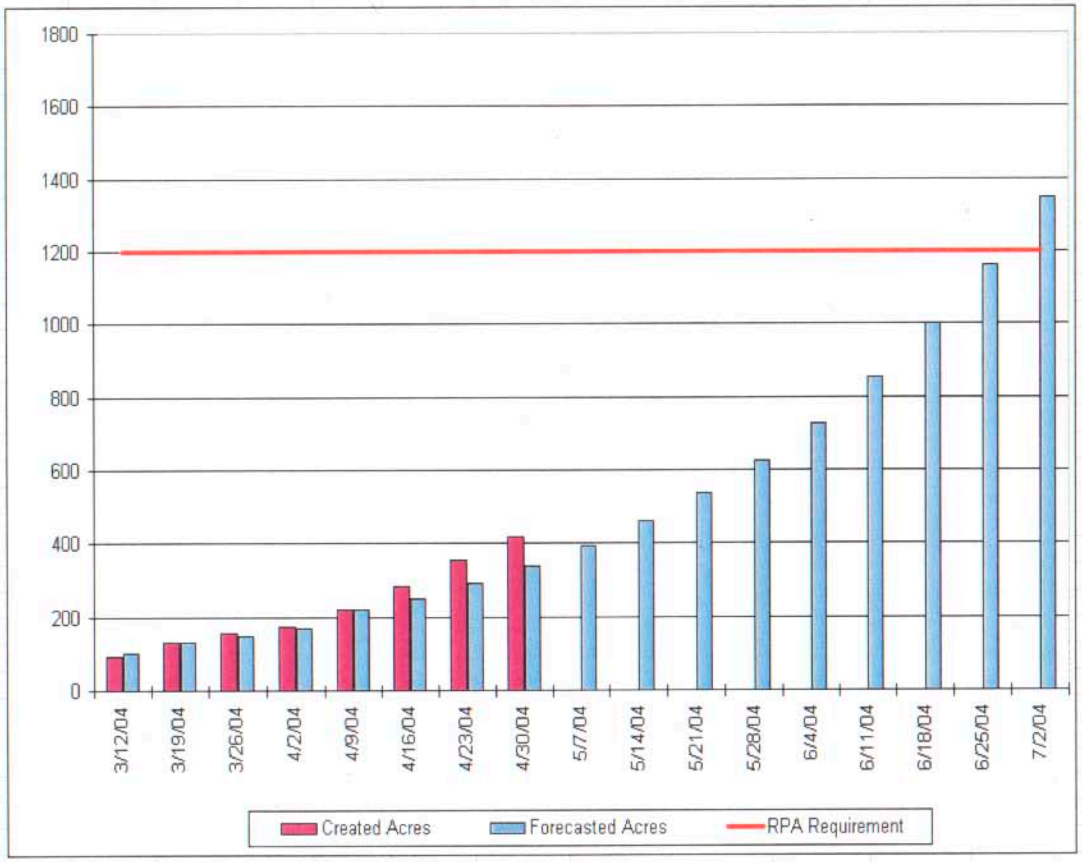
In furtherance of the development of MRRIC, we are tentatively looking at the afternoon of Thursday, 17 June for the Strategic Civil Works Review Board meeting. Bill Jennings (NWD - Portland) is to confirm the date as soon as he is able.

Also, we sent $50K to CRREL for initiation of development of the geospatial decision support framework (task 2). We are hiring two UNO/PKI students to assist Bryan Baker with data manipulation for the framework. .

The Corps will also be sponsoring Dr. Steven Yaffee for the Independent Science Review session at the MRNRC Conference, 26 - 27 May.

SWH Acres Construction Tracking

	3/12/04	3/19/04	3/26/04	4/2/04	4/9/04	4/16/04	4/23/04	4/30/04	5/7/04	5/14/04	5/21/04	5/28/04	6/4/04	6/11/04	6/18/04	6/25/04	7/2/04
Created Acres	92	132	155	172	220	285	355	420									
Forecasted Acres	100	130	150	170	220	250	290	340	395	460	535	625	725	855	1000	1160	1350
RPA Requirement	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200



SIT-REP
Biological Opinion Missouri River

May 3 - 7, 2004

Funding:
May reprogramming request is went forward on May 7 with a request for $4,638,500 to go with the $16.9M already awarded. We should expect the funds to be loaded Monday, May 10. SWH construction costs are coming in higher than forecasted for a couple of reasons: 1) The contractors are on extremely tight schedules and they are assuming risk and additional costs; 2) We are being aggressive in SWH construction in that we are on track to build considerably more than 1,200 acres. This allows for a comfort zone in acreages that we originally didn't count on but will be important when we consult with FWS in June. There is sufficient funds now to cover the higher costs but will have to be closely monitored in the June reprogramming request. Some other work may need to be deferred.

Enhanced Shallow Water Habitat:

NWK
1. Dike notching: Contractor has cut 296 notches by the end of last week. He has been able to cut approximately 7 notches per working day. NWK's in-house river fleet has been redirected from critical maintenance work on the lower river to begin notching above the mouth of the Osage River. To date they have cut 33 notches. Total notches cut is 329. Our goal is 400 notches from floating plant by the end of June. Based on current rate of notches cut per day, we should reach our goal sometime in late May. It is likely we will exceed our goal by the end of June.

2. 13 Site-Specific Projects:

1. Monkey Mountain: Under construction. Estimated completion- 5wks
2. Worthwine Island: Under construction. Estimated completion- 5 wks
3. Weston Bend: Under construction. Estimated completion- 2 wks
4. Benedictine Bottoms: Under construction. Estimated completion- 5 wks
5. Liberty Bend: Under construction. Should be completed early next week.
6. Baltimore Bend: Under construction. Estimated completion- 5 wks.
7. Grand Pass: Contractor mobilizing equipment. Est. completion- 3 wks.
8. Franklin Island: (In-house) Under construction. Est. completion- 1 wk
9. Lisbon: Construction should start within two weeks. 1 wk to construct
10. Diana Bend: (In-house) Construction will start after Franklin Island. Should be completed within 6 weeks.
11. Eagle Bluffs: Construction has not started. Estimated completion- 6 wks
12. Marion Bottoms: Under construction. Estimated completion- 6 wks
13. Smokey Waters Under construction. Estimated completion- 6 wks.

3. Verification Plan: Service has been provided a draft of NWK's verification plan. Service's feedback was incorporated into the plan. A second more detailed draft will be provided back to the Service early next week. Plan will have four sections:

    a. Listing of work accomplished.
    b. Qualitative assessment of benefits of work.
    c. Quantitative assessment of benefits of work.
    d. Assignment of acres.

Survey crews are currently collecting data and will continue to collect data over the next three weeks. River Unit engineers are currently working on the four parts of the report. Document will be completed by June 4.

NWO
Notching:

a. The Hired Labor has completed a total of 72 notches out of a possible 119. All of the notches so far have been type B (bank notches). The Hired Labor crew will pick-up the last three notches below the Platte by May 7th, and will begin to notch at Tyson Bend next week. Hired Labor has begun prep work at Tyson Bend and Lower Little Sioux River Reach. The low number of notches completed this week is due to small clean-up work around completed notches and mobilization for the fleet to sites above Omaha.

b. We inspected the dikes at Upper Decatur Bend and Lower Louisville Bend with Andy Moore from the Iowa DNR. During the inspection it was shown that the erosion that would result from the notching would not endanger the existing project. The DNR will reconsider their objection to the type B notches. They will let us know by Monday or Tuesday next week. Andy asked if the Corps could delete the downstream most notch at Upper Decatur Bend, as this is the closest dike to the Mitigation Project. This is acceptable and can be done if the State Changes their position. Otherwise we will proceed with type A notches.

c. We are seeing a variety of changes in the notched areas. Some notches have little flow through them that has resulted in little or no erosion to date. Others have experienced considerable erosion of both the high bank and the exposed downstream beach area. The shallow water in these dike fields is visibly evident from a boat, as the areas behind the dikes are beginning to trap a larger amount of large woody debris (and refrigerators, and propane tanks) than is observed in un-notched dike fields.

Major Dike Mods: The contractor has degraded most of the dikes at Snyder and Winnebago Bends and is in the process of constructing the chevrons. Five chevrons have been completed. During the inspection trip with the tribes and the states (May 4th), depths of 4-6 feet were observed behind the chevrons where one week earlier the depths were 17-20 feet (comparable river stages).

Dredging (channel widening): Pentzien has completed mobilization and is ready to go at Soldier Bend today, and will be ready to go on Monday at California Bend. Therefore, as of today, given the lack of a 404 permit and the "suspension of work" order in effect we will be incurring some delay/impact costs in all likelihood. There are two 20-inch dredges with separate tenders/barges and everything else that goes with supporting a dredging project on-site. The only on-going work is some site layout and clearing and grubbing in non-wetland areas. The only delay to the 404 permit is 401 clearance from the State of Iowa, which is expected by Tuesday of next week.

Monitoring: All field work is complete for the pre-construction surveys. Post processing is taking more time then expected, but some time invested now will make the post construction data processing faster.

Pallid Sturgeon Augmentation Support

Missouri Dept. of Conservation/Blind Pony Hatchery contract $2.03M was awarded May 5 with the NTP as scheduled.

During the last two weeks of April, a total of 8 gravid female and 20 male pallid sturgeon were captured in North Dakota from the Missouri and Yellowstone Rivers for use in the propagation program and to facilitate a field larval drift study this summer. Four male and four female pallid sturgeon were transported to the Miles City State Fish Hatchery, Miles City, Montana. Sixteen male and four female pallids were transported to the Garrison Dam National Fish Hatchery, Riverdale, North Dakota. Collection efforts were conducted by USFWS, MTFWP, USGS and USACE. Depending on water temperatures, pallid spawning at these facilities will take place around mid-June.

Comprehensive Pallid Sturgeon USGS Research Proposal

A workshop on technical aspects of pallid sturgeon (*Scaphirhynchus albus*) biology and management will be held on Tuesday, May 18 to Thursday, May 20, 2004 in Bloomington, MN. The workshop will be conducted by the University of Wyoming's William D. Ruckelshaus Institute of Environment and Natural Resources, at the request of the U.S. Fish and Wildlife Service (FWS), U.S. Army Corps of Engineers (COE), U.S. Geological Survey (USGS), and U.S. Environmental Protection Agency (EPA). The Director of the Ruckelshaus Institute, Dr. Harold Bergman, will facilitate the discussions.

The first two days will be work sessions for technical experts. Presentations and discussion will center on research needs outlined by professional fisheries biologists, fish culturists, river ecologists, physical scientists, and invited scientists with expertise on other sturgeon species. These research needs are being developed as part of an adaptive management framework aimed at reducing uncertainty surrounding pallid sturgeon ecology and management.

The goal of the workshop is to identify and prioritize critical ecological factors that influence pallid sturgeon in the Missouri River and consider how these factors are affected by river operations and management. Discussion of these factors will lead to identification of associated short-term and long-term research needs. The collaborating federal agencies (USGS, FWS, COE, and EPA) are committed to implementing a process to establish research priorities for pallid sturgeon within an adaptive management framework.

The draft report will be reviewed by workshop participants and available for both stakeholder review and formal peer review by outside scientific and technical experts who were not affiliated with the workshop. The final product will result in a prioritized research strategy aimed at influencing management of the Missouri River to benefit pallid sturgeon.

Emergent Sandbar Habitat

Ponca project: The dredge moved on site the week of May 3 and immediately started pumping stockpiled materials into the channel for island creation. Representatives from Threatened and Endangered Species Section and Planning Branch, Environmental and Economics Section, met on site with the contractor to decide on placement of dredge materials to form Emergent Sandbar Habitat. This effort should result in up to a 75 acre island by the end of June.

Due to delays by the NPS on the Section 7 consultation under the Wild and Scenic Rivers Act, funds for additional island construction will not be needed for at least 60 days. Colonel Ubbelohde met with Ernest Quintana, NPS Regional Director, and a strategy was developed where NPS is reassigning one of their experienced staffers to begin work immediately on the Section 7 certification. This will be done concurrently with the NEPA compliance work with the potential to award a contract by September.

Missouri River Recovery Implementation Program (MRRIP)

No change.

MISSOURI RIVER BIOLOGICAL OPINION
WORK AND FUNDING STATUS REPORT

May 2004

FUNDING

Funds were received at the District level of $8.788.5M on April 2 with $3.5M going to NWK and the remainder to NWO. As of May 7, $16,841.5M was obligated and $6.3M was expended. All major contracts are awarded both for SWH construction and fish propagation.

MAY WORK PLAN

Funding need for May is $4,638,500, this will go with the $16,892,500 from the March and April reprogramming. This is $84,000 less than originally scheduled. Expenditures for May will primarily be contractor in-progress payments forecasted at close to $8M. Major work items by contractors for May include 3 dredging projects (Ponca, California Bend, Tyson Bend and Soldier Bend); dike notching in NWK and NWO by in-house and contractors; dike modifications and chevron construction with placement of up to 90,000 ton of rock; and work at all of the fish propagation facilities including Gavin's Point Fish Hatchery pallid rearing facility. A contract will be awarded for approximately 100k for preparing NEPA documentation and a programmatic agreement for ESH work on the Missouri River Recreational River.

ACCOMPLISHMENTS TO DATE

Shallow Water Habitat

NWK: Contractor has cut 296 notches and has been able to cut approximately 7 notches per working day. NWK's in-house river fleet has been redirected from critical maintenance work on the lower river to begin notching above the mouth of the Osage River. To date they have cut 33 notches. Total notches cut is 329. Our goal is 400 notches from floating plant by the end of June. Based on current rate of notches cut per day, we should reach our goal sometime in late May. It is likely we will exceed our goal by the end of June.

2. 13 Site-Specific Projects:

1. Monkey Mountain: Under construction. Estimated completion- 5wks
2. Worthwine Island: Under construction. Estimated completion- 5 wks
3. Weston Bend: Under construction. Estimated completion- 2 wks
4. Benedictine Bottoms: Under construction. Estimated completion- 5 wks
5. Liberty Bend: Under construction. Should be completed early next week.
6. Baltimore Bend: Under construction. Estimated completion- 5 wks.
7. Grand Pass: Contractor mobilizing equipment. Est. completion- 3 wks.
8. Franklin Island: (In-house) Under construction. Est. completion- 1 wk
9. Lisbon: Construction should start within two weeks. 1 wk to construct

10. Diana Bend: (In-house) Construction will start after Franklin Island. Should be completed within 6 weeks.
11. Eagle Bluffs: Construction has not started. Estimated completion- 6 wks
12. Marion Bottoms: Under construction. Estimated completion- 6 wks
13. Smokey Waters Under construction. Estimated completion- 6 wks.

3. Verification Plan: Service has been provided a draft of NWK's verification plan. Service's feedback was incorporated into the plan. A second more detailed draft will be provided back to the Service early next week.

Survey crews are currently collecting data and will continue to collect data over the next three weeks. River Unit engineers are currently working on the four parts of the report. Document will be completed by June 4.

NWO: Notching:

a. The Hired Labor has completed a total of 72 notches out of a possible 119. All of the notches so far have been type B (bank notches). The Hired Labor crew will pick-up the last three notches below the Platte by May 7th, and will begin to notch at Tyson Bend next week. Hired Labor has begun prep work at Tyson Bend and Lower Little Sioux River Reach.

b. We are seeing a variety of changes in the notched areas. Some notches have little flow through them that has resulted in little or no erosion to date. Others have experienced considerable erosion of both the high bank and the exposed downstream beach area. The shallow water in these dike fields is visibly evident from a boat, as the areas behind the dikes are beginning to trap a larger amount of large woody debris (and refrigerators, and propane tanks) than is observed in un-notched dike fields.

Major Dike Modifications: The contractor has degraded most of the dikes at Snyder and Winnebago Bends and is in the process of constructing the chevrons. Five chevrons have been completed. During the inspection trip with the tribes and the states (May 4th), depths of 4-6 feet were observed behind the chevrons where one week earlier the depths were 17-20 feet (comparable river stages).

Dredging (channel widening): The Section 404 permit should be issued by next Tuesday (May 11) at the latest. The contract is awarded and the contractor is ready to go. The cost will likely increase due to lower than expected river stages.

Monitoring: All field work is complete for the pre-construction surveys. Post processing is taking more time then expected, but some time invested now will make the post construction data processing faster.

Pallid Sturgeon Augmentation Support: The Missouri Department of Conservation Blind Pony Fish Hatchery support contract was issued with NTP for $2,030,000. Work on the Gavin's Point and Riverdale national fish hatcheries started the first part of April with the Gavin's Point building estimated at 25% complete as of this date.

Comprehensive Pallid Sturgeon USGS Research Proposal: MIPR went to USGS for $752.5K for the Comprehensive Pallid Sturgeon Research Proposal with USGS reporting 4 May all funds had been expended except for $2k.

Emergent Sandbar Habitat: The Ponca contract was awarded the first week of April and work started immediately by the contractor for cutting and bank shaping. The dredge moved on site the week of May 3 and immediately started pumping stockpiled materials into the channel for island creation. This effort should result in up to a 75 acres island by the end of June. Due to delays by the NPS on the Section 7 consultation under the Wild and Scenic Rivers Act, funds for additional island construction will not be needed for at least 60 days.

Missouri River Recovery Implementation Program (MRRIP): These funds have been used for funding the PMBP effort on the BiOp as well as a government order with CRRL for developing a comprehensive GIS Missouri River data base for Adaptive Management decision making.

prepared by:
Mike George
Project Manager
CENWO
(402)221-7176

Shallow Water Habitat Construction
Tracking Sheet
Missouri River

Shallow Water Habitat Site	Date Started	Date Completed	# Notches River and Bank 2/	Low Range of Acres	High Range of Acres	Macro Habitat Type	Date Inspected by USFWS	Acres Verified	Contract Funds Obligated 1/	Date Funds Obligated	Date Funds Expended	Potential for Additional Acres / Remarks
Ponca	5-Apr		dredge	40	80	Inside Bend			$1,900,000	4/2/2004		Task Order Awarded 2 April
Winnebago/Snyder	9-Apr		dike mod	20	25	Inside Bend			$1,022,500	4/9/2004		Task Order Awarded 2 April
Tieville-Middle Decatur Bend		completed		10	308	Secondary Channel non-connected				n/a		Acreage to be decided by COE and FWS
Soldier Bend			dredge	20	25	Secondary Channel non-connected			$400,000	5/5/2004		NTP expected 11 May
Tyson Bend			dredge	20	25	Secondary Channel non-connected			$400,000	5/5/2004		NTP expected 11 May
California Bend			dredge	20	25	Secondary Channel non-connected			$400,000	5/5/2004		NTP expected 11 May
Desoto Bend Dikes			dike mod	25	30	Inside Bend			*	4/9/2004		Contract awarded 9 April
Boyer Bend			dike mod	20	30	Inside Benmd			*	4/9/2004		Contract awarded 9 April
Tobacco Bend			dike mod	20	20	Inside Bend			*	4/9/2004		Contract awarded 9 April/ may postpone work due to eagle nest
Upper Hamburg Bend	Dec-03	12-Mar	dike mod	35	40	Inside Bend	Inspected			n/a		Acreage pending via ERDC survey
Lower Hamburg Bend	Dec-03	12-Mar	dike mod	50	55	Inside Bend	Inspected			n/a		Acreage pending via ERDC survey
Langdon Bend	9-Apr		dike mod	15	18	Inside Bend			*	4/9/2004		Contract awarded 9 April
Deroin Bend	9-Apr		3 bank	25	30	Inside Bend			*	4/9/2004		Contract awarded 9 April
Rush Bottoms	postponed			0	0					xxx		real estate issues
NWO Dike Notching	30-Mar		120 river	120	145	Inside & Outside Bend			in-house			71 notches to date (30 April) by hired labor

1/ Blue is actual: Black is Government Estimate

2/ River notch = 1acre/notch

Bank notch = 4-6 acres/notch and 4 acres/1000' of chute

* = part of total $1,022,500 award

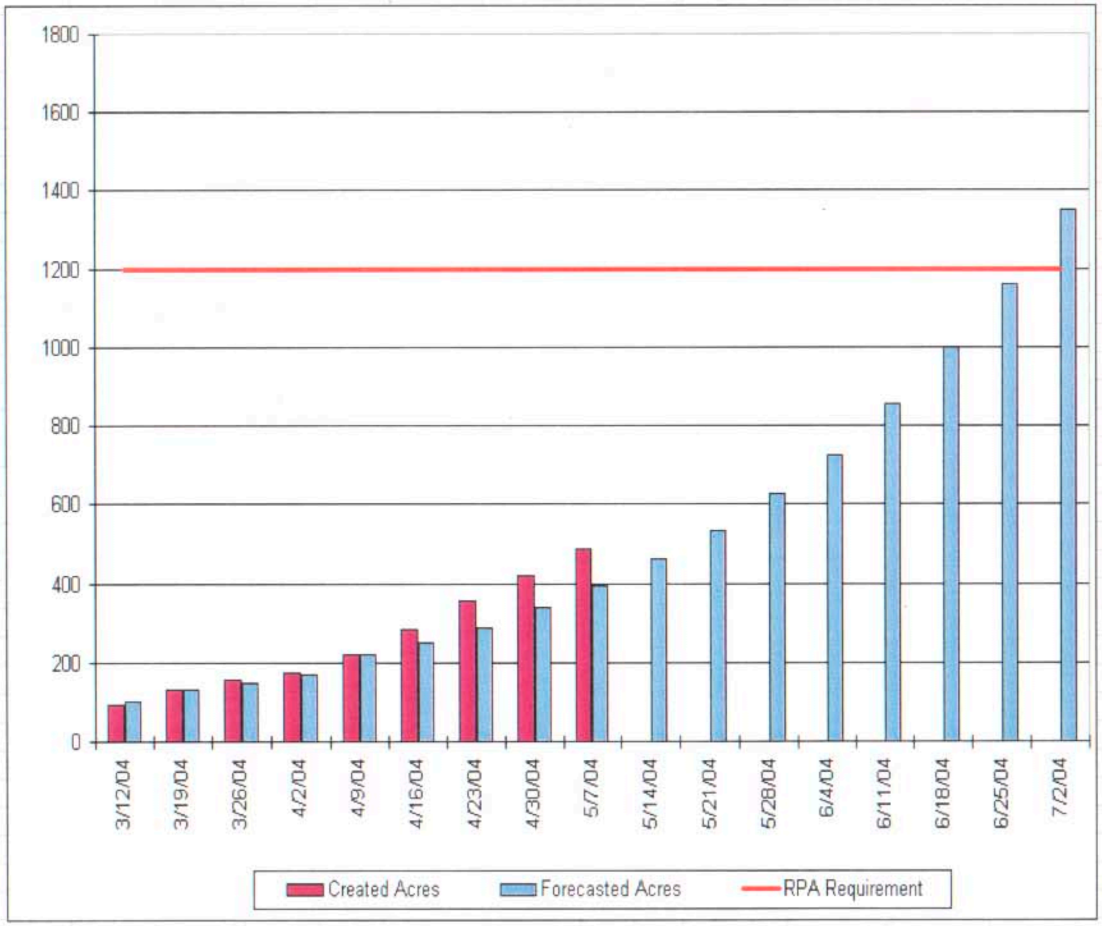
** = part of total $932,000 award

NWK Dike Notching	11-Mar		300 river	300	300	Inside & Outside Bend			$2,600,000	3/11/2004		286 notches to date (30 April)
Bob Brown	Deleted			0	0					xxx		Too close to levee
Monkey Mountain	26-Apr		5 bank	20	38	Outside Bend			$932,000	4/26/2004		NTP 26 April
Worthwine Island	26-Apr		8 bank	32	48	Inside Bend			**	4/26/2004		NTP 26 April
French Bottoms	Deleted			0	0					xxx		Too close to levee
Benedictine Bottoms	26-Apr		9 bank	36	54	Secondary Channel connected			**	4/26/2004		NTP 26 April
Fort Leavenworth	10-Mar		20 river	20	20	Inside Bend			***	4/26/2004		Dike Notch by existing Contractor (Ellis)
Weston Bend State Park			3 bank	17	23	Outside Bend			**	4/26/2004		NTP 26 April
Kansas City Reach	10-Mar		100 river	100	100	Inside & Outside Bend			***	4/26/2004		Dike notching contract
Liberty Bend	26-Apr		2 bank	13	17	Outside Bend			$3,150,000	4/26/2004		NTP 26 April
Baltimore Bend	26-Apr		8 bank	32	40	Inside & Outside Bend			****	4/26/2004		NTP 26 April
Grand Pass	26-Apr		5 bank	20	30	Inside & Outside Bend			****	4/26/2004		NTP 26 April
Lisbon Bottoms	26-Apr		dredge	30	30	Secondary Channel connected			****	4/26/2004		NTP 26 April
Franklin Island	15-Feb		7 bank	56	70	Inside & Outside Bend			in-house	3/11/2004		Hired Labor in progress
Diana Bend			2 bank	17	21	Outside Bend			in-house			Hired labor to start approx 1 May
Overton Bottoms South	postponed			0	0					xxx		Real Estate issues preclude work this year
Eagle Bluffs	26-Apr		12 bank	52	76	Inside Bend			****	4/26/2004		NTP 26 April
Marion Bottoms	26-Apr			25	35	Inside Bend			****	4/26/2004		NTP 26 April
Smokey Waters	26-Apr			10	10	Inside Bend			****	4/26/2004		NTP 26 April
TOTAL				**1220**	**1768**			**0**	**$10,804,500**			

1/ Blue is actual; Black is Government Estimate
2/ River notch = 1acre/notch
Bank notch = 4-6 acres/notch and 4 acres/1000' of chute
* = part of NWO $1,022,500 award
** = part of NWK $932,000 award
***= part of NWK $2,600,000 award
****= part of NWK $3,150,000 award

SWH Acres Construction Tracking

	3/12/04	3/19/04	3/26/04	4/2/04	4/9/04	4/16/04	4/23/04	4/30/04	5/7/04	5/14/04	5/21/04	5/28/04	6/4/04	6/11/04	6/18/04	6/25/04	7/2/04
Created Acres	92	132	155	172	220	285	355	420	486								
Forecasted Acres	100	130	150	170	220	250	290	340	395	460	535	625	725	855	1000	1160	1350
RPA Requirement	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200



SIT-REP
Biological Opinion Missouri River

May 10 - 14, 2004

Funding:
HQ identified a source and approved our reprogramming request for May. Expenditure rate vs. obligation caused the delay. Mike George will be working to make sure future reprogramming requests reflect the high expenditure rate we are experiencing on this effort.

There are some potential cost over runs on the SWH contracts. These potential over runs are as follows:

Ponca (Western). Contractor is currently over dredging approximately 1.5 feet due to river elevations/draft needed to float dredge which will increase costs. Over dredging may increase if Gavins reduces flows. Expecting July 1 completion.

River Structures (Western). CT Mod estimate assumed that total rock quantity would be 90K tons at existing contract unit price. Contractor has indicated and construction representative believes this figure may grow to 120-130K tons. In addition contractor has indicated that unit price for rock will increase due to acceleration/hauling distances/construction of temporary dock facilities etc. Expecting July 1 completion.

Channel Widening Dredging (Pentzien). Initial contract amount is $1.9M. Contractor is currently over dredging 2.5 feet due to low flows below the CRP which will significantly increase costs. Also expect some delay costs due to approximate 7 day delay for 404 permitting. Expecting July 1 completion.

Mike George will be working with construction, John Remus and Mike Chapman to get a full analysis of potential cost over runs and recommendations for resolution and funding.

Enhanced Shallow Water Habitat:

NWD
Kelly Ryan, NWK, is working with NRCS to complete development of an MOU between our two agencies regarding use of existing WRP sites for mitigation purposes. This came about as part of the negotiations for completing the SWH O&M projects this summer. The attached letter was the "agreement" that the NRCS would allow us to erode lands that were enrolled in the WRP program if we would replace the eroded areas acre for acre. The last paragraph of the letter indicates their desire to meet the week of 12 July. The NRCS intends to invite the WRP program lead out of their Washington DC office, the four State Conservationists and their assistants, and it appears after discussion with them that they intend to invite nearly all their staffs that are working on the WRP programs in all four states. They feel a two day effort is necessary and want to also have

a site visit to some of the sites. July 13 and 14 in Columbia MO have been set aside to do this. We need to have Omaha and KC staffs available. Agenda to follow as the date gets closer.

WRP Agreement 5-4-04.pdf

NWK

1. Dike notching: Contractor has cut 330 notches the end of yesterday. He has been able to cut approximately 7 notches per working day. NWK's hired labor fleet have cut 29 notches before they blew an engine. They should be back on-line the first week of June. Total notches cut is 359. Our goal is 400 notches from floating plant by the end of June. Based on current rate of notches cut per day we should reach our goal sometime in late May. Our plan is to continue constructing notches through the end of June.

2. 13 Site-Specific Projects:

    1. Monkey Mountain: 85% complete. Estimated completion- 2wks
    2. Worthwine Island: 75% complete. Estimated completion- 3 wks
    3. Weston Bend: 50% complete. Estimated completion- 2 wks
    4. Benedictine Bottoms: 35% complete. Estimated completion- 5 wks
    5. Liberty Bend: Complete
    6. Baltimore Bend: 50% complete. Estimated completion-4 wks.
    7. Grand Pass: Complete.
    8. Franklin Island: (In-house) Complete
    9. Lisbon: Construction started. 1 wk to construct
    10. Diana Bend: (In-house) Construction started. Est. completion-6 weeks.
    11. Eagle Bluffs: Construction started. Estimated completion- 6 wks
    12. Marion Bottoms: Under construction. Estimated completion- 6 wks
    13. Smokey Waters: Under construction. Estimated completion- 6 wks.

3. Verification Plan: Service has been provided a draft of NWK's verification plan. It has been decided to combine Kansas City's and Omaha's verification plan into one document that will be sent to the Service on June 7.

4. In-house survey crews are currently collecting data and will continue to collect data over the next three weeks at selected sites. River Unit engineers are currently working on the first three parts of the report looking at past and current projects. Also, USGS will be collecting pre and post construction depth and velocity data at four sites where we have excavated notches. They will have the information by June 4.

This work is estimated to result in 830 to 940 acres of SWH..

Excavation at the Lower Hamburg chute is nearing completion, see attached photos:

photo 2.jpg First fishermen2.jpg

NWO
The Hired Labor has completed a total of 92 notches out of a possible 121.

The State of Iowa has officially denied the Corps permission to notch any of the dikes at Upper Decatur and Lower Louisville Bends. They have unofficially offered four additional sites and we are pursuing these sites. The Hired Labor crew will be mobilizing to these sites next week. This construction will likely be a little slower due to the higher banks and larger amount of material to be removed.

Major Dike Mods: The contractor has moved to Desoto and Boyer Bends. The eagles nest a Tobacco Island is still active as of earlier this week. As the contractor get ready to move to the site we will make the decision as to how far away from the nest we need to be. This will effect the number of acres and will likely impact the verification surveys. This will be discussed next week in Minneapolis.

Dredging (channel widening): Dredging has begun at Ponca, Soldier and California Bends. The Omaha District is going to conduct a media day on 19 May at the Ponca construction site.

Monitoring: Post processing is continuing. The contract data is taking shape, and we should have something to share with FWS by the end of next week.

Pallid Sturgeon Augmentation Support

No change.

Comprehensive Pallid Sturgeon USGS Research Proposal

The USGS workshop will take place next week (May 18 –20). Attached is an Agenda for the workshop.

Preliminary
nnotated Agenda.d.

Emergent Sandbar Habitat

ESH creation is occurring right now at the Ponca dredging project and will result in 75 acres ± this FY. The other three island projects below Gavin's Point were in our funding schedule for a dredging contract award in May. This is not possible because the Section 7 coordination with the NPS under the Wild and Scenic Rivers Act is not finished, there are a variety of reasons for this but the primary reason is NPS had trouble filling the position for this analysis. After a meeting with Colonel Ubbelohde the NPS Regional Director made some adjustments and have now assigned an experienced person working on this analysis full time. Accordingly, in our schedule, we reflect a 90 day delay (to mid-August) for a possible award. This change in schedule has been fully coordinated with NPS. We intend to construct these islands before the next nesting season by awarding a contract with next FY years money if necessary.

Missouri River Recovery Implementation Program (MRRIP)

No change.

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
Parkade Center, Suite 250, 601 Business Loop 70 West
Columbia, Missouri 65203

April 23, 2004

Ms. Barbara J. Cunningham, Acting Chief
Real Estate Division
Kansas City District Corps of Engineers
700 Federal Building
Kansas City, Mo 64106-2896

Dear Ms. Cunningham:

We have received a copy of your April 23, 2004, letter by fax. NRCS is committed to assisting the Corps in its efforts to establish shallow water habitat and we understand it is of utmost urgency.

NRCS concurs with your proposal to compensate, acre for acre, lands currently under WRP easement that will be eroded away as a direct result of the shallow water habitat. NRCS agrees to accept a permit for wetland development as compensation. NRCS agrees with the components of the general verbal agreement as stated in your letter including, but not limited to, exact number of acres and exact locations will be worked out by future meetings and that the COE will provide all necessary surveys.

By this letter, NRCS authorizes the installation of bank notches on the same easements as per plans previously provided by your district. NRCS has already issued Compatible Use Permits to the Missouri Department of Conservation and US Fish and Wildlife Service as landowners for the WRP easements on Baltimore Bend, Marion Bottoms, Diana Bend, and Smokey Waters. These permits were previously limited to chutes only.

As stated in your letter, our agencies need to work closely to resolve the details. We propose a meeting of staff from our agencies, as well as the Missouri Department of Conservation and the US Fish and Wildlife Service, to discuss the issues which have brought us to this point, view the shallow water habitat installed in the field, and begin to set a course of action for future cooperation between all parties involved. We propose a 2-3 day meeting in Columbia during the week of July 12, 2004. Please work with Harold Deckerd, Assistant State Conservationist for Water Resources (573-876-0912), regarding the meeting arrangements.

Sincerely,

Roger A Hansen

ROGER A. HANSEN
State Conservationist

cc: Victor Cole, NRCS, Washington, D.C.
Leslie Deavers, NRCS, Washington, D.C
Jane Epperson, MDC, Jefferson City, MO
Charlie Scott, US Fish and Wildlife Service, Columbia, MO
Leslie Michael, NRCS, Jefferson City, MO
Pat Hufford, NRCS, St. Joseph, MO
Harold Deckerd, NRCS, Columbia, MO

CENWK-RE-C (405-10f)

Mr. Mueller/plh/816-983-3764
P:/RE-Civil/KARL/NRCS.doc

DEPARTMENT OF THE ARMY
KANSAS CITY DISTRICT, CORPS OF ENGINEERS
700 FEDERAL BUILDING
KANSAS CITY, MISSOURI 64106-2896

REPLY TO
ATTENTION OF

May 04, 2004

Real Estate Division

SUBJECT: Shallow Water Habitat on NRCS Easement

Mr. Harold Deckerd
Natural Resources Conservation Service
Parkade Center, Suite 250
601 Business Loop 70 West
Columbia, Missouri 65203

Dear Mr. Deckerd:

The Kansas City District Corps of Engineers is currently planning to construct shallow water habitat projects at numerous locations along the lower Missouri River. Four of the projects will be constructed on land encumbered by Wetland Reserve Program (WRP) easements that are administered by your agency.

The Corps needs to have these habitat projects constructed by July 1, 2004. Due to the short timeline of these projects, a general verbal agreement has been worked out between the Corps of Engineers and the Natural Resource Conservation Service to address long-term adverse impacts to your agencies easements. It is understood that both agencies will work closely together in the next few months to reach a final agreement and bring closure to this action. This letter serves to document the components of the general verbal agreement.

The NRCS will grant immediate Compatible Use agreements for the shallow water habitat projects at Baltimore Bend, Marion Bottoms, Diana Bend, and Smokey Waters and in exchange the COE agrees to the following:

a. The COE will compensate, acre for acre, all lands currently under a WRP easement that will be eroded away as a direct result of the construction of these projects. The exact number of acres and exact location of the acres will be worked out during subsequent meetings between our two agencies. The Corps and the NRCS will identify like areas of land that the Corps currently owns. Since a Federal easement cannot be placed on other Federal land, the Corps will grant the NRCS a permit for wetland development on those properties. The term of the permit will not exceed the term of the original WRP easement.

b. The COE agrees to provide the necessary surveys on both the existing land to be taken out of WRP and the designated COE replacement WRP land. These surveys will be to the standard currently required by the NRCS on WRP lands.

c. The COE will designate the land and provide surveys in a timely manner.

It is recommended that the COE and the NRCS meet to discuss long-term implications of our two agencies authorities and programs within the Missouri River floodplain. It is likely that our multiple authorities can compliment each other for restoration of the entire Missouri River ecosystem.

Sincerely,

Barbara J. Cunningham
Acting Chief, Real Estate Division

Copies Furnished:

Ms. Jane Epperson, Missouri Department of Conservation, P.O. Box 180, Jefferson City, MO 65102-1080

Mr. Tom Bell, U.S. Fish and Wildlife Service, 4200 New Haven Dr., Columbia, Mo 65201

EC-HH (Chapman)
PM-C (Ryan)

MUELLER
RE-C

KOSEL
RE-C

CROSS
RE-C

TOOL
EC-HH

CUNNINGHAM
RE

Lower Hamburg Chute

Lower Hamburg Chute - First Fisherman

Preliminary Annotated Agenda
Pallid Sturgeon Research Workshop
Tuesday, May 18, 2004 – Thursday, May 20, 2004
Embassy Suites Hotel
2800 American Boulevard West
Bloomington, MN

Tuesday, May 18, 2004

8:00am **Welcome and Introductions**—Harold Bergman, Director, UW Ruckelshaus Institute

8:20am **Welcome and Remarks**—Charles Wooley, Deputy Regional Director, Region 3, USFWS

8:30am **Meeting Organization/Structure/Goals/Objectives** —Harold Bergman

8:45am **Panel Review: Agency Roles in Management/Restoration of the Missouri River's Pallid Sturgeon**—Panelists: Doug Latka, ACOE; Charlie Scott, USFWS; Mike Mac, USGS; MRNRC Representative (Invited)

9:15am **Overview of Pallid Sturgeon Recovery**—Steve Krentz, USFWS

9:35am **Connecting "Best Available Science" to Policy Decisions: Lessons Learned from CALFED**—Sam Luoma, USGS

10:00am **Charge to Participants**—Harold Bergman

10:15am **Questions and Comments from Observers**

10:30am **Break**

10:45am **Breakout Session I**
***Note:** Participants will break into assigned discussion groups: a) Reproduction/Propagation/Genetics, b) Life History/Population, and c) Habitat/Flow. Each breakout group will discuss their assigned topic and identify research gaps and needs associated with pallid sturgeon management.

12:00pm **Buffet Lunch Served in Main Meeting Room: Breakout Session I Continues**

3:00pm **Break**

3:15pm **Plenary Session/Group Discussion of Breakout Reports**
Group will reconvene. Breakout groups will report on their discussions. Participants will comment and ask questions to help refine breakout findings. Group will begin to create an initial list of management needs and research gaps.

5:00 pm **Questions and Comments from Observers**

5:15pm **Meeting Adjourns for Dinner**

7:00pm **Group reconvenes—Facilitated Open Discussion**
Group will reconvene. Discussion will focus on the following points in both the short-term and longer-term contexts:

- Identification of major issues/topics for Wednesday Breakout Session
- Integrating management needs into adaptive management framework

9:00pm **Meeting Adjourned for the Evening**

Wednesday, May 19, 2004

8:00am **Breakout Session II**
Participants will be reassigned to new breakout groups based on discussion topics identified in previous plenary session.

10:00am **Break**

10:15am **Continue Breakout Session II**

12:00pm **Buffet Lunch Served: Plenary Session**
Lunch will be served and breakout groups will return to plenary session. Breakout groups will report on their discussions and participants will comment and ask questions to help refine breakout findings.

1:45 **Questions and Comments from Observers**

2:00pm **Break**

2:15pm **Plenary Session Continues**

3:00 pm **Questions and Comments from Observers**

3:15pm **Plenary Discussion and Conclusions: Draft Research Priority List**

4:15pm **Closing Remarks**—Harold Bergman

4:30pm **Meeting Adjourned**

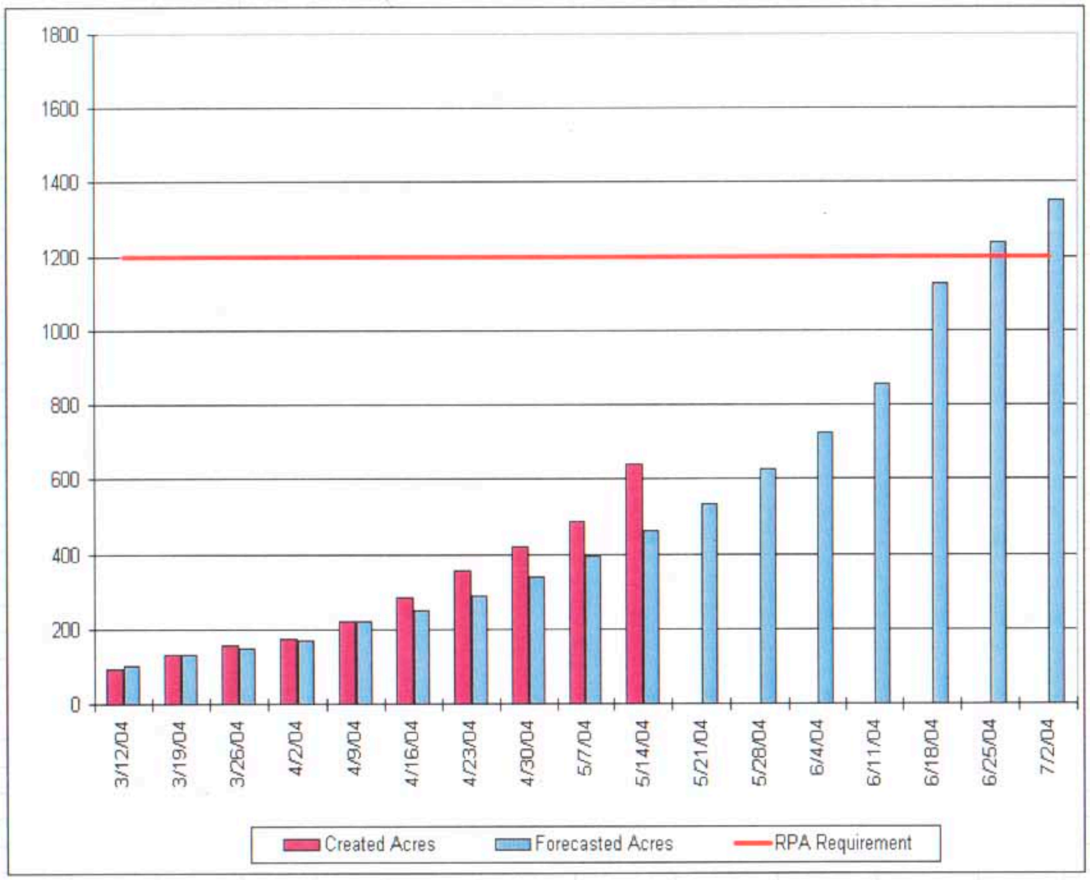
Thursday, May 20, 2004

9:00am **Public Stakeholder Information Exchange**—Harold Bergman (facilitator)
An open dialogue will take place among the workshop steering committee, participants, and members of the public regarding the initial proceedings of the workshop.

12:00pm **Meeting Adjourned**

SWH Acres Construction Tracking

	3/12/04	3/19/04	3/26/04	4/2/04	4/9/04	4/16/04	4/23/04	4/30/04	5/7/04	5/14/04	5/21/04	5/28/04	6/4/04	6/11/04	6/18/04	6/25/04	7/2/04
Created Acres	92	132	155	172	220	285	355	420	486	639							
Forecasted Acres	100	130	150	170	220	250	290	340	395	460	535	625	725	855	1125	1235	1350
RPA Requirement	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200



SIT-REP
Biological Opinion Missouri River

May 17 - 21, 2004

Funding:
Funding in the amount of $4.6M came from HQ on May 19 in the form of M&O funds. Accruals are being prepared for the May work.

Enhanced Shallow Water Habitat:

NWD
Kelly Ryan, NWK, is continuing to work with NRCS to complete development of an MOU between our two agencies regarding use of existing WRP sites for mitigation purposes. A pre-meeting will be held on 25 May to develop and finalize the agenda for the bigger COE and NRCS meeting. Real Estate and PM's from both NWK and NWO have confirmed attendance. Agenda for larger WRP meeting will be distributed first week of June.

Dave Ponganis, Doug Latka, Mike Chapman, John Remus and Mike George met with the FWS staff on 19 May in Minneapolis, MN to go over the SWH report outline. There was agreement from both agencies on how the report should look and the expected due dates.

NWK
1. Dike notching: Contractor has cut 341 notches the end of yesterday. He has been able to cut approximately 7 notches per working day. NWK's hired labor fleet have cut 29 notches before they blew an engine. They should be back on-line the first week of June. Total notches cut is 370. Our goal is 400 notches from floating plant by the end of June. Based on current rate of notches cut per day we should reach our goal sometime in late May. Our plan is to continue constructing notches through the end of June.

2. 13 Site-Specific Projects:

1. Monkey Mountain: Complete.
2. Worthwine Island: 90% complete. Estimated completion- 2 wks
3. Weston Bend: 90% complete. Estimated completion- 2 wks
4. Benedictine Bottoms: 65% complete. Estimated completion- 3 wks
5. Liberty Bend: Complete
6. Baltimore Bend: 80% complete. Estimated completion-2 wks.
7. Grand Pass: 70% Complete.
8. Franklin Island: (In-house) Complete
9. Lisbon: Construction started. 1 wk to construct
10. Diana Bend: (In-house) Construction started. Est. completion-6 weeks.
11. Eagle Bluffs: Construction started. Estimated completion- 5 wks
12. Marion Bottoms: Under construction. Estimated completion- 5 wks

13. Smokey Waters: Under construction. Estimated completion- 5 wks.

3. Verification Plan: Service has been provided a draft of NWK's verification plan. It has been decided to combine Kansas City's and Omaha's verification plan into one document that will be sent to the Service on June 7.

4. In-house survey crews are currently collecting data and will continue to collect data over the next few weeks at selected sites. River Unit engineers are currently working on the first three parts of the report looking at past and current projects. Also, USGS will be collecting pre and post construction depth and velocity data at four sites where we have excavated notches. They will have the information by June 4.

This work is estimated to result in 830 to 940 acres of SWH..

NWO

1. The Hired Labor has completed a total of 106 notches out of a possible 121.

2. 11 Site Specific Projects:
   - Ponca - 40% Complete
   - Winnebago/Snyder - Complete
   - Soldier Bend - 10% complete
   - Tyson Bend - Not started, on schedule for June 30 completion
   - California Bend - 10% complete
   - Desoto Bend Dikes - 50% complete
   - Boyer Bend - 50% complete
   - Tobacco Bend - Not started, scope will be reduced or scheduled slipped due to the presence of eaglets
   - Upper Hamburg Bend - Complete
   - Lower Hamburg Bend - Complete
   - Langdon Bend - Not started, on schedule for June 30 completion

3. ERDC indicated we would have the upper and lower Hamburg bend data by Tuesday, May 4, at the latest. This will allow us to assess the major dike mods/chevrons and give solid acreage estimates.

4. The post notching surveys will be delayed by at least three days due to thigh water from the recent storm events. This will impact our acreage estimate verifications for the June 7th report though we will still be able to verify the acreages by July 1.

5. There are eaglets in the nest at Tobacco Island. This will require the delay in lowering 7 dikes and constructing 3 chevrons. This will also delay any post construction surveys until late July or early August, if at all. This will cost us about 10 acres off our acreage estimate.

Pallid Sturgeon Augmentation Support

The contractor is in the process of the pouring the floor for the Advanced Rearing and Broodstock Building at the Gavins Point NFH. At the Neosho NFH, the expansion of the existing building is progressing well with a projected completion date of June 15th. This will increase their production for propagation efforts this year by 1/3. Construction plans for the new "Pallid Building" at the Neosho NFH are in the final stages.

Blind Pony State Fish Hatchery: Blind Pony Lake has been completely drained to accommodate the renovation of the lake and upgraded water supply line. Completion of the 404 Permit is required before lake excavation can begin. All of the engineering for this effort has been completed. Tanks, piping and sub-contractor building activities are ongoing.

Comprehensive Pallid Sturgeon USGS Research Proposal

Pallid work shop was held in Minneapolis, MN from May 18 – 20. More details in next weeks report.

Emergent Sandbar Habitat

The NPS has appointed a person who has started work on the Section 7 Wild and Scenic River Act clearances for the dredged islands. This person has made contact with the Corps environmental staff and started work on the coordination.

John Remus and Becky Latka were on the Ponca site on May 19 for a media day. There was very positive press on our efforts to create sandbar islands and backwater fisheries including stories in the Sioux City Journal and the Omaha World Herald.

Missouri River Recovery Implementation Program (MRRIP)

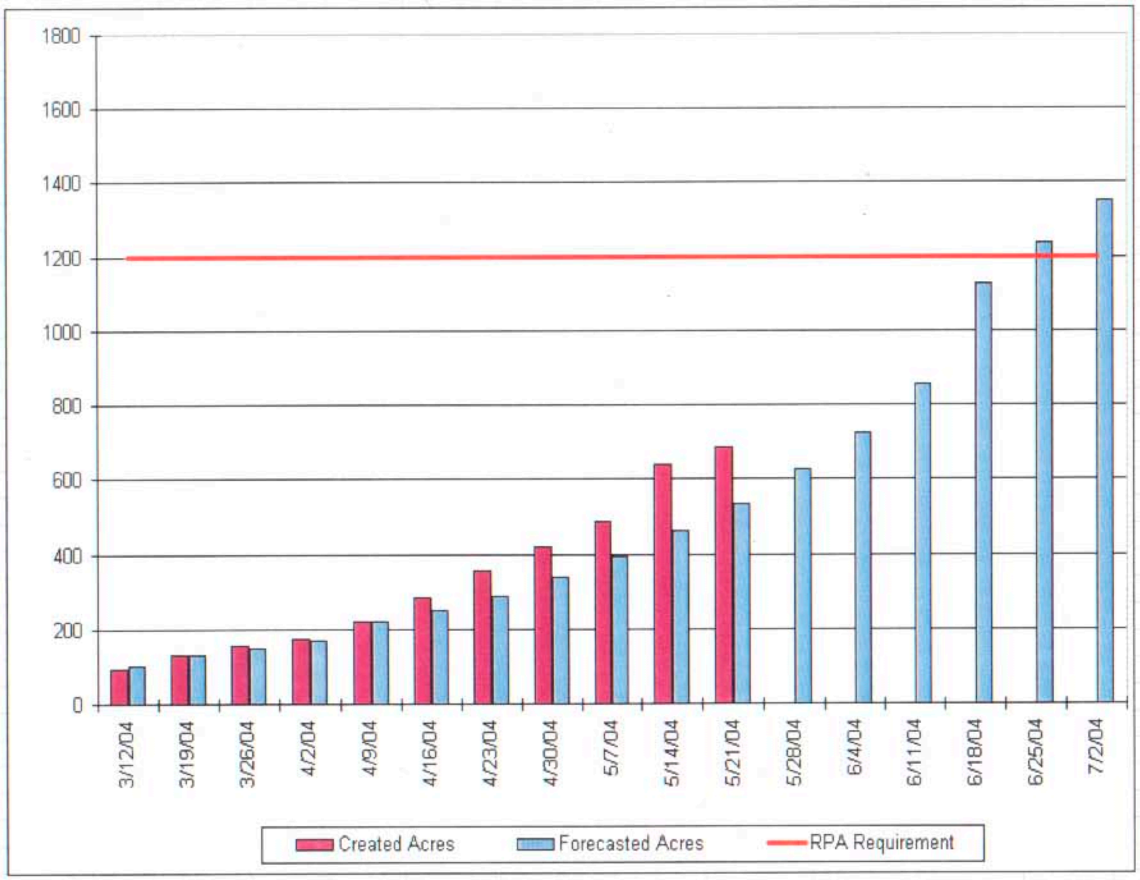
No change.

APPENDIX E

DIKE NOTCHING SUMMARY

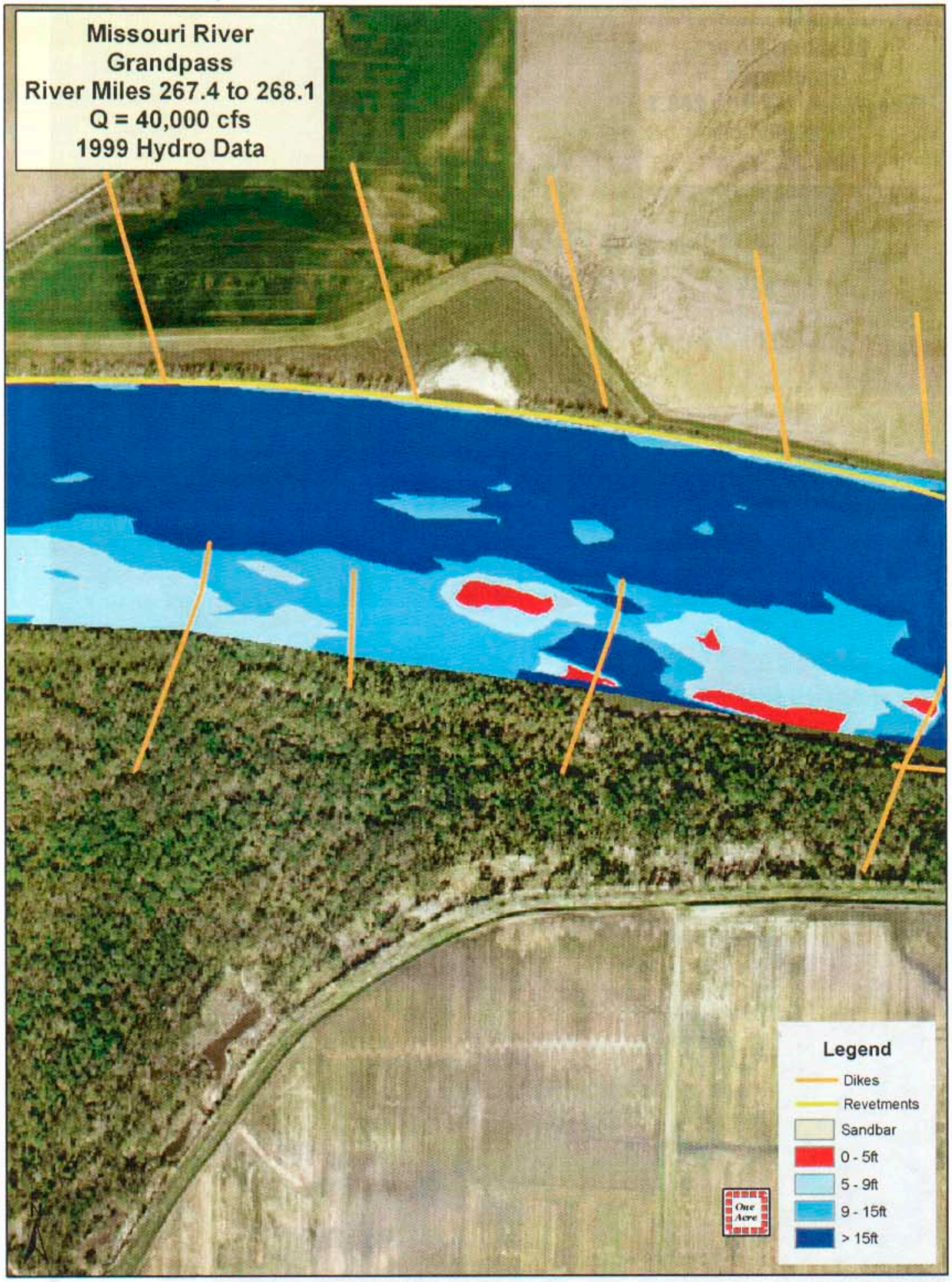
SWH Acres Construction Tracking

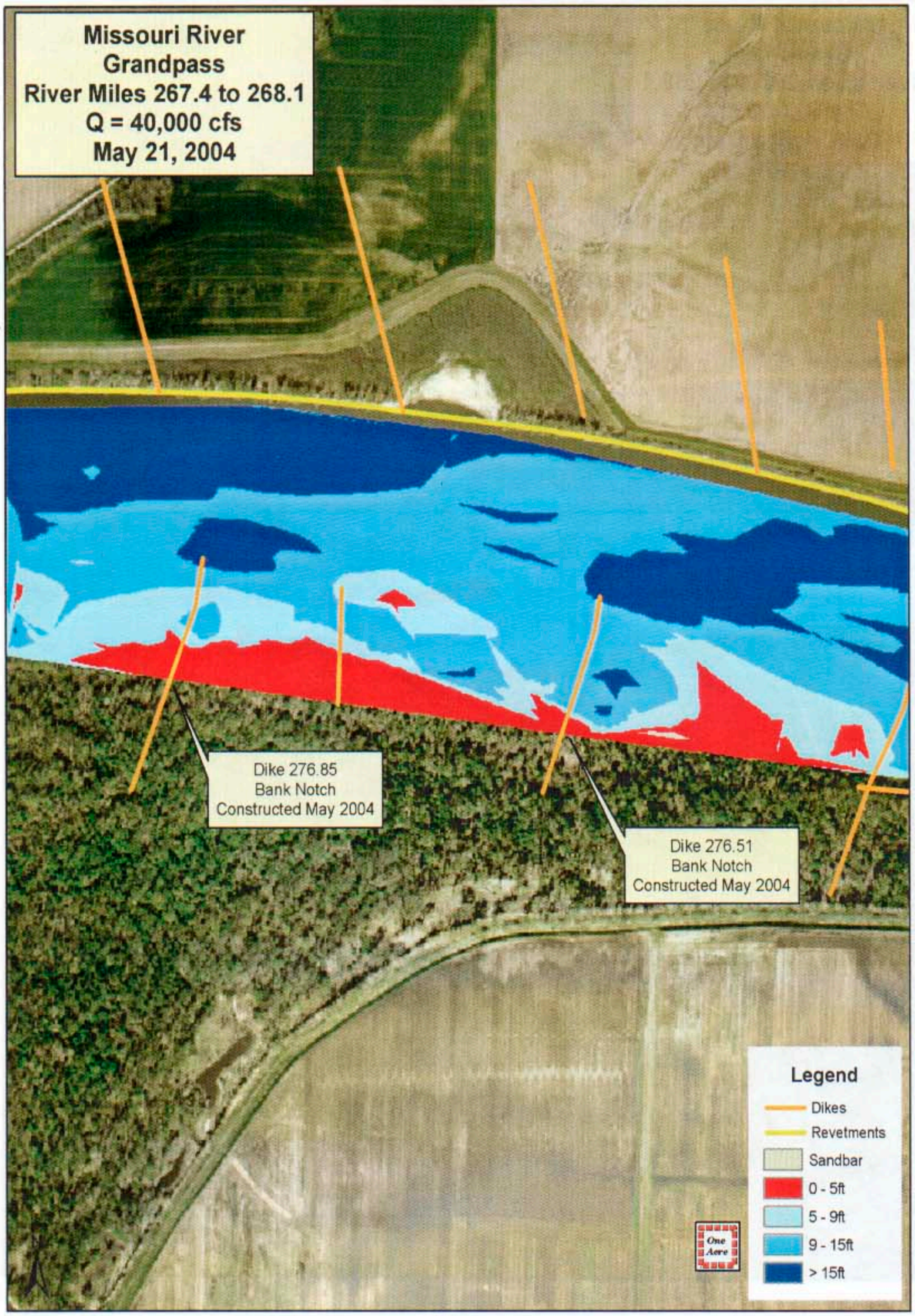
	3/12/04	3/19/04	3/26/04	4/2/04	4/9/04	4/16/04	4/23/04	4/30/04	5/7/04	5/14/04	5/21/04	5/28/04	6/4/04	6/11/04	6/18/04	6/25/04	7/2/04
Created Acres	92	132	155	172	220	285	355	420	486	639	688						
Forecasted Acres	100	130	150	170	220	250	290	340	395	460	535	625	725	855	1125	1235	1350
RPA Requirement	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200

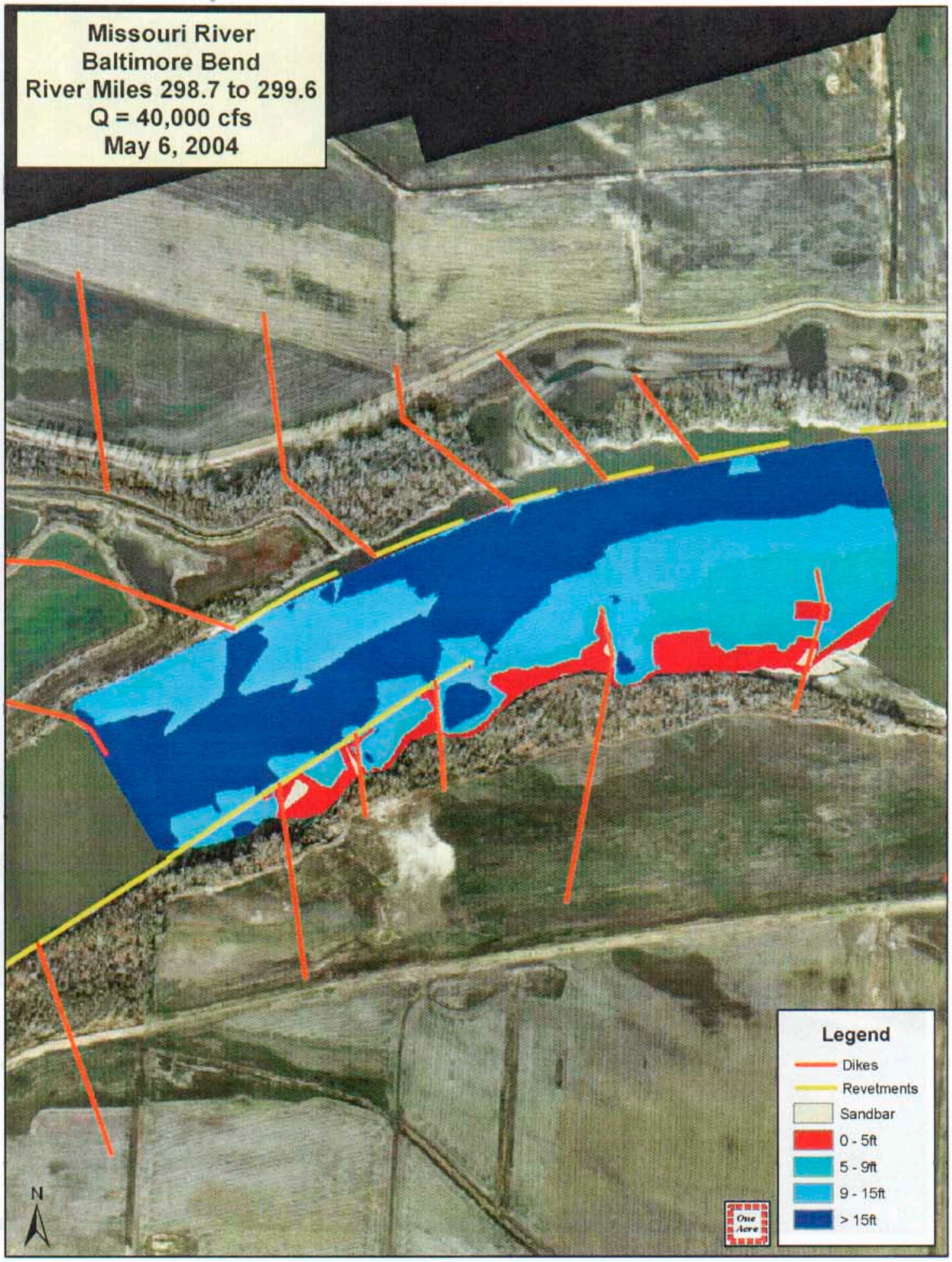


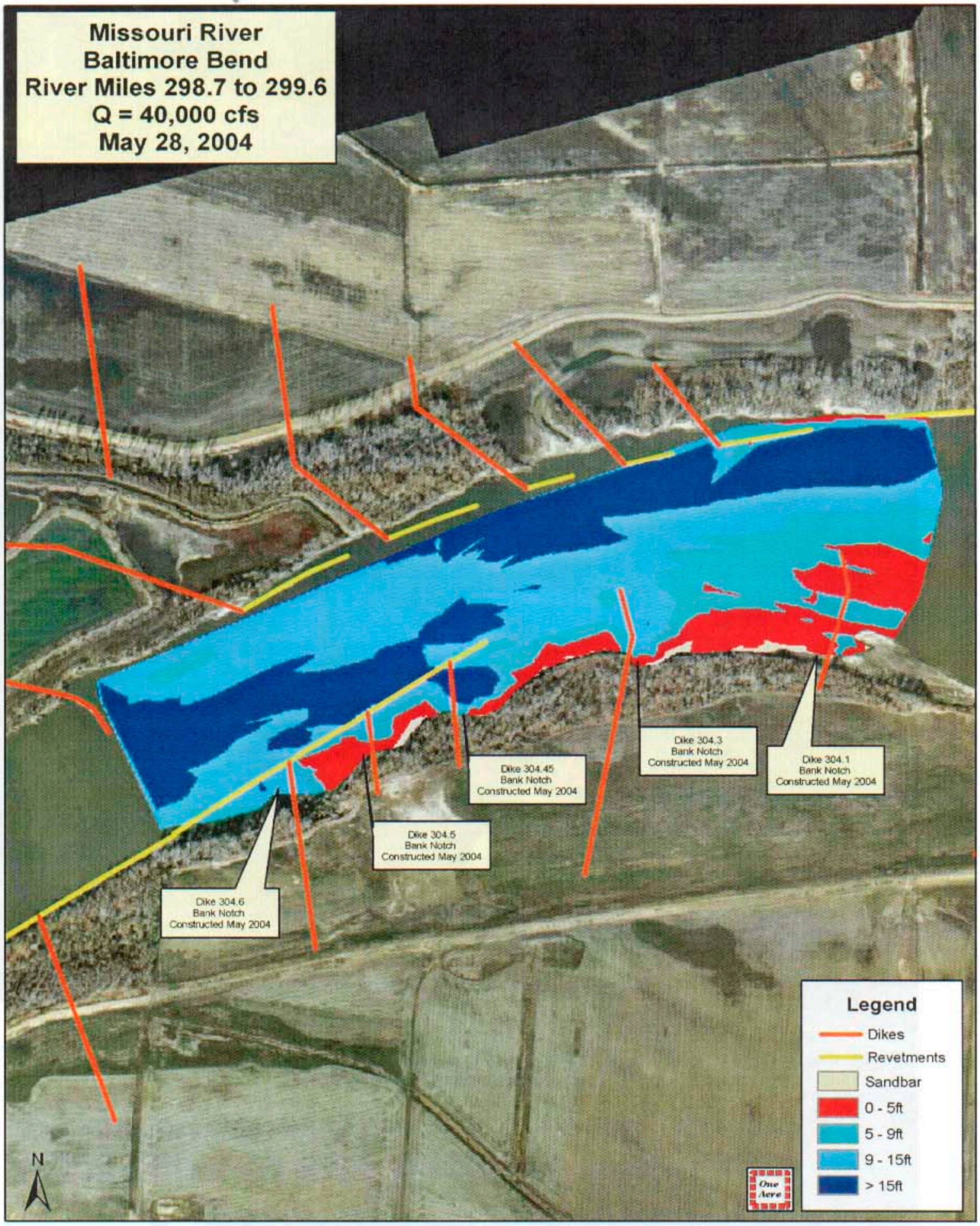
APPENDIX D

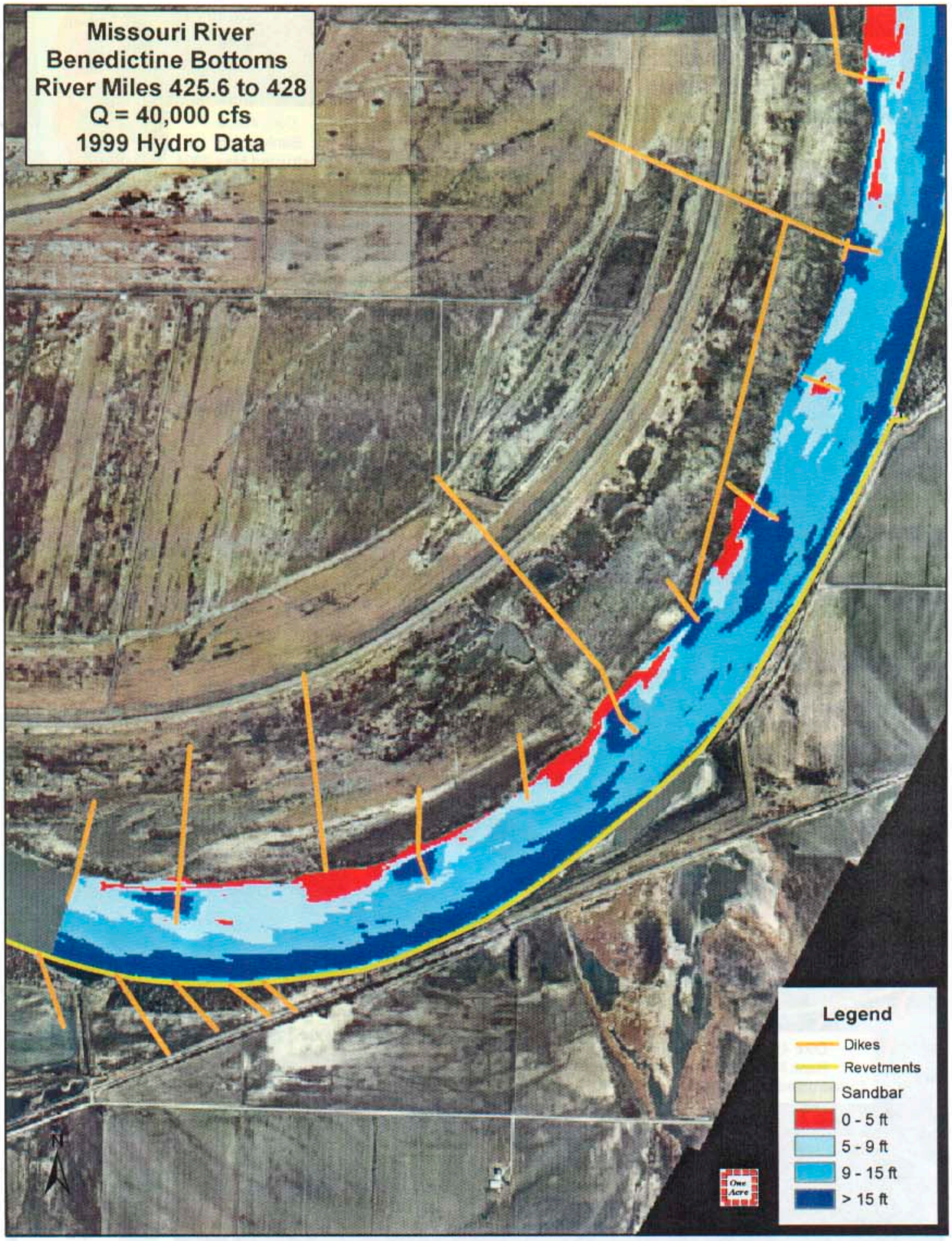
SHALLOW WATER HABITAT MONITORING DATA


Missouri River
Grandpass
River Miles 267.4 to 268.1
Q = 40,000 cfs
1999 Hydro Data
Legend
Dikes
Revetments
Sandbar
0 - 5ft
5 - 9ft
9 - 15ft
> 15ft
One Acre

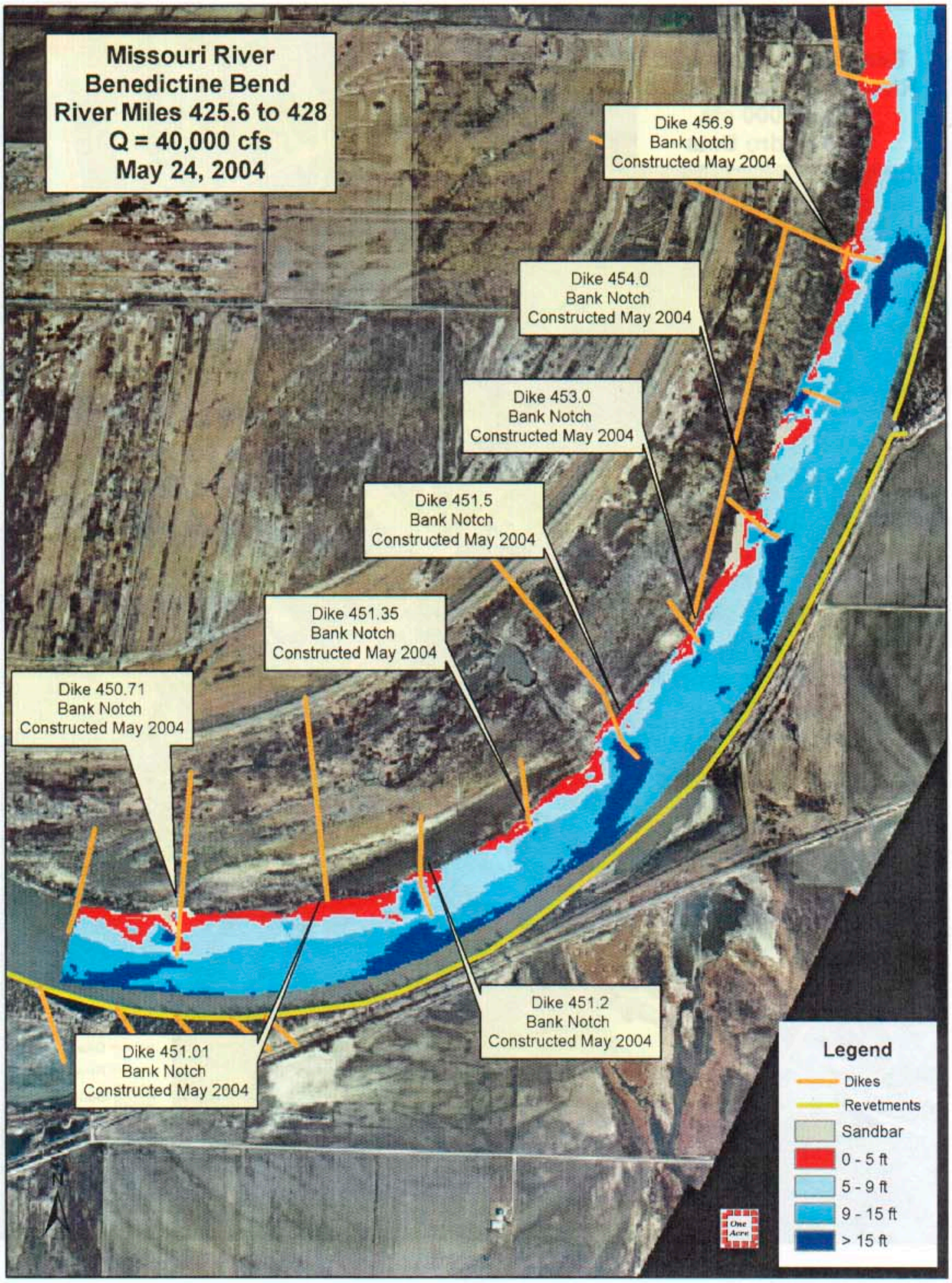

Missouri River
Grandpass
River Miles 267.4 to 268.1
Q = 40,000 cfs
May 21, 2004
Dike 276.85
Bank Notch
Constructed May 2004
Dike 276.51
Bank Notch
Constructed May 2004
Legend
Dikes
Revetments
Sandbar
0 - 5ft
5 - 9ft
9 - 15ft
> 15ft
One Acre


Missouri River
Baltimore Bend
River Miles 298.7 to 299.6
Q = 40,000 cfs
May 6, 2004
Legend
Dikes
Revetments
Sandbar
0 - 5ft
5 - 9ft
9 - 15ft
> 15ft
One Acre
N


Missouri River
Baltimore Bend
River Miles 298.7 to 299.6
Q = 40,000 cfs
May 28, 2004
Dike 304.3
Bank Notch
Constructed May 2004
Dike 304.1
Bank Notch
Constructed May 2004
Dike 304.45
Bank Notch
Constructed May 2004
Dike 304.5
Bank Notch
Constructed May 2004
Dike 304.6
Bank Notch
Constructed May 2004
Legend
Dikes
Revetments
Sandbar
0 - 5ft
5 - 9ft
9 - 15ft
> 15ft
One Acre
N

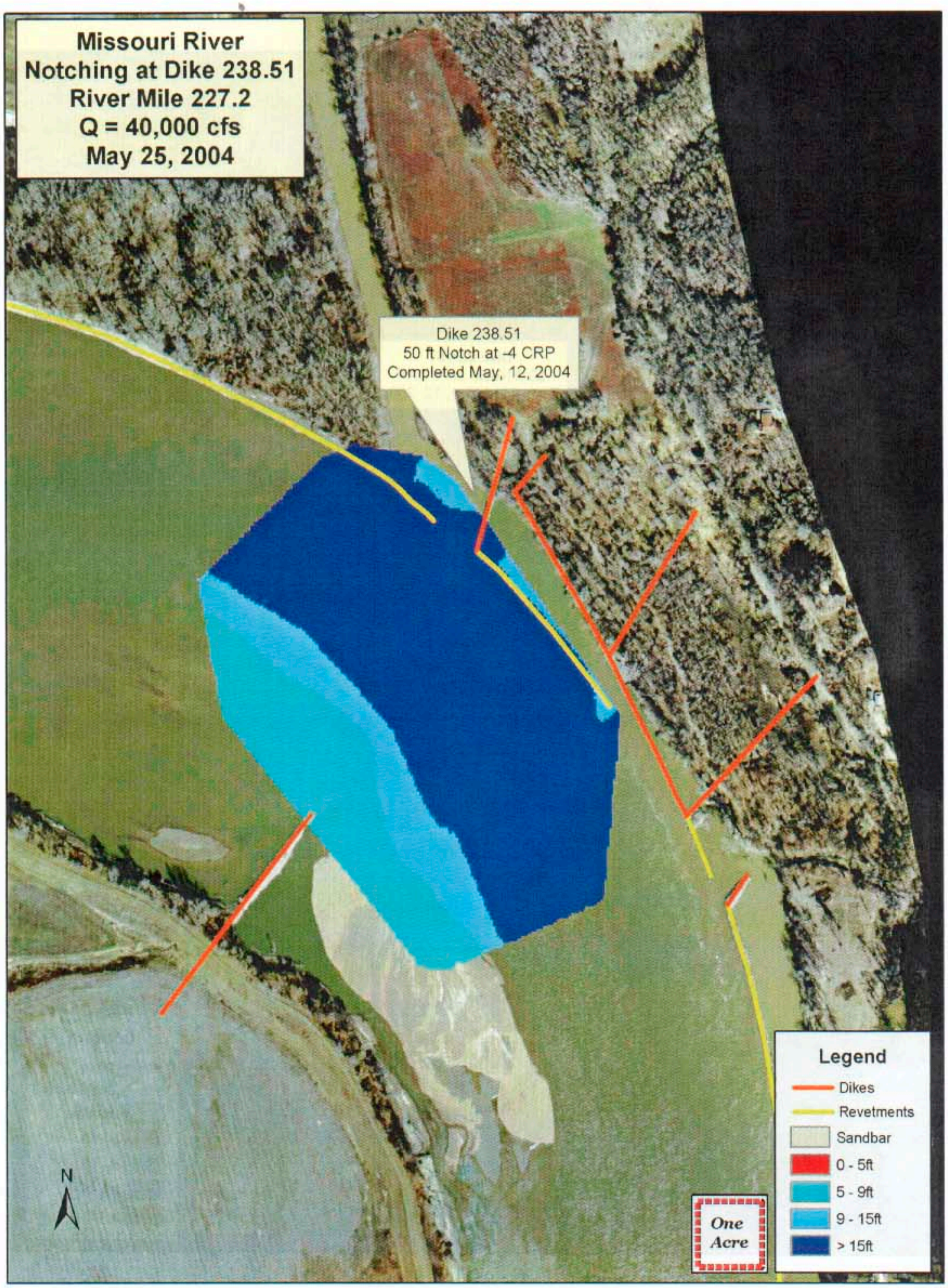


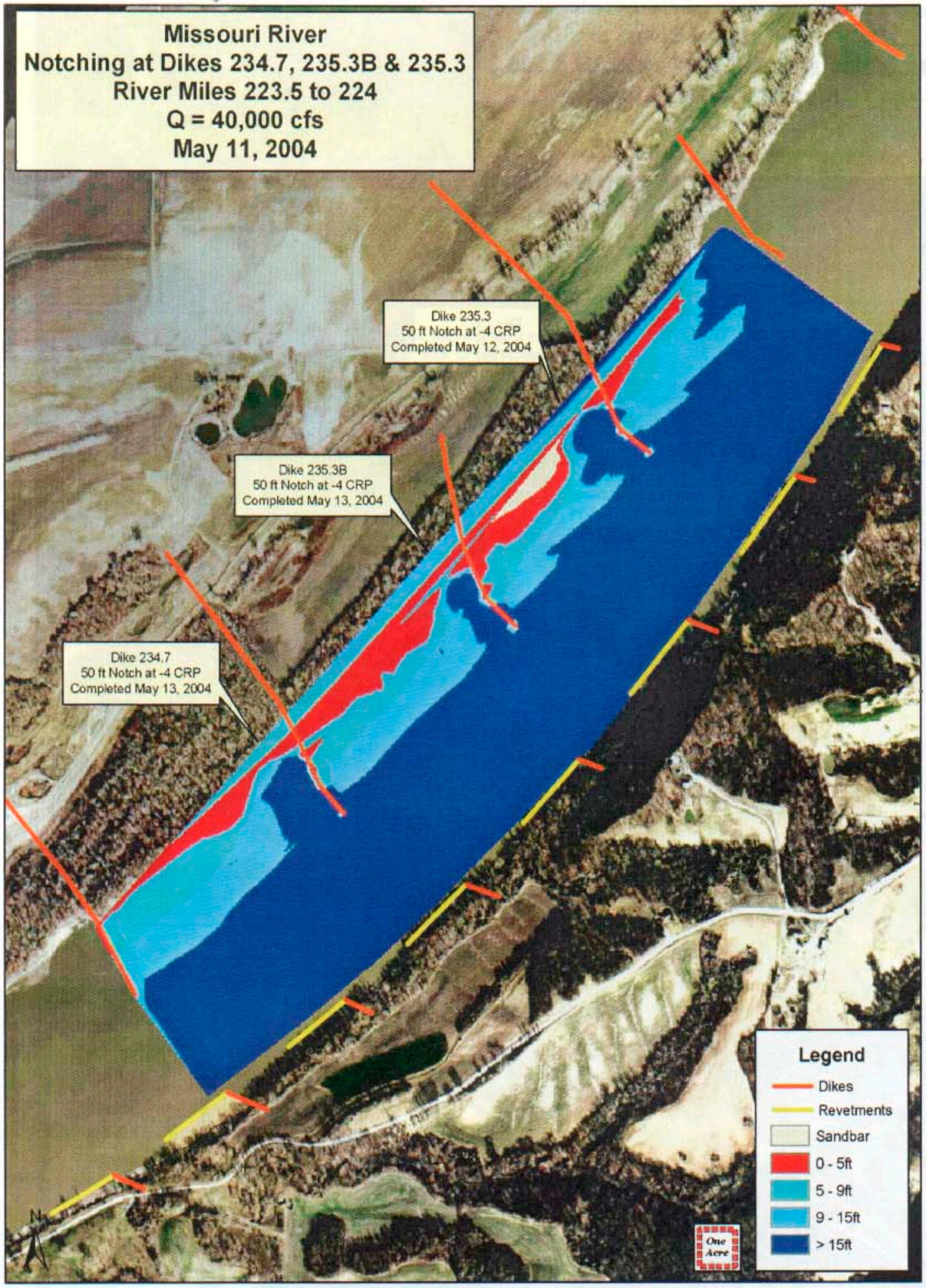
Pre-construction

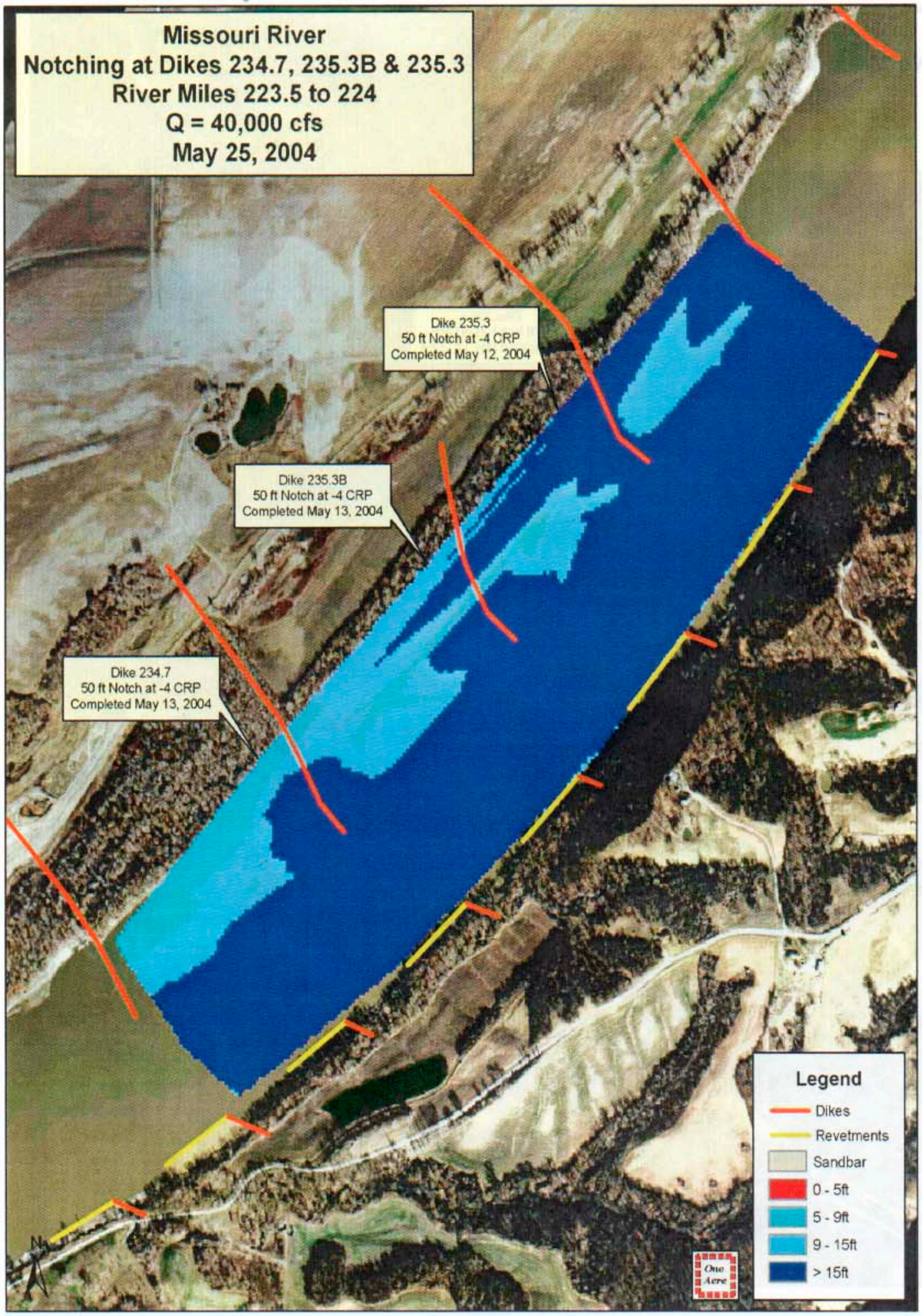


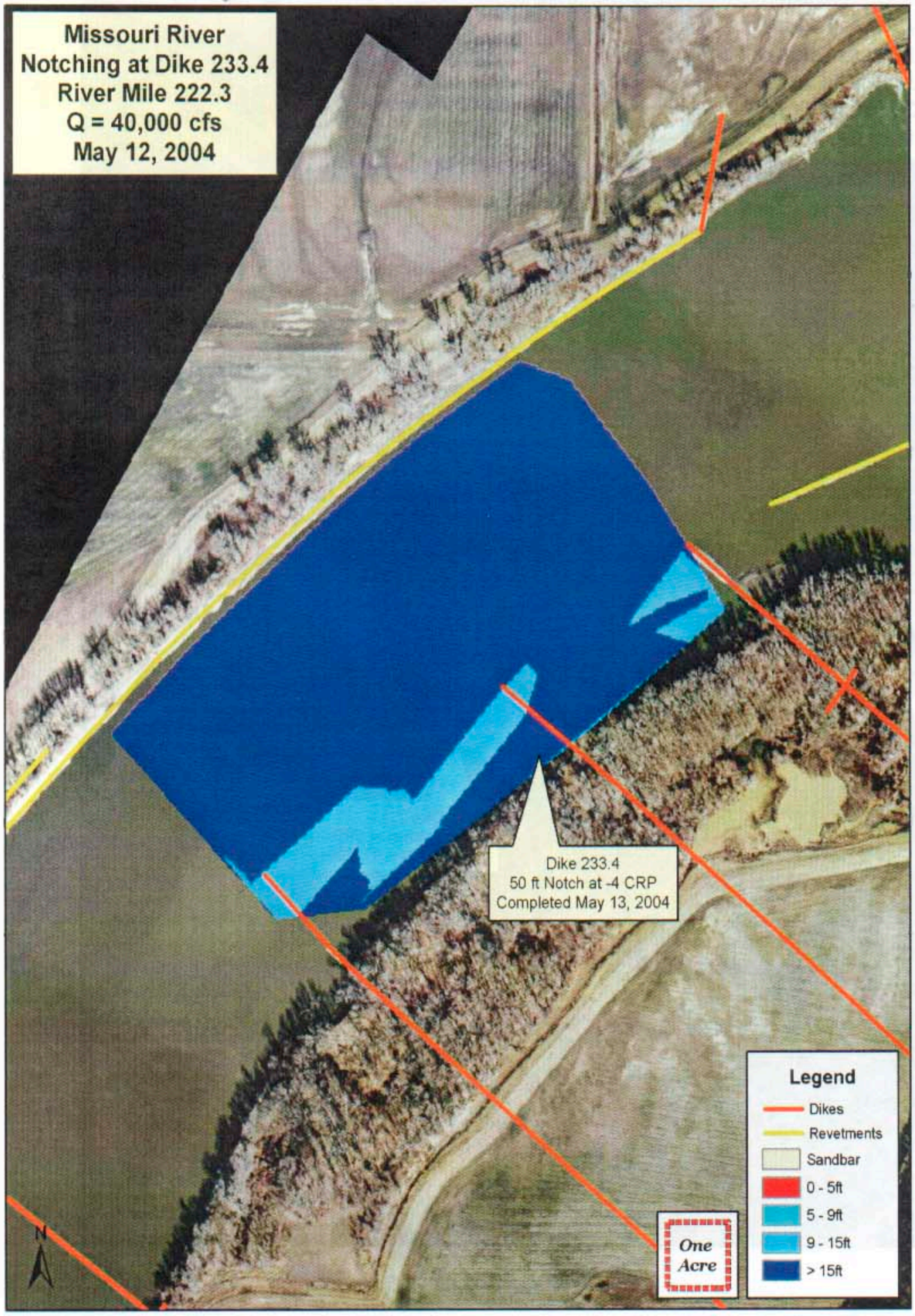
Post Construction

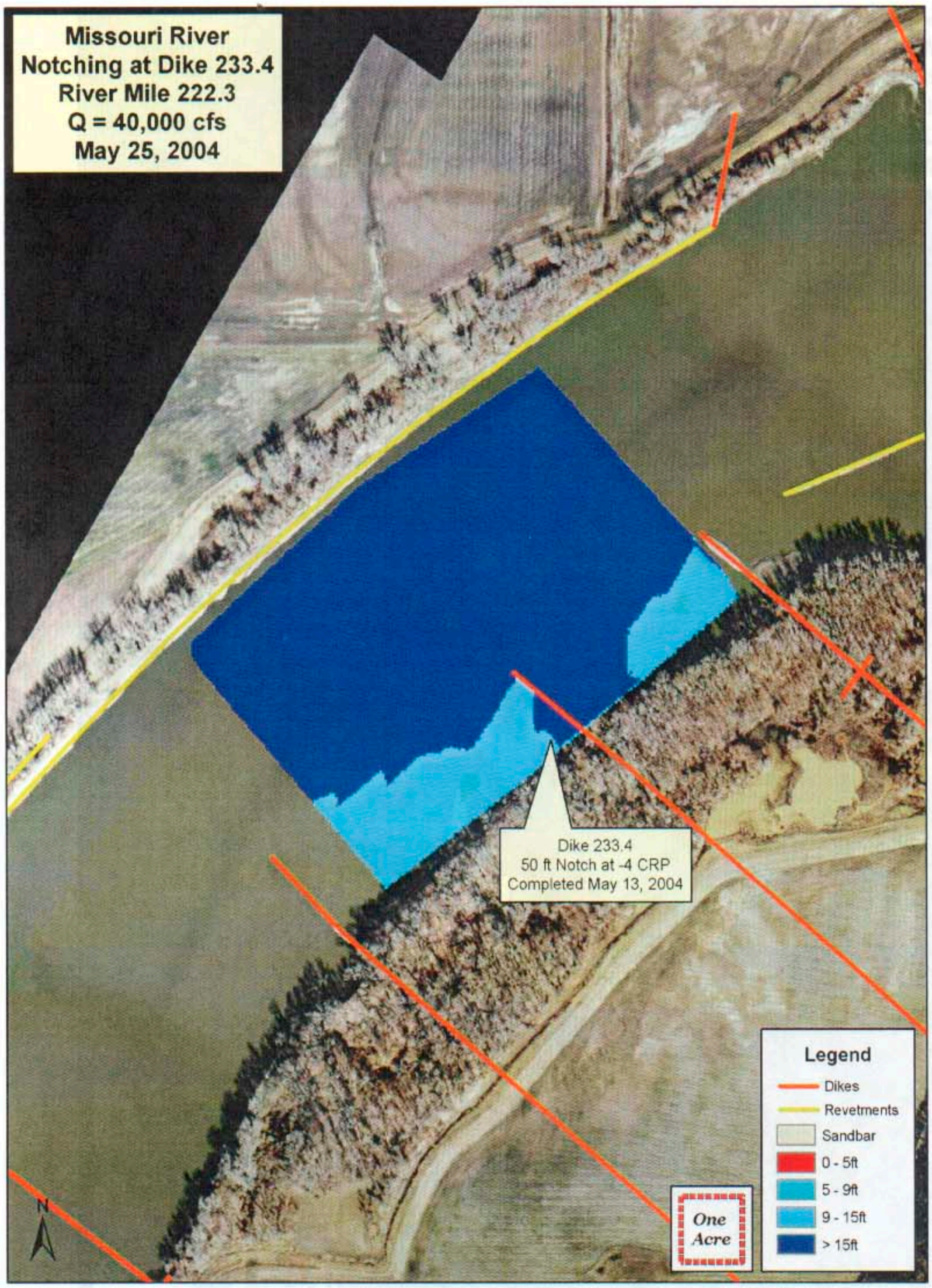

Missouri River
Notching at Dike 238.51
River Mile 227.2
Q = 40,000 cfs
May 11, 2004
Dike 238.51
50 ft Notch at -4 CRP
Completed May, 12, 2004
Legend
Dikes
Revetments
Sandbar
0 - 5ft
5 - 9ft
9 - 15ft
> 15ft
One
Acre
N

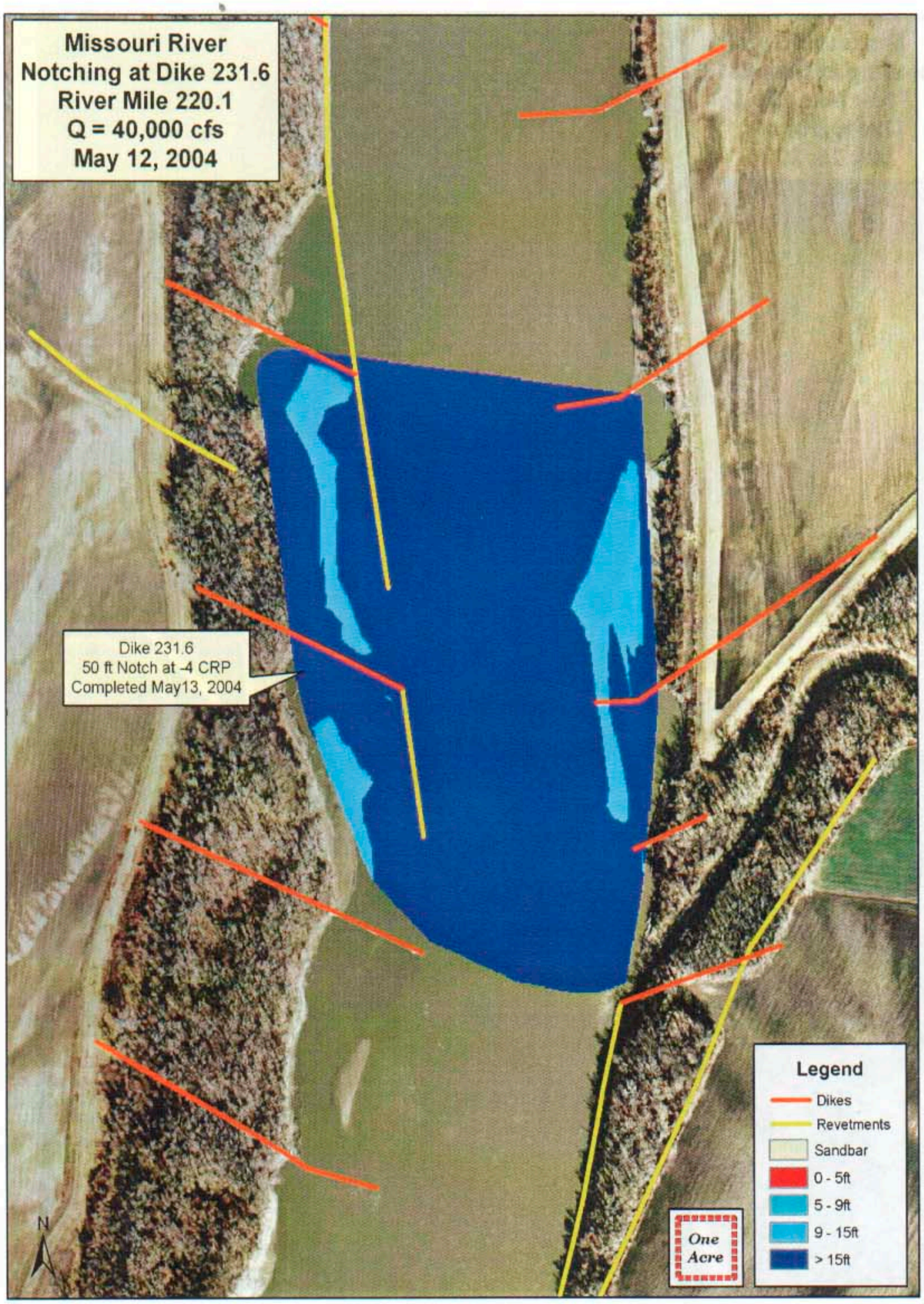

Missouri River
Notching at Dike 238.51
River Mile 227.2
Q = 40,000 cfs
May 25, 2004
Dike 238.51
50 ft Notch at -4 CRP
Completed May, 12, 2004
Legend
Dikes
Revetments
Sandbar
0 - 5ft
5 - 9ft
9 - 15ft
> 15ft
One Acre
N

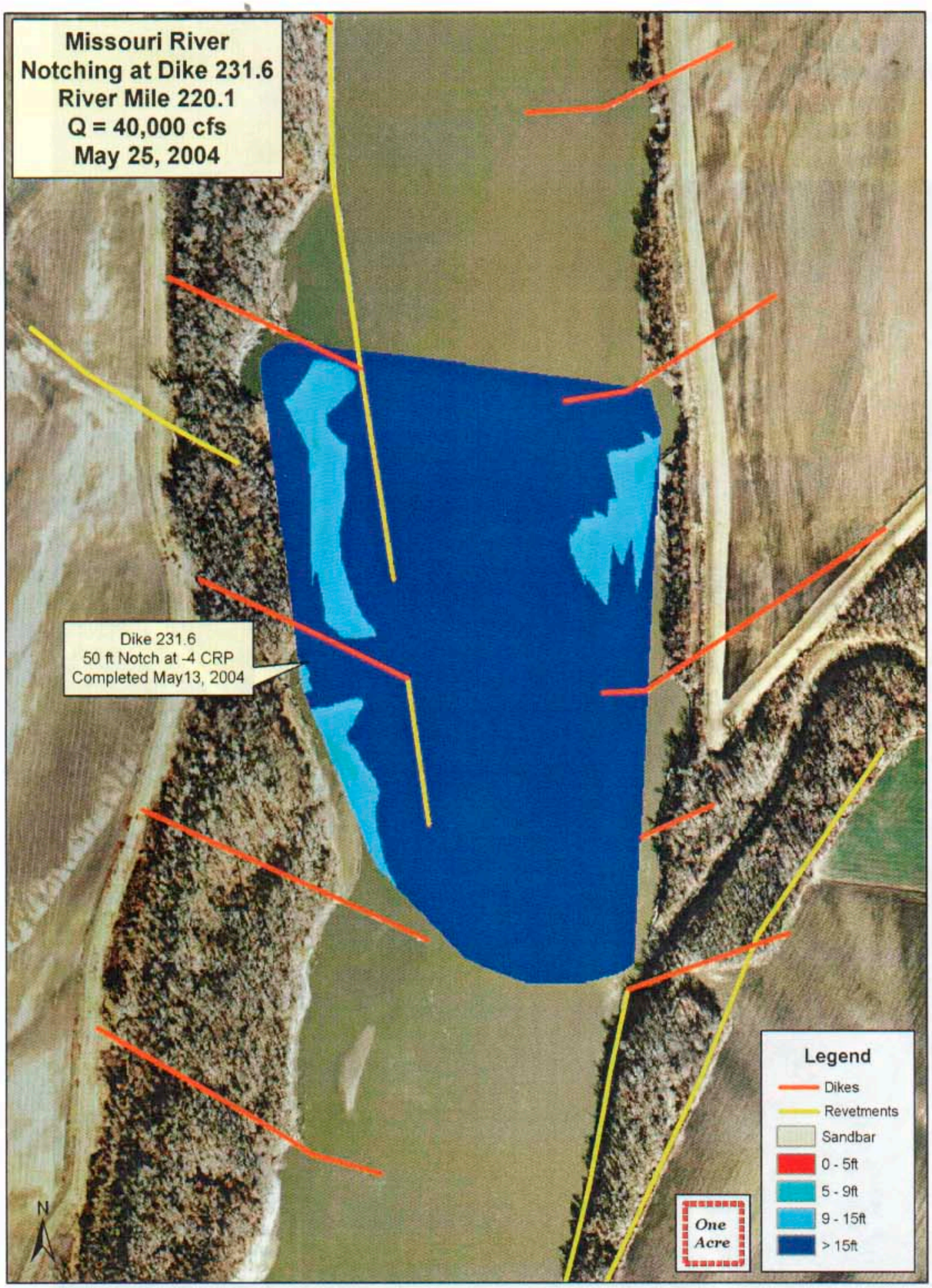

Missouri River
Notching at Dikes 234.7, 235.3B & 235.3
River Miles 223.5 to 224
Q = 40,000 cfs
May 11, 2004
Dike 235.3
50 ft Notch at -4 CRP
Completed May 12, 2004
Dike 235.3B
50 ft Notch at -4 CRP
Completed May 13, 2004
Dike 234.7
50 ft Notch at -4 CRP
Completed May 13, 2004
Legend
Dikes
Revetments
Sandbar
0 - 5ft
5 - 9ft
9 - 15ft
> 15ft
One Acre


Missouri River
Notching at Dikes 234.7, 235.3B & 235.3
River Miles 223.5 to 224
Q = 40,000 cfs
May 25, 2004
Dike 235.3
50 ft Notch at -4 CRP
Completed May 12, 2004
Dike 235.3B
50 ft Notch at -4 CRP
Completed May 13, 2004
Dike 234.7
50 ft Notch at -4 CRP
Completed May 13, 2004
Legend
Dikes
Revetments
Sandbar
0 - 5ft
5 - 9ft
9 - 15ft
> 15ft
One Acre


Missouri River
Notching at Dike 233.4
River Mile 222.3
Q = 40,000 cfs
May 12, 2004
Dike 233.4
50 ft Notch at -4 CRP
Completed May 13, 2004
Legend
Dikes
Revetments
Sandbar
0 - 5ft
5 - 9ft
9 - 15ft
> 15ft
One
Acre
N


Missouri River
Notching at Dike 233.4
River Mile 222.3
Q = 40,000 cfs
May 25, 2004
Dike 233.4
50 ft Notch at -4 CRP
Completed May 13, 2004
Legend
Dikes
Revetments
Sandbar
0 - 5ft
5 - 9ft
9 - 15ft
> 15ft
One
Acre
N


Missouri River
Notching at Dike 231.6
River Mile 220.1
Q = 40,000 cfs
May 12, 2004
Dike 231.6
50 ft Notch at -4 CRP
Completed May13, 2004
N
One
Acre
Legend
Dikes
Revetments
Sandbar
0 - 5ft
5 - 9ft
9 - 15ft
> 15ft


Missouri River
Notching at Dike 231.6
River Mile 220.1
Q = 40,000 cfs
May 25, 2004
Dike 231.6
50 ft Notch at -4 CRP
Completed May13, 2004
Legend
Dikes
Revetments
Sandbar
0 - 5ft
5 - 9ft
9 - 15ft
> 15ft
One Acre
N

APPENDIX E

DIKE NOTCHING SUMMARY

Dike Notching Summary

Missouri River – Sioux City to Rulo

June 2004

Missouri River, Sioux City to Rulo, FY 2004 Dike Notching Plan								
Dikes high lighted below were selected for pre- and post construction surveys.								
Project Site	River Miles	River Bank	State	Dike Number	US/DS River Mile	# of Notches	Material Removed CY	Notch Type
Lower Dakota Bend	722.5-722.1	Right	Iowa			5	2000	B
				798.0	722.5	**Completed**		
				797.8		**Completed**		
				797.55		**Completed**		
				797.47		**Completed**		
				797.4	722.1	**Completed**		
~~Omadi Bend~~	~~720.3-719.0~~	~~Left~~	Iowa	~~794.5~~	~~720.3~~	~~9~~	~~3600~~	~~B~~
				~~794.35~~				
				~~794.3~~		Deleted due to RE issues.		
				~~792.75~~				
				~~792.35~~				
				~~791.6~~				
				~~791~~				
				~~790.9~~				
				~~789.75~~	~~719.1~~			
~~Upper Monona Bend~~	~~702.2-700.8~~	~~Left~~	~~Iowa~~	~~761.7~~	~~702.05~~	~~7~~	~~2800~~	~~B~~
				~~761.4~~				
				~~761.25~~		Deleted due to RE issues.		
				~~761.15~~				
				~~761~~				
				~~760.9~~				
				~~760.5~~	~~701.3~~			

Missouri River, Sioux City to Rulo, FY 2004 Dike Notching Plan

Dikes high lighted below were selected for pre- and post construction surveys.

Project Site	River Miles	River Bank	State	Dike Number	US/DS River Mile	# of Notches	Material Removed CY	Notch Type
Lower Monona Bend	700.8-699.6	Right	Iowa			10	4000	B
				759.25	700.8	**Completed**		
				729.23		**Completed**		
				759.21		**Completed**		
				758.9		**Completed**		
				758.6		**Completed**		
				758.45		**Completed**		
				758.3		**Completed**		
				758.3-C		**Completed**		
				758.3-D		**Completed**		
				758.3-B	699.6	**Completed**		
Upper Blenco Bend	680.0-678.9	Left	Iowa			6	2400	B
				731.85	679.6	**Completed**		
				731.76		**Completed**		
				731.66		**Completed**		
				731.57		**Completed**		
				731.49		**Completed**		
				731.35	678.9	**Completed**		
Sandy Point Bend	658.5	Right	Iowa			7	2800	B
				706.3	657.4	**Completed**		
				706.16		**Completed**		
				706.0		**Completed**		
				705.8		**Completed**		
				706.62		**Completed**		
				705.58		**Completed**		
				705.53	656.5	**Completed**		

Missouri River, Sioux City to Rulo, FY 2004 Dike Notching Plan

Dikes high lighted below were selected for pre- and post construction surveys.

Project Site	River Miles	River Bank	State	Dike Number	US/DS River Mile	# of Notches	Material Removed CY	Notch Type
~~Upper Decatur Bend~~	~~691.0-689.3~~	~~Left~~	~~Iowa~~			~~12~~	~~4800~~	~~A~~
				~~743.89~~	~~690.9~~			
				~~743.79~~				
				~~743.75~~				
				~~743.7~~				
				~~743.68~~		This site is deleted due to State of		
				~~743.66~~		Iowa objections.		
				~~743.64~~				
				~~743.62~~				
				~~743.54~~				
				~~743.43~~				
				~~743.36~~				
				~~743..29~~	~~689.3~~			
~~Lower Louisville Bend~~	~~683.2-681.7~~	~~Left~~	~~Iowa~~			~~11~~	~~4400~~	~~A~~
				~~734.8~~	~~682.95~~			
				~~734.7~~				
				~~734.6~~				
				~~734.49~~		This site is deleted due to State of		
				~~734.32~~		Iowa objections.		
				~~734.25~~				
				~~734..08~~				
				~~733.92~~				
				~~733.76~~				
				~~733.7~~				
				~~733.63~~	~~681.7~~			

Missouri River, Sioux City to Rulo, FY 2004 Dike Notching Plan								
Dikes high lighted below were selected for pre- and post construction surveys.								
	River	River		Dike	US/DS		Material Removed	Notch
Project Site	Miles	Bank	State	Number	River Mile	# of Notches	CY	Type
Lower Little Sioux Reach	672.5-670.5	Left	Iowa			14	5600	B
				725.2	672.4	Completed		
				725.3-B		Completed		
				724.9		Completed		
				725.3-A		Completed		
				724.46		Completed		
				724.37		Completed		
				724.2		Completed		
				724.1		Completed		
				724.05		Completed		
				724.0		Completed		
				723.8		Completed		
				723.75		Completed		
				723.6		Completed		
				723.53	670.5	Completed		
Tyson Bend	654.5-653.0	Left	Iowa			7	2800	B
				704.0	655.4	Completed		
				703.78		Completed		
				703.68		Completed		
				702.98		Completed		
				702.88		Completed		
				702.78		Completed		
				702.65	653.1	Completed		

Missouri River, Sioux City to Rulo, FY 2004 Dike Notching Plan								
Dikes high lighted below were selected for pre- and post construction surveys.								
Project Site	River Miles	River Bank	State	Dike Number	US/DS River Mile	# of Notches	Material Removed CY	Notch Type
Nottleman Island	585.9-582.8	Left	Iowa			15	6000	B
				628.1	584.8	Completed		
				627.87		Completed		
				627.82		Completed		
				627.51		Completed		
				627.45		Completed		
				627.25		Completed		
				627.15		Completed		
				626.95		Completed		
				626.9		Completed		
				626.82		Completed		
				626.75		Completed		
				626.6		Completed		
				626.37		Completed		
				626.35		Completed		
				626.33	582.8	Completed		
Aulden Bar	578.8-576.8	Left	Iowa			13	5200	B
				632.31	578.7	Completed		
				623.25		Completed		
				623.15		Completed		
				623.04		Completed		
				623.0		Completed		
				622.93		Completed		
				622.88		Completed		
				622.83		Completed		
				622.62		Completed		
				622.5		Completed		
				622.3		Completed		
				622.19		Completed		
				622.15		Completed		
				~~622.05~~		Not available due to Real Estate		
				~~621.89~~	576.8	Not available due to Real Estate		

Missouri River, Sioux City to Rulo, FY 2004 Dike Notching Plan

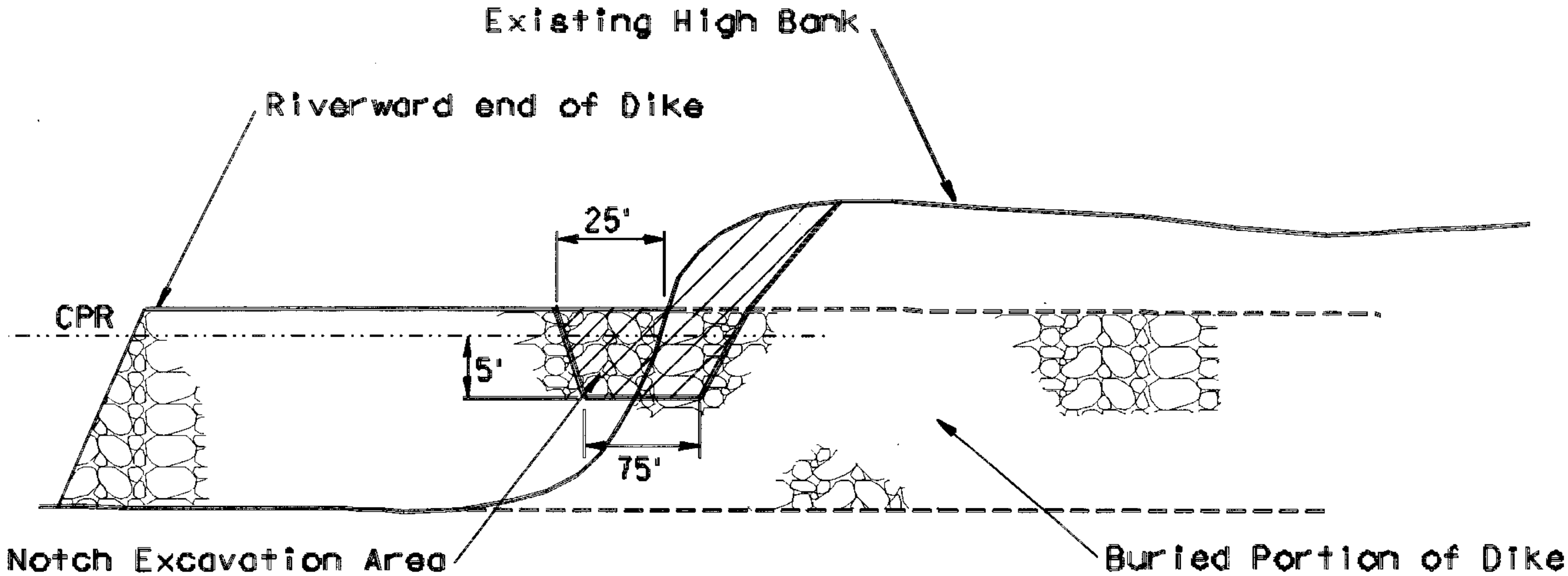
Dikes high lighted below were selected for pre- and post construction surveys.

Project Site	River Miles	River Bank	State	Dike Number	US/DS River Mile	# of Notches	Material Removed CY	Notch Type
Copeland Bend	569.2-565.3	Left	Iowa			21	8400	B
				614.95	569.2	Completed		
				614.85		Completed		
				614.77		Completed		
				614.7-B		Completed		
				613.9		Completed		
				613.8		Completed		
				613.6		Completed		
				613.45		Completed		
				613.3		Completed		
				613.1		Completed		
				613.0		Completed		
				612.9		Completed		
				612.7		Completed		
				612.5		Completed		
				612.2		Completed		
				612.0		Completed		
				611.85		Completed		
				611.75		Completed		
				611.55		Completed		
				611.4		Completed		
				611.2	565.4	Completed		
Nebraska Bend	562.7-561.5	Left	Iowa			8	3200	B
				608.5	562.7	Completed		
				608.3		Completed		
				608.07		Completed		
				607.92		Completed		
				607.8		Completed		
				607.69		Completed		
				607.6		Completed		
				607.4	561.5	Completed		

Missouri River, Sioux City to Rulo, FY 2004 Dike Notching Plan

Dikes high lighted below were selected for pre- and post construction surveys.

Project Site	River Miles	River Bank	State	Dike Number	US/DS River Mile	# of Notches	Material Removed CY	Notch Type
U/L Deroin and Indain Cave B.	519.8-516.2					17	6800	B
		Left	Missouri	561.15	519.7	Completed		
				561.0		Completed		
				560.9		Completed		
				560.75		Completed		
				560.6		Completed		
				560.55		Completed		
				560.35		Completed		
				560.3		Completed		
				560.2		Completed		
		Right	Nebraska	559.55		Completed		
				559.5		Completed		
				559.45		Completed		
		Left	Missouri	559.0		Completed		
				558.6		Completed		
				558.45		Completed		
				558.31		Completed		
				558.2	516.3	Completed		
Cottier Bend	509.2-508.5	Left	Missouri			1	400	B
				~~549.55~~	509.2	Not available due to Real Estate		
				548.61	508.4	Completed		
Total						**124**	**47600**	



Notch Typical Profile - Type B

Dike Notching Summary

Mouth of Osage River and Rulo Nebraska

NOTCHING BETWEEN MOUTH OF OSAGE AND RULO NEBRASKA

				Done				
				To be done by end of June				
				Site Specific Project				

River Mile	Bank	Start STA	End STA	Depth	Width (ft)	Quantity	Notes	
130.8	R			-5	75		Smokey Waters	
131.1	R			-5	75		Smokey Waters	
131.3	R			-5	75		Smokey Waters	
131.7	R			-5	75		Smokey Waters	
132.4	R	6+85	7+60	-4	75	500	In-House	
132.7	R			-5	75		Smokey Waters	
132.8	R	4+30	5+05	-4	75	575	In-House	
132.9	R			-5	75		Smokey Waters	
133.7	R	82+00	83+00	-4	100	890	In-House	
134.7	R	2+24	3+24	-4	100	160	In-House	
135	R	4+05	5+05	-4	100	150	In-House	
135.5	R	5+00	6+00	-4	100	150	In-House	
135.8	R	4+24	5+24	-4	100	583	In-House	
136	R	0+00	1+00	-4	100	290	In-House	
136.2	R	1+26	1+76	-4	50	120	In-House	
137.8	R	3+97	4+47	-4	50	150	In-House	
138.1	R	6+20	6+95	-4	75	250	In-House	
138.7	R	3+97	4+47	-4	50	1600	In-House	
138.8	R	3+20	3+95	-4	75	560	In-House	
139	R	2+30	3+05	-4	75	560	In-House	
139.2	R	2+50	3+00	-4	50	375	In-House	
142.1	L	9+15	9+90	-4	75	560	In-House	
142.2	R	5+10	5+75	-4	65	560	In-House	
142.4	R	2+25	3+00	-4	75	900	In-House	
142.5	L	68+00	69+00	-4	100	975	In-House	
143	R	7+50	8+00	-4	50	330	In-House	
143	R	9+00	9+50	-4	50	330	In-House	
143	L	30+00	31+00	-4	100	750	In-House	
143	R			-4	100		In-House	
143	R	9+50	10+00	-4	50		In-House	
143.2	R			-4	75		In-House	
143.2	R	8+00	8+75	-4	75		In-House	
143.3	R			-4	100		In-House	
144.2	L			-4	50		In-House	
144.3	L			-4	50		In-House	
144.4	L			-4	50		In-House	
145	R	39+00	39+75	-4	75		In-House	
145.2	R	46+50	47+25	-4	75		In-House	
147.2	R			-4	50		In-House	
148.3	L			-4	50		In-House	

149	L			-4	50		In-House	
149.2	L			-4	50		In-House	
149.6	R	105+00	180+00	-4	75		In-House	
150.1	R			-4	50		In-House	
150.3	R			-4	50		In-House	
151.6	K			-4	50		In-House	
151.9	R			-4	50		In-House	
152.1	R			-4	75		In-House	
152.4	R			-4	75		In-House	
152.8	R			-4	100		In-House	
153.1	R			-4	100		In-House	
153.6	R			-4	75		In-House	
153.8	R	7+30	7+80	-4	50			
154.1	R	10+50	11+00	-4	50			
154.5	R	13+50	14+00	-4	50			
154.8	R	6+50	7+00	-4	50			
154.9	R	11+50	12+00	-4	50			
155	R	11+00	11+50	-4	50			
155.2	R	5+00	5+50	-4	50			
155.3	R			-4	125			
155.4	R	5+00	5+50	-4	50			
155.8	R	4+00	4+50	-4	50			
156.9	R	1+40	1+90	-4	50			
158.4	L	5+50	6+00	-4	50			
159.3	L			-4	50			
159.5	L	4+00	4+50	-4	50			
159.8	R			-5	75		Marion Bend	
160.0	R			-5	75		Marion Bend	
160.1	R			-5	75		Marion Bend	
160.3	R			-5	75		Marion Bend	
160.4	R			-5	75		Marion Bend	
160.6	R			-5	75		Marion Bend	
160.8	R			-5	75		Marion Bend	
161.5	R			-5	75		Marion Bend	
161.6	R			-5	75		Marion Bend	
161.7	L	1+50	2+00	-4	50			
166.7	L	6+50	7+00	-4	50			
166.9	L	3+00	3+50	-4	50			
167.1	L			-4	100			
167.4	R	7+50	8+00	-4	50			
167.4	R	8+00	8+50	-4	50			
167.6	R	4+00	4+50	-4	50			
171.8	R			-4	50			
172	R	113+00	113+75	-4	75			
172.1	R	105+00	105+75	-4	75			
172.2	L			-5	75		Eagle Bluffs	
172.6	L			-5	75		Eagle Bluffs	
172.9	L			-5	75		Eagle Bluffs	

173.1	L			-5	75		Eagle Bluffs	
173.3	L			-5	75		Eagle Bluffs	
174.0	L			-5	75		Eagle Bluffs	
174.4	L			-5	75		Eagle Bluffs	
174.8	R	1+00	1+50	-4	50			
174.8	L			-5	75		Eagle Bluffs	
175.0	L			-5	75		Eagle Bluffs	
175.2	L	73+00	73+75	-4	75			
175.2	R	1+00	1+75	-4	50			
175.2	L			-5	75		Eagle Bluffs	
175.3	L	68+00	68+75	-4	75			
175.3	R	1+00	1+50	-4	50			
175.3	L			-5	75		Eagle Bluffs	
175.7	R	1+00	1+75	-4	75			
176	R	2+50	3+25	-4	75			
176.3	R	3+50	4+25	-4	75			
176.5	R	1+00	1+75	-4	75			
176.6	R	1+00	1+75	-4	75			
177.1	L			-5	75		Eagle Bluffs	
178	L	16+50	17+50	-4	50			
178.3	L	12+00	12+50	-4	50			
181.5	L	7+35	7+85	-4	50			
181.5	L	4+25	4+75	-4	50			
181.7	L	4+00	4+50	-4	50			
181.9	L	1+90	2+40	-4	50			
182	L	1+20	1+70	-4	50			
181.7	L	4+08	4+58	-4	50			
181.9	L	1+90	2+40	-4	50			
182	L	1+20	1+70	-4	50			
183.5	L	3+25	3+75	-4	50			
184.6	L	4+19	4+94	-4	75			
184.6	L	13+00	13+75	-4	75			
184.7	L	3+00	3+75	-4	75			
184.9	L	2+28	2+78	-4	50			
185	L	2+24	2+74	-4	50			
185.2	L	1+20	1+70	-4	50			
186.7		1+60	2+10	-3	50		Diana Bend	
186.9		2+80	3+30	-3	50		Diana Bend	
187		7+40	7+90	-5	50		Diana Bend	
187.2		10+85	11+60	-5	75		Diana Bend	
187.4				-5	50		Diana Bend	
189	R	14+30	14+80	-4	50			
189.1	L	3+00	3+50	-4	50			
189.2	L	0+00	0+50	-4	50			
189.3	R	13+90	14+40	-4	50			
189.5	R	15+75	16+25	-4	50			
189.8	R	7+50	8+00	-4	50			
190	R	21+00	21+50	-4	50			
190.1	R	8+00	8+50	-4	50			

192.3	L			-5	75		Franklin Island	
193	L			-5	75		Franklin Island	
193.4	R	1+00	1+50	-4	50			
193.5	L			-5	75		Franklin Island	
193.5	L			-5	75		Franklin Island	
193.7	R	1+84	2+34	-4	50			
193.7	L			-5	75		Franklin Island	
193.8	R	1+65	2+40	-4	75			
193.9	L			-5	75		Franklin Island	
194	L			-5	75		Franklin Island	
194.2	L			-5	75		Franklin Island	
194.3	L			-5	75		Franklin Island	
194.5	R	7+75	8+50	-5	75			
194.5	R	6+54	7+29	-5	75			
195		39+25	40+25	-4	100			
195.5	R	4+15	4+90	-4	75			
195.6		1+75	2+50	-4	75			
196	R	2+00	2+50	-4	75			
196.1	L	13+73	14+23	-4	50			
196.8		2+00	2+75	-4	75	383		
199.8		2+94	3+44	-4	50	189		
201.1		9+20	9+70	-4	50	267		
203.3		32+80	33+30	-4	50	67		
207.4		3+50	4+00	-4	50	188		
207.6		50+40	50+90	-4	50	188		
208	R	3+00	3+50	-4	50			
209.3		2+44	2+94	-4	50	358		
209.4		1+64	2+14	-4	50	392		
209.4	R	1+50	2+00	-4	50			
210.3		25+50	26+50	-4	100	190		
210.3		34+00	35+00		100	0		
211.2		4+57	5+32	-4	75	183		
217.1		36+18	36+68	-4	50	74		
217.1		41+75	42+25	-4	50	214		
218.2		l+00	l+50	3	50	142		
218.2		1+50	1+100	0	50			
218.2		1+100	1+150	2	50			
220.1		5+25	5+75	-4	50	125		
222.3		16+96	17+46	-4	50	144		
222.5		12+13	12+63	-4	50	266		
223.5		14+09	14+59	-4	50	211		
223.9		6+40	6+90	-4	50	211		
224		16+17	16+67	-4	50	211		
224.7		2+16	2+66	-4	50	156		
224.8		4+20	4+70	-4	50	237		
225.3		5+37	5+87	-4	50	292		
227.2		3+39	3+89	-4	50	214		
227.3		120+00	120+50	-4	50	125		
229.2		6+99	7+49	-4	50	211		

230	L	17+00	17+75	-4	75			
231.4		46+00	47+00	-4	100	415		
232	R	14+00	15+00	-4	100			
233.9		8+55	9+05	-4	50	167		
234		30+54	31+04	-4	50	352		
234.2		6+80	7+55	-4	75	130		
234.4		4+19	4+94	-4	75	528		
234.5		25+17	25+92	-4	75	733		
234.7		2+77	3+27	-4	50	540		
234.8		18+63	19+38	-4	75	1000		
235		12+89	13+39	-4	50	540		
235.1		8+96	9+46	-4	50	267		
235.3		4+99	5+74	-4	75	528		
236.6		24+73	25+23	-4	50	155		
238	R	1+00	1+50	-4	50			
239	R	15+00	15+50	-4	50			
239.5		2+00	2+50	-4	50	106		
239.6		7+26	7+76	-4	50	144		
239.7		4+04	4+54	-4	50	237		
239.85		2+88	3+38	-4	50	392		
240.4		4+91	5+41	-4	50	233		
240.5		96+00	97+00	-4	100	237		
240.5		104+50	105+50	-4	100	778		
240.8		0+90	1+40	-4	50	950		
241		3+85	4+35	-4	50	48		
241		1+30	1+80	-4	50	662		
241.2		6+49	6+99	-4	50	189		
241.7		5+30	5+80	-4	50	116		
242		7+00	7+50	-4	50	256		
242.4		10+50	11+00	-4	50	318		
242.8		15+83	16+33	-4	50	89		
243.2		19+43	19+93	-4	50	292		
243.5		16+95	17+45	-4	50	292		
244		20+13	20+63	()- CRP	50	125		
244.3		24+55	25+05	-4	50	204		
245		25+00	25+50	-4	50	110		
245.3		1+45	1+95	-4	50	266		
245.7		5+55	6+05	-4	50	564		
246.2		7+72	8+22	-4	50	376		
246.3		1+15	1+90	-4	75	375		
247.7		7+45	7+95	-4	50	227		
250.1		5+50	6+00	-4	50	145		
250.3		7+55	8+05	-4	50	188		
251.8		64+17	64+67	-4	50	175		
251.8		90+00	90+50	-4	50	122		
251.8		122+00	122+75	-4	75	301		
253.4		24+14	24+64	-4	50	267		
253.65		13+60	14+10	-4	50	458		

254.8		4+54	5+04	-4	50	116		
255		3+94	4+44	-4	50	58		
255.4		1+20	1+70	-4	50	74		
255.8		5+80	6+30	-4	50	92		
257.2		17+50	18+25	-4	75	163		
257.4		11+75	12+50	-4	75	268		
257.65		9+68	10+18	-4	50	189		
257.8		3+23	3+73	-4	50	392		
257.9		6+60	7+10	-4	50	500		
258.05		3+16	3+66	-4	50	463		
258.15		2+77	3+27	-4	50	463		
258.25		2+78	3+28	-4	50	481		
258.35		1+70	2+20	-4	50	581		
258.5		2+92	3+42	-4	50	642		
260.5		33+50	34+00	-4	50	175		
260.5		50+50	51+00	-4	50	144		
260.5		53+00	53+50	-4	50	188		
261.4		6+37	6+87	-4	50	537		
261.7		4+94	5+44	-4	50	144		
261.8		41+92	42+92	-4	100	148		
261.9		4+31	4+81	-4	50	333		
262		1+68	2+18	-4	50	537		
262.1		2+63	3+13	-4	50	292		
262.3		1+23	1+73	-4	50	469		
265.2		1+32	1+82	-4	50	245		
265.6		3+27	3+77	-4	50	128		
265.6		3+05	3+55	-4	50	233		
265.8		0+08	0+58	-4	50	233		
268.8	R			-5	75		Grand Pass	
269.0	R			-5	75		Grand Pass	
269.7	R			-5	75		Grand Pass	
269.8	R			-5	75		Grand Pass	
271.1	R			-5	75		Grand Pass	
271.5		15+70	16+70	-4	100	59		
271.8		6+41	7+41	-4	100	329		
279.1		36+22	36+72	-4	50	47		
279.1		41+70	42+20	-4	50	93		
279.1		42+40	42+90	-4	50	63		
279.1		49+20	49+70	-4	50	63		
279.1		49+90	50+40	-4	50	63		
279.1		53+22	53+72	-4	50	170		
279.3	L	7+50	8+00	-4	50			
279.5		7+30	7+80	-4	50	107		
279.6		2+70	3+45	-4	75	149		
280.1		36+00	36+50	-4	50	157		
280.1		37+00	37+50	-4	50	81		
280.1		43+06	43+56	-4	50	157		
280.1		43+74	44+49	-4	75	161		
280.1		50+28	50+78	-4	50	253		

280.1		51+21	51+71	-4	50	41		
280.1		56+99	57+74	-4	50			
280.7	L	1+50	2+00	-4	50			
282		8+75	9+50	-4	75	122		
282.1		10+96	11+46	-4	50	88		
282.1		120+00	120+50	-4	50	122		
282.1		126+00	126+50	-4	50	74		
284.4		27+46	28+21	-4	75	250		
284.7		9+82	10+32	-4	50	144		
285.4		5+75	6+25	-4	50	81		
285.8		8+15	8+65	-4	50	74		
286.35		35+40	35+90	-4	50	104		
286.35		37+40	37+90	-4	50	104		
286.9		25+30	25+80	-4	50	58		
287.3		7+90	8+40	-4	50	47		
287.8		6+70	7+20	-4	50	58		
288		4+83	5+33	-4	50	74		
292.5		8+55	9+05	-4	50	144		
293.1		6+75	7+25	-4	50	19		
293.4		5+90	6+40	-4	50	189		
293.8		4+00	4+50	-4	50	104		
293.8	L	4+00	4+50	-4	50			
294.3		3+00	3+50	-4	50	125		
294.4		2+20	2+70	-4	50	233		
294.5		2+25	2+75	-4	50	67		
295.8		1+75	2+25	-4	50	233		
296		3+38	3+88	-4	50	171		
296.7	R			-5	75		Baltimore Bend	
297	R			-5	75		Baltimore Bend	
297.3	R			-5	75		Baltimore Bend	
298.7	R			-5	75		Baltimore Bend	
298.8		5+00	5+50	-4	50	161		
299	R			-5	75		Baltimore Bend	
299.2	R			-5	75		Baltimore Bend	
299.2		14+50	15+00	-4	50	234		
299.3	R			-5	75		Baltimore Bend	
299.4	R			-5	75		Baltimore Bend	
300.8		76+00	76+50	-5	50	122		
300.8		87+00	87+50	-5	50	122		
300.8		98+50	99+50	-5	100	474		
300.8		103+00	104+00	-5	100	94		
300.8		135+60	136+80	-5	120	213		
300.8		142+35	143+35	-5	100	194		
306.3		1+05	1+55	-4	50	103		
306.3		24+00	24+50	-4	50	121		
306.9	L	7+00	7+50	-4	50			
307		4+12	4+62	-4	50	86		
308.9		19+05	19+55	-4	50	121		
309.2		5+07	5+57	-4	50	86		

309.4		1+93	2+43	-4	50	127		
311.1		5+49	5+99	-4	50	495		
311.3		328+60	329+10	-4	50	289		
311.3		333+00	333+50	-4	50	234		
311.3		350+00	350+50	-4	50	403		
313.7		8+80	9+30	-4	50	103		
314.2		6+95	7+45	-4	50	93		
314.3		6+60	7+10	-4	50	119		
315		3+70	4+20	-4	50	119		
315.3		5+54	6+04	-4	50	209		
317.9		5+05	5+55	-4	50	162		
319.3		1+20	1+70	-4	50	121		
319.4		4+90	5+50	-4	60	350		
321		6+41	7+16	-4	75	393		
321.2	R	5+08	5+58	-4	50	262		
321.3	R	2+60	3+10	-4	50	126		
321.5	R	39+00	40+00	-4	50	198		
325.5	R	10+90	11+40	-4	50	137		
329.4	L	5+00	5+50	-4	50	126		
329.8	L	7+10	7+60	-4	50	123		
332.4	L	0+00	0+00	-4	75			
332.6	L	1+79	2+54	-4	50	661		
332.6	R	1+00	1+50	-4	50	190		
332.9	L	112+00	112+50	-4	50	297		
332.9	L	115+00	115+50	-4	50	275		
332.9	L	115+75	116+25	-4	50	275		
334.45	R	10+80	11+30	-4	50	27		
334.8	R	6+01	6+76	-4	50	396		
335	R	3+33	4+08	-4	50	332		
335.1	R	4+00	4+50	-4	50	278		
335.3	R	1+94	2+44	-4	50	371		
335.4	R	2+99	3+49	-4	50	154		
335.7	R	6+00	6+50	-4	50			
335.8	R	3+91	4+41	-4	50	331		
336	R	2+33	2+83	-4	50	247		
337	L	3+92	4+42	-4	50	244		
337	L	109+00	110+00	-4	50	114		
337	L	3+00	4+00	-4	100			
337.4	R	2+98	3+48	-4	50	108		
338.7	R	4+25	4+75	-4	50			
338.8	R	3+22	3+72	-4	50	166		
339	R	2+22	2+72	-4	50	261		
339.2	R	2+80	3+30	-4	50	194		
339.3	R	2+97	3+47	-4	50	181		
339.4	R	1+91	2+41	-4	50	126		
339.5	R	56+50	57+00	-4	50	185		
340.1	L	29+50	30+00	-4	50	111		
340.3	R	8+72	9+22	-4	50	320		
340.4	R	9+00	9+50	-4	50			

340.6	R	11+06	11+56	-4	50	21		
340.7	R	5+45	5+95	-4	50	162		
340.9	R	3+06	3+56	-4	50	82		
341	L	1+00	2+00	-5	100			
341.3	R	7+73	8+23	-4	50	127		
341.4	L	1+00	2+00	-5	100			
342	R	4+50	5+00	-4	50			
342.3	R	22+40	22+90	-4	50	192		
342.5	R	47+50	48+00	-4	50	234		
342.5	R	53+95	54+45	-4	50	209		
342.6	L	8+91	9+41	-4	50	71		
343.7	R	3+00	3+50	-4	50	119		
343.7	L	40+93	41+43	-4	50	194		
343.7	L	46+56	47+06	-4	50	139		
344.2	R	1+30	2+30	-4	50	370		
344.9	R	2+50	3+00	-4	50	104		
345.1	L	95+50	96+00	-4	50	135		
345.2	L	3+00	3+50	-4	50			
345.3	L	3+00	3+50	-4	50	443		
345.4	R	54+93	55+43	-4	50	258		
345.8	R	48+57	49+07	-4	50	352		
346.2	R	6+35	6+85	-4	50	367		
346.3	R	7+00	7+50	-4	50	412		
346.6	R	5+30	5+80	-4	50	578		
346.7	R	5+50	6+00	-4	50	501		
346.9	R	4+00	4+50	-4	50	559		
347.2	R	6+47	6+97	-4	50	479		
347.2	L	11+34	11+84	-4	50	405		
347.3	R	4+63	5+13	-4	50	559		
347.4	R	16+25	16+75	-4	50	617		
347.5	L	14+50	15+00	-4	50	111		
347.5	R	7+70	8+20	-4	50	427		
348	L	15+00	15+50	-4	50	45		
348.4	L	3+40	3+90	-4	50	295		
349.5	L	11+00	11+50	-4	50	140		
350.7	R	66+30	67+30	-4	50	285		
350.7	R	69+30	69+80	-4	50	131		
350.8	L			-4	75			
351.2	L			-3	50		Liberty Bend	
351.3	L	0+00	1+00	-5	100			
351.4	L	3+20	4+20	-5	100	288		
351.9	R	3+95	4+45	-4	50	189		
352.3	R	3+50	4+00	-4	50	292		
352.35	L	114+15	114+90	-4	75	282		
352.35	L	105+00	105+75	-4	75	437		
353	R	13+50	14+00	-4	50	237		
353.1	R	3+59	4+09	-4	50	144		
353.4	R	12+36	12+86	-4	50	167		
353.7	R	14+45	14+95	-4	50	237		

353.7	R	11+75	12+25	-4	50	558		
353.9	R	9+38	9+88	-4	50	558		
354.1	R	7+90	8+40	-4	50	358		
354.2	R	60+28	60+78	-4	50	267		
355	R	1+77	2+27	-4	50	581		
355.1	R	4+10	4+60	-4	50	581		
357	R	86+00	86+75	-4	75	626		
358.4	L	7+29	7+79	-4	50	379		
358.7	R	11+95	12+45	-4	50	295		
358.8	L	18+70	19+20	-4	50	222		
358.9	R	13+23	13+73	-4	50	189		
359.1	R	14+50	15+00	-4	50	125		
359.6	R	9+88	10+48	-4	60	467		
359.6	R	10+48	11+83	-2	135	110		
359.9	R	9+60	10+20	-4	60	196		
359.9	R	10+35	11+85	-2	150	267		
360.3	R	10+35	8+85	-2	150			
360.3	R	8+50	9+10	-4	60			
360.5	R	5+00	6+50	-4	150	118		
360.5	R	4+43	5+03	-4	60			
360.75	R	8+53	7+93	-4	60			
360.8	R	9+63	11+13	-2	150	356		
361.1	R	9+06	9+66	-4	60	250		
361.1	R	10+16	11+66	-2	150	800		
361.4	R	4+60	5+20	-4	60	102		
361.4	R	5+20	6+40	-2	120	613		
361.8	R	1+70	2+30	-4	60	124		
361.8	R	3+00	4+50	-2	150	633		
361.8	R	2+74	2+14	-4	60			
362.1	R	16+82	16+02	-2	80			
362.1	R	16+02	15+42	-4	60			
362.4	R	8+50	7+00	-2	150			
362.4	R	5+66	6+26	-4	60			
362.8	R	14+20	12+70	1	150			
362.8	R	10+24	10+84	-4	60			
362.9	R	15+83	17+33	3	150	1041		
363.4	R	224+94	225+54	-4	60	70		
363.4	R	230+38	230+98	-4	60	107		
363.4	R	245+90	246+90	-4	100	800		
363.4	R	261+07	262+07	-4	100	711		
363.4	L	2+14	1+54	-4	60			
363.7	L	6+28	4+28	-2	200			
363.85	L	4+20	4+80	-4	60	288		
364	L	5+00	5+60	-4	60	288		
364.1	L	3+00	3+75	-4	75	96		
364.3	L	7+44	6+09	-2	135			
364.3	L	5+41	6+41	-4	100			
364.4	L	6+08	4+58	-2	150			
364.4	L	3+62	4+62	-4	100			

364.6	L	7+66	6+16	-2	150			
364.6	L	5+00	6+00	-4	100			
364.7	L	4+55	3+55	-4	100			
364.9	L	6+10	4+60	-2	150			
364.9	L	2+93	3+93	-4	100			
365.1	L	4+26	3+26	-4	100			
365.3	L	3+17	4+17	-4	100	422		
365.7	L	5+32	5+92	-4	60	250		
365.7	L	5+92	7+55	-2	163	353		
366	L	5+00	6+00	-4	100	333		
366.3	L	3+75	4+75	-4	100			
366.8	L	11+30	12+30	-4	100			
367.2	L	14+80	15+80	-4	100			
367.5	L	17+00	18+00	-4	100			
367.8	L	13+31	14+31	-4	100			
368.2	L	10+83	11+83	-4	100	593		
368.4	L	10+05	9+45	-4	60			
369.1	R	6+22	5+62	-4	60			
369.3	R	5+71	5+11	-4	60			
369.5	R	9+81	9+06	-4	75			
369.7	R	9+92	9+32	-4	60			
369.9	R	10+27	9+67	-4	60			
370.3	R	11+42	10+82	-4	60			
370.7	R	10+76	10+16	-4	60			
371.0	R	11+10	10+50	-4	60			
371.6	R	21+02	20+42	-4	60			
371.7	R	14+74	14+14	-4	60			
371.9	R	12+48	11+88	-4	60			
371.9	R	1+73	1+13	-4	60			
372	R	77+60	78+35	-4	75	208		
372.2	L	4+50	3+50	-4	100			
372.4	L	8+00	7+25	-4	75			
372.7	L	7+80	8+80	-4	100	400		
372.9	L	5+50	4+75	-4	75			
373.2	L	6+55	7+30	-4	75	215		
373.4	L	7+30	6+55	-4	75			
373.8	L	2+75	2+00	-4	75			
375.0	L	6+05	5+45	-4	60			
375.2	L	2+55	1+55	-4	100			
375.3	L	177+00	177+75	-4	75	833		
375.6	R	2+00	2+60	-4	60			
375.9	R	4+93	4+33	-4	60			
376.2	R	4+40	5+00	-4	60	247		
376.45	R	3+10	3+70	-4	60	169		
376.7	R	2+72	3+32	-4	60	267		
376.9	R	30+72	31+32	-4	60	151		
377.2	R	36+81	36+21	-4	60			
377.7	R	47+94	47+34	-4	60			
377.9	R	6+50	7+00	-4	50			

378.1	R	45+92	46+52	-4	60	600		
378.3	R	5+73	6+33	-4	60	1216		
378.4	R	239+50	240+00	-4	50	520		
378.55	L	1+00	1+50	-4	50	244		
378.9	L	6+25	6+75	-4	50	322		
379.3	L	6+23	6+73	-4	50	89		
380.4	L	44+44	43+84	-4	60			
380.6	L	3+40	3+90	-4	50	89		
380.8	L	24+43	23+83	-4	50			
381	L	4+15	4+65	-4	50	89		
381.1	L	4+54	3+94	-4	50			
381.3	L	3+20	3+70	-4	50	104		
381.5	L	54+10	54+60	-4	50	104		
381.7	L	3+25	3+75	-4	50	104		
381.9	L	3+50	4+00	-4	50	89		
382.8	L	23+00	23+50	-4	50			
383.3	R	6+00	6+50	-4	50	370		
383.8	R	5+43	5+93	-4	50	408		
385	R	12+50	13+00	-4	50			
385.1	R	12+70	13+20	-4	50	500		
385.2	R	12+15	11+65	-4	50			
385.9	L	5+00	5+50	-4	50	89		
388.1	L	10+00	10+50	-4	50			
388.7	L	7+37	7+87	-4	50	430		
397.5	L	5+00	5+60	-4	60	453		
397.7	L	12+10	12+70	-4	60	142		
399.4	L	16+30	16+90		60	645		
399.8	L	23+00	23+60	-4	60			
400.1	L	4+75	5+35	-4	60	319		
400.2	L	1+40	2+00	-4	60	688		
401.4	R	8+50	9+25	-5	75			
401.7	R	9+40	10+15	-5	75			
402.3	R	5+74	6+49	-5	75	688		
402.3	R	7+30	8+05	-5	75			
402.5	R	2+10	2+85	-5	75	283		
403				-3	50		Weston Bend	
403.1				-3	50		Weston Bend	
403.6	R	7+00	7+75	-5	75			
403.8	R	24+95	25+60	-5	75			
404.5	R	5+58	6+33	-5	75	1108		
404.8	R	4+00	4+50	-5	50	984		
405.3	R	6+25	6+75	-5	50	602		
407	L	44+00	44+50	-4	50	227		
408.3	R	76+50	77+00	-4	50	162		
409.3	L	7+50	8+00	-4	50			
409.7	L	9+00	9+50	-4	50			
409.9	R	8+00	8+50	-4	50			
413.3	L	5+00	5+50	-4	50			
414.5	R	1+20	1+70	-4	50	460		

414.65	L	15+00	16+50	-4	50	125		
415.8	L	181+35	181+85	-4	50	200		
419.3	L	7+35	7+85	-4	50	69		
422.2	L	5+32	5+82	-4	50	26		
422.3	L	5+44	5+94	-4	50	26		
422.4	L	8+10	8+60	-4	50	133		
422.6	L	3+85	4+35	-4	50	155		
423	L	4+75	5+25	-4	50	145		
424.25				-3	50		Benedictine Bottoms	
424.3				-3	50		Benedictine Bottoms	
425.7	L	171+50	172+00	-4	50	125		
425.8				-5	75		Benedictine Bottoms	
426.1				-5	75		Benedictine Bottoms	
426.3				-5	75		Benedictine Bottoms	
426.6				-5	75		Benedictine Bottoms	
426.8				-5	75		Benedictine Bottoms	
427.1				-5	75		Benedictine Bottoms	
427.3				-5	75		Benedictine Bottoms	
427.8				-5	75		Benedictine Bottoms	
				-5	75		Benedictine Bottoms	
430.2	L	5+35	5+85	-4	50	118		
431	L	21+00	21+50	-4	50	47		
431.8	R	4+00	4+50	-4	50	47		
433	L	9+90	10+40	-4	50	162		
433.3	L	6+15	6+65	-4	50	181		
436.4	R	8+55	9+05	-4	50	165		
437.4	R	7+00	7+50	-4	50	76		
437.5	R	9+50	10+00	-4	50	76		
443.2	R	4+30	4+80	-4	50	125		
443.4	R	4+00	4+50	-4	50	116		
444.5	R	13+80	14+30	-4	50	57		
444.9	R	5+18	5+68	-4	50	50		
445.6	R	4+70	5+20	-4	50	38		
446.3	R	14+30	14+80	-4	50	268		
446.6	R	14+00	14+50	-4	50	152		
446.9	R	12+85	13+35	-4	50	33		
447.1	R	12+36	12+86	-4	50	76		
448.5	R	2+00	2+50	-4	50			
449.6	R	126+97	127+47	-4	50	212		
450.1	L	2+75	3+25	-4	50	156		
451.6	L	1+44	1+94	-4	50	145		
456.3				-5	75		Worthwine Island	
456.5				-5	75		Worthwine Island	
456.7				-5	75		Worthwine Island	
456.8				-5	75		Worthwine Island	
457.0				-5	75		Worthwine Island	
457.1				-5	75		Worthwine Island	
457.3				-5	75		Worthwine Island	
458.4				-5	75		Worthwine Island	

458.7				-5	75		Worthwine Island
458.9				-5	75		Worthwine Island
459.0				-5	75		Worthwine Island
459				-5	50		Worthwine Island
459							Worthwine Island
459.5							Worthwine Island
464.5	L			-3	50		Monkey Mountain
464.5	L	142+99	143+99	-5			Monkey Mountain
464.7	L	32+83	33+58	-5	75		Monkey Mountain
464.9	L	3+51	4+26	-5	75		Monkey Mountain
465	L	2+32	3+07	-5	75		Monkey Mountain
465.1	L	1+47	2+22	-5	75		Monkey Mountain
465.2	L	20+62	21+37	-5	75		Monkey Mountain
465.3	L			-3	50		Monkey Mountain
465.4	L	73+08	74+08	-5			Monkey Mountain
465.7	L			-3	50		Monkey Mountain
465.8	L	68+58	69+58	-5			Monkey Mountain

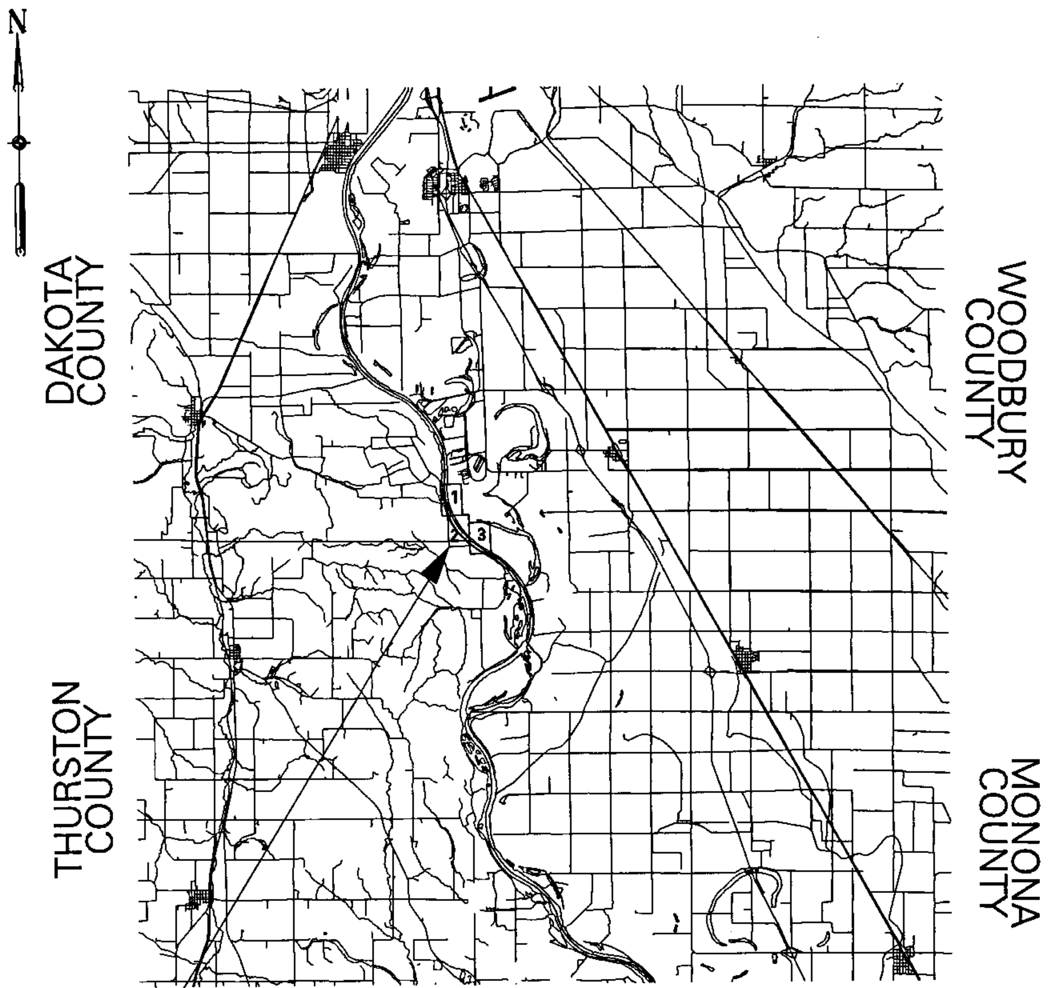
APPENDIX F

MAJOR DIKE MODIFICATIONS

Major Dike Modifications

Design Details

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



VICINITY MAP
NOT TO SCALE

PROJECT SITE

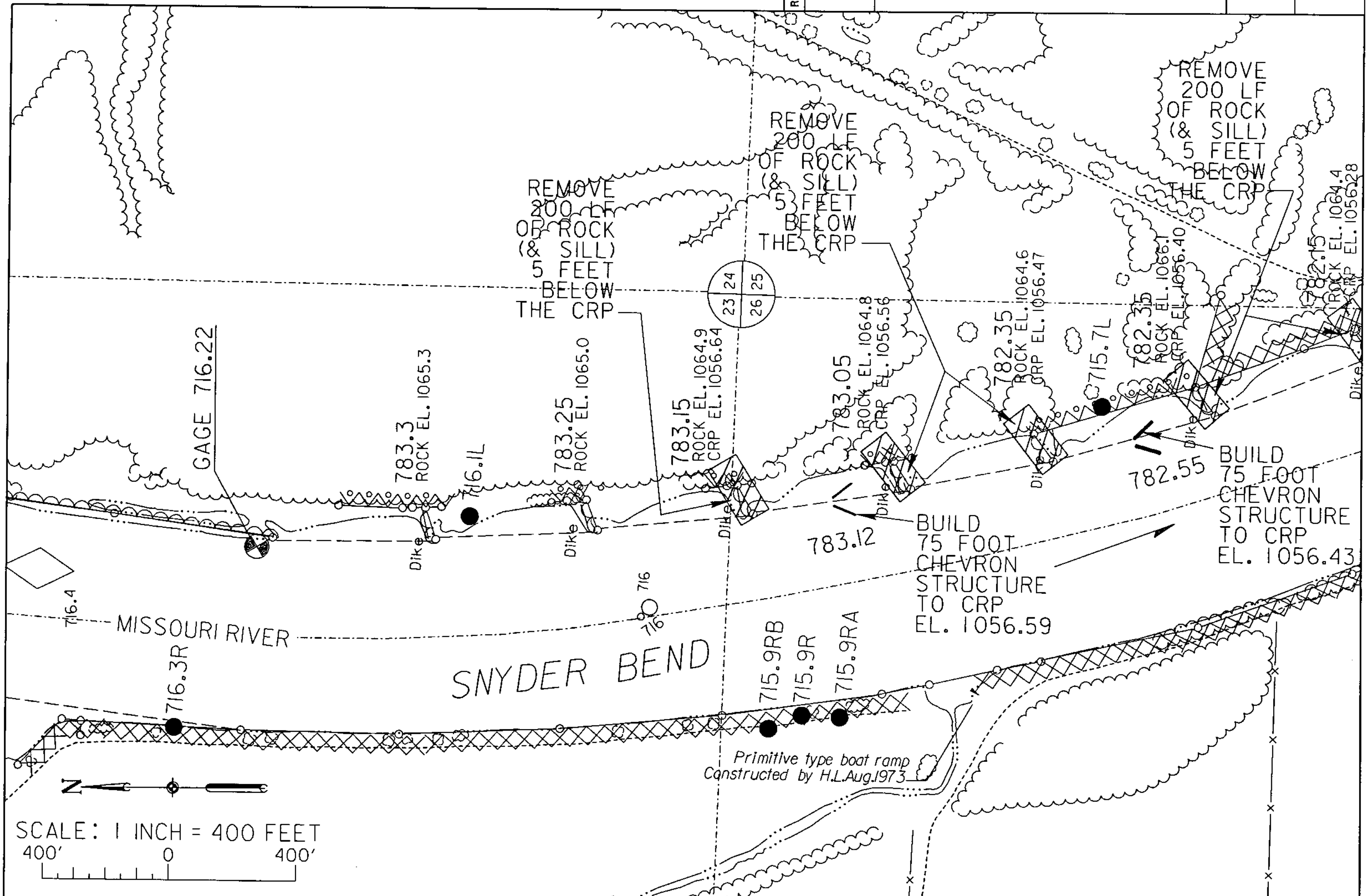
LOCATION MAP
NOT TO SCALE

LEGEND

	PILE DIKE
	STONE FILL DIKE OR REVETMENT OR PILE DIKE STONE FILL
	PILE REVETMENT
	PILE REVETMENT, STONE FILL
	TOE TRENCH OR STANDARD REVETMENT OR REINFORCED STD. REVET. OR ACCRETMENT
	ASPHALT REVETMENT
	DESIGNED STABILIZED CHANNEL LINE
	BLUFF LINE
569	1960 CHANNEL MILAGE
580.3	BEND CHANGE
615.8	STRUCTURE NUMBERS ARE BASED ON 1890 MILAGE
CRP	THIS IS THE CONTRUCTION REFERENCE PLANE WHICH REPRESENTS A SYNTHESIZED WATER SURFACE PROFILE OF A STEADY DISCHARGE THAT IS EQUALED OR EXCEEDED 75% OF THE TIME DURING THE NAVIGATION SEASON (APRIL - NOVEMBER).

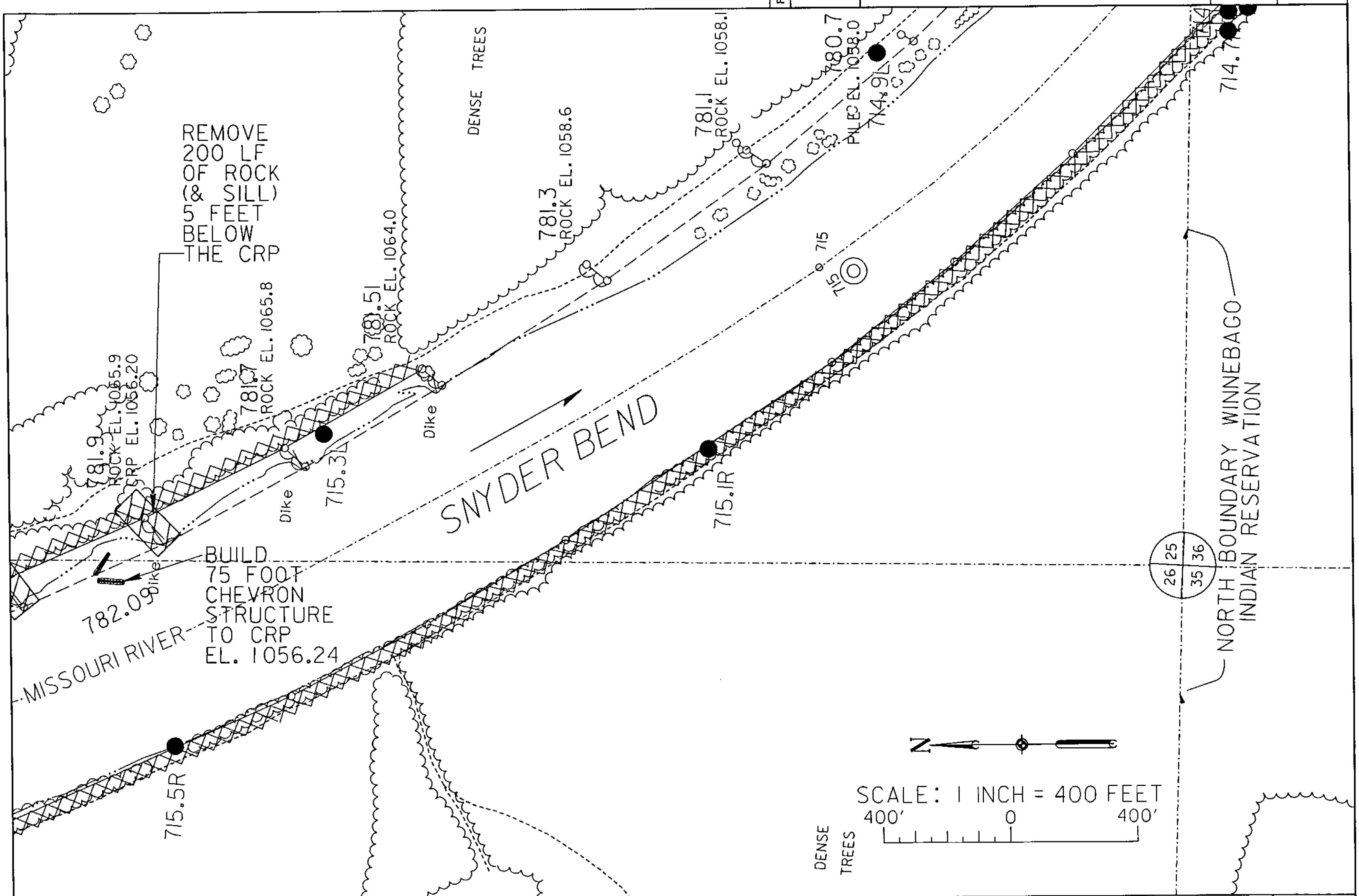
Sheet No.							
S0	Computer File: SHEET0.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA / IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 714.3 TO 716.4 SITE MAP	Submitted by:	Designed by: R.G.P.	Checked by: J.I.R.
	Date: MAR. 2004	Contract No. W9128F-04-C-000X			Chief SED. & CHAN. STAB. Section	Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X						

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



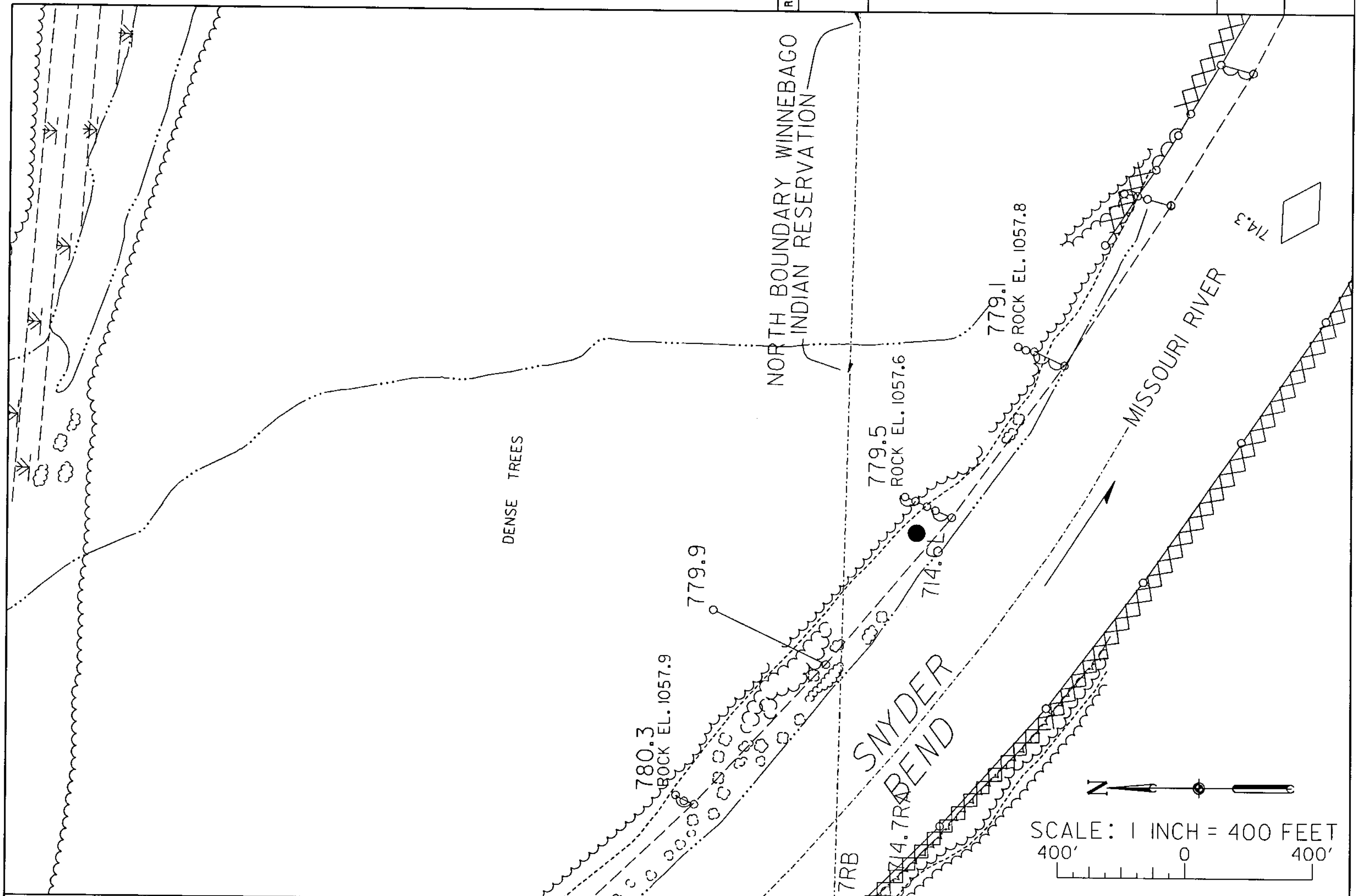
Sheet No. S1	Computer File: sheet1.dgn	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 714.3 TO 716.4 SITE MAP	Submitted by:	Designed by: R.G.P.	Checked by: J.I.R.
	Date: MAR. 2004	Contract No. W9128F-04-C-000X			Chief SED. & CHAN. STAB. Section	Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X						

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



Sheet No.	Computer File: sheet2.dgn	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA / IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 714.3 TO 716.4 SITE MAP	Submitted by:	Designed by: R.G.P.	Checked by: J.I.R.
S2	Date: MAR. 2004	Contract No. W9128F-04-C-000X			Chief SED. & CHAN. STAB. Section	Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code:	PUBDATA\RICKP\X					

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



F-5

Sheet No.	Computer File: sheet3.dgn	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA / IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 714.3 TO 716.4 SITE MAP	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P.	Checked by: J.I.R.
S3	Date: MAR. 2004	Contract No. W9128F-04-C-000X				Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X						

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED

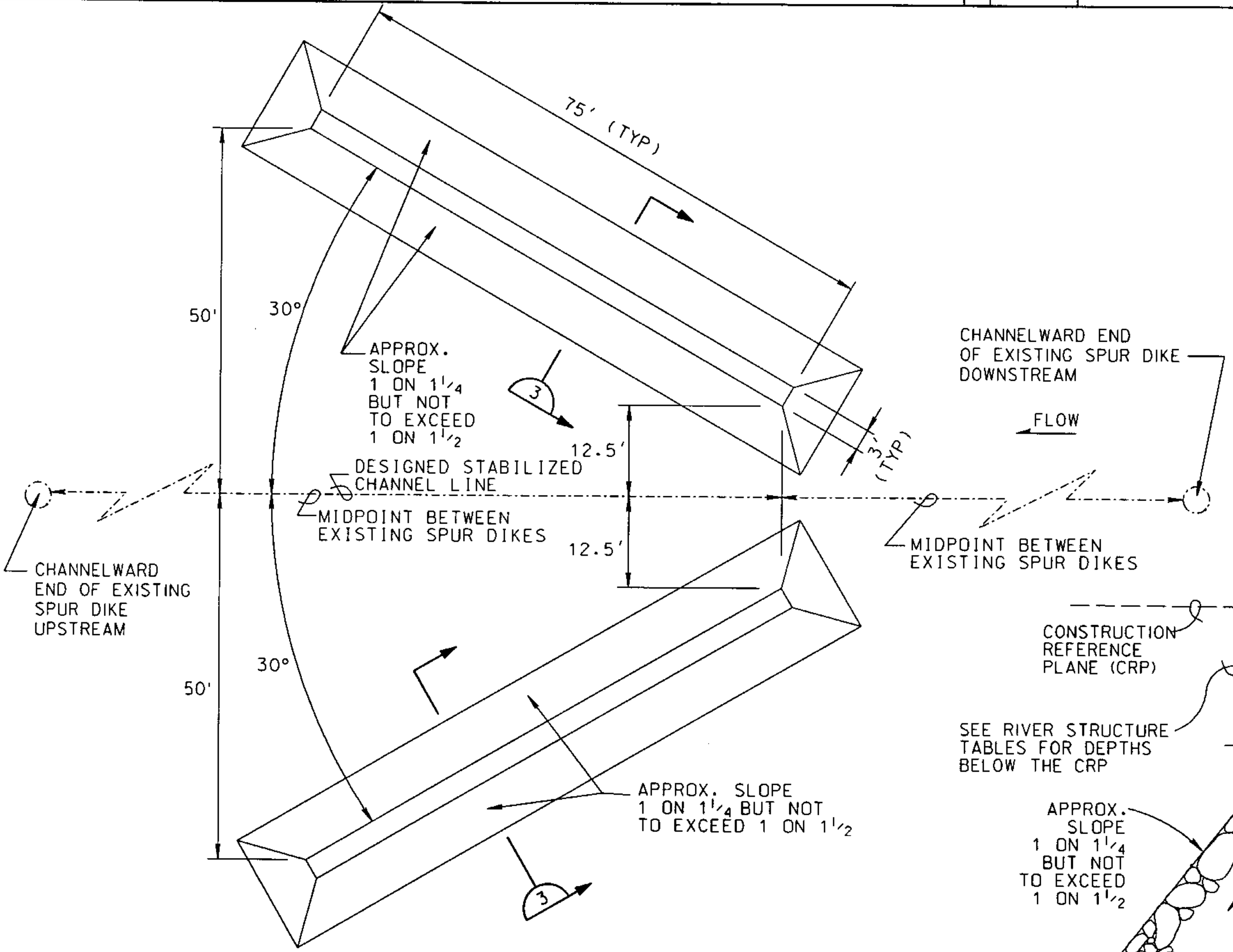
RIVER STRUCTURE TABLE

RIVER MILE	STRUCTURE NUMBER	BANK	RIPRAP MATERIAL REMOVED TO DEPTH BELOW CRP	RIPRAP MATERIAL PLACED TO DEPTH BELOW CRP
715.92	783.15	LT	5 FEET	---
715.87	783.12	LT	---	0 FEET
715.83	783.05	LT	5 FEET	---
715.74	782.75	LT	5 FEET	---
715.69	782.55	LT	---	0 FEET
715.66	782.35	LT	5 FEET	---
715.54	782.15	LT	5 FEET	---
715.49	782.09	LT	---	0 FEET
715.45	781.90	LT	5 FEET	---

F-6

Sheet No. S4	Computer File: Sheet4.DGN Date: MAR. 2004 Drawing Code: PUBDATA\RICKP\X	Spec. No. W9128F-04-R-000X Contract No. W9128F-04-C-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 714.3 TO 716.4 SITE MAP	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P. Checked by: J.I.R. Reviewed by: J.I.R. Drawn by: R.G.P.

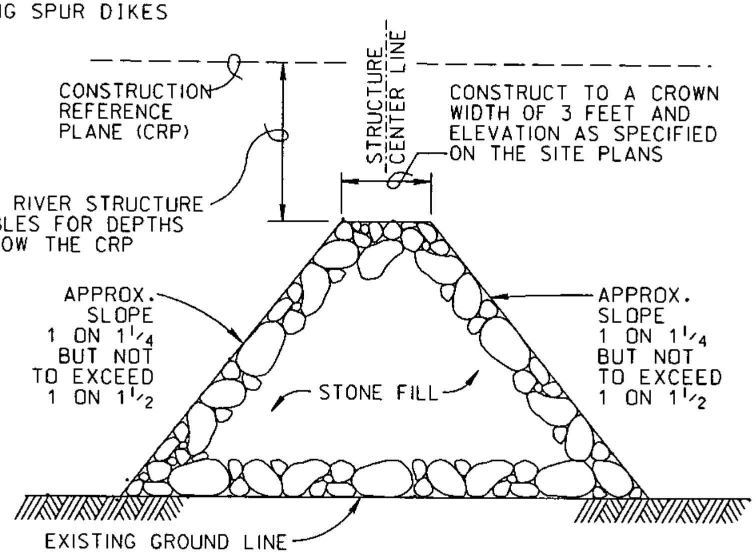
REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



NEW CHEVRON DETAIL

PLAN VIEW

NOT TO SCALE

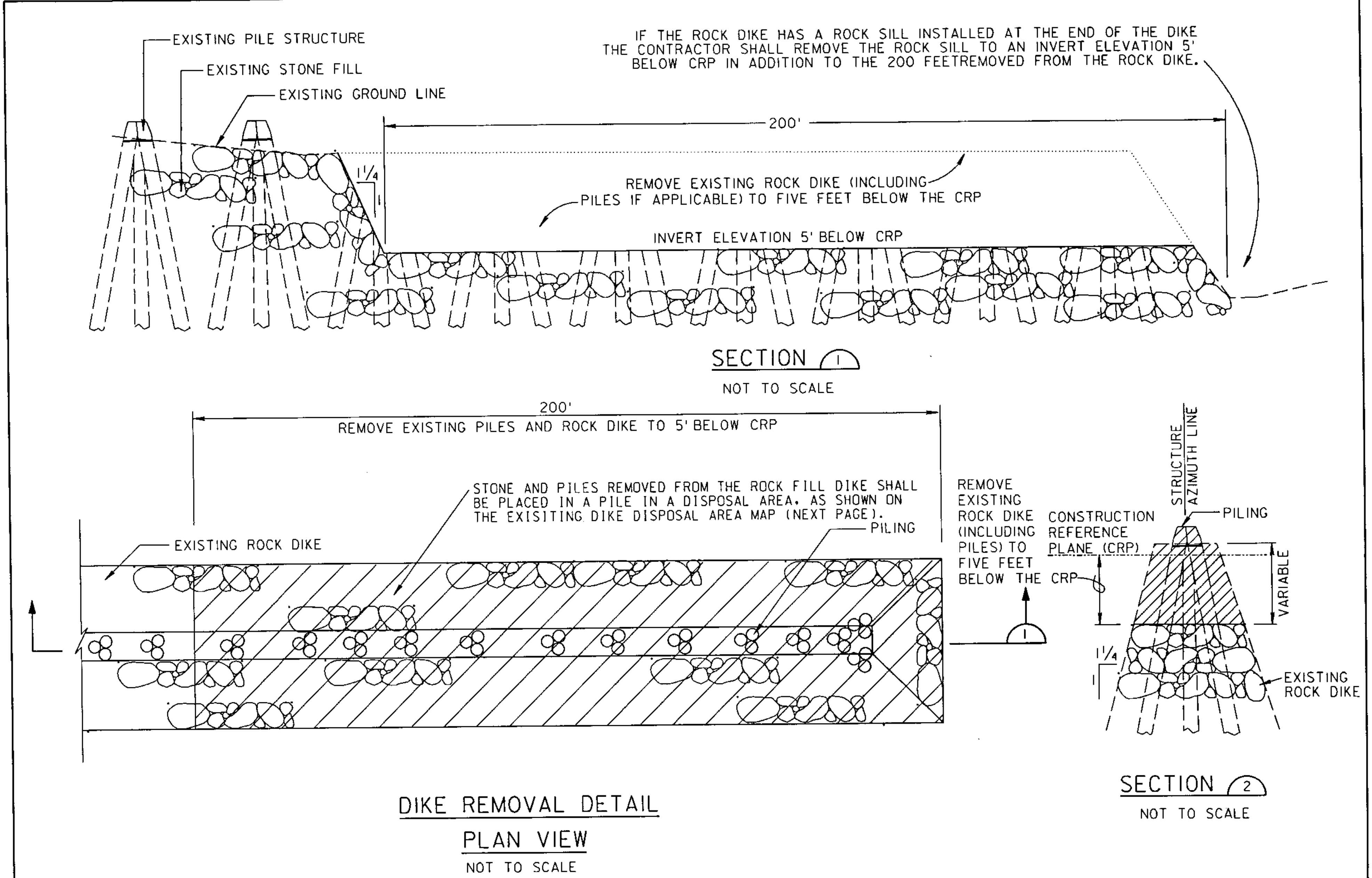


SECTION 3

NOT TO SCALE

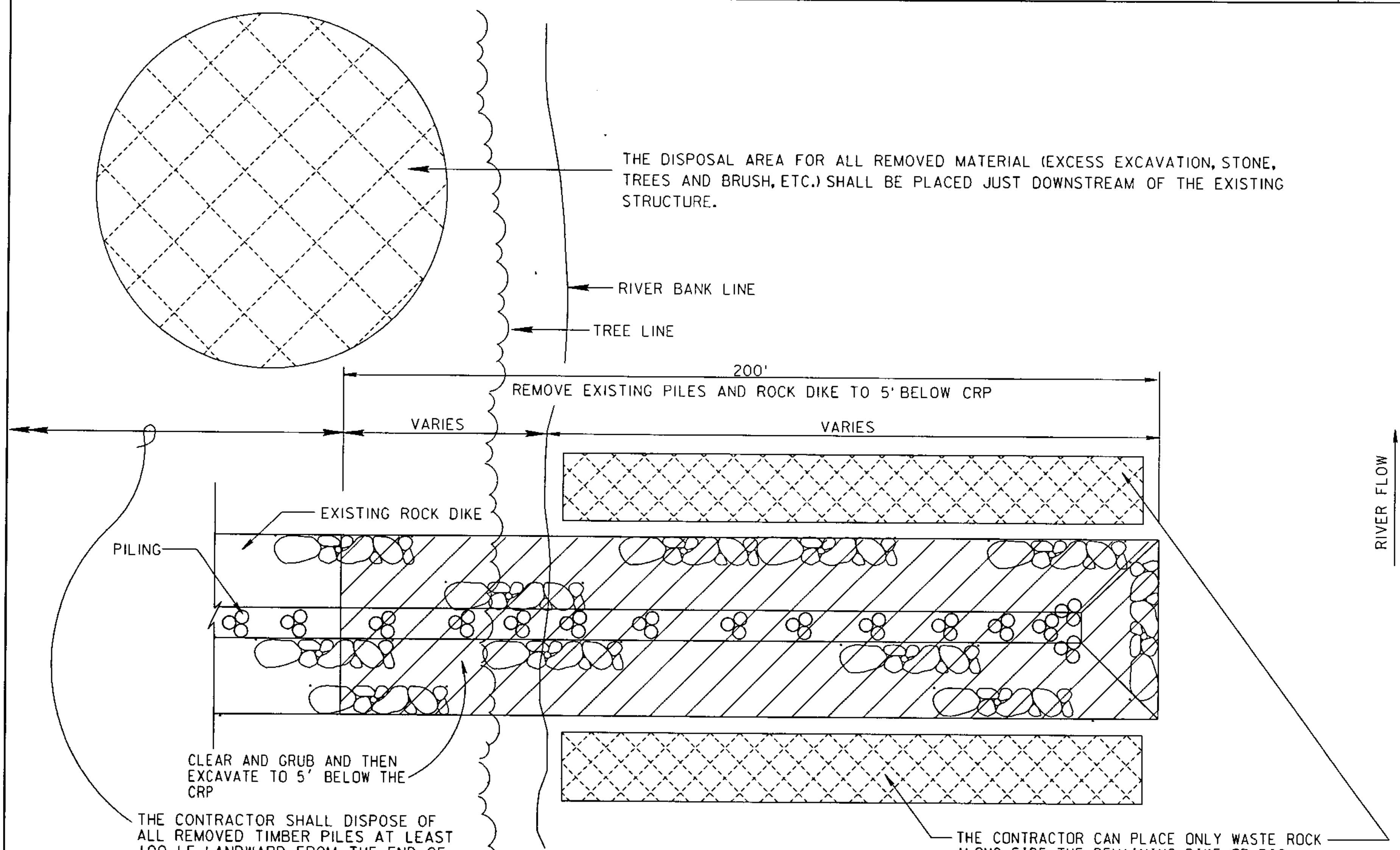
Sheet No.						
S5	Computer File: SHEET5.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA / IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 714.3 TO 716.4 CHEVRON STRUCTURE	Submitted by:	Designed by: R.G.P. / Checked by: J.I.R.
	Date: MAR. 2004	Contract No. W9128F-04-C-000X				Reviewed by: J.I.R. / Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X				Chief SED. & CHAN. STAB. Section	

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



Sheet No.						
S6	Computer File: SHEET6.DGN Date: MAR. 2004 Drawing Code: PUBDATA\RICKP\X	Spec. No. W9128F-04-R-000X Contract No. W9128F-04-C-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA / IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 714.3 TO 716.4 EXISTING DIKE REMOVAL DETAILS	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P. Checked by: J.I.R. Reviewed by: J.I.R. Drawn by: R.G.P.

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



THE CONTRACTOR SHALL DISPOSE OF ALL REMOVED TIMBER PILES AT LEAST 100 LF LANDWARD FROM THE END OF THE DIKE EXCAVATION. THE CONTRACTOR WILL DIG A HOLE AND PLACE THE PILES INSIDE AND BACKFILL WITH A MINIMUM COVER OF AT LEAST 5 FEET OVER THE TOP OF THE PILES. THE CONTRACTOR CAN ALSO DISPOSE OF REMOVED TIMBER PILES AT AN APPROVED LANDFILL AT HIS OWN EXPENSE.

THE CONTRACTOR CAN PLACE ONLY WASTE ROCK ALONG SIDE THE REMAINING DIKE OR DIG A TRENCH (5 TO 6 FEET DEEP) BY SIDE CASTING THE SOIL AND ALLOWING THE RIVER TO RECLAIM IT. THE CONTRACTOR THEN CAN ROLL THE WASTE ROCK INTO THE TRENCH. IN NO CASE WILL THE CONTRACTOR LENGTHEN THE DIKE.

DIKE DISPOSAL AREA

PLAN VIEW

NOT TO SCALE

Sheet No.						
S7	Computer File: SHEET7.DGN Spec. No. W9128F-04-R-000X Date: MAR. 2004 Contract No. W9128F-04-C-000X Drawing Code: PUBDATA\RICKP\X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA / IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 714.3 TO 716.4 EXISTING DIKE DISPOSAL AREA MAP	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P. Reviewed by: J.I.R.	Checked by: J.I.R. Drawn by: R.G.P.

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED

BENCH MARK INFORMATION
COORDINATE POINT

POINT	BANK	NORTHING	EASTING	ELEVATION
714.6	L	15373512.96276	733165.76822	1072.51000
714.7	R	15373655.95095	731956.60381	1068.00000
714.9	L	15374740.94194	731832.50424	1074.76000
715.1	R	15375302.08485	730598.43267	1068.27000
715.3	L	15376514.20855	730658.83927	1063.21000
715.5	R	15376997.68912	729677.85700	1069.27000
715.7	L	15378342.67270	729961.74811	1063.85000
715.9	R	15379283.90588	728985.04111	1069.51000
716.1	L	15380314.31211	729613.25981	1063.55000
716.3	R	15381238.88757	728937.18924	1069.03000

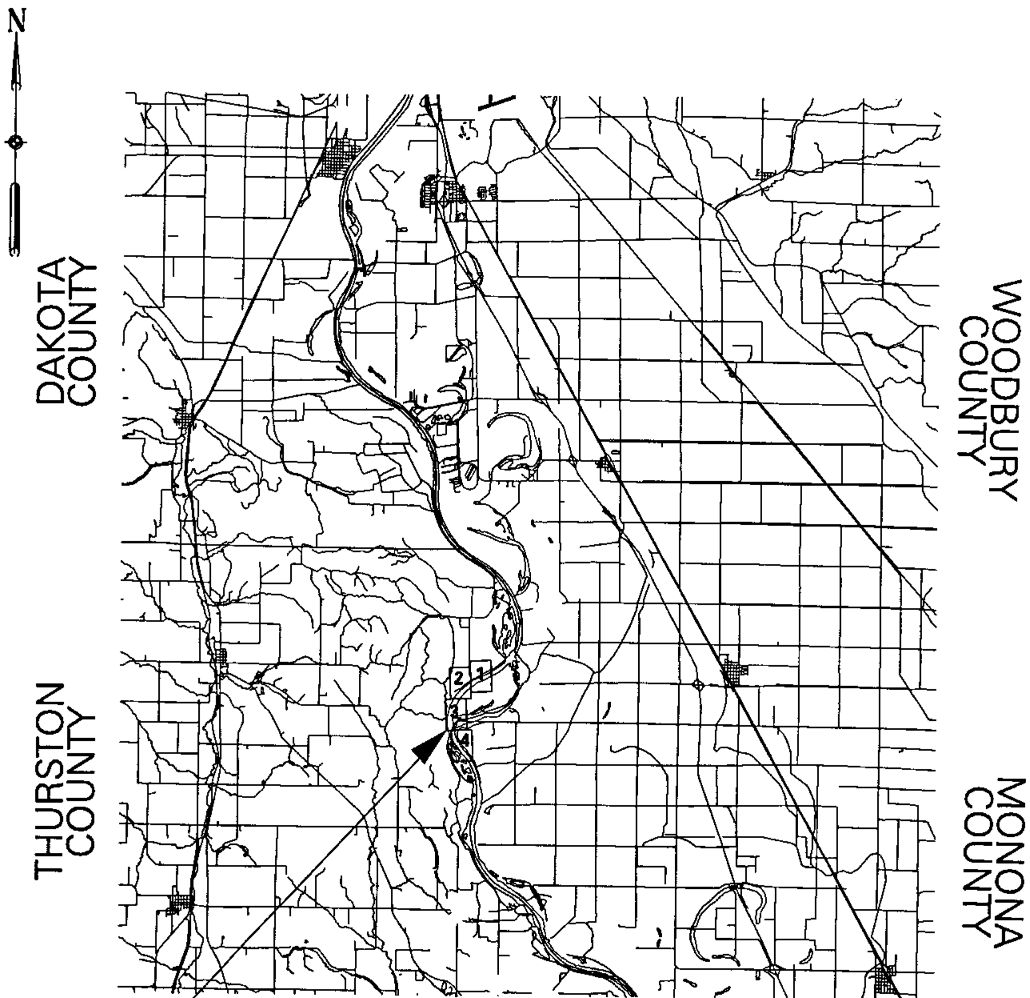
CONDITION OF MISSOURI RIVER CONTROL POINTS:

1. NO EFFORT HAS BEEN MADE TO MONITOR THESE POINTS. SOME HAVE ERODED INTO THE RIVER WHILE OTHERS MAY BE BURIED UNDER 1-5 FEET OF SEDIMENT.
2. EACH CONTROL POINT IS A 3-1/4 INCH DIAMETER CORPS OF ENGINEERS BRASS CAP. THEY ARE STAMPED WITH THE RIVER MILE AND LEFT/RIGHT BANK.
3. THE CONTROL POINTS ARE MARKED WITH ORANGE FIBERGLASS WITNESS POSTS (CARSONITE BRAND). THE POSTS WERE TYPICALLY SET 3-8 INCHES LANDWARD OF THE BRASS CAP.
4. HORIZONTAL CONTROL: UTM ZONE 15, NAD 83
   VERTICAL CONTROL: NGVD 29 (ALSO REFERENCED AS "MEAN SEA LEVEL" DATUM)

F-10

Sheet No.	Computer File: Sheet8.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 714.3 TO 716.4 BENCHMARK INFOMATION	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P.	Checked by: J.I.R.
S8	Date: MAR. 2004	Contract No. W9128F-04-C-000X				Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X						

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



VICINITY MAP

NOT TO SCALE

PROJECT SITE

LOCATION MAP

NOT TO SCALE

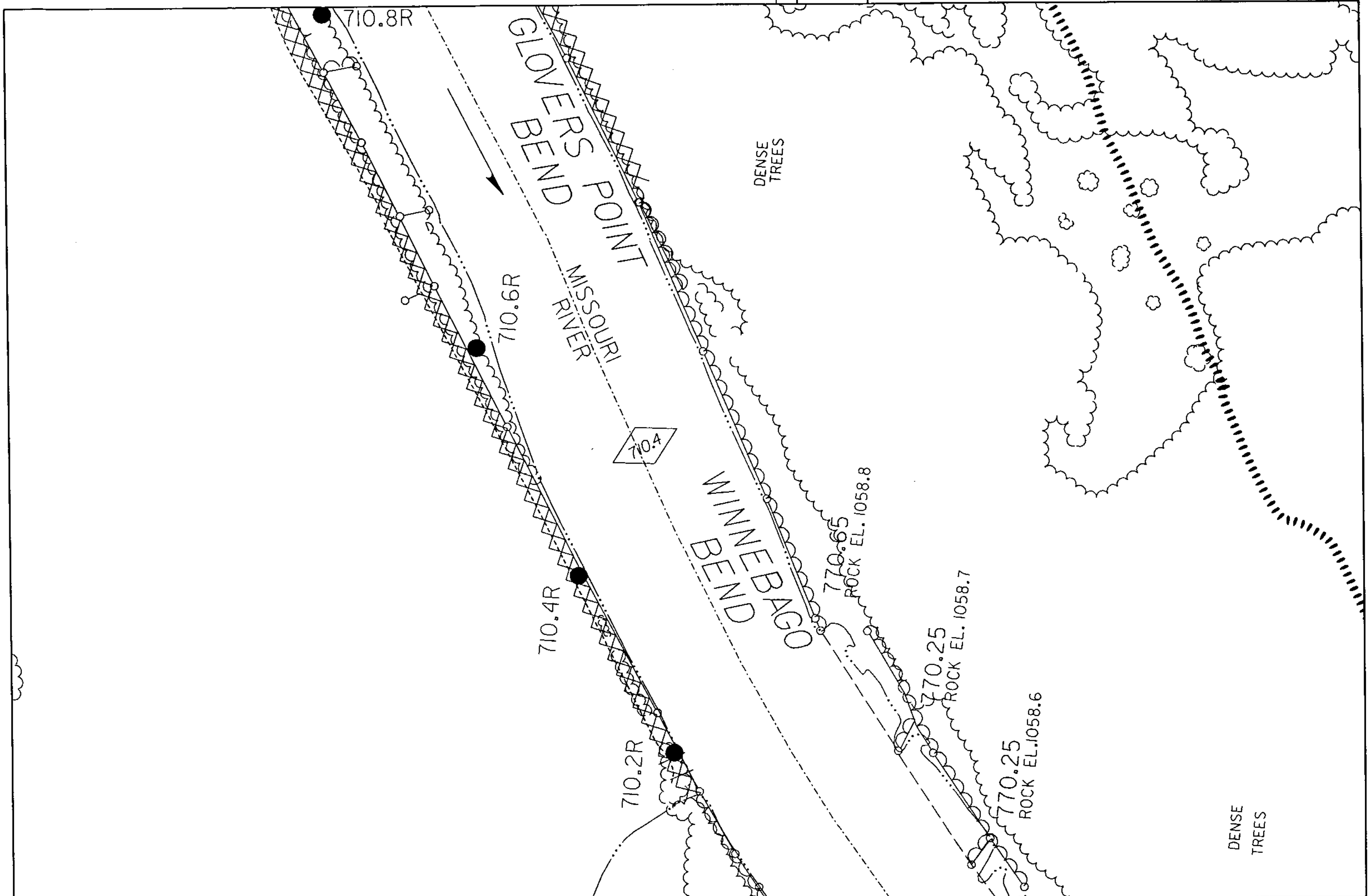
LEGEND

	PILE DIKE
	STONE FILL DIKE OR REVETMENT OR PILE DIKE STONE FILL
	PILE REVETMENT
	PILE REVETMENT, STONE FILL
	TOE TRENCH OR STANDARD REVETMENT OR REINFORCED STD. REVET. OR ACCRETMENT
	ASPHALT REVETMENT
	DESIGNED STABILIZED CHANNEL LINE
	BLUFF LINE
569	1960 CHANNEL MILAGE
580.3	BEND CHANGE
615.8	STRUCTURE NUMBERS ARE BASED ON 1890 MILAGE
CRP	THIS IS THE CONTRUCTION REFERENCE PLANE WHICH REPRESENTS A SYNTHESIZED WATER SURFACE PROFILE OF A STEADY DISCHARGE THAT IS EQUALED OR EXCEEDED 75% OF THE TIME DURING THE NAVIGATION SEASON (APRIL - NOVEMBER).

F-11

Sheet No.	Computer File: SHEETØ.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 714.3 TO 716.4 SITE MAP	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P.	Checked by: J.I.R.
OW	Date: MAR. 2004	Contract No. W9128F-04-C-000X				Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code:	PUBDATA\RICKP\X					

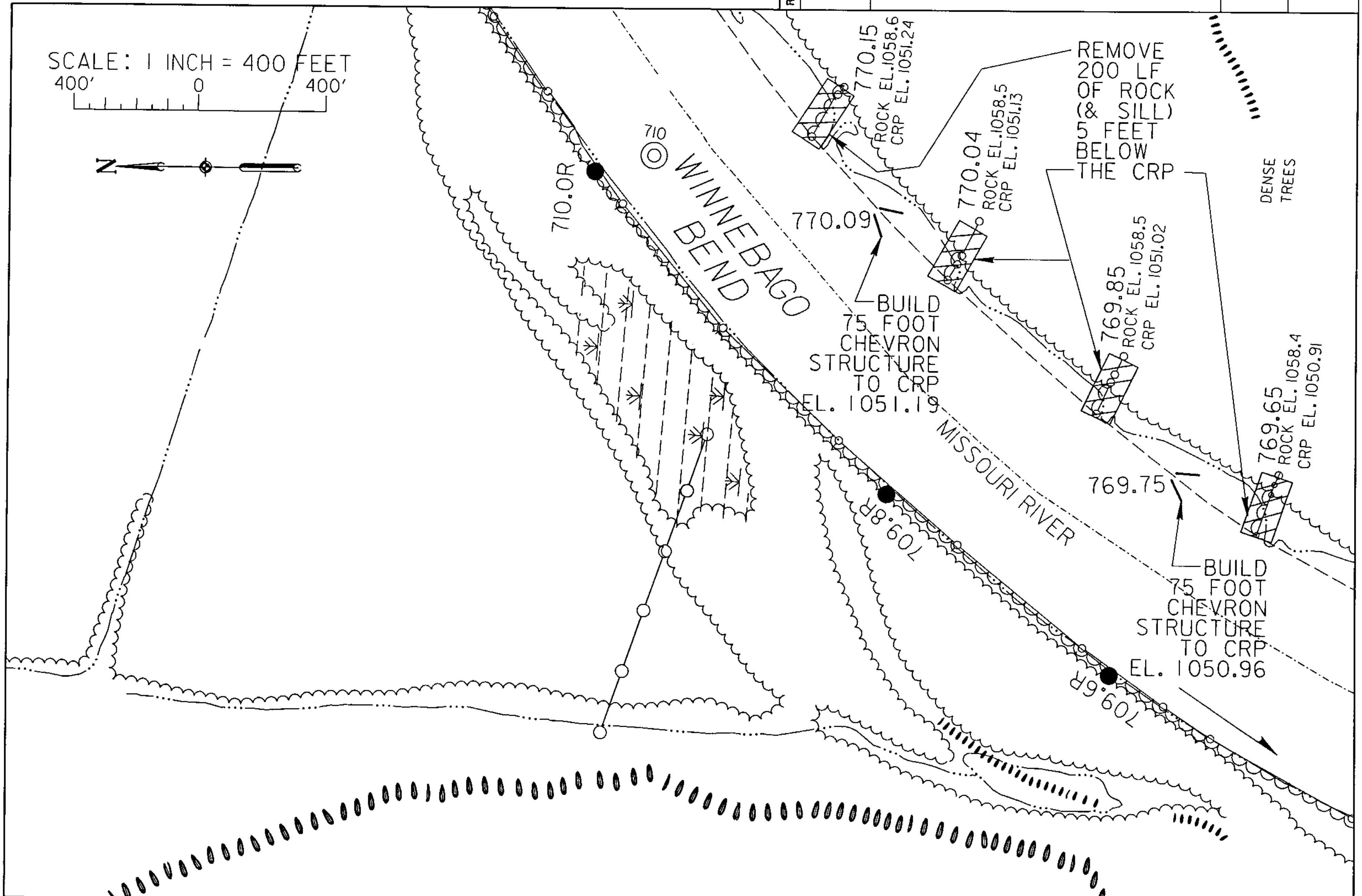
REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



F-12

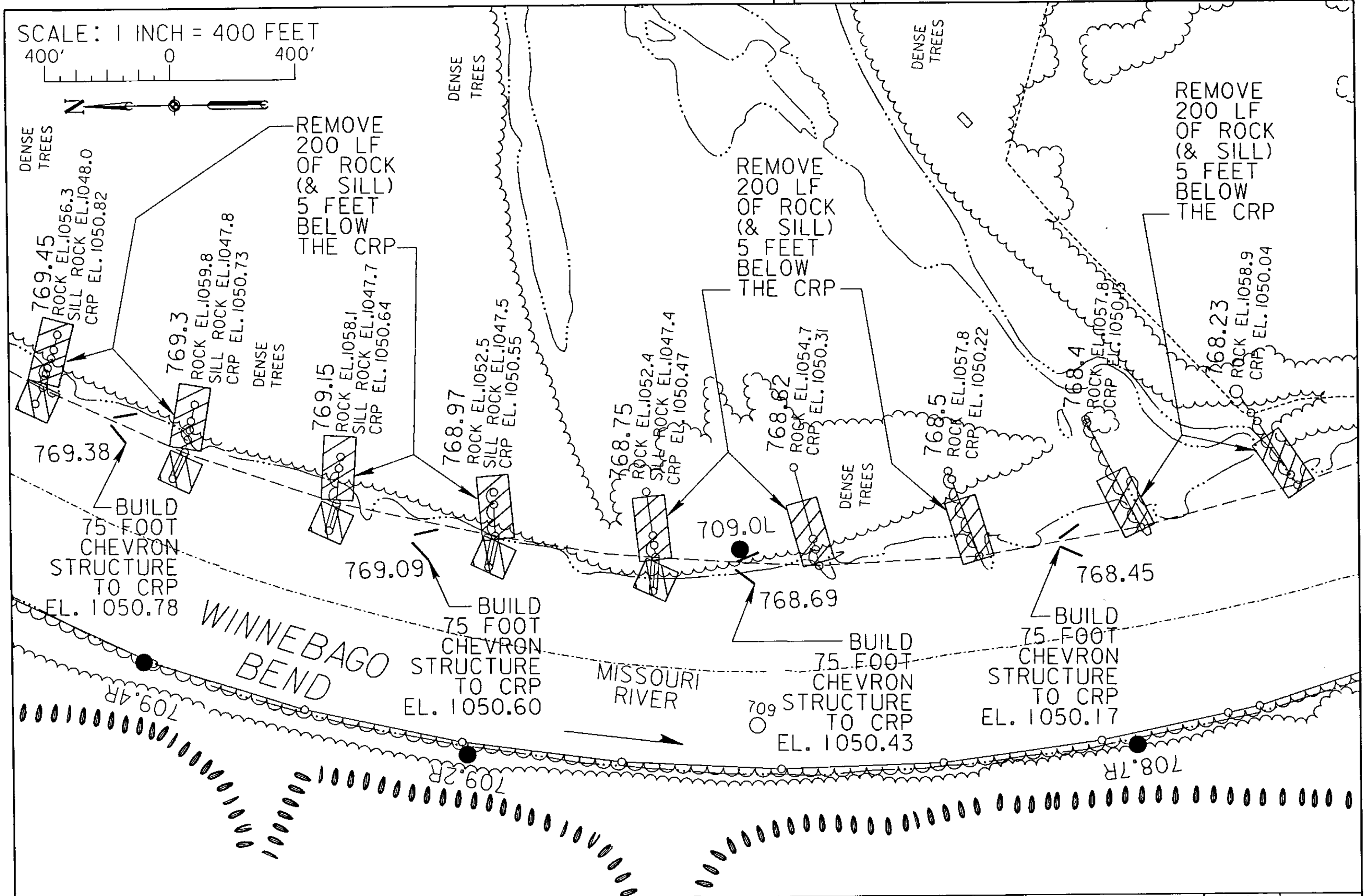
Sheet No. W1	Computer File: sheet1.dgn	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA / IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 714.3 TO 716.4 SITE MAP	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P. Reviewed by: J.I.R.	Checked by: J.I.R. Drawn by: R.G.P.
	Date: MAR. 2004	Contract No. W9128F-04-C-000X					
	Drawing Code: PUBDATA\RICKP\X						

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



Sheet No. W2	Computer File: sheet2.dgn	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA / IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 714.3 TO 716.4 SITE MAP	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P. / Checked by: J.I.R.
	Date: MAR. 2004	Contract No. W9128F-04-C-000X				Reviewed by: J.I.R. / Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X					

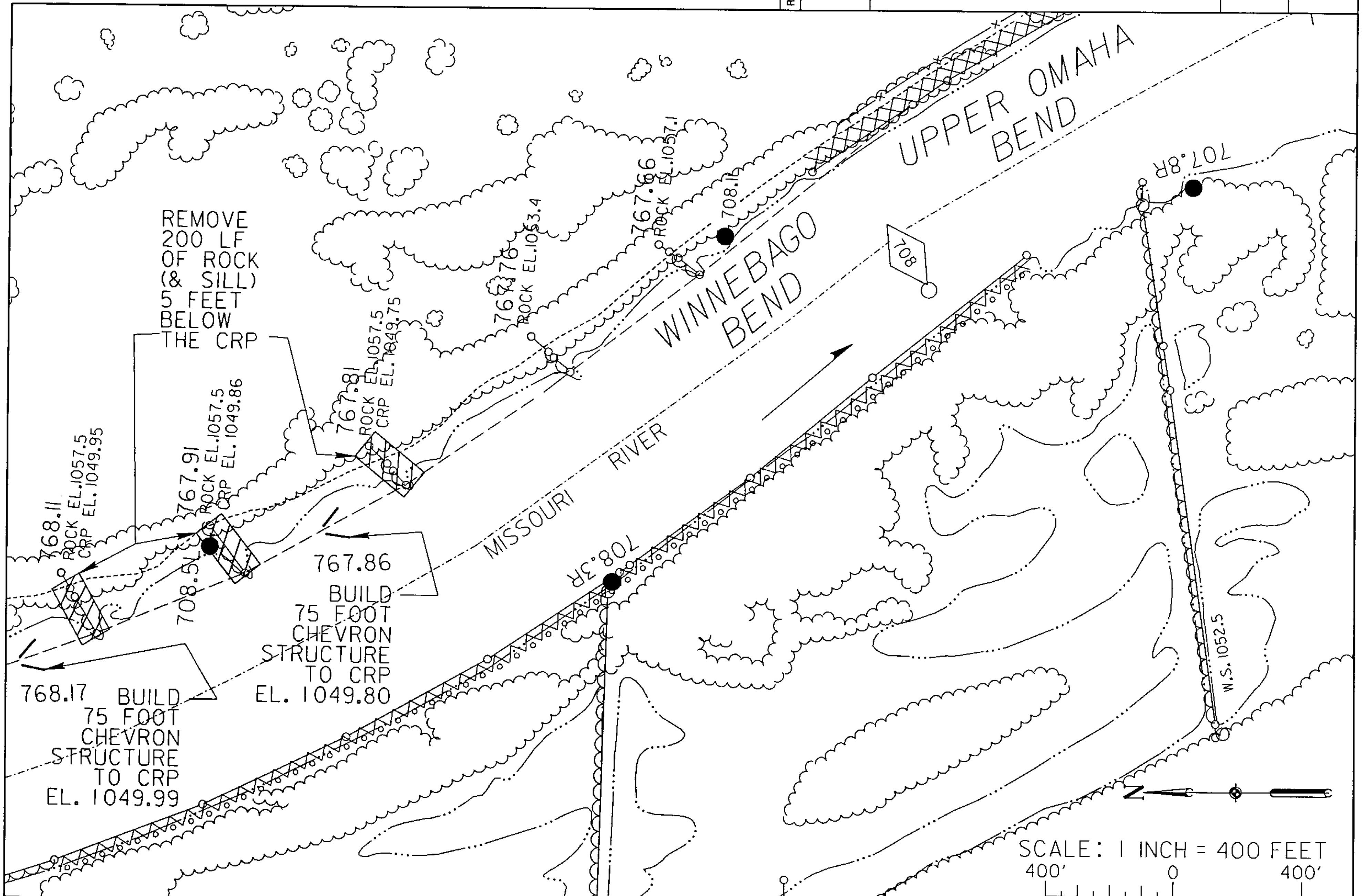
REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



F-14

Sheet No.	Computer File: sheet3.dgn	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA / IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 714.3 TO 716.4 SITE MAP	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P.	Checked by: J.I.R.
W3	Date: MAR. 2004	Contract No. W9128F-04-C-000X				Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X						

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



Sheet No. W4	Computer File: sheet4.dgn	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 714.3 TO 716.4 SITE MAP	Submitted by:	Designed by: R.G.P.	Checked by: J.I.R.
	Date: MAR. 2004	Contract No. W9128F-04-C-000X			Chief SED. & CHAN. STAB. Section	Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code:	PUBDATA\RICKP\X					

REVISIONS SYMBOL	DESCRIPTIONS	DATE	APPROVED

RIVER STRUCTURE TABLE

RIVER MILE	STRUCTURE NUMBER	BANK	RIPRAP MATERIAL REMOVED TO DEPTH BELOW CRP	RIPRAP MATERIAL PLACED TO DEPTH BELOW CRP
709.92	770.15	LT	5 FEET	---
709.87	770.09	LT	---	0 FEET
709.81	770.04	LT	5 FEET	---
709.69	769.85	LT	5 FEET	---
709.63	769.75	LT	---	0 FEET
709.57	769.65	LT	5 FEET	---
709.48	769.45	LT	5 FEET	---
709.43	769.38	LT	---	0 FEET
709.38	769.30	LT	5 FEET	---
709.29	769.15	LT	5 FEET	---
709.24	769.09	LT	---	0 FOOT
709.19	768.97	LT	5 FEET	---
709.10	768.75	LT	5 FEET	---
708.06	768.69	LT	---	0 FOOT
708.93	768.62	LT	5 FEET	---
708.84	768.50	LT	5 FEET	---
708.79	768.45	LT	---	0 FOOT
708.74	768.40	LT	5 FEET	---
708.65	768.23	LT	5 FEET	---
708.59	768.17	LT	---	0 FOOT
708.55	768.11	LT	5 FEET	---
708.45	767.97	LT	5 FEET	---
708.39	767.86	LT	---	0 FOOT
708.34	767.81	LT	5 FEET	---

F-16

Sheet No. W5	Computer File: Sheet5.DGN	Spec. No. W9128F-04-R-000X
	Date: MAR. 2004	Contract No. W9128F-04-C-000X
	Drawing Code:	PUBDATA\RICKP\X

U S ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA, NEBRASKA

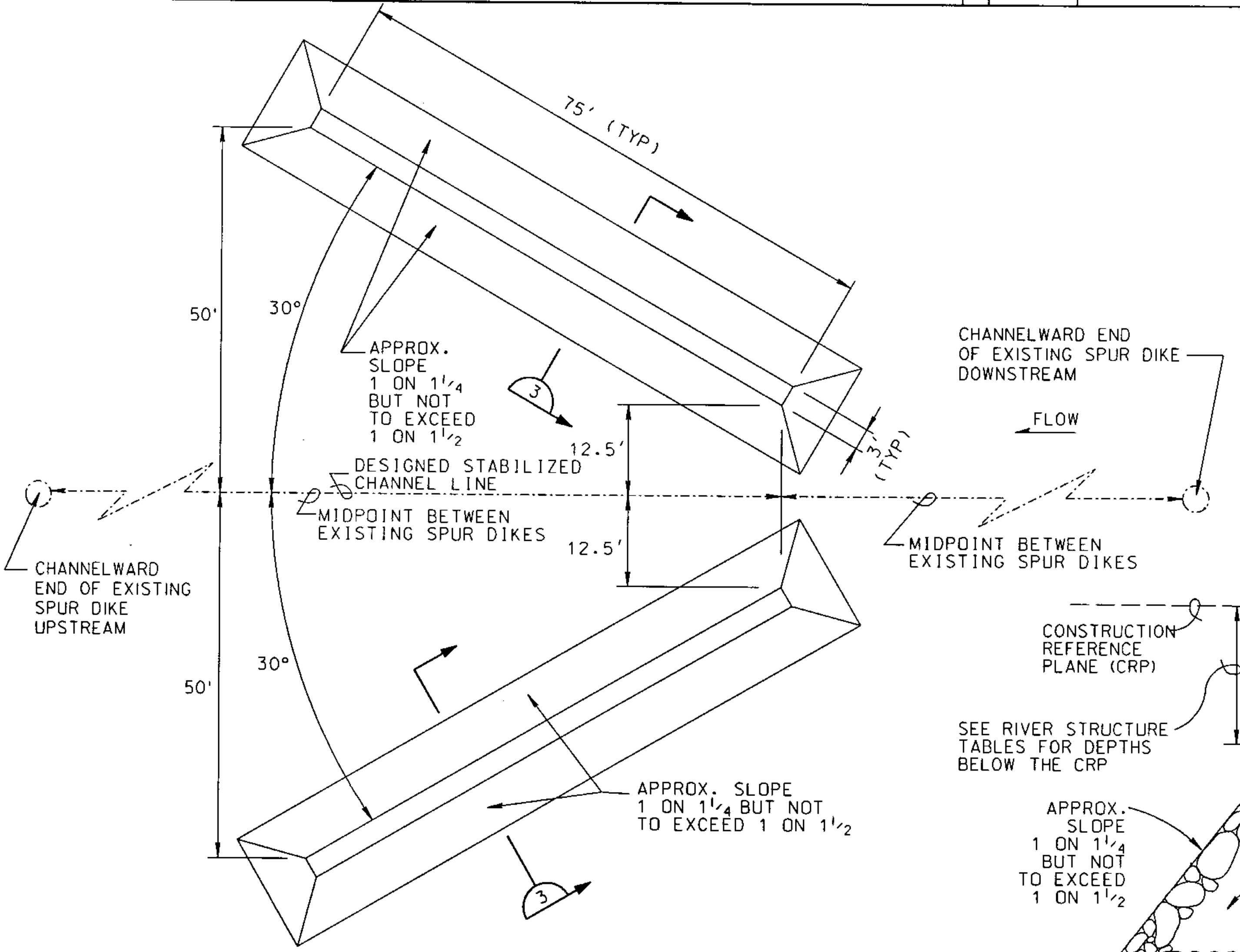
MISSOURI RIVER; NEBRASKA / IOWA
RIVER CONTROL STRUCTURE MODIFICATIONS
RIVER MILE 714.3 TO 716.4
SITE MAP

Submitted by:

Chief SED. & CHAN. STAB. Section

Designed by: R.G.P.	Checked by: J.I.R.
Reviewed by: J.I.R.	Drawn by: R.G.P.

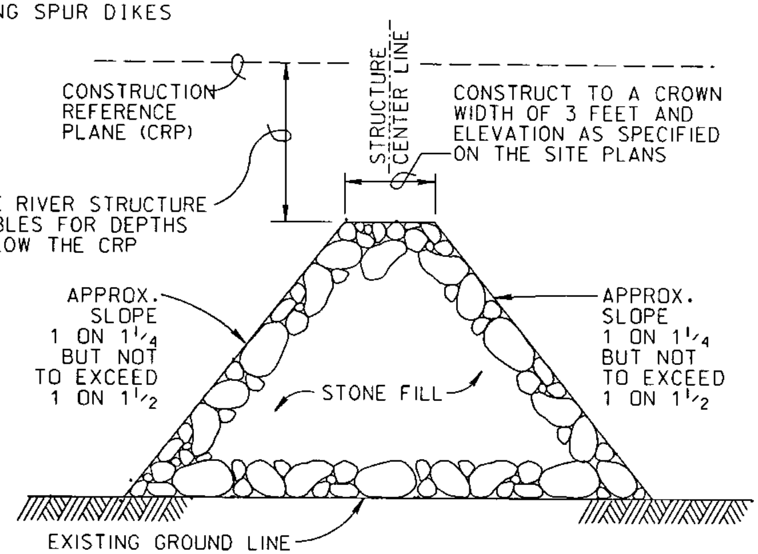
REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



NEW CHEVRON DETAIL

PLAN VIEW

NOT TO SCALE

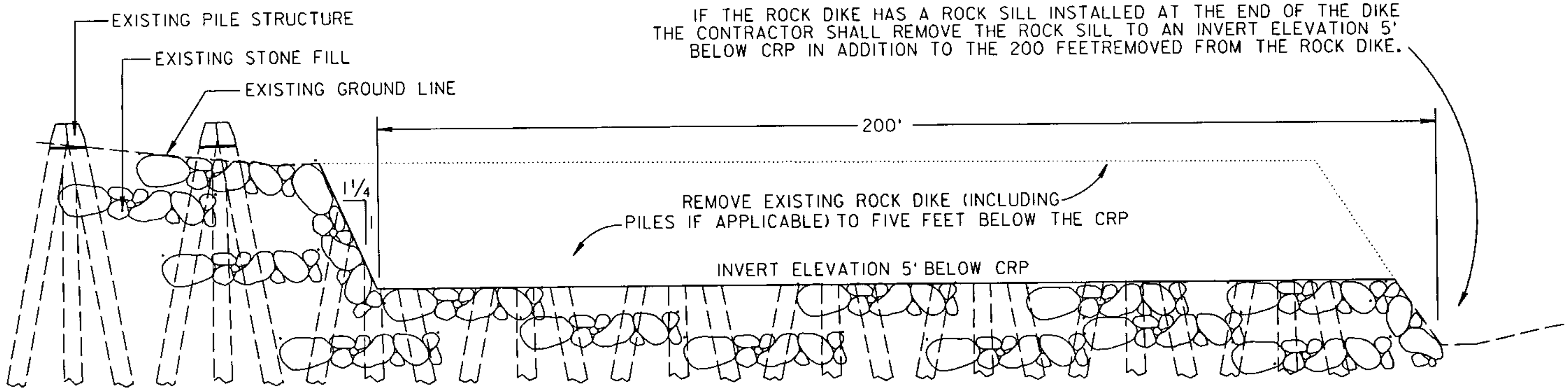


SECTION 3

NOT TO SCALE

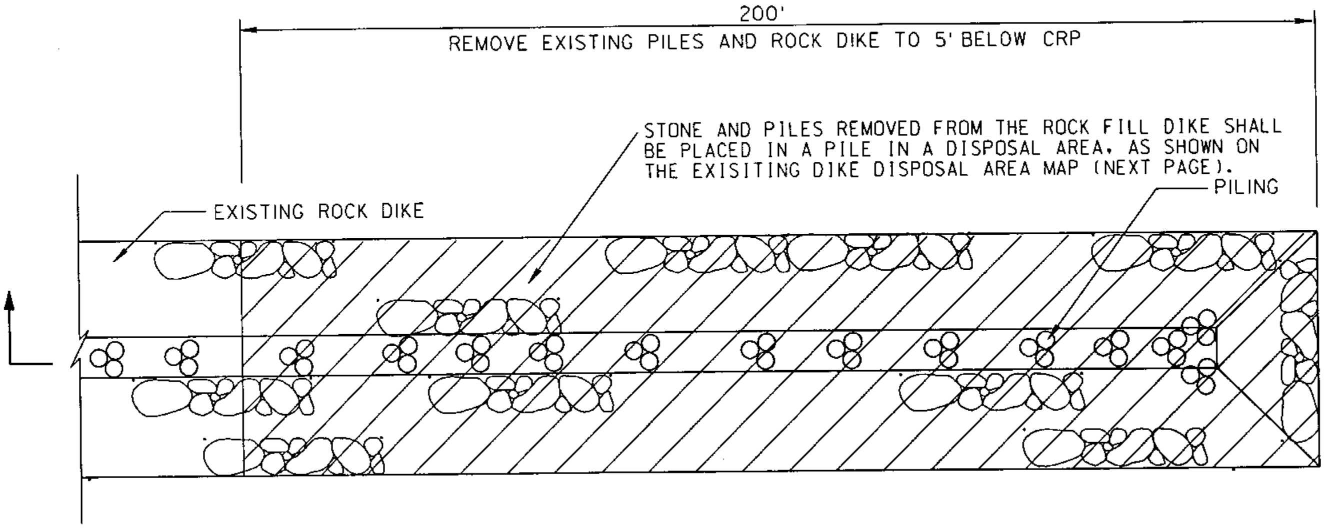
Sheet No.	Computer File: SHEET6.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA / IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 714.3 TO 716.4 CHEVRON STRUCTURE	Submitted by:	Designed by: R.G.P.	Checked by: J.I.R.
W6	Date: MAR. 2004	Contract No. W9128F-04-C-000X			Chief SED. & CHAN. STAB. Section	Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X						

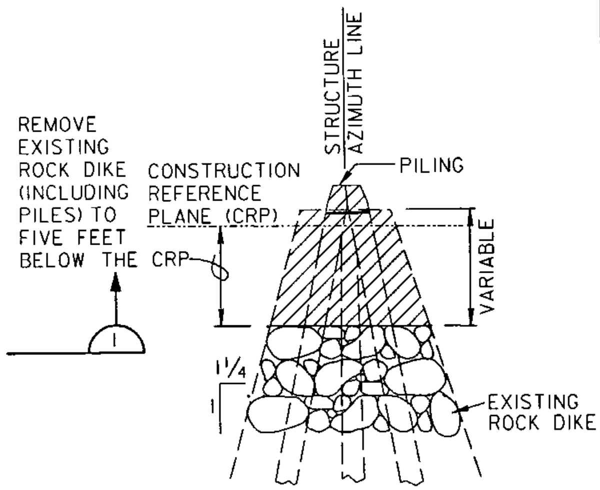
REVISIONS SYMBOL	DESCRIPTIONS	DATE	APPROVED



SECTION 1

NOT TO SCALE





SECTION 2

NOT TO SCALE

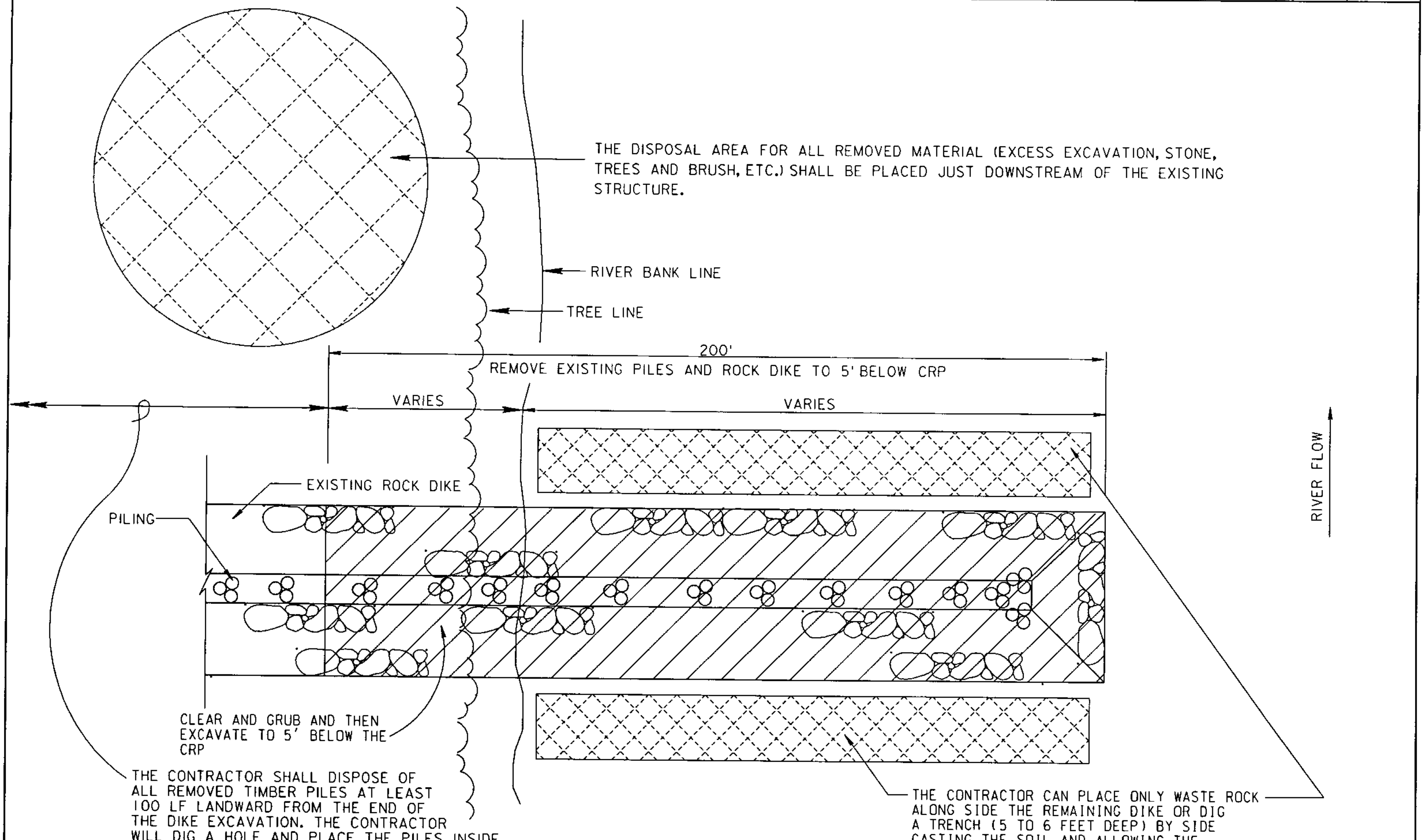
DIKE REMOVAL DETAIL

PLAN VIEW

NOT TO SCALE

Sheet No.						
W7	Computer File: SHEET7.DGN Date: MAR. 2004 Drawing Code: PUBDATA\RICKP\X	Spec. No. W9128F-04-R-000X Contract No. W9128F-04-C-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA / IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 714.3 TO 716.4 EXISTING DIKE REMOVAL DETAILS	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P. Checked by: J.I.R. Reviewed by: J.I.R. Drawn by: R.G.P.

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



DIKE DISPOSAL AREA

PLAN VIEW

NOT TO SCALE

Sheet No.	Computer File: SHEET8.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA / IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 714.3 TO 716.4 EXISTING DIKE DISPOSAL AREA MAP	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P.	Checked by: J.I.R.
W8	Date: MAR. 2004	Contract No. W9128F-04-C-000X				Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X						

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED

BENCH MARK INFORMATION
COORDINATE POINT

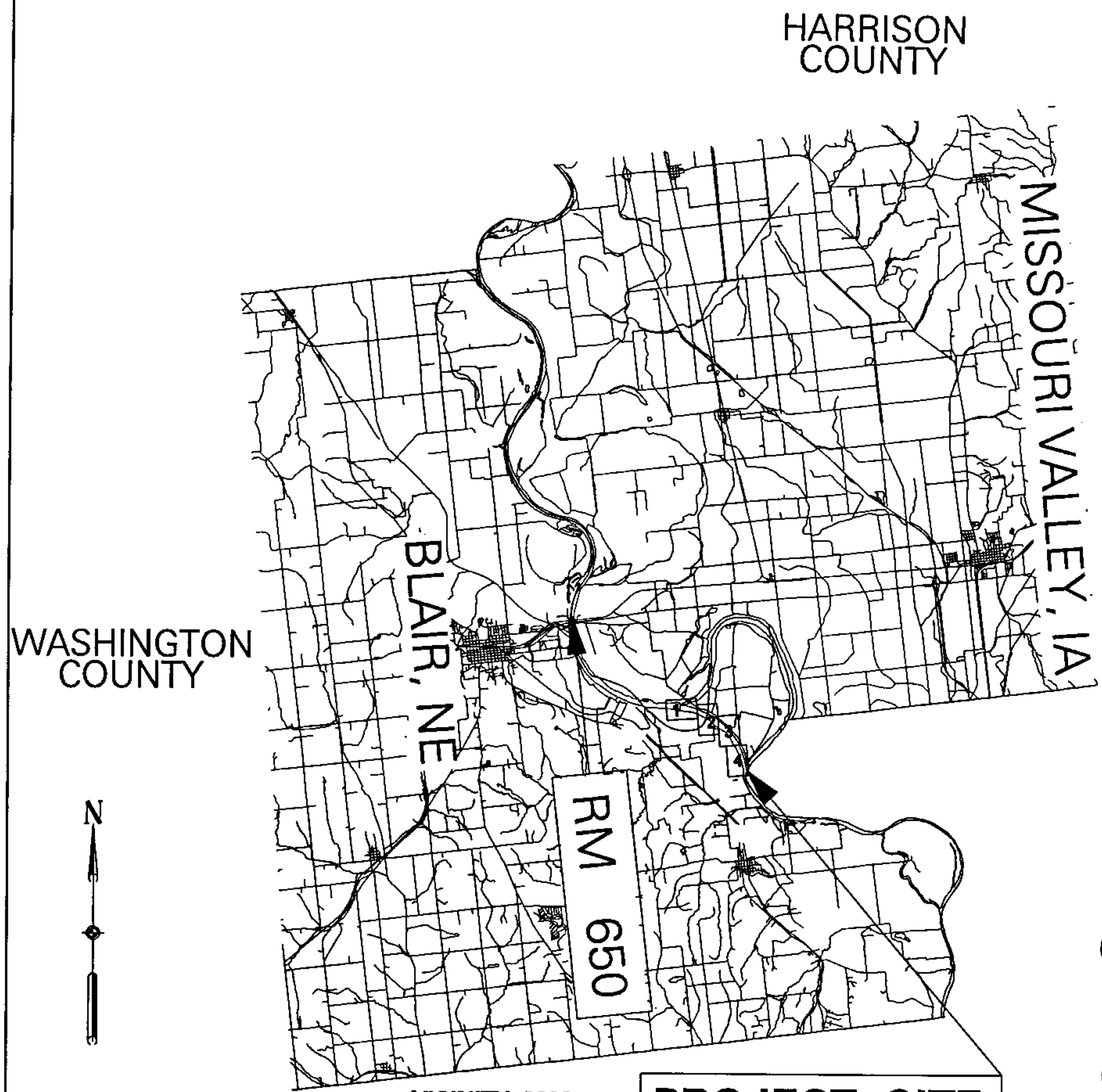
POINT	BANK	NORTHING	EASTING	ELEVATION
707.8	R	15345704.93065	732441.64994	1054.31000
708.1	L	15347181.67534	732254.47761	1055.42000
708.3	R	15347494.04108	731155.14368	1058.24000
708.5	L	15348789.68545	731287.34064	1052.74000
708.7	R	15350161.29196	730006.24516	1058.31000
709.0	L	15351387.18302	730639.05187	1058.52000
709.2	R	15352239.11092	729992.41590	1056.77000
709.8	R	15355139.19583	731499.68102	1059.82000
710.0	R	15356053.61211	732507.96653	1061.63000
710.4	R	15356981.93538	734029.45734	1067.02000
710.6	R	15357298.74203	734747.02599	1057.85000
710.8	R	15357761.79454	735780.93781	1071.17000

CONDITION OF MISSOURI RIVER CONTROL POINTS:

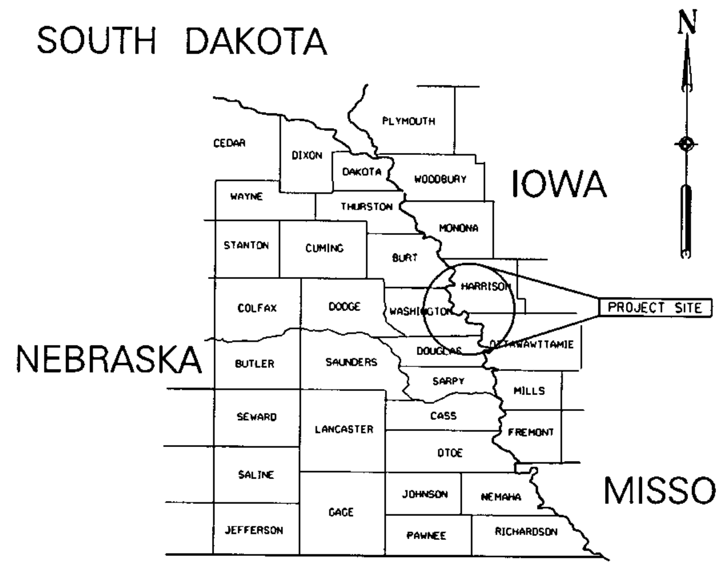
1. NO EFFORT HAS BEEN MADE TO MONITOR THESE POINTS. SOME HAVE ERODED INTO THE RIVER WHILE OTHERS MAY BE BURIED UNDER 1-5 FEET OF SEDIMENT.
2. EACH CONTROL POINT IS A 3-1/4 INCH DIAMETER CORPS OF ENGINEERS BRASS CAP. THEY ARE STAMPED WITH THE RIVER MILE AND LEFT/RIGHT BANK.
3. THE CONTROL POINTS ARE MARKED WITH ORANGE FIBERGLASS WITNESS POSTS (CARSONITE BRAND). THE POSTS WERE TYPICALLY SET 3-8 INCHES LANDWARD OF THE BRASS CAP.
4. HORIZONTAL CONTROL: UTM ZONE 15, NAD 83
   VERTICAL CONTROL: NGVD 29 (ALSO REFERENCED AS "MEAN SEA LEVEL" DATUM)

Sheet No.	Computer File: Sheet9.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 714.3 TO 716.4 BENCHMARK INFOMATION	Submitted by:	Designed by: R.G.P.	Checked by: J.I.R.
W9	Date: MAR. 2004	Contract No. W9128F-04-C-000X			Chief SED. & CHAN. STAB. Section	Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code:	PUBDATA\RICKP\X					

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



VICINITY MAP
NOT TO SCALE



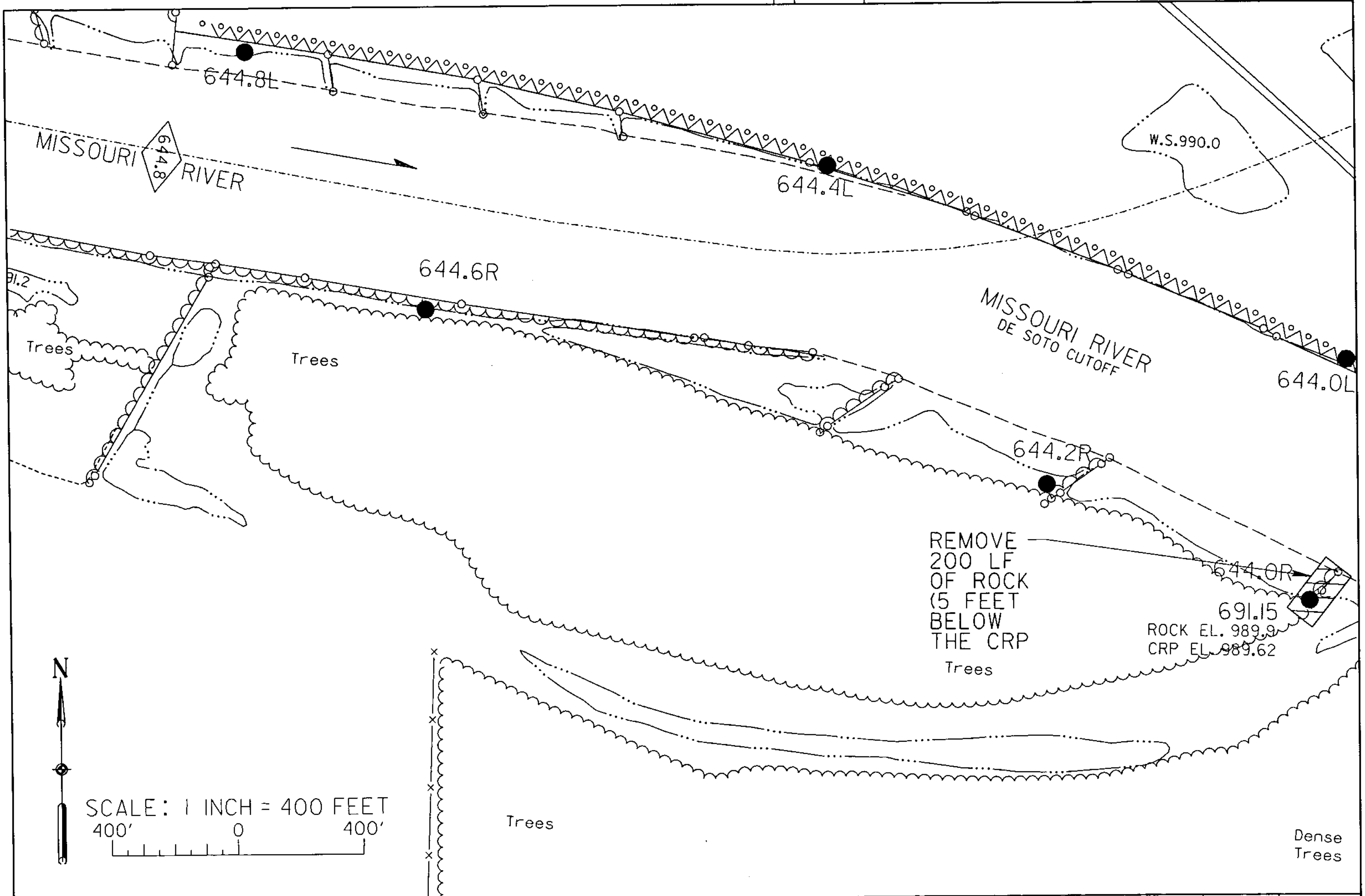
LOCATION MAP
NOT TO SCALE

LEGEND

- PILE DIKE
- STONE FILL DIKE OR REVETMENT OR PILE DIKE STONE FILL
- PILE REVETMENT
- PILE REVETMENT, STONE FILL
- TOE TRENCH OR STANDARD REVETMENT OR REINFORCED STD. REVET. OR ACCRETMENT
- ASPHALT REVETMENT
- DESIGNED STABILIZED CHANNEL LINE
- BLUFF LINE
- 569 — 1960 CHANNEL MILAGE
- 580.3 — BEND CHANGE
- 615.8 — STRUCTURE NUMBERS ARE BASED ON 1890 MILAGE
- CRP — THIS IS THE CONTRUCTION REFERENCE PLANE WHICH REPRESENTS A SYNTHESIZED WATER SURFACE PROFILE OF A STEADY DISCHARGE THAT IS EQUALED OR EXCEEDED 75% OF THE TIME DURING THE NAVIGATION SEASON (APRIL – NOVEMBER).

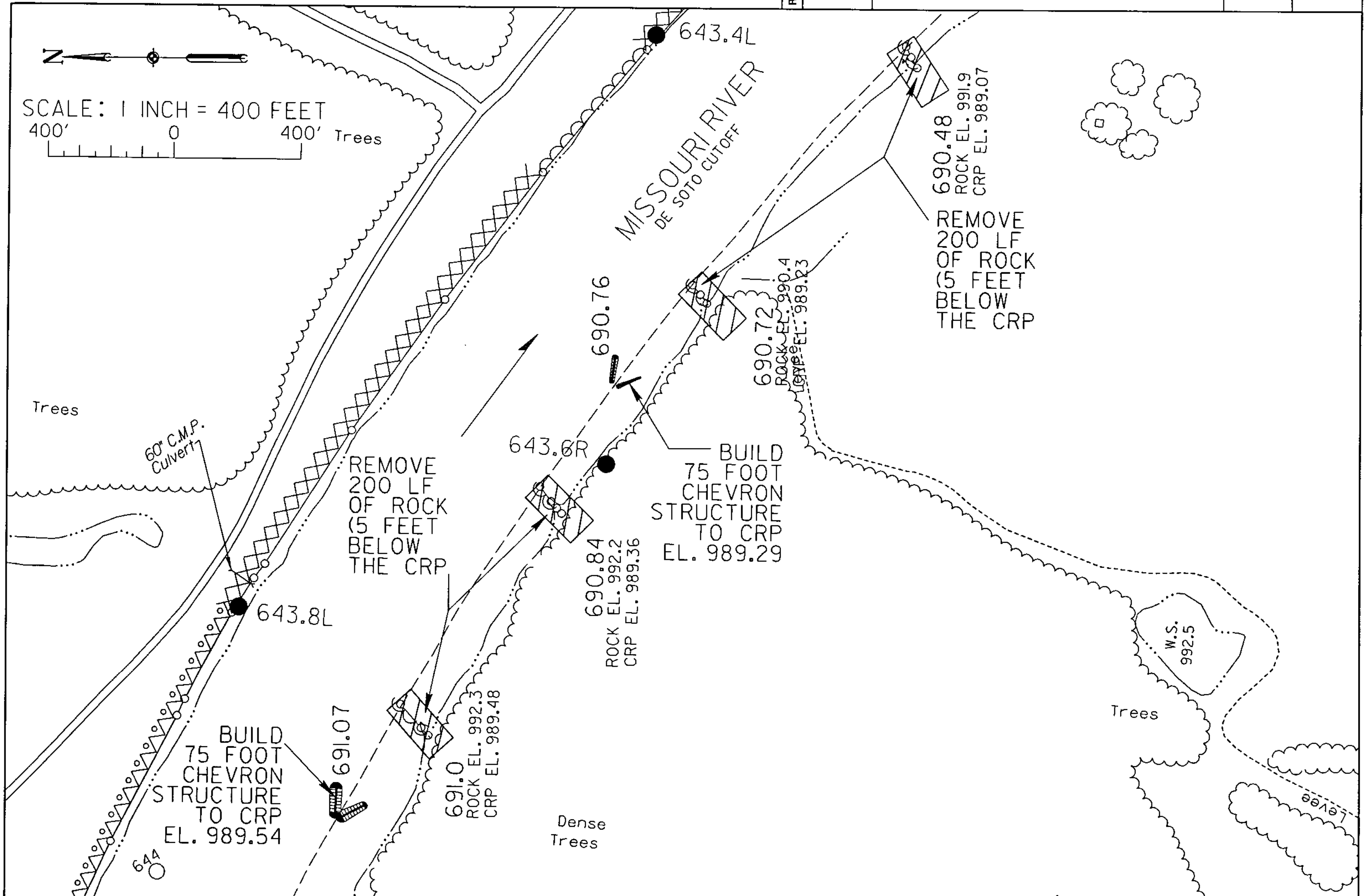
Sheet No.							
D0	Computer File: SHEET0.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; IOWA / NEBRASKA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 642 TO 644 SITE MAP	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P.	Checked by: J.I.R.
	Date: MAR. 2004	Contract No. W9128F-04-C-000X				Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X						

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



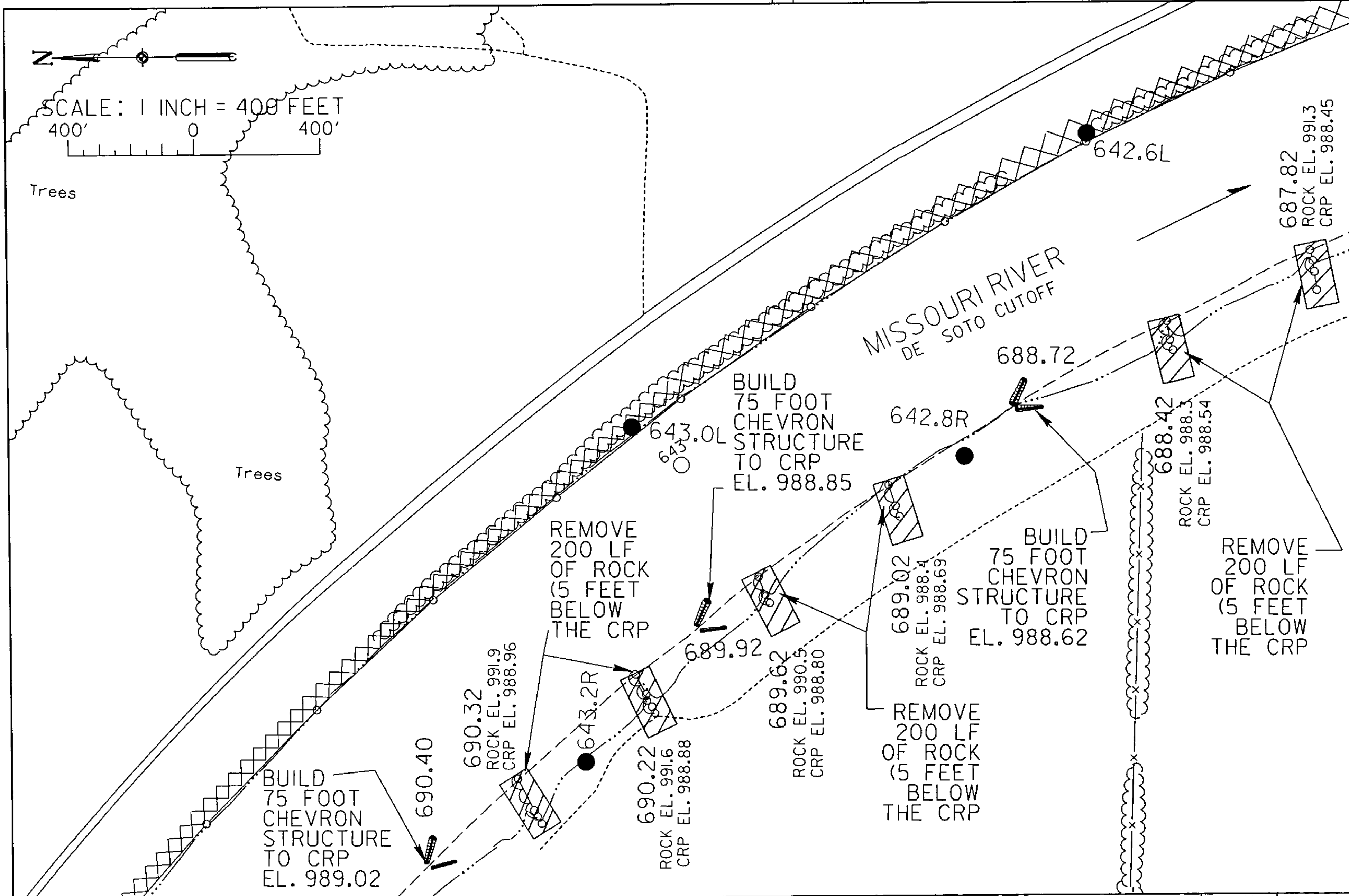
Sheet No.					
D1	Computer File: sheet1.dgn	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; IOWA / NEBRASKA **RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 642 TO 644 SITE MAP**	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P.	Checked by: J.I.R.
	Date: MAR. 2004	Contract No. W9128F-04-C-000X				Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X						

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



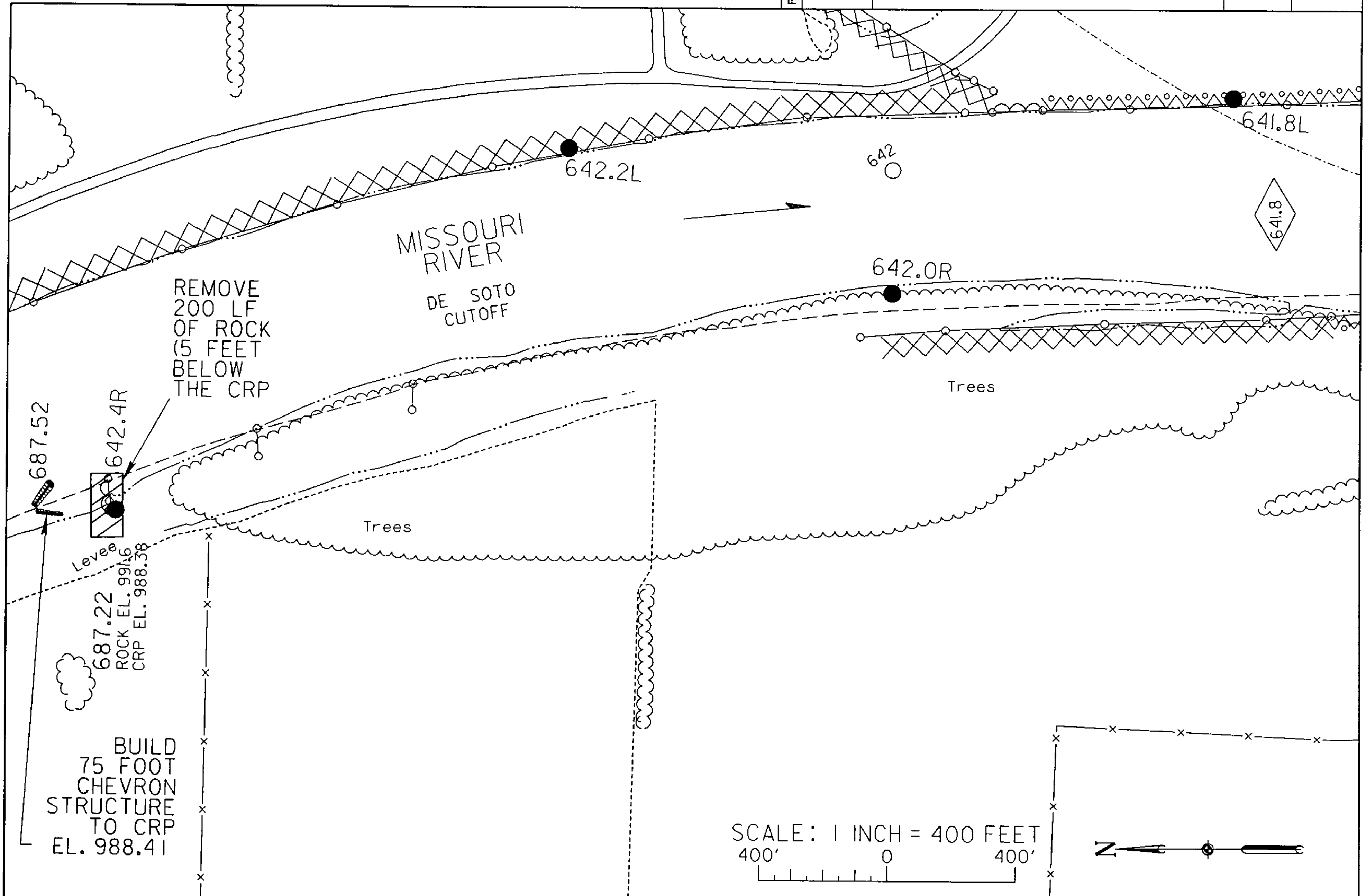
Sheet No.	Computer File: sheet2.dgn	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; IOWA / NEBRASKA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 642 TO 644 SITE MAP	Submitted by:	Designed by: R.G.P.	Checked by: J.I.R.
D2	Date: MAR. 2004	Contract No. W9128F-04-C-000X			Chief SED. & CHAN. STAB. Section	Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code:	PUBDATA\RICKP\X					

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



D3	Sheet No.	Computer File: sheet3.dgn	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; IOWA / NEBRASKA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 642 TO 644 SITE MAP	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P.	Checked by: J.I.R.
		Date: MAR. 2004	Contract No. W9128F-04-C-000X				Reviewed by: J.I.R.	Drawn by: R.G.P.
		Drawing Code:	PUBDATA\RICKP\X					

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



Sheet No.					
D4	Computer File: sheet4.dgn	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; IOWA / NEBRASKA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 642 TO 644 SITE MAP	Submitted by: Chief SED. & CHAN. STAB. Section
	Date: MAR. 2004	Contract No. W9128F-04-C-000X			Designed by: R.G.P. · Checked by: J.I.R.
	Drawing Code: PUBDATA\RICKP\X				Reviewed by: J.I.R. · Drawn by: R.G.P.

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED

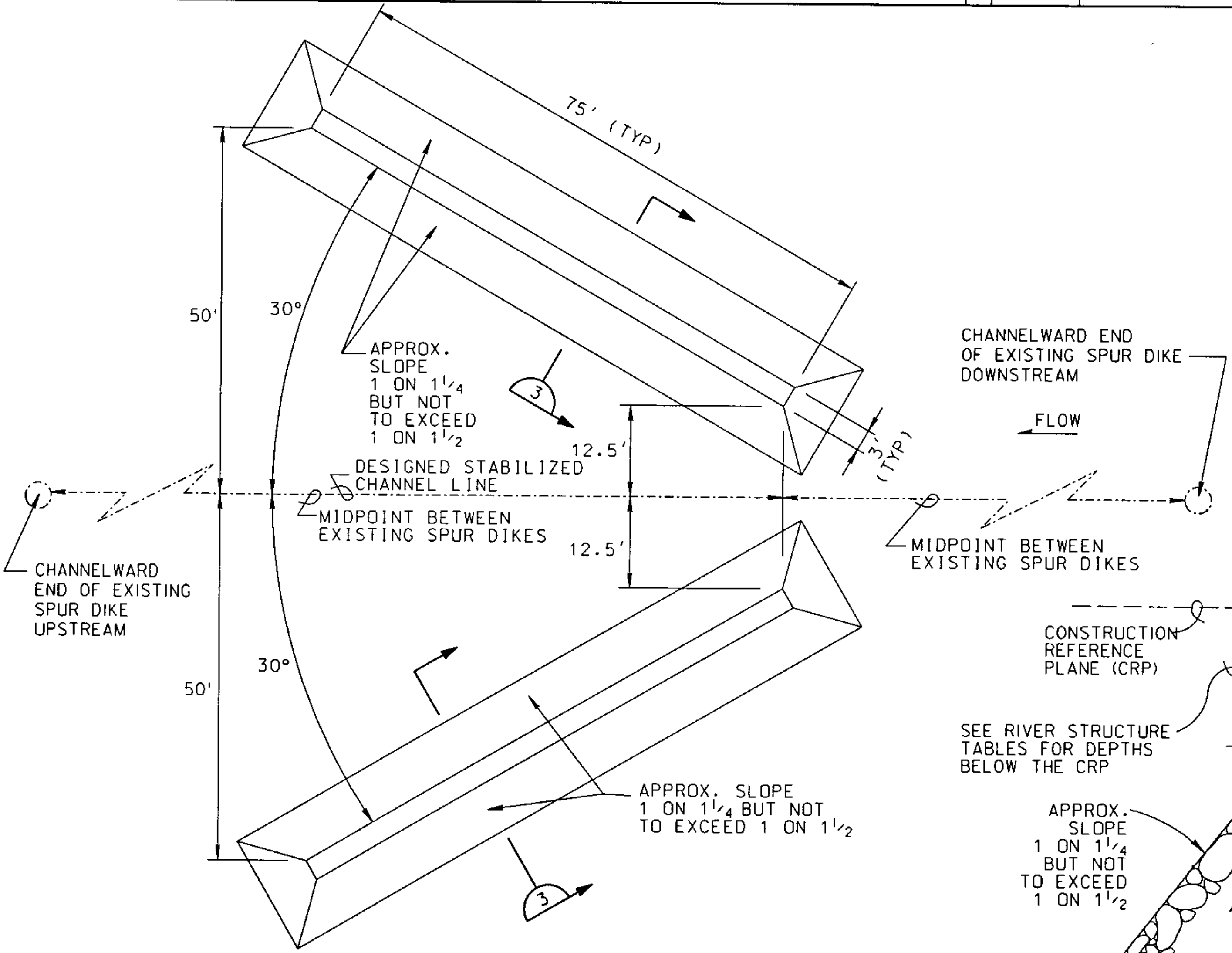
RIVER STRUCTURE TABLE

RIVER MILE	STRUCTURE NUMBER	BANK	RIPRAP MATERIAL REMOVED TO DEPTH BELOW CRP	RIPRAP MATERIAL PLACED TO DEPTH BELOW CRP
643.98	691.15	RT	5 FEET	---
643.90	691.07	RT	---	0 FEET
643.83	691.00	RT	5 FEET	---
643.68	690.84	RT	5 FEET	---
643.60	690.76	RT	---	0 FEET
643.53	690.72	RT	5 FEET	---
643.34	690.48	RT	5 FEET	---
643.28	690.40	RT	---	0 FEET
643.21	690.32	RT	5 FEET	---
643.12	690.22	RT	5 FEET	---
643.07	689.92	RT	---	0 FOOT
643.01	689.62	RT	5 FEET	---
642.89	689.02	RT	5 FEET	---
642.80	688.72	RT	---	0 FOOT
642.70	688.42	RT	5 FEET	---
642.60	687.82	RT	5 FEET	---
642.55	687.52	RT	---	0 FOOT
642.51	687.22	RT	5 FEET	---

F-26

Sheet No.	Computer File: Sheet5.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; IOWA / NEBRASKA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 642 TO 644 SITE MAP	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P.	Checked by: J.I.R.
D5	Date: MAR. 2004	Contract No. W9128F-04-C-000X				Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X						

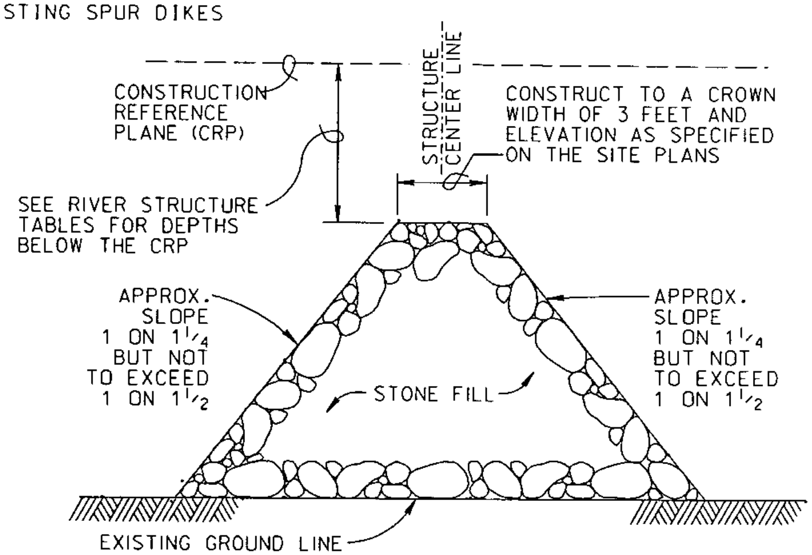
REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



NEW CHEVRON DETAIL

PLAN VIEW

NOT TO SCALE

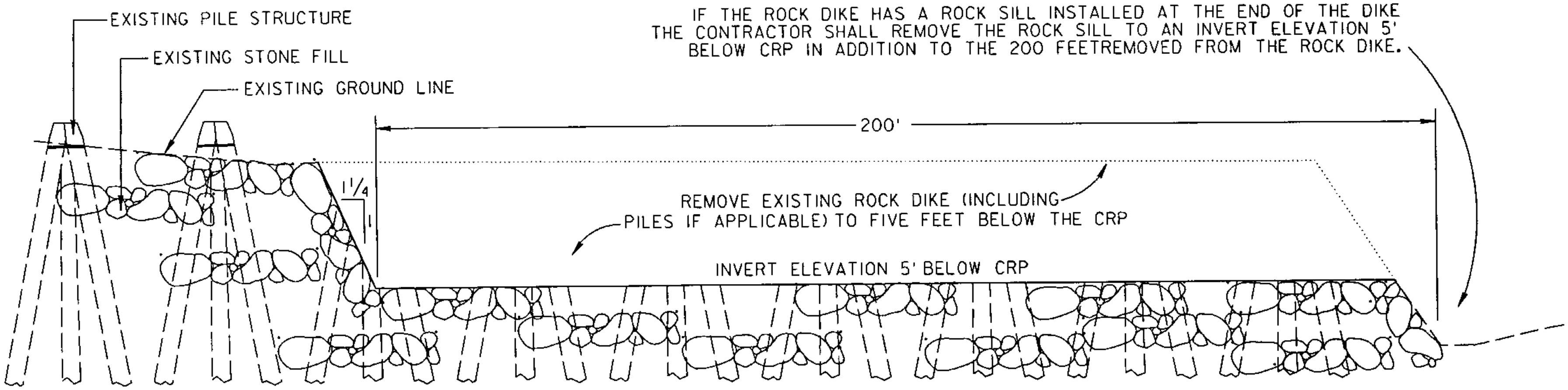


SECTION 3

NOT TO SCALE

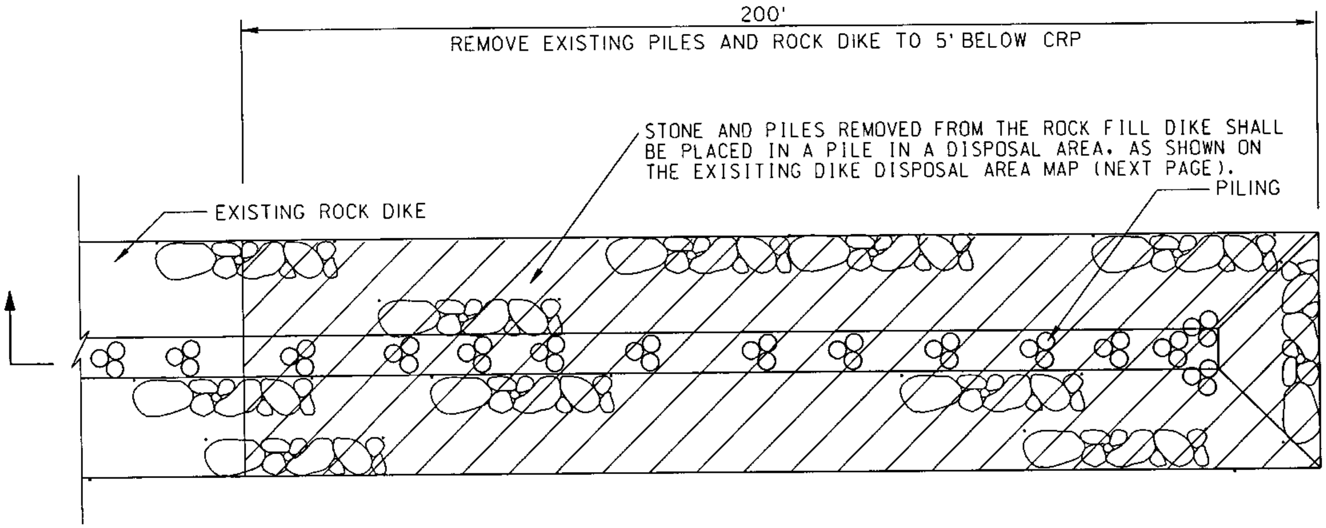
Sheet No.					
D6	Computer File: SHEET6.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; IOWA / NEBRASKA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 642 TO 644 CHEVRON STRUCTURE	Submitted by: Chief SED. & CHAN. STAB. Section
	Date: MAR. 2004	Contract No. W9128F-04-C-000X			Designed by: R.G.P. Checked by: J.I.R.
	Drawing Code: PUBDATA\RICKP\X				Reviewed by: J.I.R. Drawn by: R.G.P.

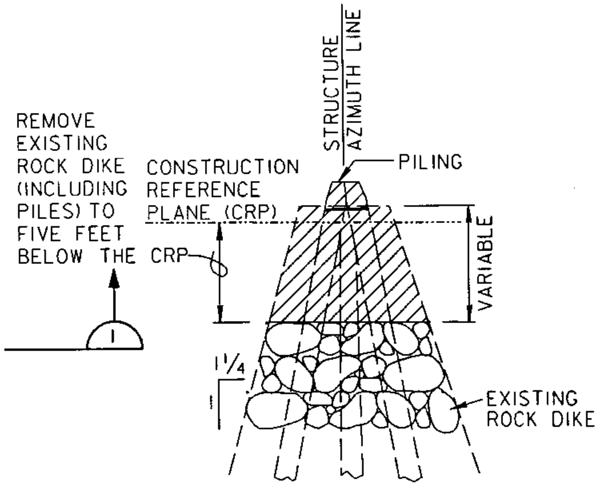
REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



SECTION 1

NOT TO SCALE





SECTION 2

NOT TO SCALE

DIKE REMOVAL DETAIL

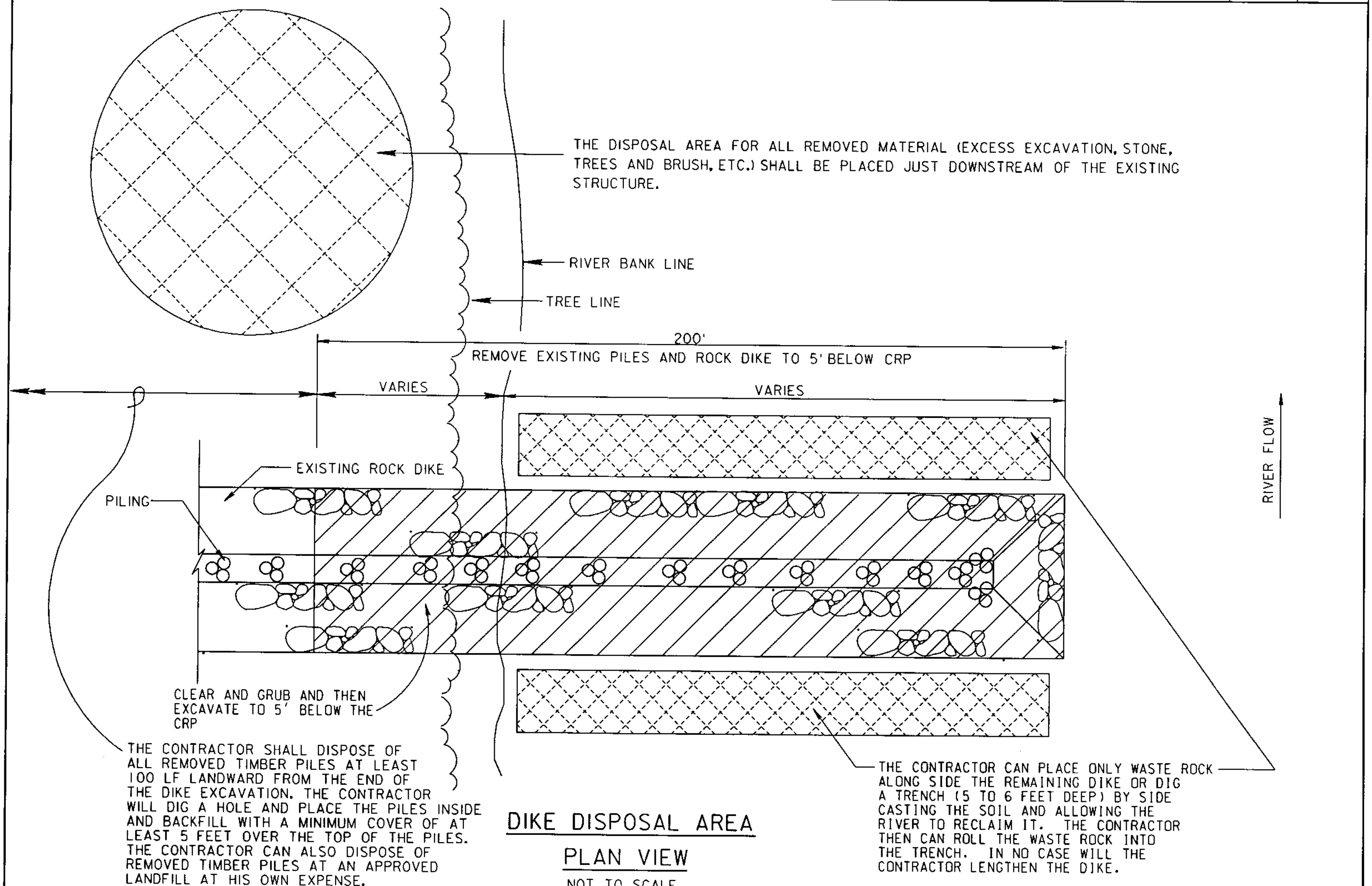
PLAN VIEW

NOT TO SCALE

F-28

Sheet No.						
D7	Computer File: SHEET7.DGN Date: MAR. 2004 Drawing Code: PUBDATA\RICKP\X	Spec. No. W9128F-04-R-000X Contract No. W9128F-04-C-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; IOWA / NEBRASKA **RIVER CONTROL STRUCTURE MODIFICATIONS** **RIVER MILE 642 TO 644** **EXISTING DIKE REMOVAL DETAILS**	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P. Reviewed by: J.I.R.	Checked by: J.I.R. Drawn by: R.G.P.

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



DIKE DISPOSAL AREA

PLAN VIEW

NOT TO SCALE

Sheet No. D8	Computer File: SHEET8.DGN	Spec. No. W9128F-04-R-000X	
	Date: MAR. 2004	Contract No. W9128F-04-C-000X	
	Drawing Code: PUBDATA\RICKP\X		

U S ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA, NEBRASKA

MISSOURI RIVER; IOWA / NEBRASKA
RIVER CONTROL STRUCTURE MODIFICATIONS
RIVER MILE 642 TO 644
EXISTING DIKE DISPOSAL AREA MAP

Submitted by:	Designed by:	Checked by:
	R.G.P.	J.I.R.
Chief SED. & CHAN. STAB. Section	Reviewed by: J.I.R.	Drawn by: R.G.P.

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED

BENCH MARK INFORMATION
COORDINATE POINT

POINT	BANK	NORTHING	EASTING	ELEVATION
641.8	L	15083670.49887	813707.69832	993.38000
642.0	R	15084743.94618	813096.66719	1005.64000
642.2	L	15085750.82428	813555.63470	994.87000
642.4	R	15087166.71863	812424.19627	1003.20000
642.6	L	15088357.75736	812700.01276	1000.87000
642.8	R	15088753.27916	811695.47563	1005.43000
643.0	L	15089792.78098	811807.02925	1003.08000
643.2	R	15089945.32638	810747.15859	994.11000
643.4	L	15091450.30321	810251.07979	997.69000
643.6	R	15091601.77059	808910.61482	1005.74000
643.8	L	15092746.42518	808465.19284	1000.10000
644.0	L	15093248.82073	807488.19022	994.87000
644.0	R	15092496.56064	807361.31851	1002.49000
644.2	R	15092876.68757	806539.54204	994.67000
644.4	L	15093878.75420	805877.67468	995.55000
644.6	R	15093442.28987	804615.97566	995.62000
644.8	L	15094255.18467	804055.37020	994.52000

CONDITION OF MISSOURI RIVER CONTROL POINTS:

1. NO EFFORT HAS BEEN MADE TO MONITOR THESE POINTS. SOME HAVE ERODED INTO THE RIVER WHILE OTHERS MAY BE BURIED UNDER 1-5 FEET OF SEDIMENT.

2. EACH CONTROL POINT IS A 3-1/4 INCH DIAMETER CORPS OF ENGINEERS BRASS CAP. THEY ARE STAMPED WITH THE RIVER MILE AND LEFT/RIGHT BANK.

3. THE CONTROL POINTS ARE MARKED WITH ORANGE FIBERGLASS WITNESS POSTS (CARSONITE BRAND). THE POSTS WERE TYPICALLY SET 3-8 INCHES LANDWARD OF THE BRASS CAP.

4. HORIZONTAL CONTROL: UTM ZONE 15, NAD 83
VERTICAL CONTROL: NGVD 29 (ALSO REFERENCED AS "MEAN SEA LEVEL" DATUM)

Sheet No. D9

Computer File: Sheet9.DGN
Spec. No. W9128F-04-R-000X
Date: MAR. 2004
Contract No. W9128F-04-C-000X
Drawing Code: PUBDATA\RICKP\X

U S ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA, NEBRASKA

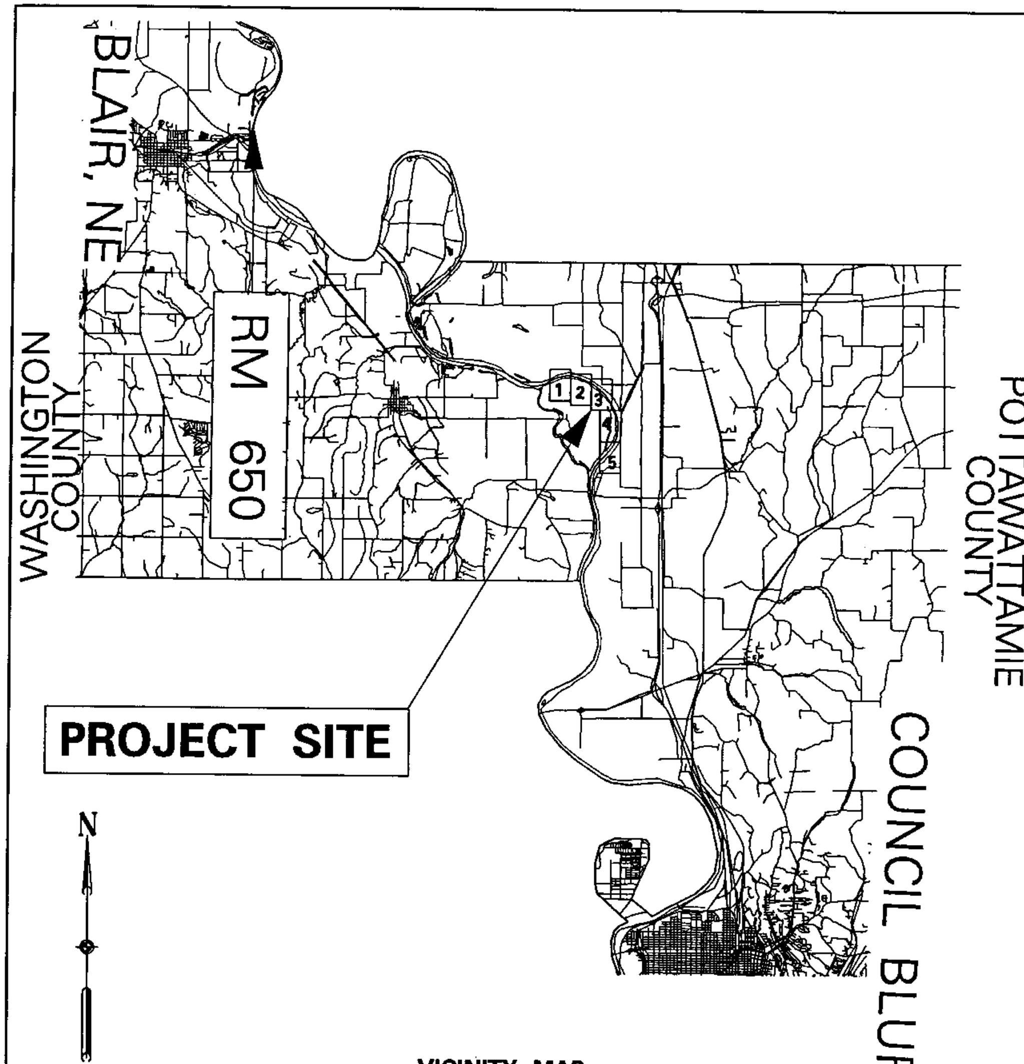
MISSOURI RIVER; IOWA / NEBRASKA
RIVER CONTROL STRUCTURE MODIFICATIONS
RIVER MILE 642 TO 644
BENCHMARK INFOMATION

Submitted by:

Chief SED. & CHAN. STAB. Section

Designed by: R.G.P.
Checked by: J.I.R.
Reviewed by: J.I.R.
Drawn by: R.G.P.

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



VICINITY MAP
NOT TO SCALE

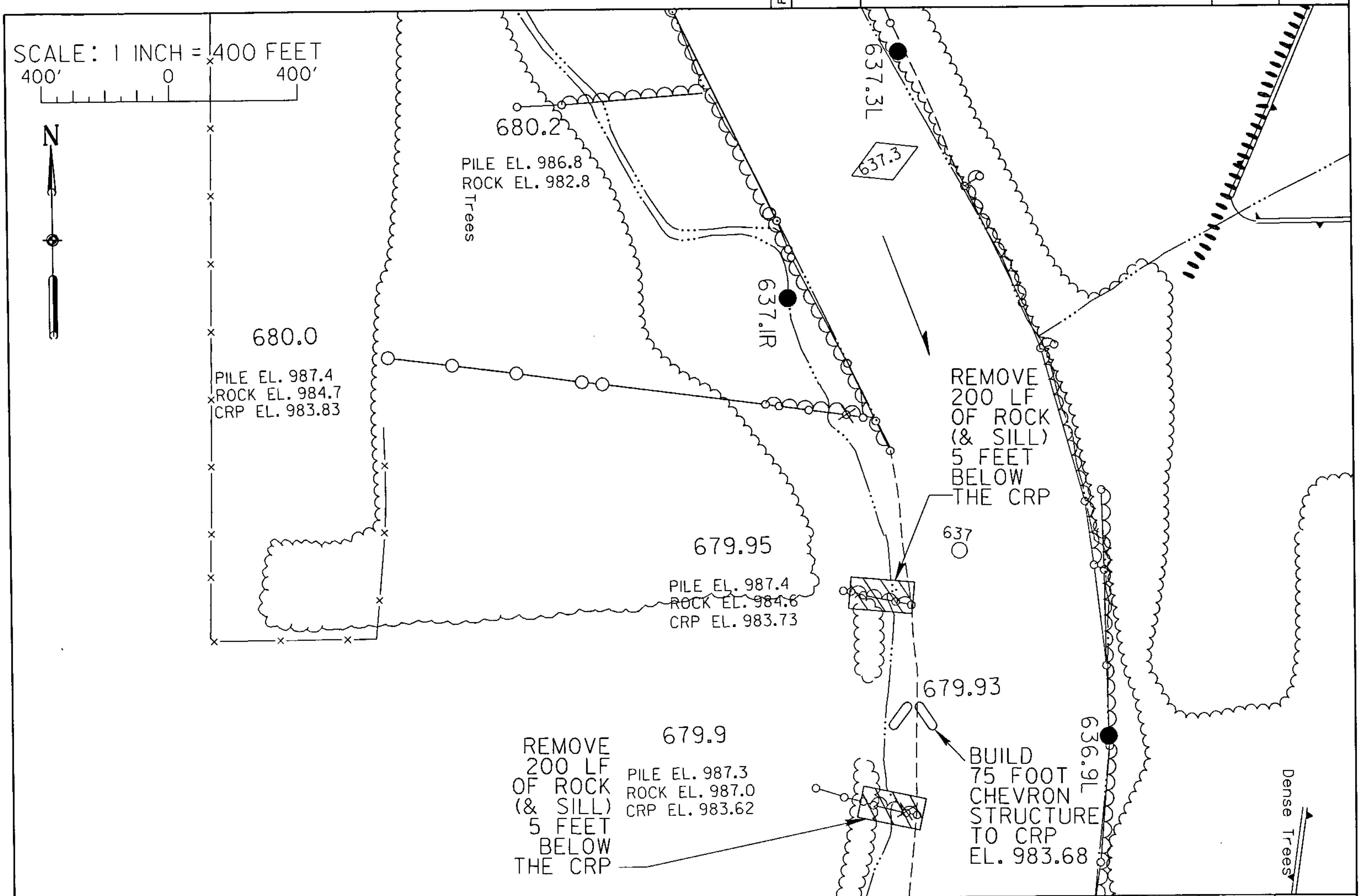
LOCATION MAP
NOT TO SCALE

LEGEND

- PILE DIKE
- STONE FILL DIKE OR REVETMENT OR PILE DIKE STONE FILL
- PILE REVETMENT
- PILE REVETMENT, STONE FILL
- TOE TRENCH OR STANDARD REVETMENT OR REINFORCED STD. REVET. OR ACCRETMENT
- ASPHALT REVETMENT
- DESIGNED STABILIZED CHANNEL LINE
- BLUFF LINE
- ○ 569 — 1960 CHANNEL MILAGE
- ◇ 580.3 — BEND CHANGE
- 615.8 — STRUCTURE NUMBERS ARE BASED ON 1890 MILAGE
- CRP — THIS IS THE CONTRUCTION REFERENCE PLANE WHICH REPRESENTS A SYNTHESIZED WATER SURFACE PROFILE OF A STEADY DISCHARGE THAT IS EQUALED OR EXCEEDED 75% OF THE TIME DURING THE NAVIGATION SEASON (APRIL - NOVEMBER).

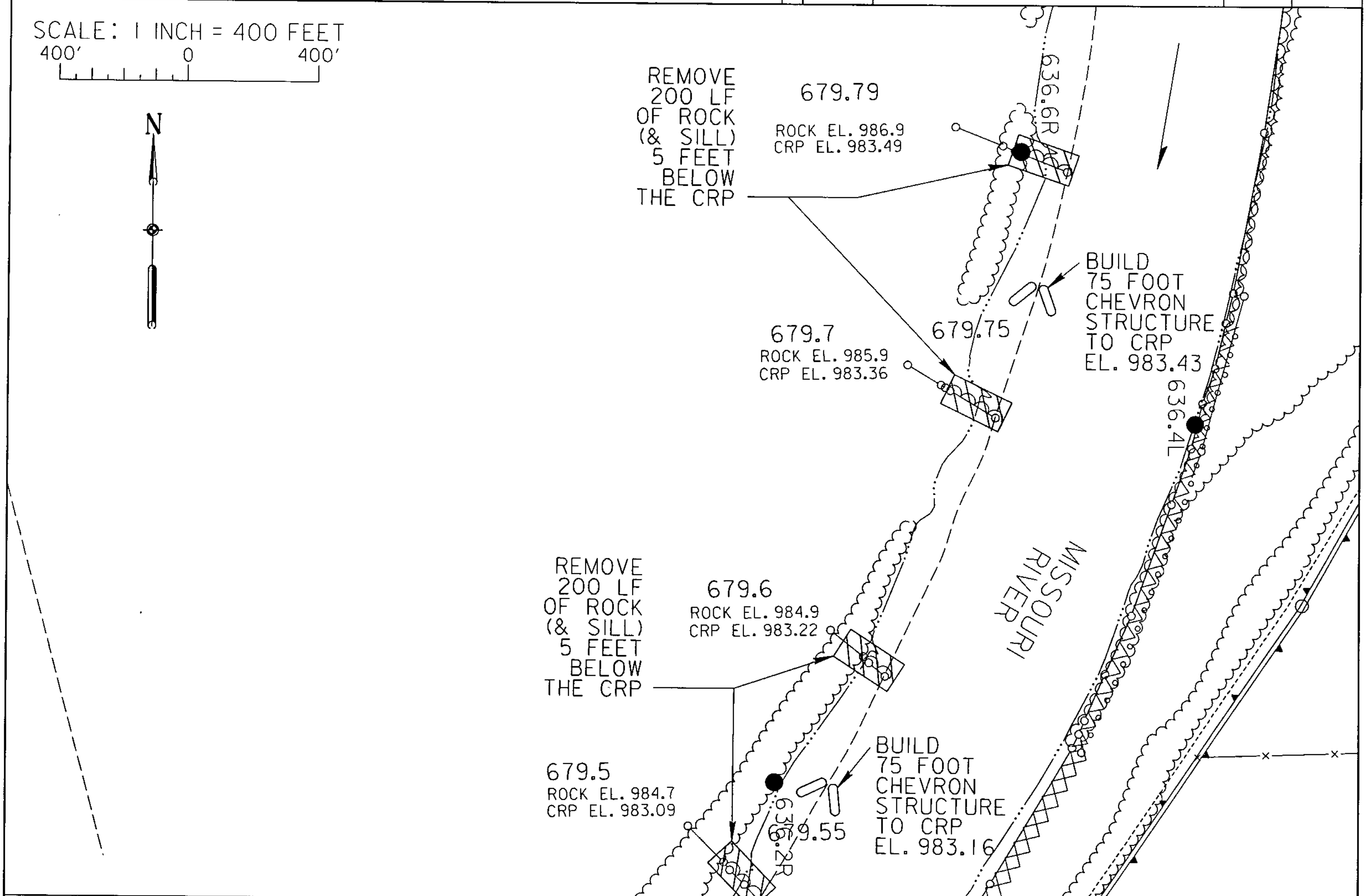
Sheet No.	Computer File / Date / Drawing Code	Spec. No. / Contract No.	Agency	Title	Submitted by	Designed / Reviewed	Checked / Drawn
B0	Computer File: SHEET0.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 634.1 TO 637.3 SITE MAP	Submitted by:	Designed by: R.G.P.	Checked by: J.I.R.
	Date: MAR. 2004	Contract No. W9128F-04-C-000X			Chief SED. & CHAN. STAB. Section	Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X						

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



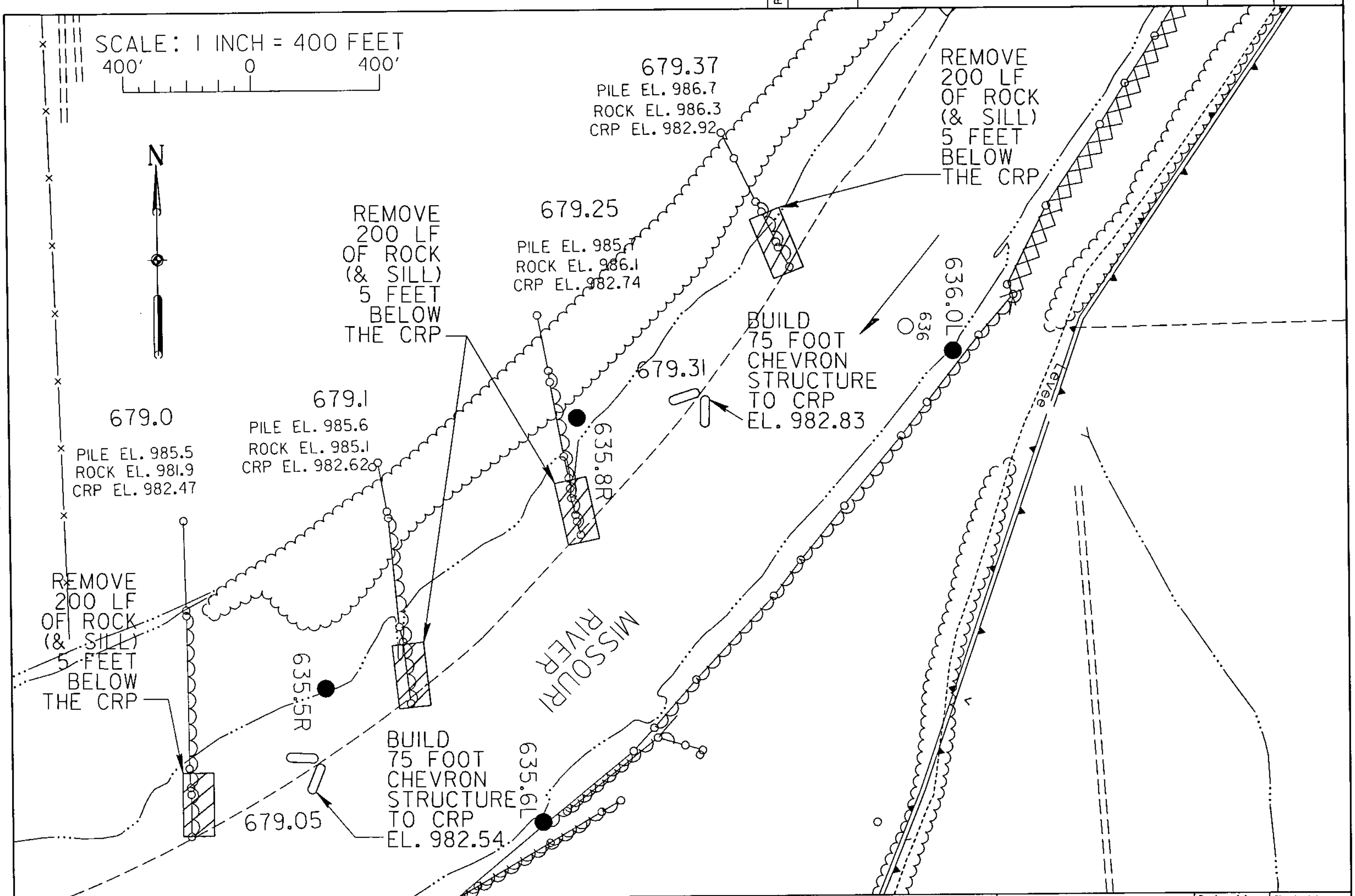
Sheet No.	Computer File: sheet1.dgn	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA / IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 634.1 TO 637.3 SITE MAP	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P.	Checked by: J.I.R.
B1	Date: MAR. 2004	Contract No. W9128F-04-C-000X				Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code:	PUBDATA\RICKP\X					

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



Sheet No. B2	Computer File: sheet2.dgn	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA / IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 634.1 TO 637.3 SITE MAP	Submitted by:	Designed by: R.G.P.	Checked by: J.I.R.
	Date: MAR. 2004	Contract No. W9128F-04-C-000X				Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X				Chief SED. & CHAN. STAB. Section		

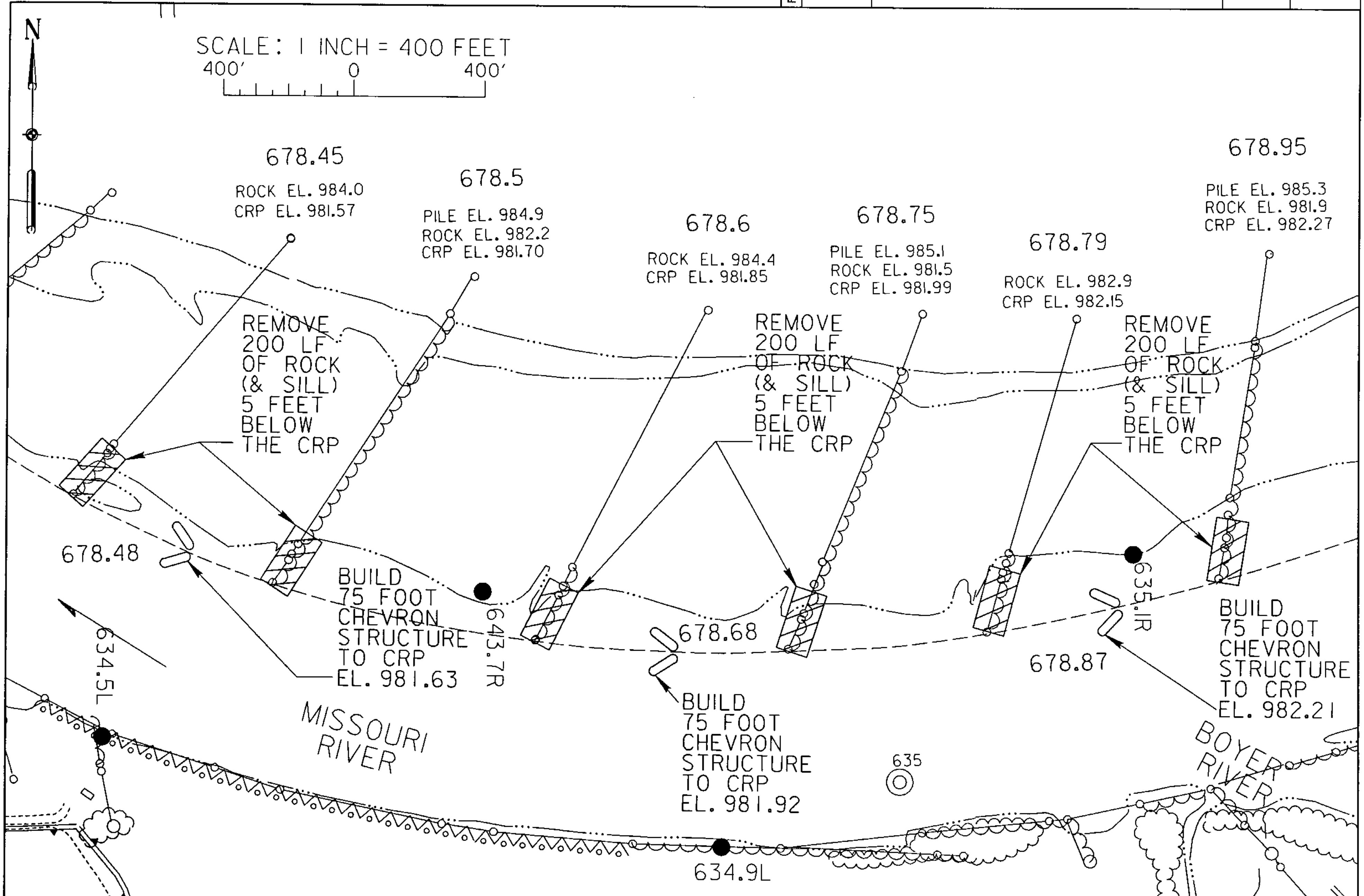
REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



F-34

Sheet No.						
B3	Computer File: sheet3.dgn	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 634.1 TO 637.3 SITE MAP	Submitted by:	Designed by: R.G.P. / Checked by: J.I.R.
	Date: MAR. 2004	Contract No. W9128F-04-C-000X			Chief SED. & CHAN. STAB. Section	Reviewed by: J.I.R. / Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X					

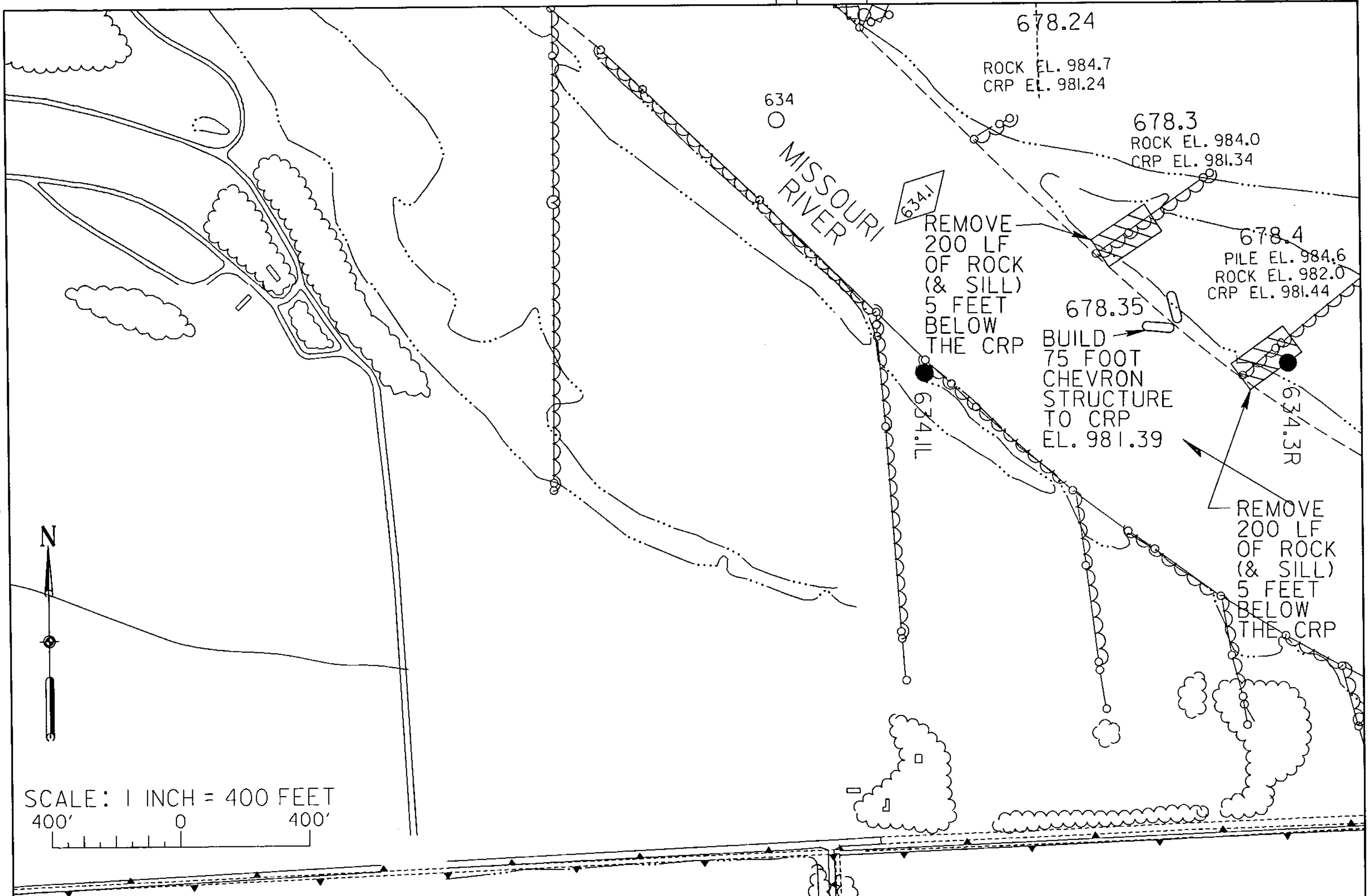
REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



F-35

Sheet No.						
B4	Computer File: sheet4.dgn	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA / IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 634.1 TO 637.3 SITE MAP	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P. / Checked by: J.I.R.
	Date: MAR. 2004	Contract No. W9128F-04-C-000X				Reviewed by: J.I.R. / Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X					

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



Sheet No.					
B5	Computer File: sheet5.dgn	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER: NEBRASKA / IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 634.1 TO 637.3 SITE MAP	Submitted by: Chief SED. & CHAN. STAB. Section
	Date: MAR. 2004	Contract No. W9128F-04-C-000X			Designed by: R.G.P. / Checked by: J.I.R.
	Drawing Code: PUBDATA\RICKP\X				Reviewed by: J.I.R. / Drawn by: R.G.P.

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED

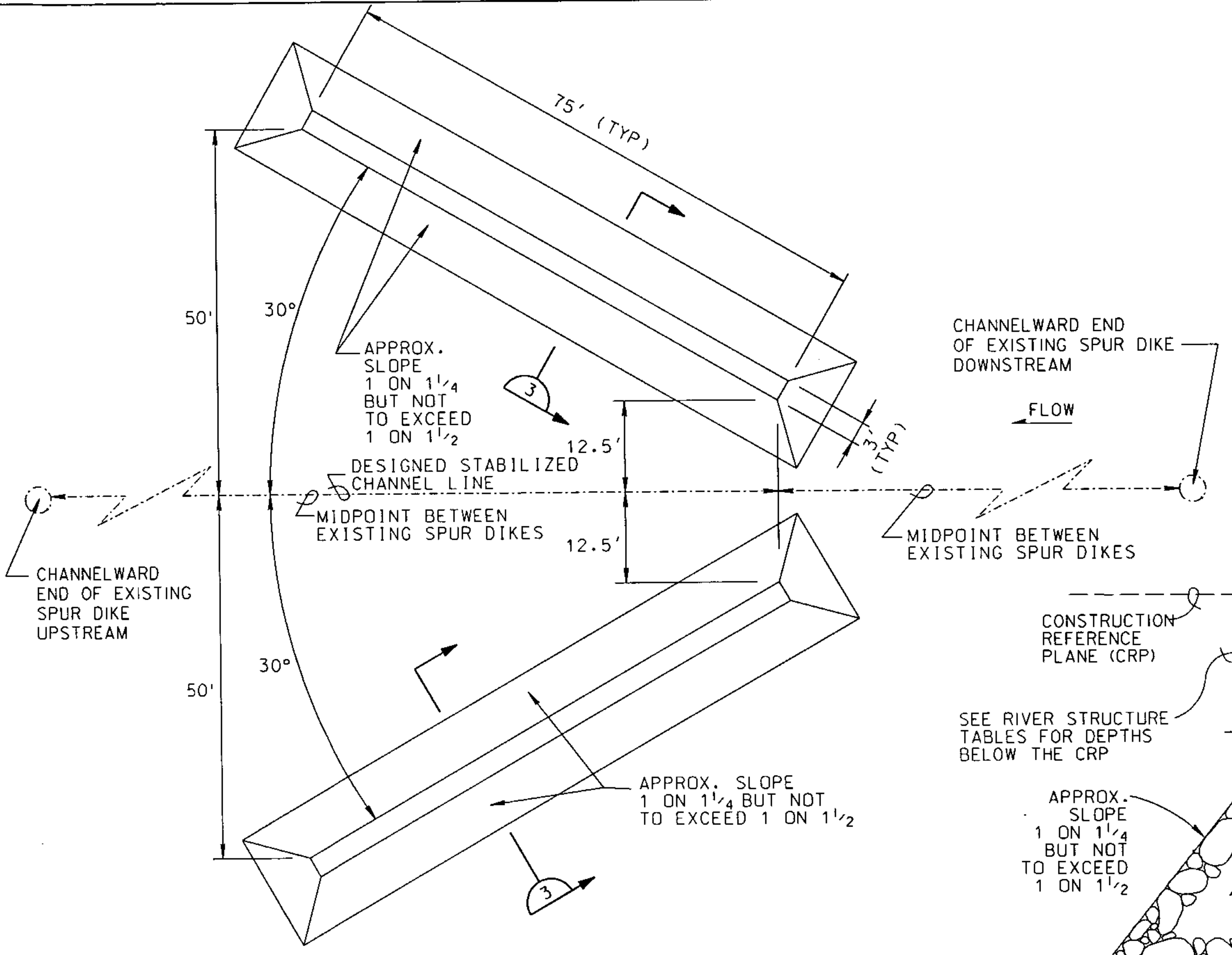
RIVER STRUCTURE TABLE

RIVER MILE	STRUCTURE NUMBER	BANK	RIPRAP MATERIAL REMOVED TO DEPTH BELOW CRP	RIPRAP MATERIAL PLACED TO DEPTH BELOW CRP
636.97	679.95	RT	5 FEET	---
636.90	679.93	RT	---	0 FEET
636.84	679.90	RT	5 FEET	---
636.69	679.79	RT	5 FEET	---
636.61	679.75	RT	---	0 FEET
636.53	679.70	RT	5 FEET	---
636.36	679.60	RT	5 FEET	---
636.28	679.55	RT	---	0 FEET
636.21	679.50	RT	5 FEET	---
636.00	679.37	RT	5 FEET	---
635.90	679.31	RT	---	0 FOOT
635.79	679.25	RT	5 FEET	---
635.64	679.10	RT	5 FEET	---
635.55	679.05	RT	---	0 FOOT
635.46	679.00	RT	5 FEET	---
635.23	678.95	RT	5 FEET	---
635.17	678.87	RT	---	0 FOOT
635.10	678.79	RT	5 FEET	---
634.93	678.75	RT	5 FEET	---
634.85	678.68	RT	---	0 FOOT
634.78	678.60	RT	5 FEET	---
634.60	678.50	RT	5 FEET	---
634.53	678.48	RT	---	0 FOOT
634.46	678.45	RT	5 FEET	---
634.32	678.40	RT	5 FEET	---
634.26	678.35	RT	---	0 FOOT
634.21	678.03	RT	5 FEET	---

Sheet No.					
B6	Computer File: Sheet6.DGN Date: MAR. 2004 Drawing Code: PUBDATA\RICKP\X	Spec. No. W9128F-04-R-000X Contract No. W9128F-04-C-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA / IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 634.1 TO 637.3 SITE MAP	Submitted by: Chief SED. & CHAN. STAB. Section

Designed by:	Checked by:
R.G.P.	J.I.R.
Reviewed by:	Drawn by:
J.I.R.	R.G.P.

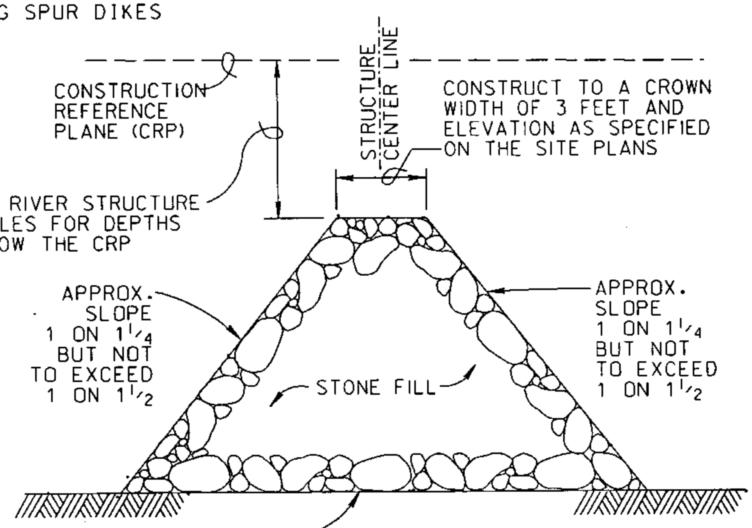
REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



NEW CHEVRON DETAIL

PLAN VIEW

NOT TO SCALE



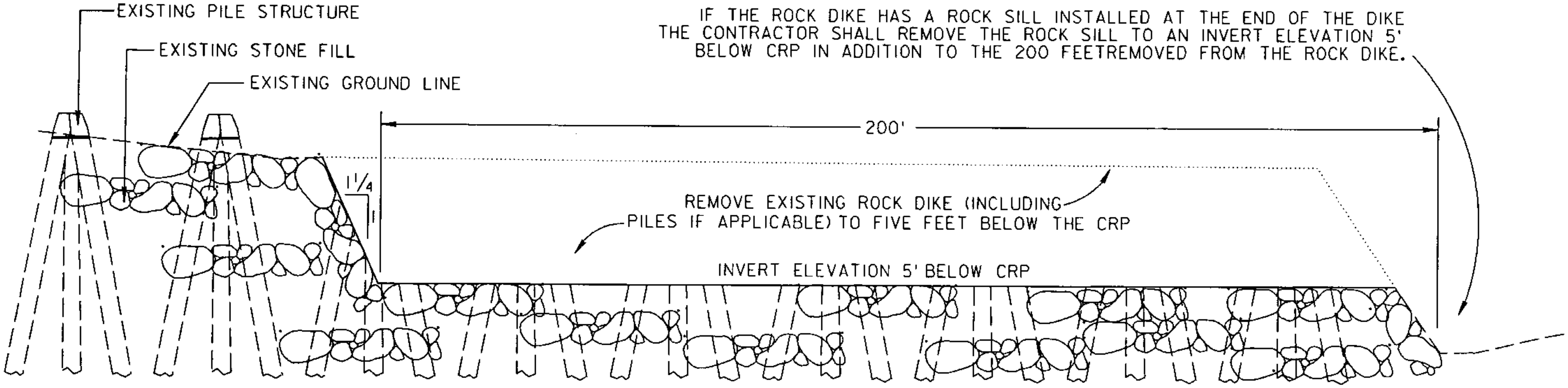
SECTION 3

NOT TO SCALE

F-38

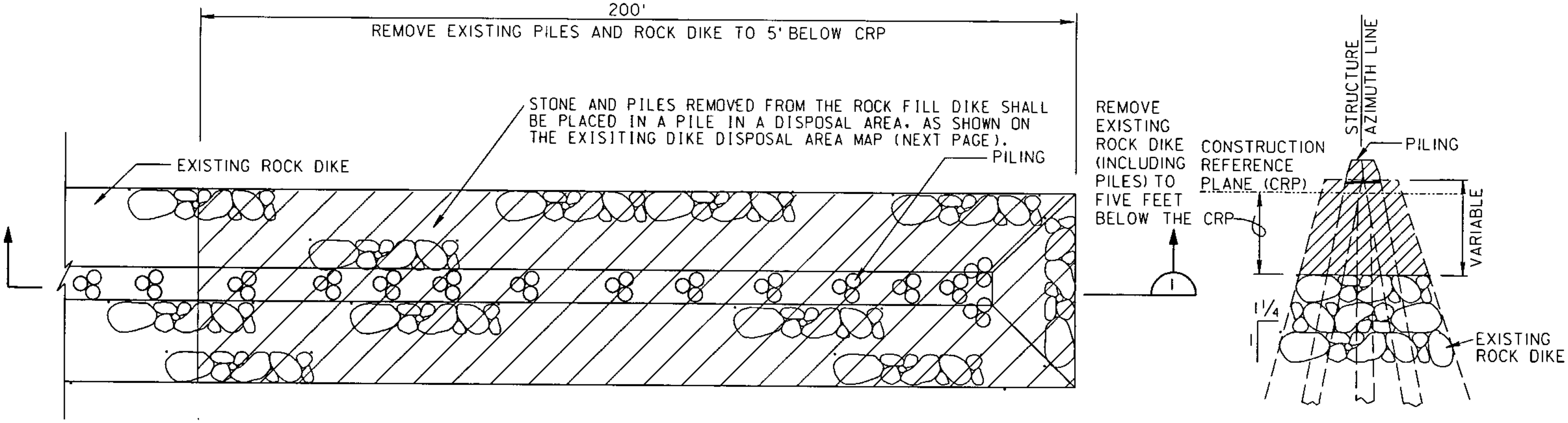
Sheet No.						
B7	Computer File: SHEET7.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA / IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 634.1 TO 637.3 CHEVRON STRUCTURE	Submitted by:	Designed by: R.G.P. / Checked by: J.I.R.
	Date: MAR. 2004	Contract No. W9128F-04-C-000X			Chief SED. & CHAN. STAB. Section	Reviewed by: J.I.R. / Drawn by: R.G.P.
	Drawing Code:	PUBDATA\RICKP\X				

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



SECTION 1

NOT TO SCALE



DIKE REMOVAL DETAIL

PLAN VIEW

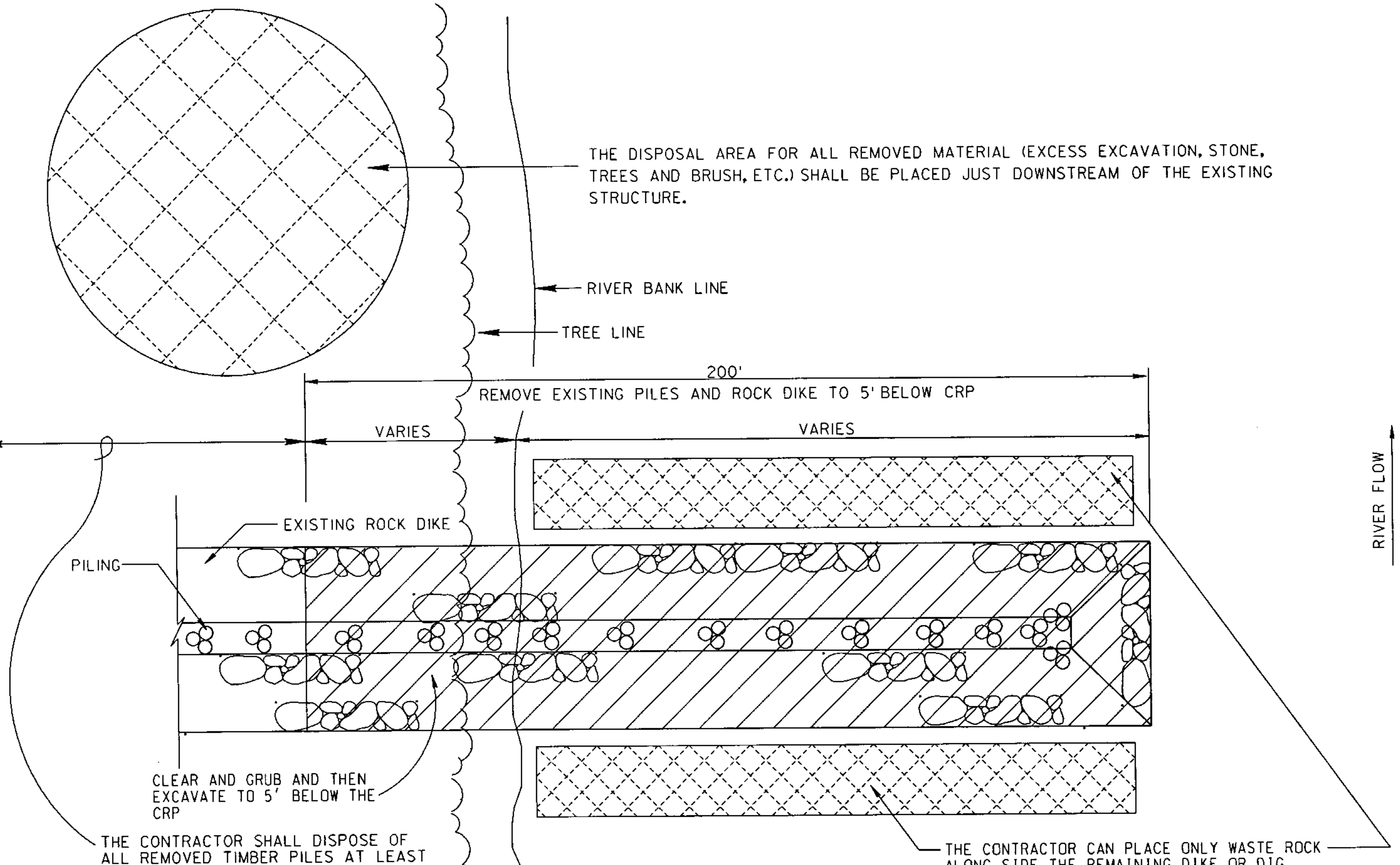
NOT TO SCALE

SECTION 2

NOT TO SCALE

Sheet No.							
B8	Computer File: SHEET8.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 634.1 TO 637.3 EXISTING DIKE REMOVAL DETAILS	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P.	Checked by: J.I.R.
	Date: MAR. 2004	Contract No. W9128F-04-C-000X				Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code:	PUBDATA\RICKP\X					

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



DIKE DISPOSAL AREA

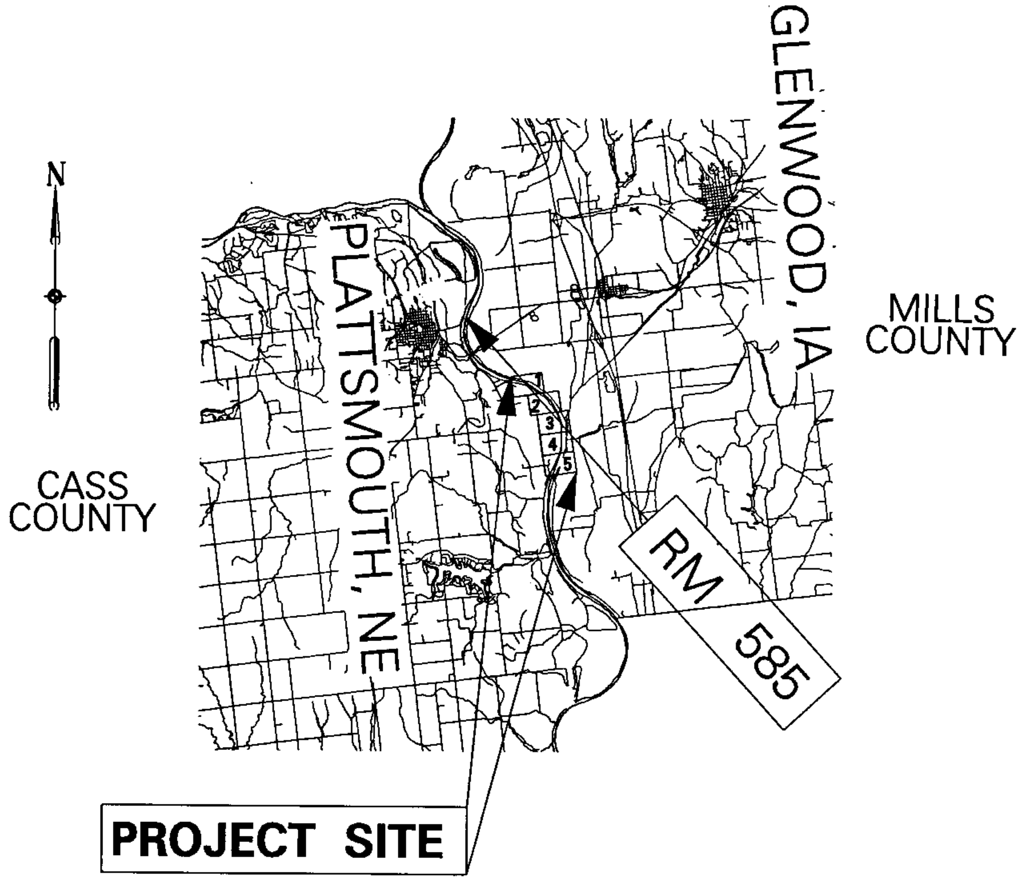
PLAN VIEW

NOT TO SCALE

F-40

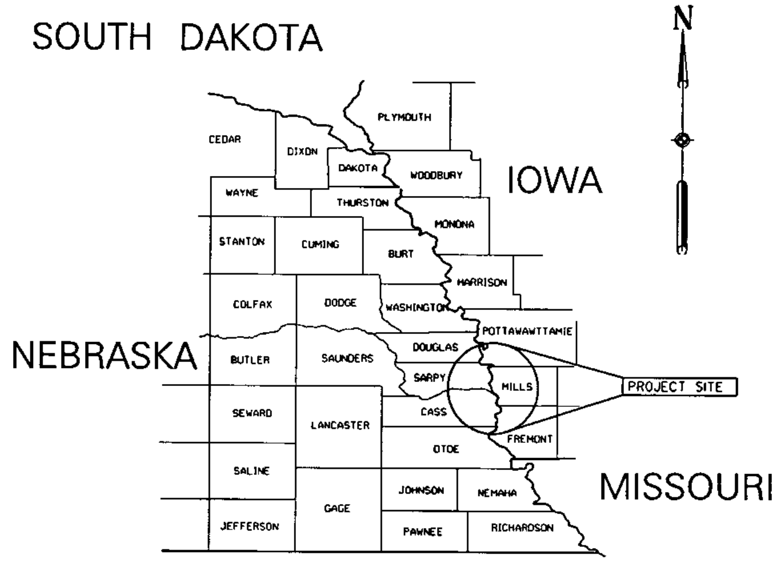
Sheet No.							
B9	Computer File: SHEET9.DGN Date: MAR. 2004 Drawing Code: PUBDATA\RICKP\X	Spec. No. W9128F-04-R-000X Contract No. W9128F-04-C-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /IOWA **RIVER CONTROL STRUCTURE MODIFICATIONS** **RIVER MILE 634.1 TO 637.3** **EXISTING DIKE DISPOSAL AREA MAP**	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P. Reviewed by: J.I.R.	Checked by: J.I.R. Drawn by: R.G.P.

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



VICINITY MAP

NOT TO SCALE



LOCATION MAP

NOT TO SCALE

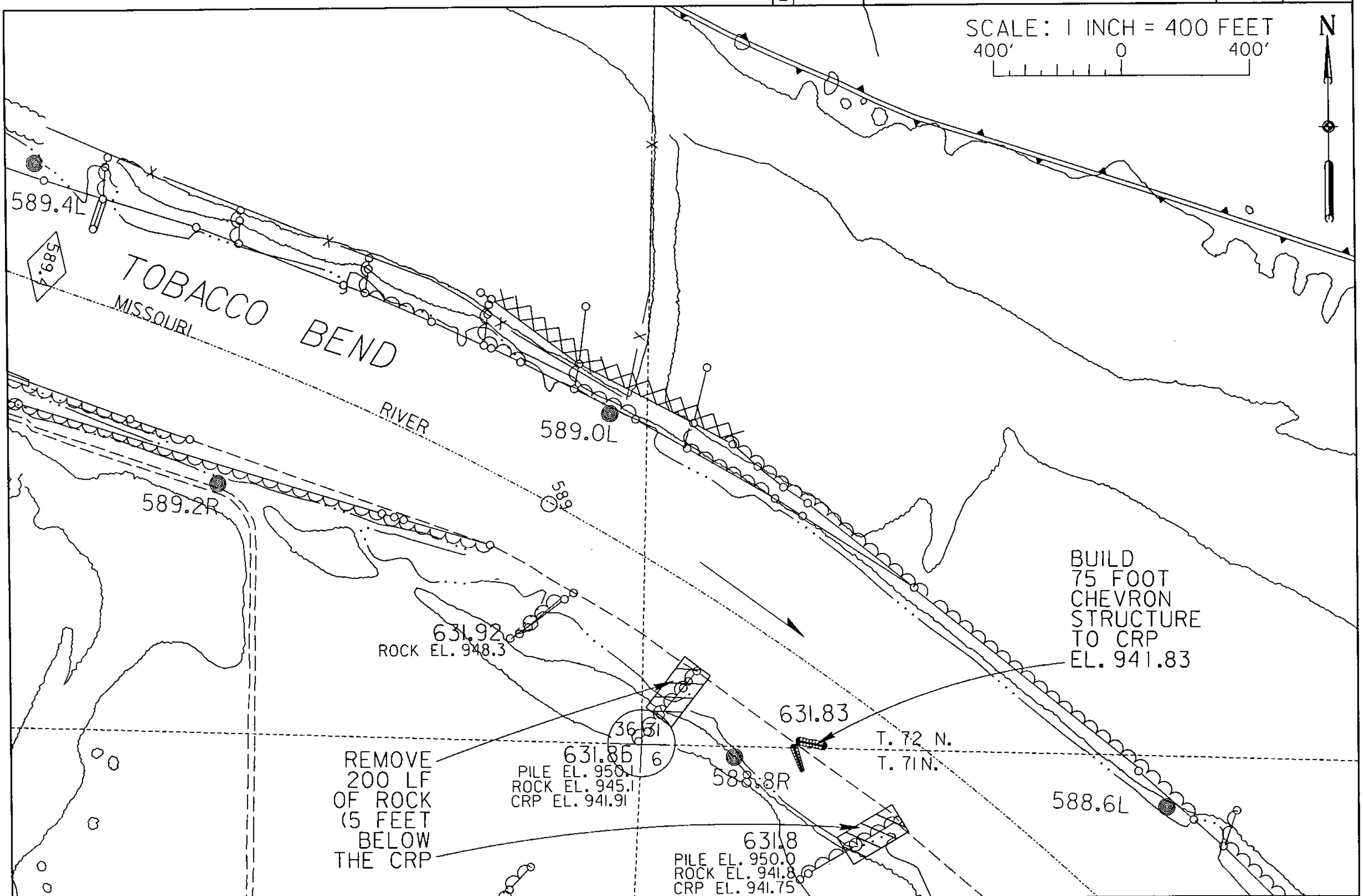
LEGEND

	PILE DIKE
	STONE FILL DIKE OR REVETMENT OR PILE DIKE STONE FILL
	PILE REVETMENT
	PILE REVETMENT, STONE FILL
	TOE TRENCH OR STANDARD REVETMENT OR REINFORCED STD. REVET. OR ACCRETMENT
	ASPHALT REVETMENT
	DESIGNED STABILIZED CHANNEL LINE
	BLUFF LINE
○569	1960 CHANNEL MILAGE
580.3	BEND CHANGE
615.8	STRUCTURE NUMBERS ARE BASED ON 1890 MILAGE
CRP	THIS IS THE CONTRUCTION REFERENCE PLANE WHICH REPRESENTS A SYNTHESIZED WATER SURFACE PROFILE OF A STEADY DISCHARGE THAT IS EQUALED OR EXCEEDED 75% OF THE TIME DURING THE NAVIGATION SEASON (APRIL - NOVEMBER).

F-41

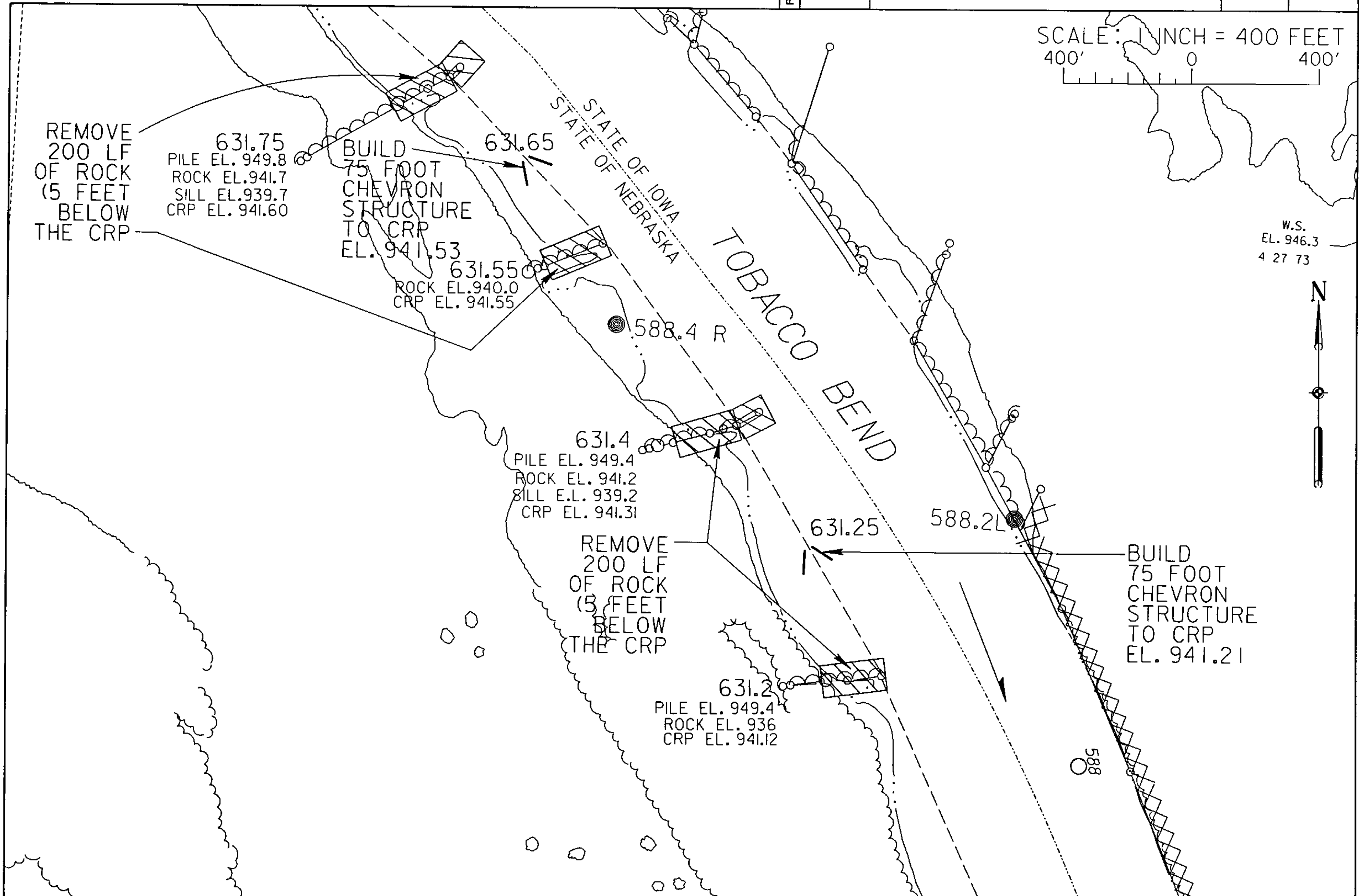
Sheet No.	Computer File: SHEETØ.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 586 TO 589 SITE MAP	Submitted by:	Designed by: R.G.P.	Checked by: J.I.R.
T0	Date: MAR. 2004	Contract No. W9128F-04-C-000X			Chief SED. & CHAN. STAB. Section	Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X						

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



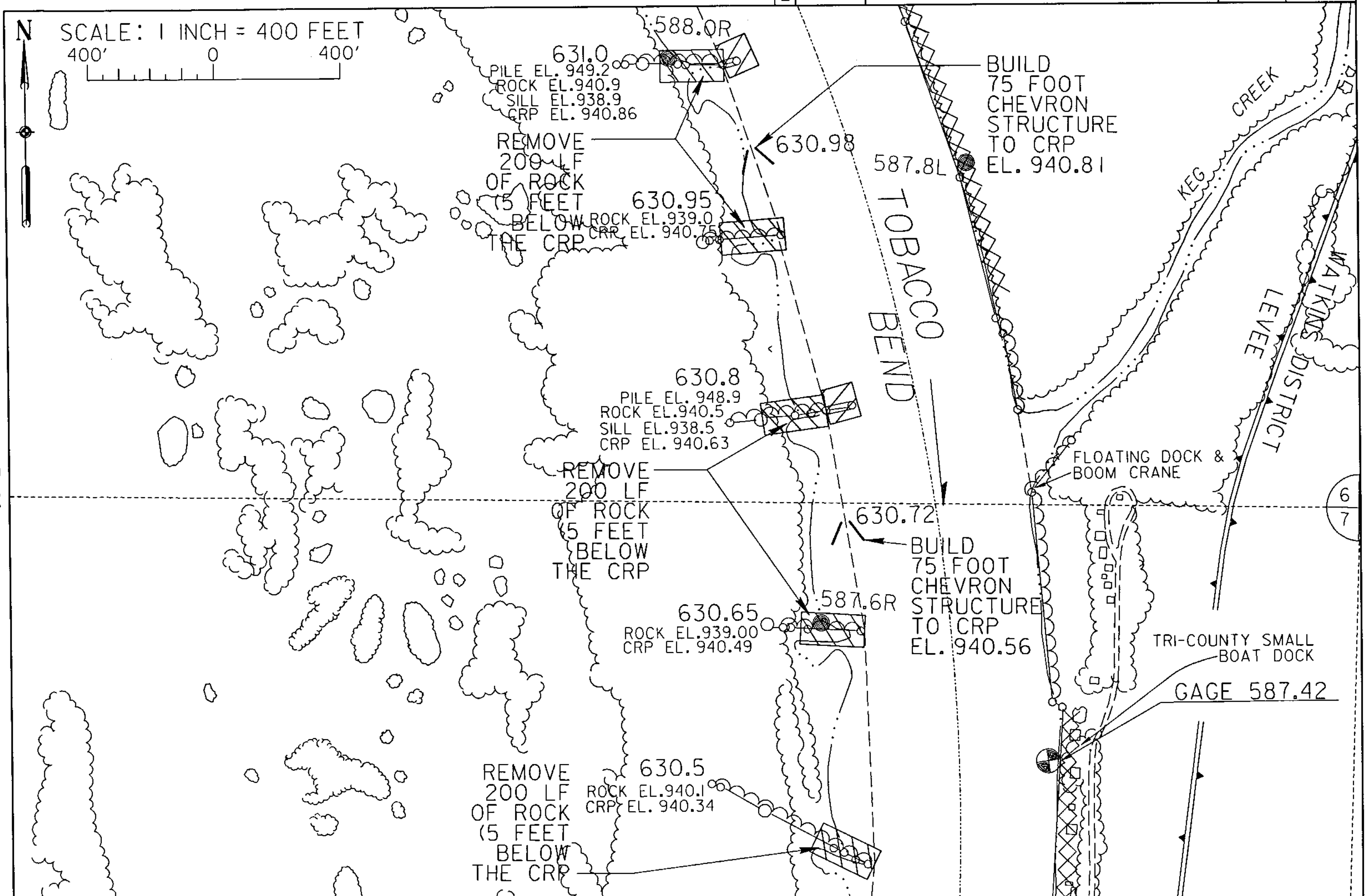
Sheet No. T1	Computer File: sheet1.dgn	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 586 TO 589 SITE MAP	Submitted by:	Designed by: R.G.P.	Checked by: J.I.R.
	Date: MAR. 2004	Contract No. W9128F-04-C-000X			Chief SED. & CHAN. STAB. Section	Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code:	PUBDATA\RICKP\X					

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



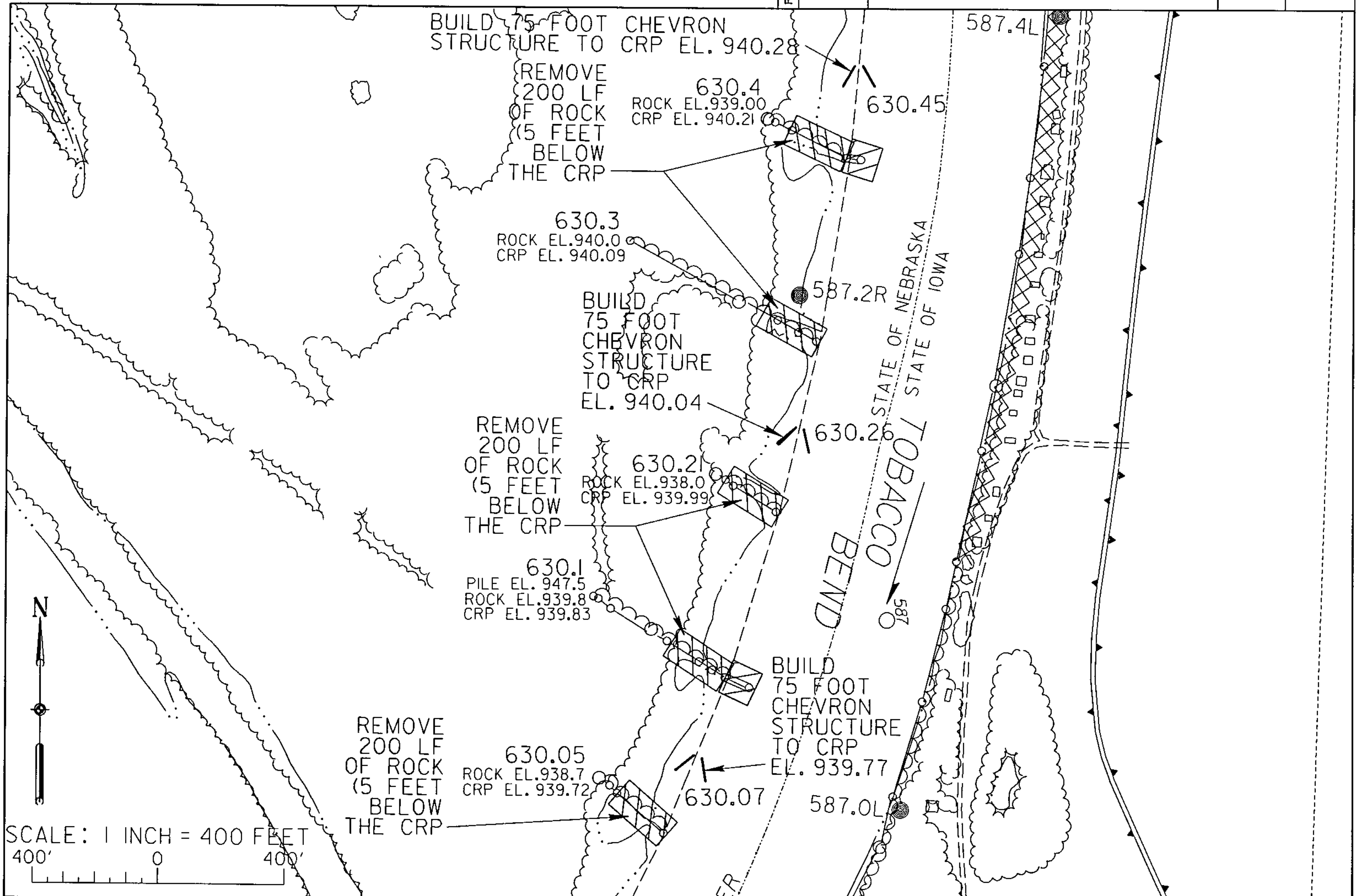
Sheet No.	Computer File: SHEET2.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 586 TO 589 SITE MAP	Submitted by:	Designed by: R.G.P.	Checked by: J.I.R.
T2	Date: MAR. 2004	Contract No. W9128F-04-C-000X			Chief SED. & CHAN. STAB. Section	Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X						

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



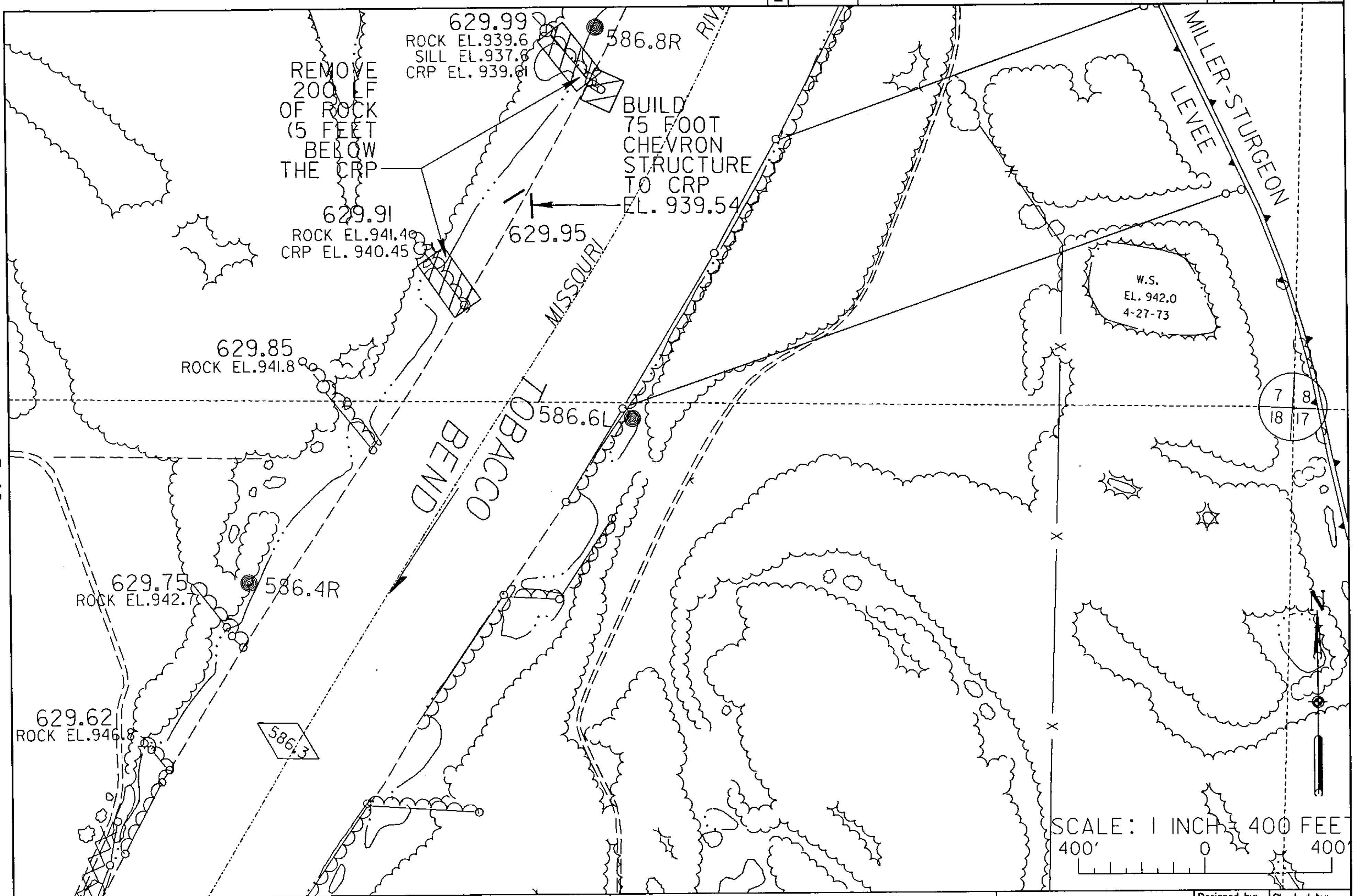
Sheet No.					
T3	Computer File: SHEET3.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 586 TO 589 SITE MAP	Submitted by: Chief SED. & CHAN. STAB. Section
	Date: MAR. 2004	Contract No. W9128F-04-C-000X			Designed by: R.G.P. / Checked by: J.I.R.
	Drawing Code: PUBDATA\RICKP\X				Reviewed by: J.I.R. / Drawn by: R.G.P.

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



Sheet No.	Computer File: SHEET4.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 586 TO 589 SITE MAP	Submitted by:	Designed by: R.G.P.	Checked by: J.I.R.
T4	Date: MAR. 2004	Contract No. W9128F-04-C-000X			Chief SED. & CHAN. STAB. Section	Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X						

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



Sheet No.				
T5	Computer File: SHEET5.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 586 TO 589 SITE MAP
	Date: MAR. 2004	Contract No. W9128F-04-C-000X		
	Drawing Code: PUBDATA\RICKP\X			

Submitted by:

Chief SED. & CHAN. STAB. Section

Designed by: R.G.P.	Checked by: J.I.R.
Reviewed by: J.I.R.	Drawn by: R.G.P.

REVISIONS SYMBOL	DESCRIPTIONS	DATE	APPROVED

RIVER STRUCTURE TABLE

RIVER MILE	STRUCTURE NUMBER	BANK	RIPRAP MATERIAL REMOVED TO DEPTH BELOW CRP	RIPRAP MATERIAL PLACED TO DEPTH BELOW CRP
588.86	631.85	RT	5 FEET	---
588.79	631.83	RT	---	0 FEET
588.71	631.80	RT	5 FEET	---
588.57	631.75	RT	5 FEET	---
588.50	631.65	RT	---	0 FEET
588.43	631.55	RT	5 FEET	---
588.30	631.40	RT	5 FEET	---
588.21	631.25	RT	---	0 FEET
588.12	631.20	RT	5 FEET	---
587.88	631.00	RT	5 FEET	---
587.83	630.98	RT	---	0 FOOT
587.78	630.95	RT	5 FEET	---
587.67	630.80	RT	5 FEET	---
587.60	630.72	RT	---	0 FOOT
587.54	630.65	RT	5 FEET	---
587.40	630.50	RT	5 FEET	---
587.34	630.45	RT	---	0 FOOT
587.28	630.40	RT	5 FEET	---
587.17	630.30	RT	5 FEET	---
587.12	630.26	RT	---	0 FOOT
587.07	630.21	RT	5 FEET	---
586.92	630.10	RT	5 FEET	---
586.87	630.07	RT	---	0 FOOT
586.82	630.05	RT	5 FEET	---
586.72	629.99	RT	5 FEET	---
586.65	629.95	RT	---	0 FOOT
586.57	629.91	RT	5 FEET	---

F-47

Sheet No. T6	Computer File: Sheet6.DGN	Spec. No. W9128F-04-R-000X
	Date: MAR. 2004	Contract No. W9128F-04-C-000X
	Drawing Code:	PUBDATA\RICKP\X

U S ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA, NEBRASKA

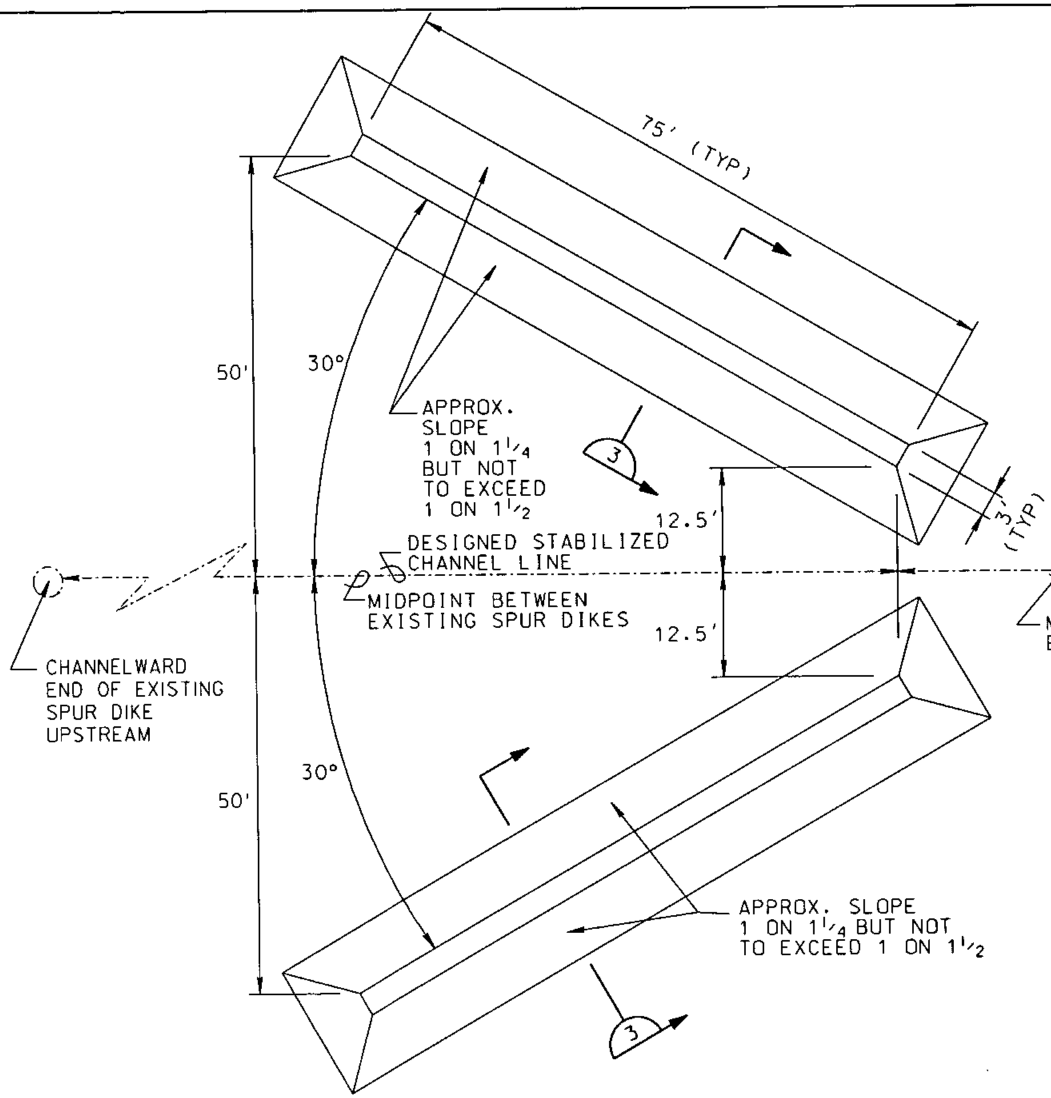
MISSOURI RIVER; NEBRASKA /IOWA
RIVER CONTROL STRUCTURE MODIFICATIONS
RIVER MILE 586 TO 589
SITE MAP

Submitted by:

Chief SED. & CHAN. STAB. Section

Designed by: R.G.P.	Checked by: J.I.R.
Reviewed by: J.I.R.	Drawn by: R.G.P.

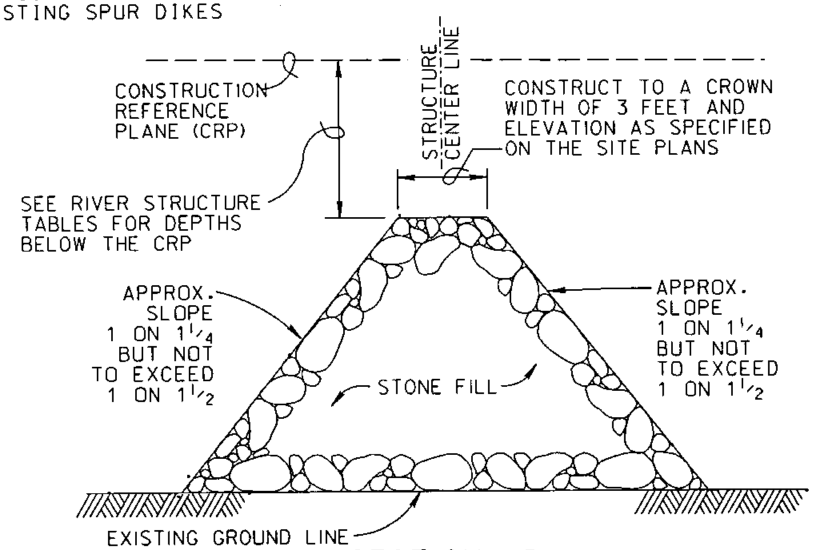
REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



NEW CHEVRON DETAIL

PLAN VIEW

NOT TO SCALE

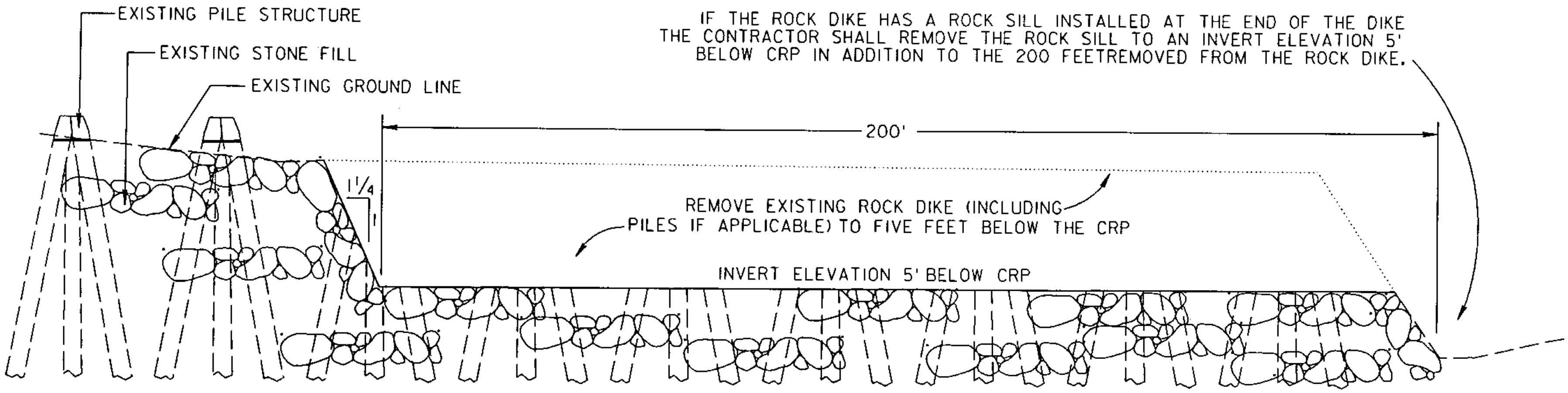


SECTION 3

NOT TO SCALE

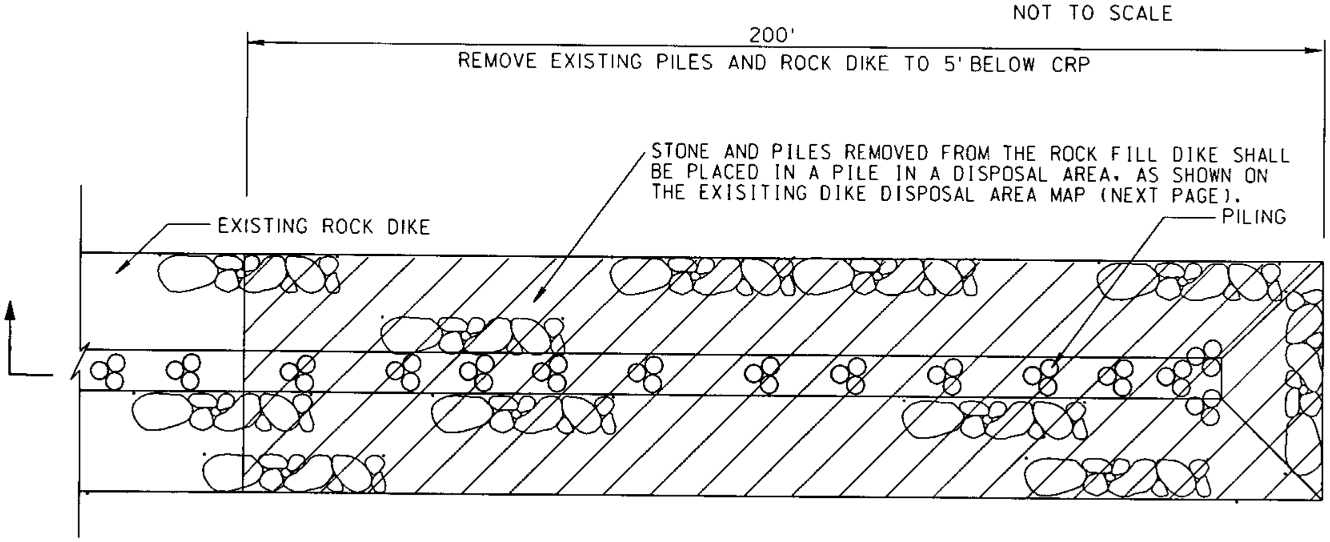
Sheet No.	Computer File: SHEET7.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 586 TO 589 CHEVRON STRUCTURE	Submitted by:	Designed by: R.G.P.	Checked by: J.I.R.
T7	Date: MAR. 2004	Contract No. W9128F-04-C-000X			Chief SED. & CHAN. STAB. Section	Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code:	PUBDATA\RICKP\X					

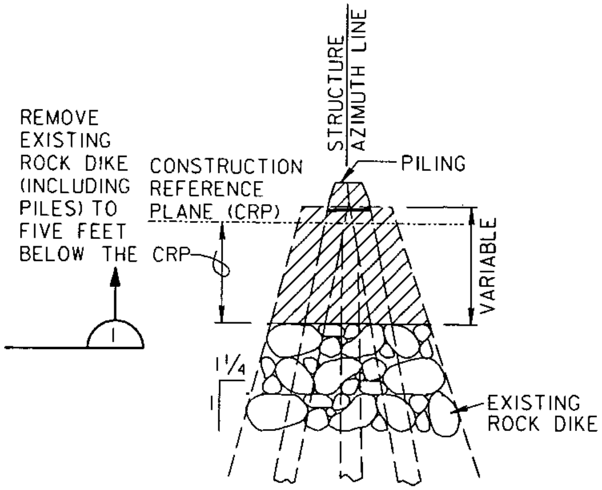
REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



SECTION 1

NOT TO SCALE





DIKE REMOVAL DETAIL

PLAN VIEW

NOT TO SCALE

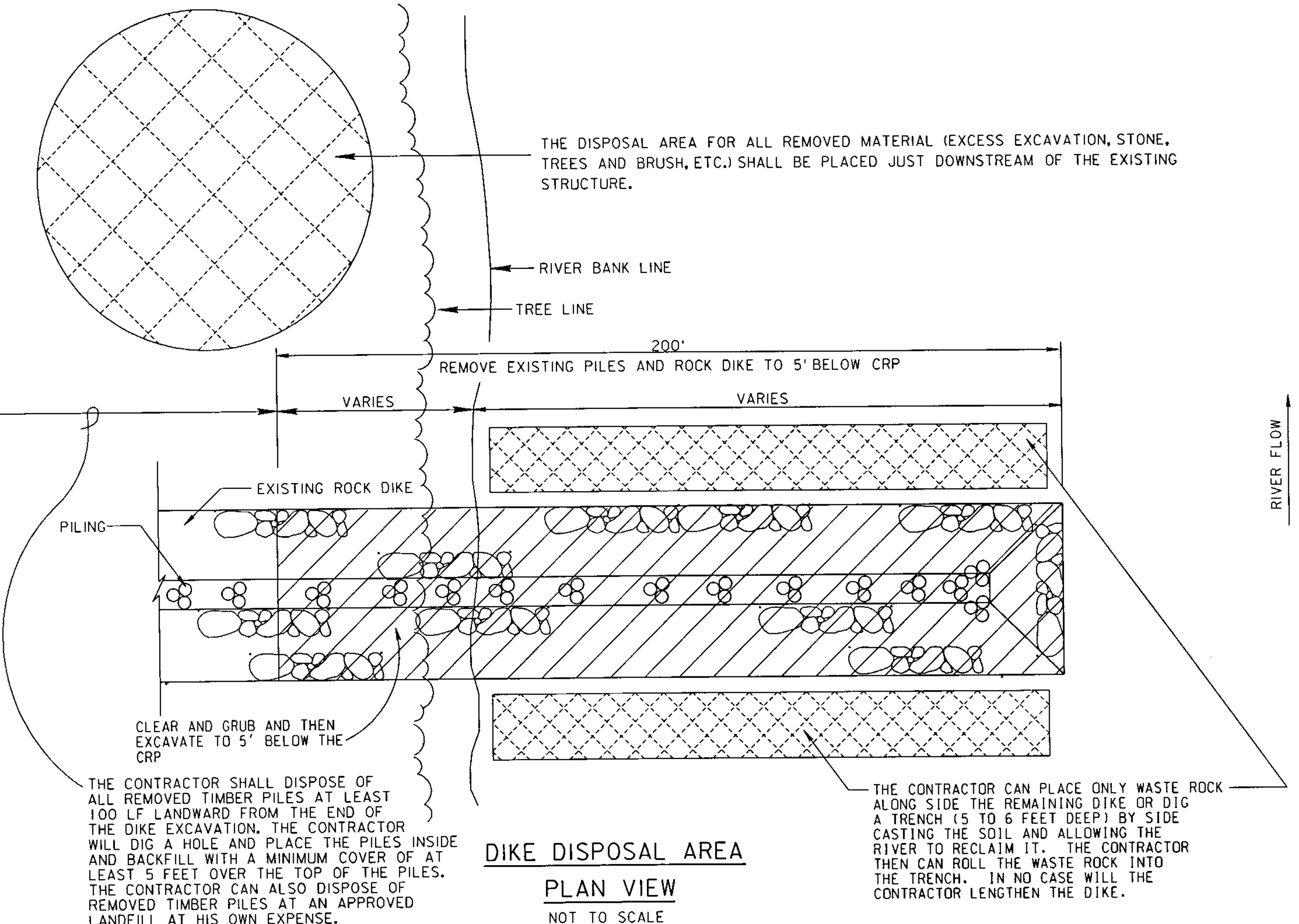
SECTION 2

NOT TO SCALE

F-49

Sheet No.	Computer File: SHEET8.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 586 TO 589 EXISTING DIKE REMOVAL DETAILS	Submitted by:	Designed by: R.G.P.	Checked by: J.I.R.
T8	Date: MAR. 2004	Contract No. W9128F-04-C-000X			Chief SED. & CHAN. STAB. Section	Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code:	PUBDATA\RICKP\X					

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



DIKE DISPOSAL AREA

PLAN VIEW

NOT TO SCALE

Sheet No.						
T9	Computer File: SHEET9.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 586 TO 589 EXISTING DIKE DISPOSAL AREA MAP	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P. / Checked by: J.I.R. / Reviewed by: J.I.R. / Drawn by: R.G.P.
	Date: MAR. 2004	Contract No. W9128F-04-C-000X				
	Drawing Code: PUBDATA\RICKP\X					

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED

BENCH MARK INFORMATION
COORDINATE POINT

POINT	BANK	NORTHING	EASTING	ELEVATION
586.4	R	14888203.90969	857576.22774	947.53000
586.6	L	14888710.18409	858782.62193	946.02000
586.8	R	14889959.20301	858674.02856	946.19000
587.0	L	14890303.93773	859617.09955	950.18000
587.2	R	14891912.53990	859314.05783	945.70000
587.4	L	14892796.63900	860110.21285	950.33000
587.6	R	14893683.21223	859352.58893	948.12000
587.8	L	14895132.39772	859817.48427	948.28000
588.0	R	14895455.02969	858898.71469	949.45000
588.2	L	14896816.37663	859105.51119	948.90000
588.4	R	14897425.08750	857854.02065	947.60000
588.6	L	14898698.67720	857657.03261	951.31000
588.8	R	14898859.53631	856297.37784	948.18000
589.0	L	14899943.38897	855904.64182	950.00000
589.2	R	14899735.19739	854690.69294	951.12000
589.4	L	14900713.79650	854097.24865	946.93000

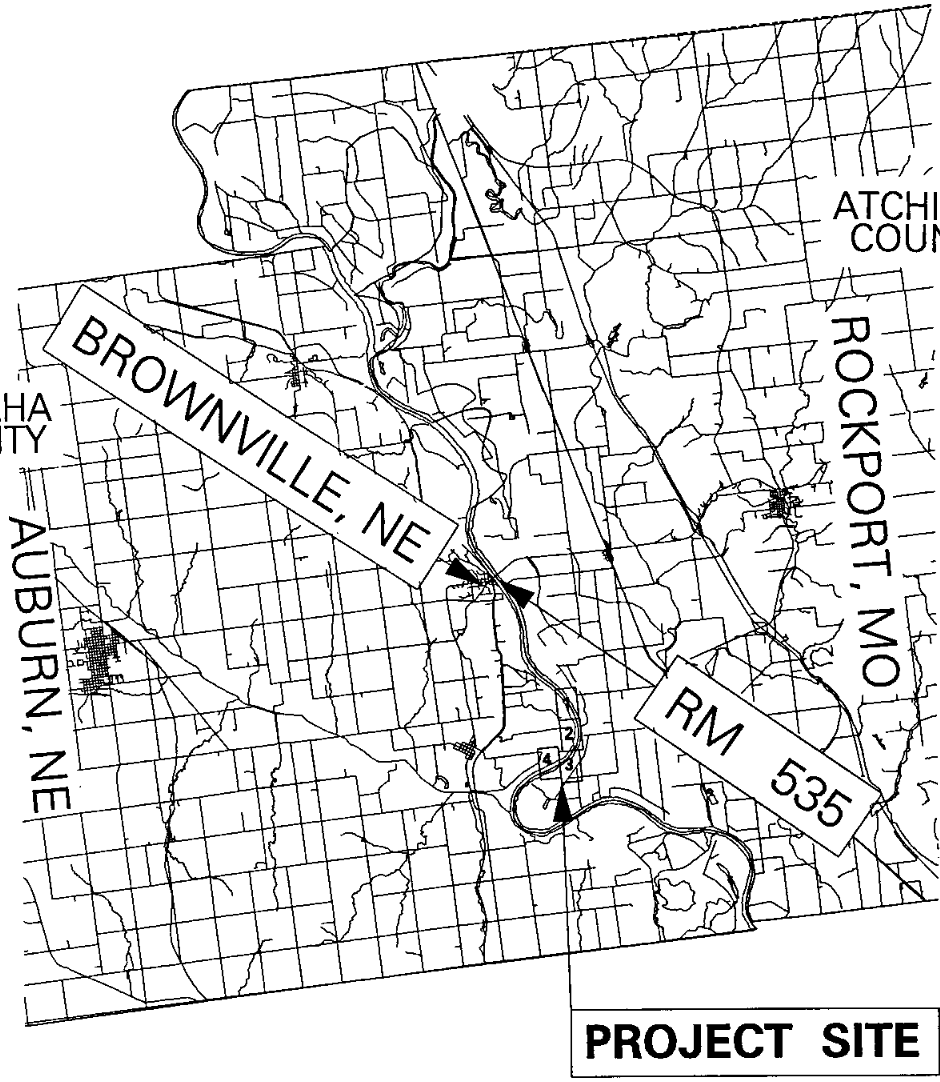
CONDITION OF MISSOURI RIVER CONTROL POINTS:

1. NO EFFORT HAS BEEN MADE TO MONITOR THESE POINTS. SOME HAVE ERODED INTO THE RIVER WHILE OTHERS MAY BE BURIED UNDER 1-5 FEET OF SEDIMENT.
2. EACH CONTROL POINT IS A 3-1/4 INCH DIAMETER CORPS OF ENGINEERS BRASS CAP. THEY ARE STAMPED WITH THE RIVER MILE AND LEFT/RIGHT BANK.
3. THE CONTROL POINTS ARE MARKED WITH ORANGE FIBERGLASS WITNESS POSTS (CARSONITE BRAND). THE POSTS WERE TYPICALLY SET 3-8 INCHES LANDWARD OF THE BRASS CAP.
4. HORIZONTAL CONTROL: UTM ZONE 15, NAD 83
   VERTICAL CONTROL: NGVD 29 (ALSO REFERENCED AS "MEAN SEA LEVEL" DATUM)

Sheet No.						
T10	Computer File: Sheet10.DGN Date: MAR. 2004 Drawing Code: PUBDATA\RICKP\X	Spec. No. W9128F-04-R-000X Contract No. W9128F-04-C-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /IOWA RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 586 TO 589 BENCHMARK INFOMATION	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P. Checked by: J.I.R. Reviewed by: J.I.R. Drawn by: R.G.P.

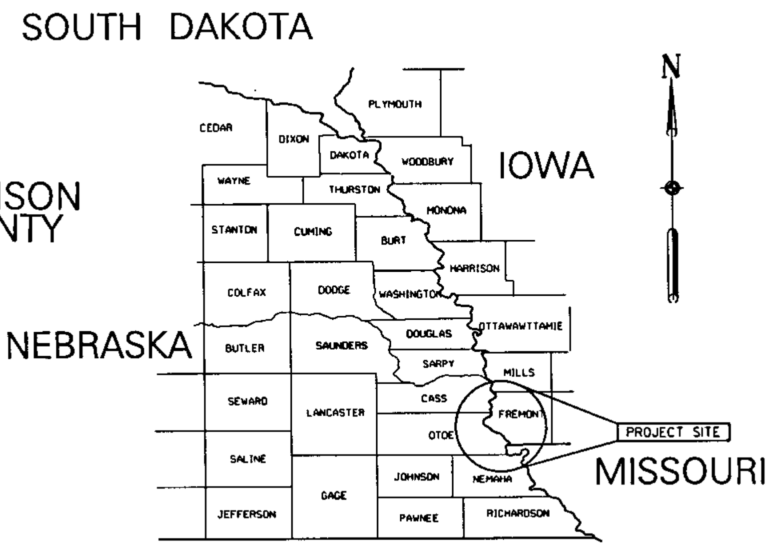
REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED

F-52



VICINITY MAP

NOT TO SCALE



LOCATION MAP

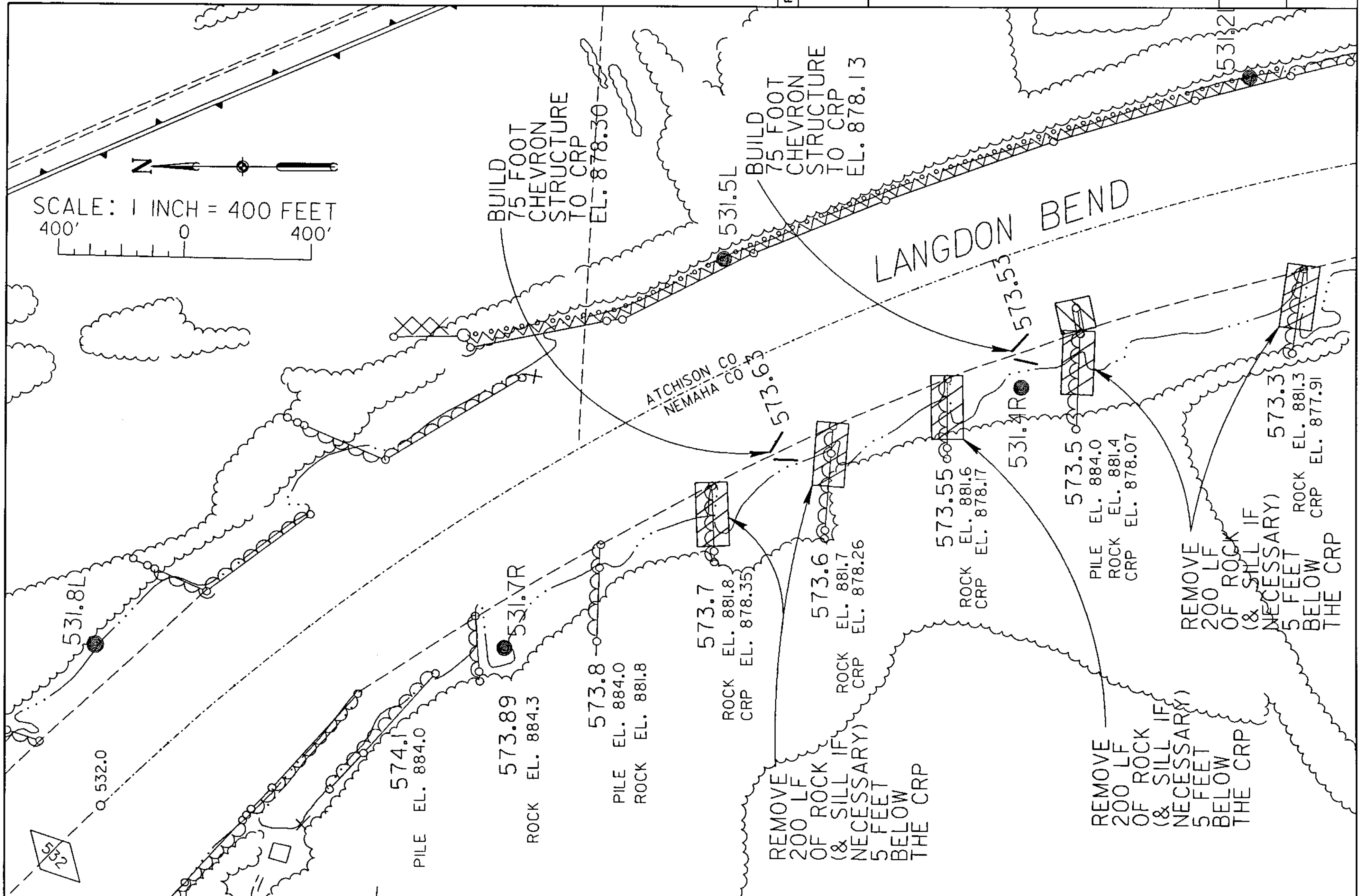
NOT TO SCALE

LEGEND

	PILE DIKE
	STONE FILL DIKE OR REVETMENT OR PILE DIKE STONE FILL
	PILE REVETMENT
	PILE REVETMENT, STONE FILL
	TOE TRENCH OR STANDARD REVETMENT OR REINFORCED STD. REVET. OR ACCRETMENT
	ASPHALT REVETMENT
	DESIGNED STABILIZED CHANNEL LINE
	BLUFF LINE
569	1960 CHANNEL MILAGE
580.3	BEND CHANGE
615.8	STRUCTURE NUMBERS ARE BASED ON 1890 MILAGE
CRP	THIS IS THE CONTRUCTION REFERENCE PLANE WHICH REPRESENTS A SYNTHESIZED WATER SURFACE PROFILE OF A STEADY DISCHARGE THAT IS EQUALED OR EXCEEDED 75% OF THE TIME DURING THE NAVIGATION SEASON (APRIL - NOVEMBER).

Sheet No.	Computer File: SHEETØ.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /MISSOURI RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 529 TO 532 SITE MAP	Submitted by:	Designed by: R.G.P.	Checked by: J.I.R.
L0	Date: NOV. 2004	Contract No. W9128F-04-C-000X			Chief SED. & CHAN. STAB. Section	Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code:	PUBDATA\RICKP\X					

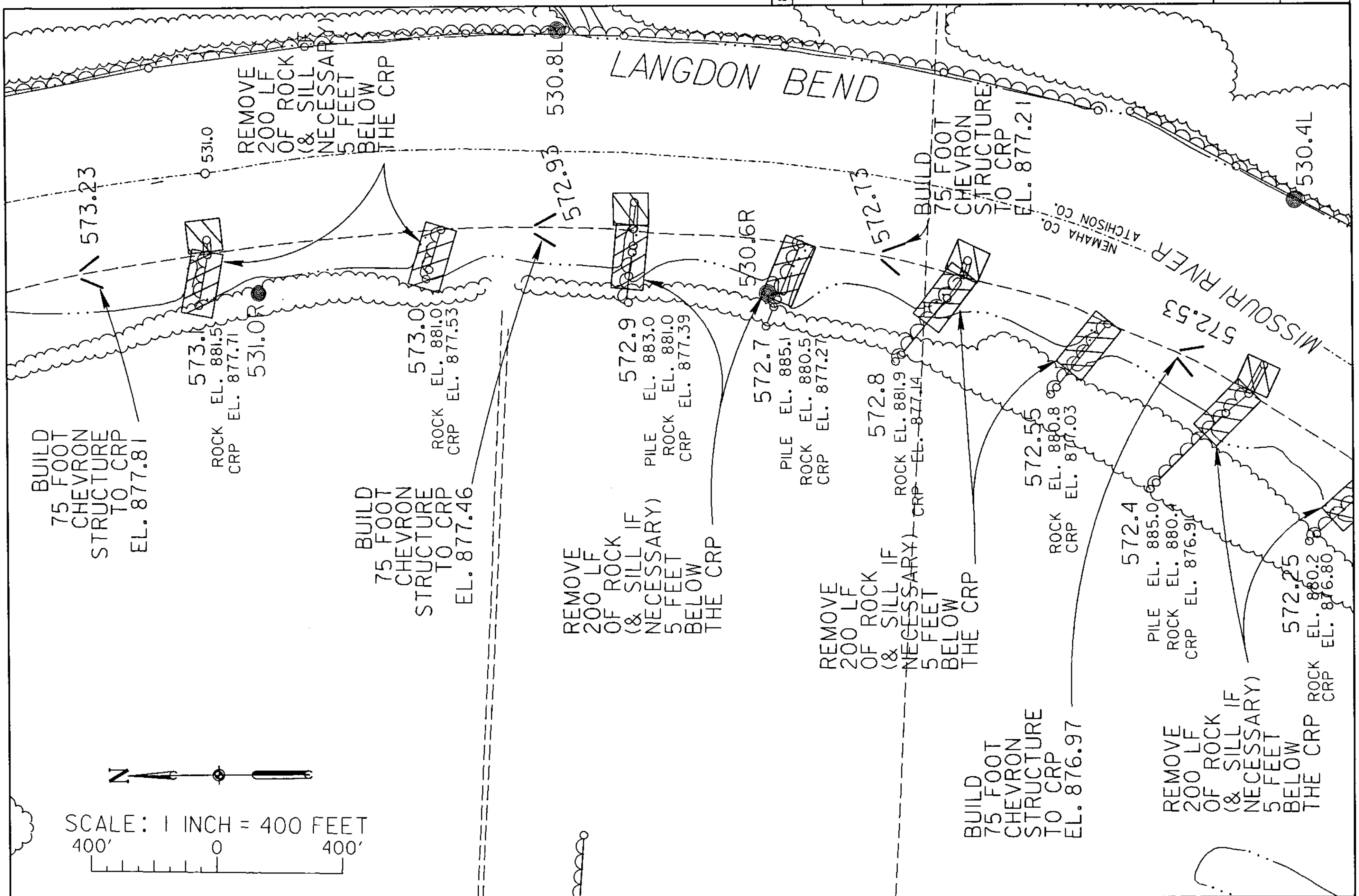
REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



F-53

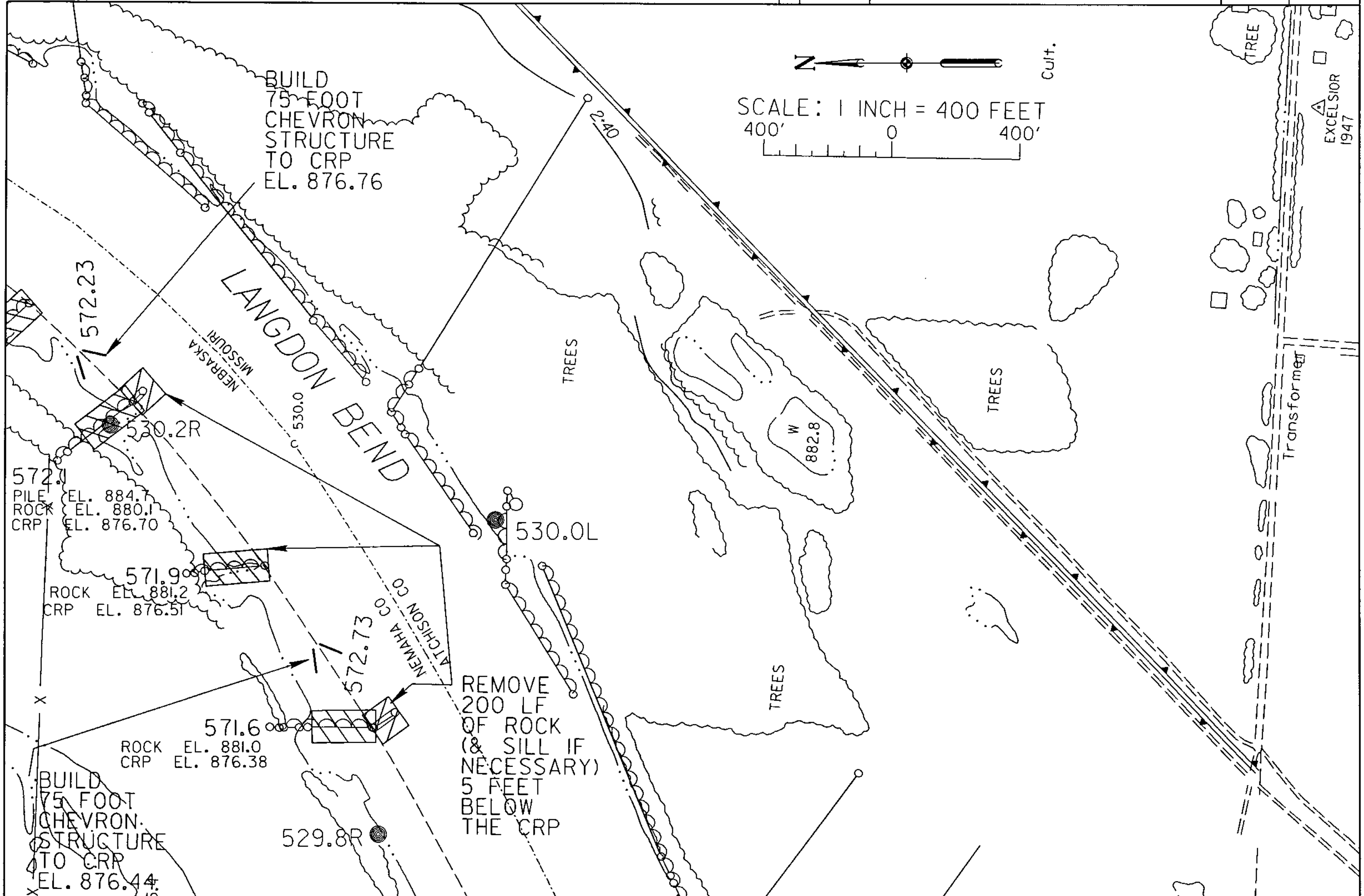
Sheet No.	Computer File: sheet1.dgn	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /MISSOURI RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 529 TO 532 SITE MAP	Submitted by:	Designed by: R.G.P.	Checked by: J.I.R.
L1	Date: NOV. 2004	Contract No. W9128F-04-C-000X				Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X				Chief SED. & CHAN. STAB. Section		

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



Sheet No.					
L2	Computer File: sheet2.dgn	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /MISSOURI RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 529 TO 532 SITE MAP	Submitted by: Chief SED. & CHAN. STAB. Section
	Date: NOV. 2004	Contract No. W9128F-04-C-000X			Designed by: R.G.P. Checked by: J.I.R.
	Drawing Code: PUBDATA\RICKP\X				Reviewed by: J.I.R. Drawn by: R.G.P.

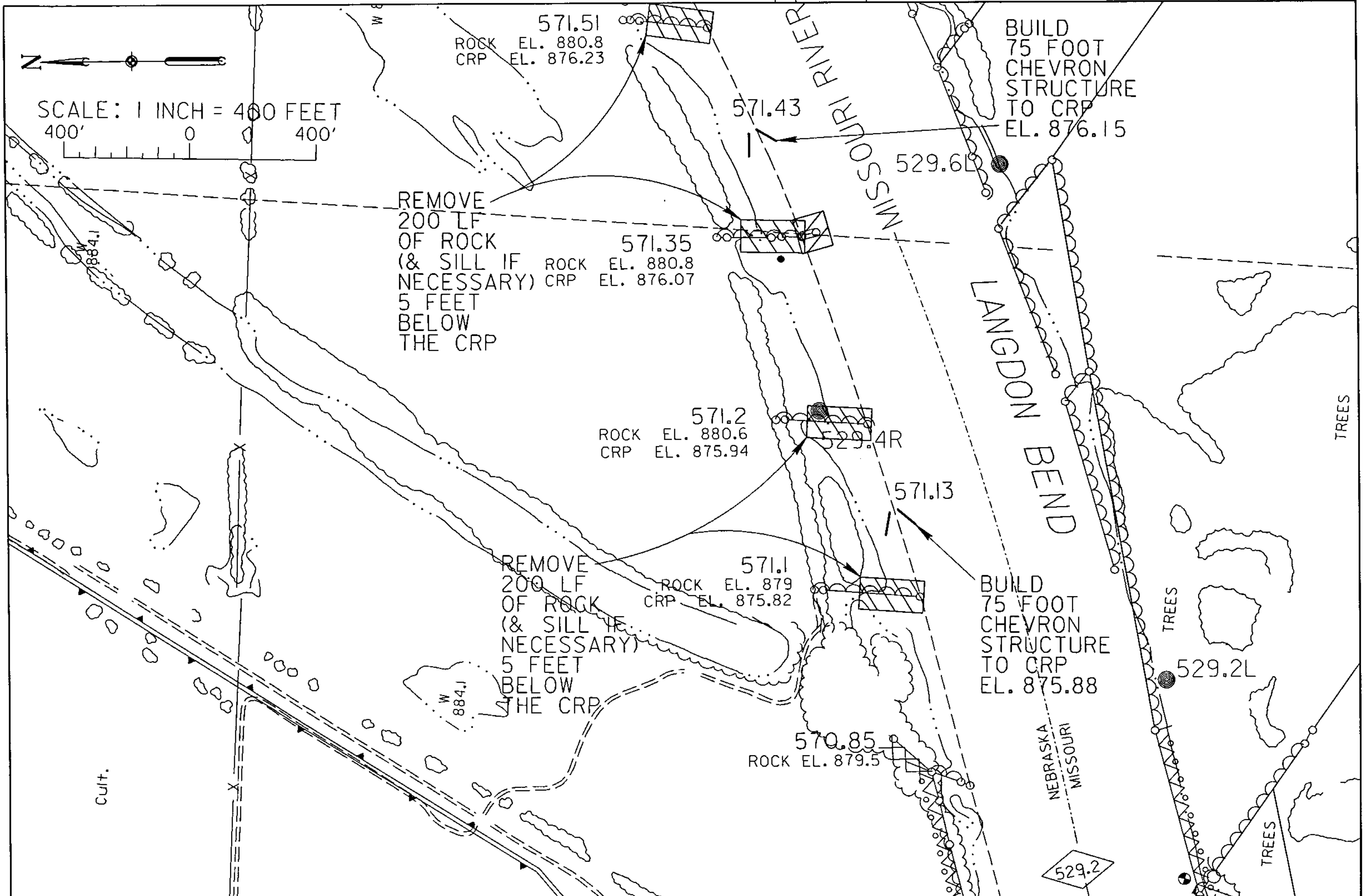
REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



F-55

Sheet No.					
L3	Computer File: sheet3.dgn	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /MISSOURI RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 529 TO 532 SITE MAP	Submitted by: Chief SED. & CHAN. STAB. Section
	Date: NOV. 2004	Contract No. W9128F-04-C-000X			Designed by: R.G.P. / Checked by: J.I.R.
	Drawing Code: PUBDATA\RICKP\X				Reviewed by: J.I.R. / Drawn by: R.G.P.

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



F-56

Sheet No.	Computer File: sheet4.dgn	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER: NEBRASKA /MISSOURI RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 529 TO 532 SITE MAP	Submitted by:	Designed by: R.G.P.	Checked by: J.I.R.
L4	Date: NOV. 2004	Contract No. W9128F-04-C-000X			Chief SED. & CHAN. STAB. Section	Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code:	PUBDATA\RICKP\X					

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED

RIVER STRUCTURE TABLE

RIVER MILE	STRUCTURE NUMBER	BANK	RIPRAP MATERIAL REMOVED TO DEPTH BELOW CRP	RIPRAP MATERIAL PLACED TO DEPTH BELOW CRP
531.57	573.70	RT	5 FEET	---
531.53	573.63	RT	---	0 FEET
531.49	573.60	RT	5 FEET	---
531.41	573.55	RT	5 FEET	---
531.37	573.53	RT	---	0 FEET
531.32	573.50	RT	5 FEET	---
531.18	573.30	RT	5 FEET	---
531.09	573.23	RT	---	0 FEET
531.00	573.10	RT	5 FEET	---
530.84	573.00	RT	5 FEET	---
530.78	572.93	RT	---	0 FOOT
530.71	572.90	RT	5 FEET	---
530.49	572.80	RT	5 FEET	---
530.55	572.73	RT	---	0 FOOT
530.61	572.70	RT	5 FEET	---
530.39	572.55	RT	5 FEET	---
530.34	572.53	RT	---	0 FOOT
530.29	572.40	RT	5 FEET	---
530.19	572.25	RT	5 FEET	---
530.15	572.23	RT	---	0 FEET
530.10	572.10	RT	5 FEET	---
529.93	571.90	RT	5 FEET	---
529.87	571.73	RT	---	0 FEET
529.81	571.60	RT	5 FEET	---
529.68	571.51	RT	5 FEET	---
529.61	571.43	RT	---	0 FEET
529.54	571.35	RT	5 FEET	---
529.42	571.20	RT	5 FEET	---
529.37	571.13	RT	---	0 FEET
529.32	571.10	RT	5 FEET	---

Sheet No. L5

Computer File: Sheet5.DGN
Spec. No. W9128F-04-R-000X
Date: NOV. 2004
Contract No. W9128F-04-C-000X
Drawing Code: PUBDATA\RICKP\X

U S ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA, NEBRASKA

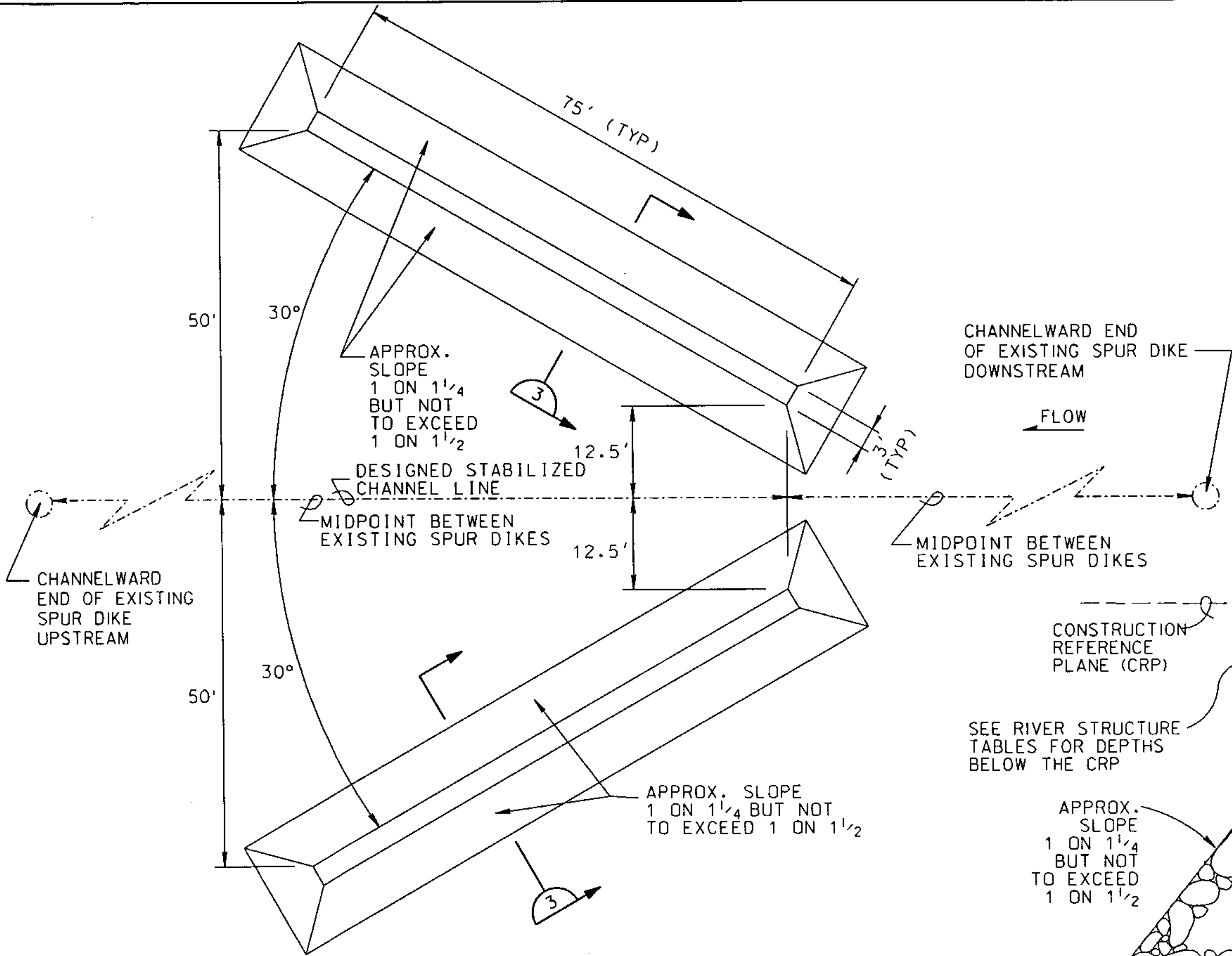
MISSOURI RIVER; NEBRASKA /MISSOURI
RIVER CONTROL STRUCTURE MODIFICATIONS
RIVER MILE 529 TO 532
SITE MAP

Submitted by:

Chief SED. & CHAN. STAB. Section

Designed by: R.G.P.
Checked by: J.I.R.
Reviewed by: J.I.R.
Drawn by: R.G.P.

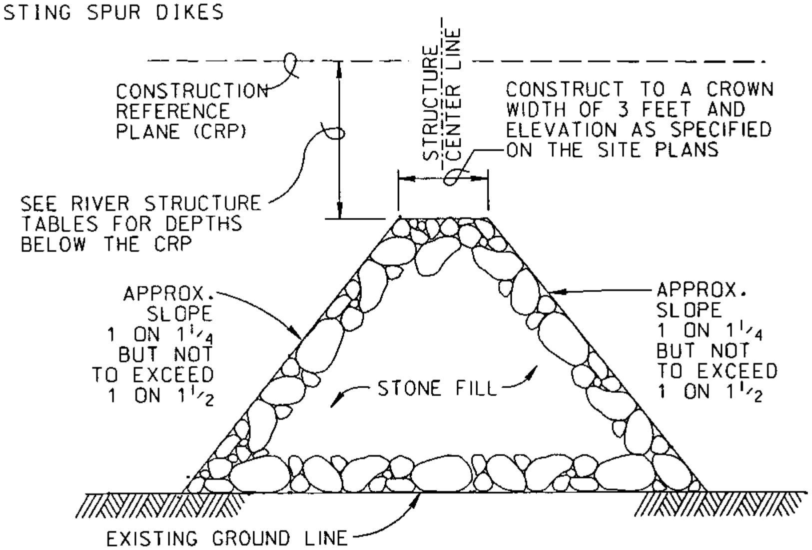
REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



NEW CHEVRON DETAIL

PLAN VIEW

NOT TO SCALE

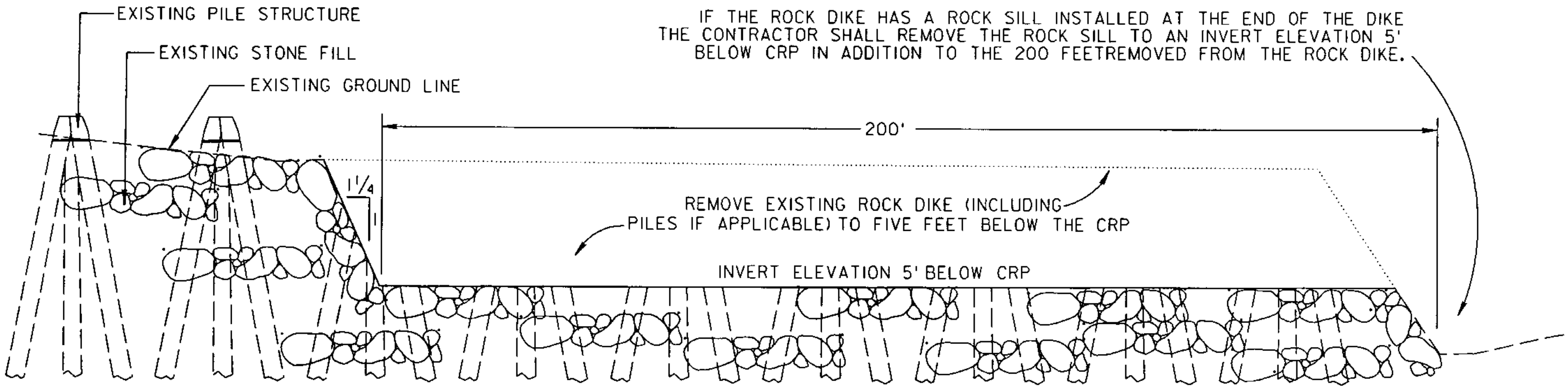


SECTION 3

NOT TO SCALE

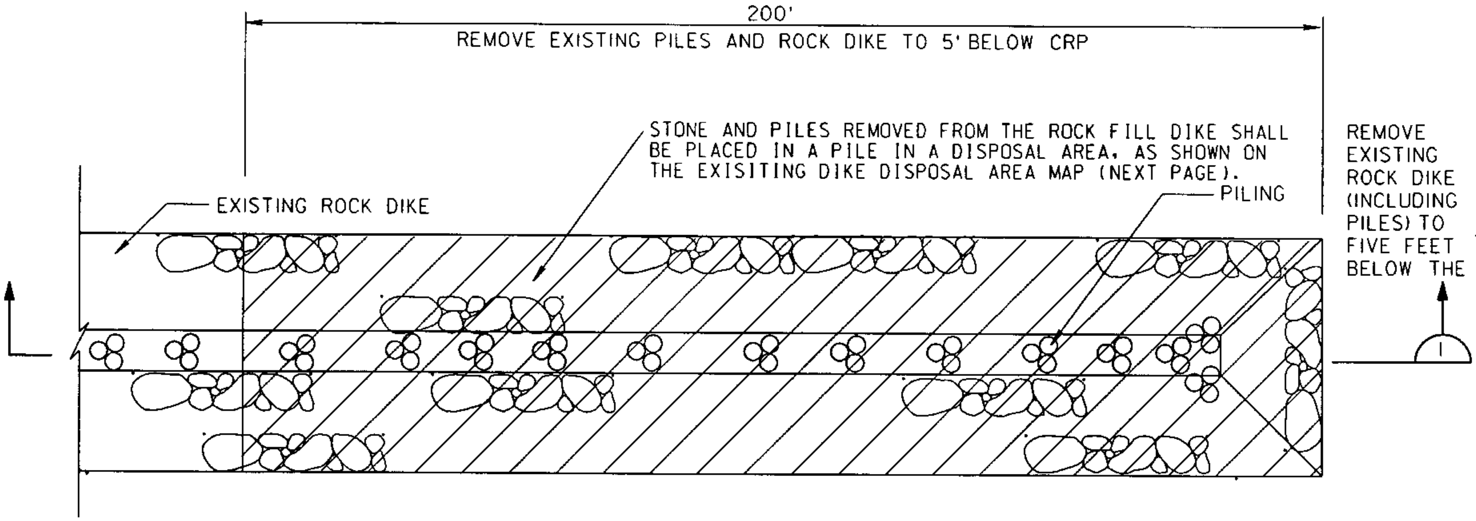
Sheet No. L6	Computer File: SHEET6.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /MISSOURI RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 529 TO 532 CHEVRON STRUCTURE	Submitted by:	Designed by: R.G.P. / Checked by: J.I.R.
	Date: NOV. 2004	Contract No. W9128F-04-C-000X			Chief SED. & CHAN. STAB. Section	Reviewed by: J.I.R. / Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X					

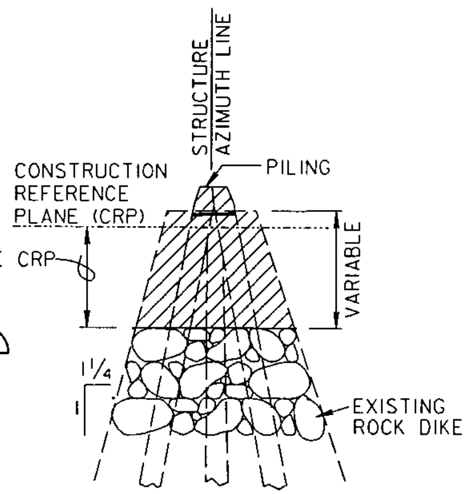
REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



SECTION 1

NOT TO SCALE





DIKE REMOVAL DETAIL

PLAN VIEW

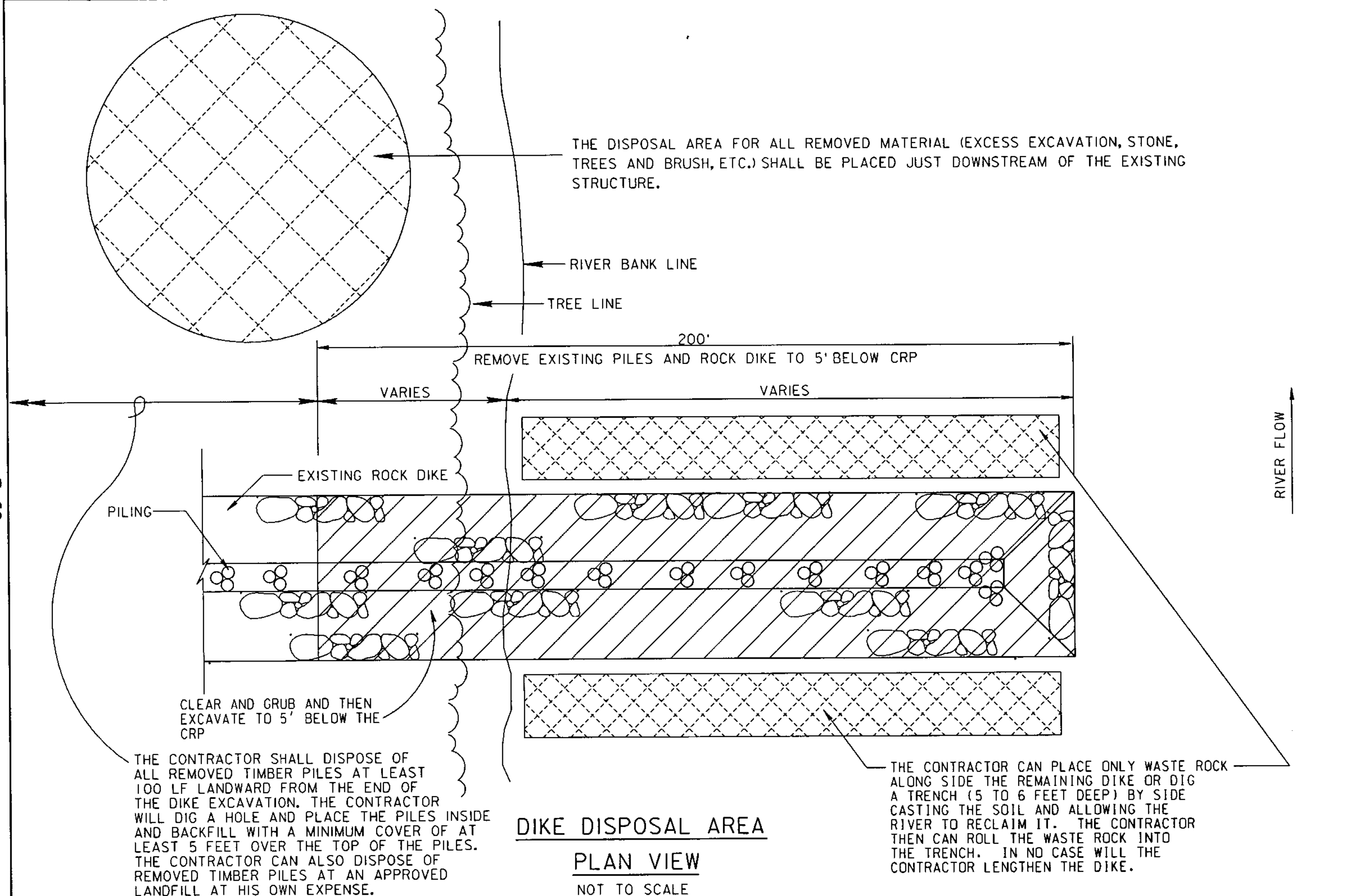
NOT TO SCALE

SECTION 2

NOT TO SCALE

Sheet No.						
L7	Computer File: SHEET7.DGN Date: NOV. 2004 Drawing Code: PUBDATA\RICKP\X	Spec. No. W9128F-04-R-000X Contract No. W9128F-04-C-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /MISSOURI RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 529 TO 532 EXISTING DIKE REMOVAL DETAILS	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P. Checked by: J.I.R. Reviewed by: J.I.R. Drawn by: R.G.P.

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



DIKE DISPOSAL AREA

PLAN VIEW

NOT TO SCALE

Sheet No.	Computer File: SHEET8.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /MISSOURI RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 529 TO 532 EXISTING DIKE DISPOSAL AREA MAP	Submitted by:	Designed by: R.G.P.	Checked by: J.I.R.
L8	Date: NOV. 2004	Contract No. W9128F-04-C-000X			Chief SED. & CHAN. STAB. Section	Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code:	PUBDATA\RICKP\X					

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED

BENCH MARK INFORMATION

POINT	COORDINATE POINT		ELEVATION
529.2L	N264169.49	E3075897.09	883.19
529.4R	N265270.26	E3076677.52	886.83
529.6L	N264778.42	E3077489.32	884.57
529.8R	N266036.49	E3078152.41	886.17
530.0L	N265760.62	E3079148.67	884.76
530.2R	N267015.80	E3079355.18	884.26
530.4L	N267577.99	E3080573.19	890.15
530.6R	N269204.52	E3080156.42	888.31
530.8L	N269930.71	E3080917.95	889.84
531.0R	N270770.73	E3080038.40	886.60
531.2L	N271993.04	E3080474.46	885.56
531.4R	N272623.78	E3079464.39	887.36
531.5L	N273577.67	E3079789.99	890.05
531.7R	N274128.27	E3078451.76	887.10
531.9L	N275445.75	E3078409.54	886.31

F-61

CONDITION OF MISSOURI RIVER CONTROL POINTS:

1. NO EFFORT HAS BEEN MADE TO MONITOR THESE POINTS. SOME HAVE ERODED INTO THE RIVER WHILE OTHERS MAY BE BURIED UNDER 1-5 FEET OF SEDIMENT.

2. EACH CONTROL POINT IS A 3-1/4 INCH DIAMETER CORPS OF ENGINEERS BRASS CAP. THEY ARE STAMPED WITH THE RIVER MILE AND LEFT/RIGHT BANK.

3. THE CONTROL POINTS ARE MARKED WITH ORANGE FIBERGLASS WITNESS POSTS (CARSONITE BRAND). THE POSTS WERE TYPICALLY SET 3-8 INCHES LANDWARD OF THE BRASS CAP.

4. HORIZONTAL CONTROL: STATE PLANE, NAD 27, NEBRASKA SOUTH
VERTICAL CONTROL: NGVD 29

Sheet No.						
9	Computer File: Sheet9.DGN Date: NOV. 2004 Drawing Code: PUBDATA\RICKP\X	Spec. No. W9128F-04-R-000X Contract No. W9128F-04-C-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; NEBRASKA /MISSOURI RIVER CONTROL STRUCTURE MODIFICATIONS RIVER MILE 529 TO 532 BENCHMARK INFOMATION	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P. Checked by: J.I.R. Reviewed by: J.I.R. Drawn by: R.G.P.

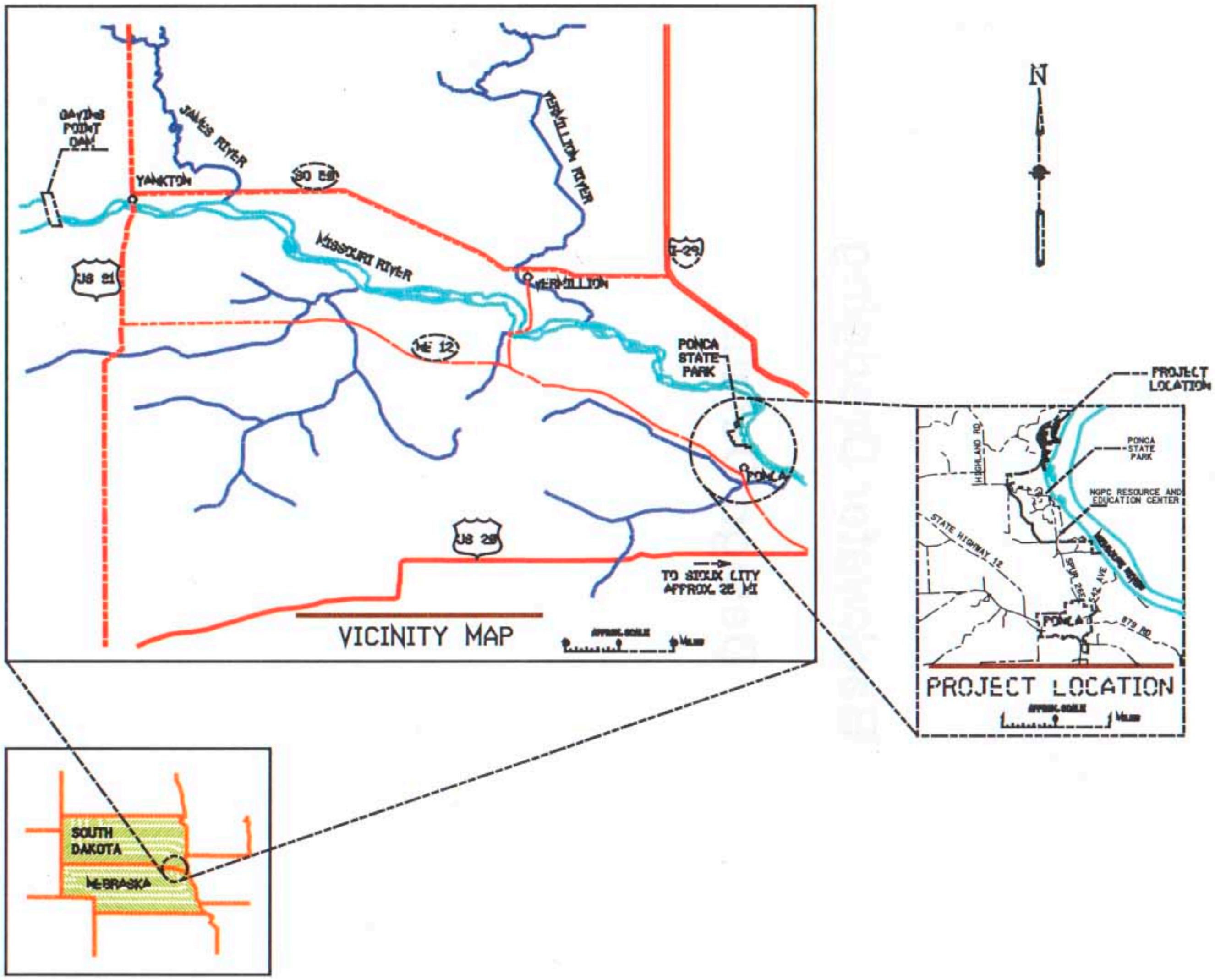
APPENDIX G

BACKWATER DREDGING

Backwater Dredging

Design Details

G-2



N

NOTES:

1. ALL FEATURES AND SCALES SHOWN ARE APPROXIMATE. LOCATION MAPS SHOULD BE USED FOR REFERENCE ONLY.

2. REFER TO REAL ESTATE SHEET G-6 FOR PROJECT BOUNDARIES AND ACCESS.

ALL SCALES SHOWN ARE BASED ON A STANDARD DRAWING SIZE OF 28" X 40" OR METRIC DRAWING SIZE OF 841mm X 594mm. IF ANY OTHER SIZE DRAWINGS ARE FURNISHED OR PLOTTED THE CONTRACTOR SHALL ADJUST THE SCALES ACCORDINGLY. THE CONTRACTOR SHALL ALSO ADVISE HIS SUB-CONTRACTORS OF THE ABOVE.

$$ – THINK VALUE ENGINEERING – $$

TETRA TECH, INC.
PORTLAND, OREGON

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA, NEBRASKA

Designed by:
(503) 223-5388
Date: 08/28/2002
Drawn by:
STATUS:
RTA

Submitted by:
Date:

MISSOURI NATIONAL RECREATIONAL RIVER
PONCA STATE PARK
HABITAT RESTORATION PROJECT

LOCATION AND VICINITY MAPS

Date: APRIL 2004
Drawing Code: MRP1-170E03
Sheet ref. number: G-3

C:\temp\mr44wl01.dgn 06/01/2004 07:55:47 AM

ALL SCALES SHOWN ARE BASED ON A STANDARD DRAWING SIZE OF 28" X 40" OR METRIC DRAWING SIZE OF 841mm X 594mm IF ANY OTHER SIZE DRAWINGS ARE FURNISHED OR PLOTTED THE CONTRACTOR SHALL ADJUST THE SCALES ACCORDINGLY THE CONTRACTOR SHALL ALSO ADVISE HIS SUB-CONTRACTORS OF THE ABOVE.

$$ - THINK VALUE ENGINEERING - $$

TETRA TECH, INC.
PORTLAND, OREGON

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA, NEBRASKA

Designed by: EHP
(503) 775-8368
Date: 10/06/2003
Drawn by: EHR
STATUS
NTA

MISSOURI NATIONAL RECREATIONAL RIVER
PONCA STATE PARK
HABITAT RESTORATION PROJECT

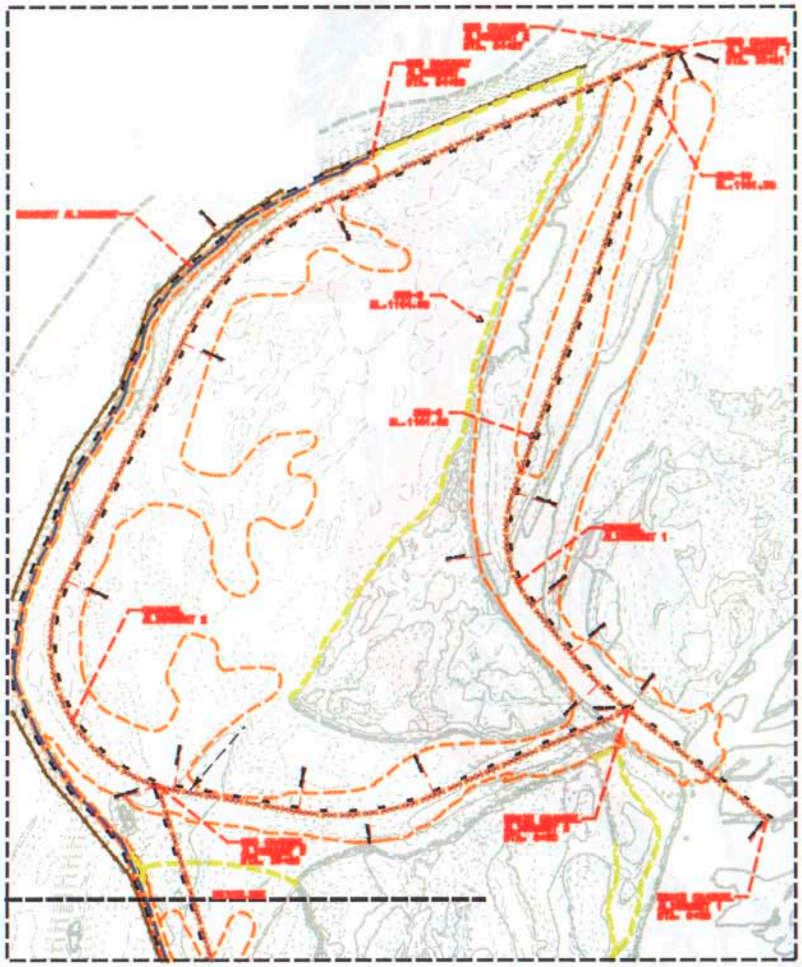
DREDGE DISPOSAL
AND BORROW AREAS

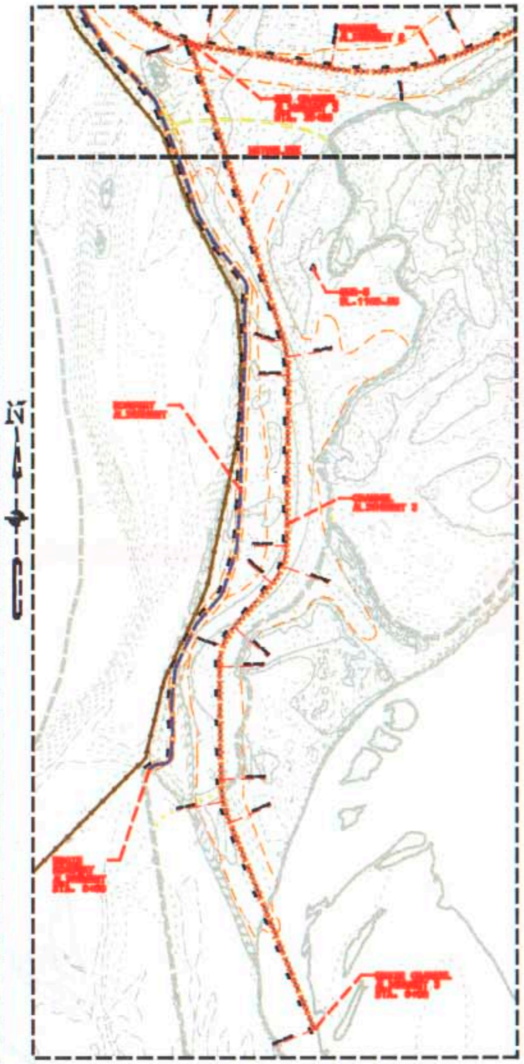
Submitted by:
Date:

Date: APRIL 2004
Drawing Code: MRP1-170E61
D-5

C:\temp\mr44wh01.dgn 06/01/2004 07:54:08 AM

G-3





ID	NORTHING	EASTING	ELEVATION
SUR-5	N.1031212.065	E.2524050.143	EL.1105.55
SUR-8	N.1033159.047	E.2524903.802	EL.1101.08
SUR-9	N.1033555.429	E.2524728.758	EL.1104.60
SUR-10	N.1034283.361	E.2525335.407	EL.1101.30

ALL SCALES SHOWN ARE BASED ON A STANDARD DRAWING SIZE OF 28" X 40" OR METRIC DRAWING SIZE OF 841mm X 594mm IF ANY OTHER SIZE DRAWINGS ARE FURNISHED OR PLOTTED THE CONTRACTOR SHALL ADJUST THE SCALES ACCORDINGLY THE CONTRACTOR SHALL ALSO ADVISE HIS SUB-CONTRACTORS OF THE ABOVE

$$ - THINK VALUE ENGINEERING - $$

TETRA TECH, INC.
PORTLAND, OREGON

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA, NEBRASKA

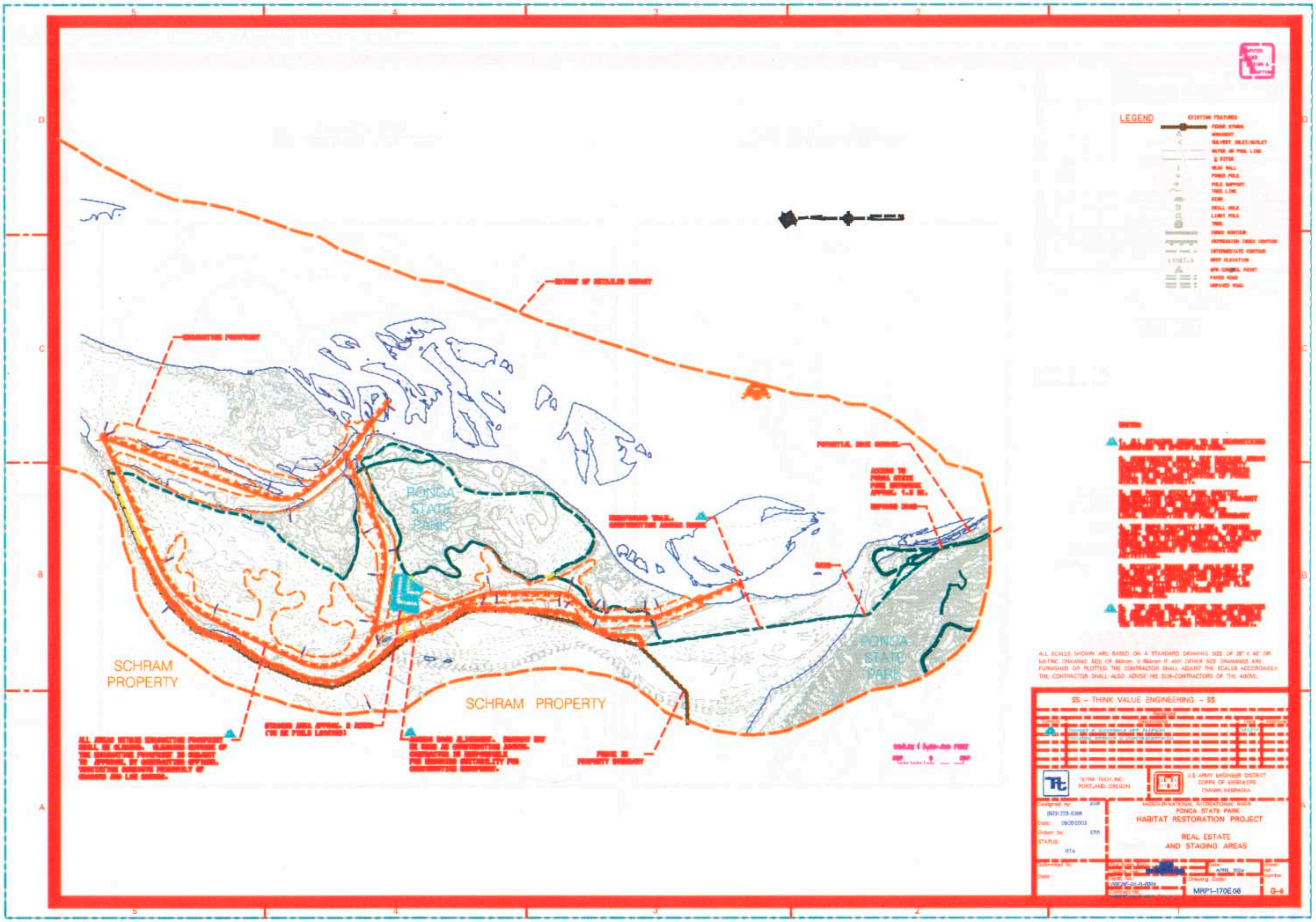
Designed by: KHP
(503) 223-4388
Date: 08/26/2003
Drawn by: ERR
STATUS:
RTA

MISSOURI NATIONAL RECREATIONAL RIVER
PONCA STATE PARK
HABITAT RESTORATION PROJECT

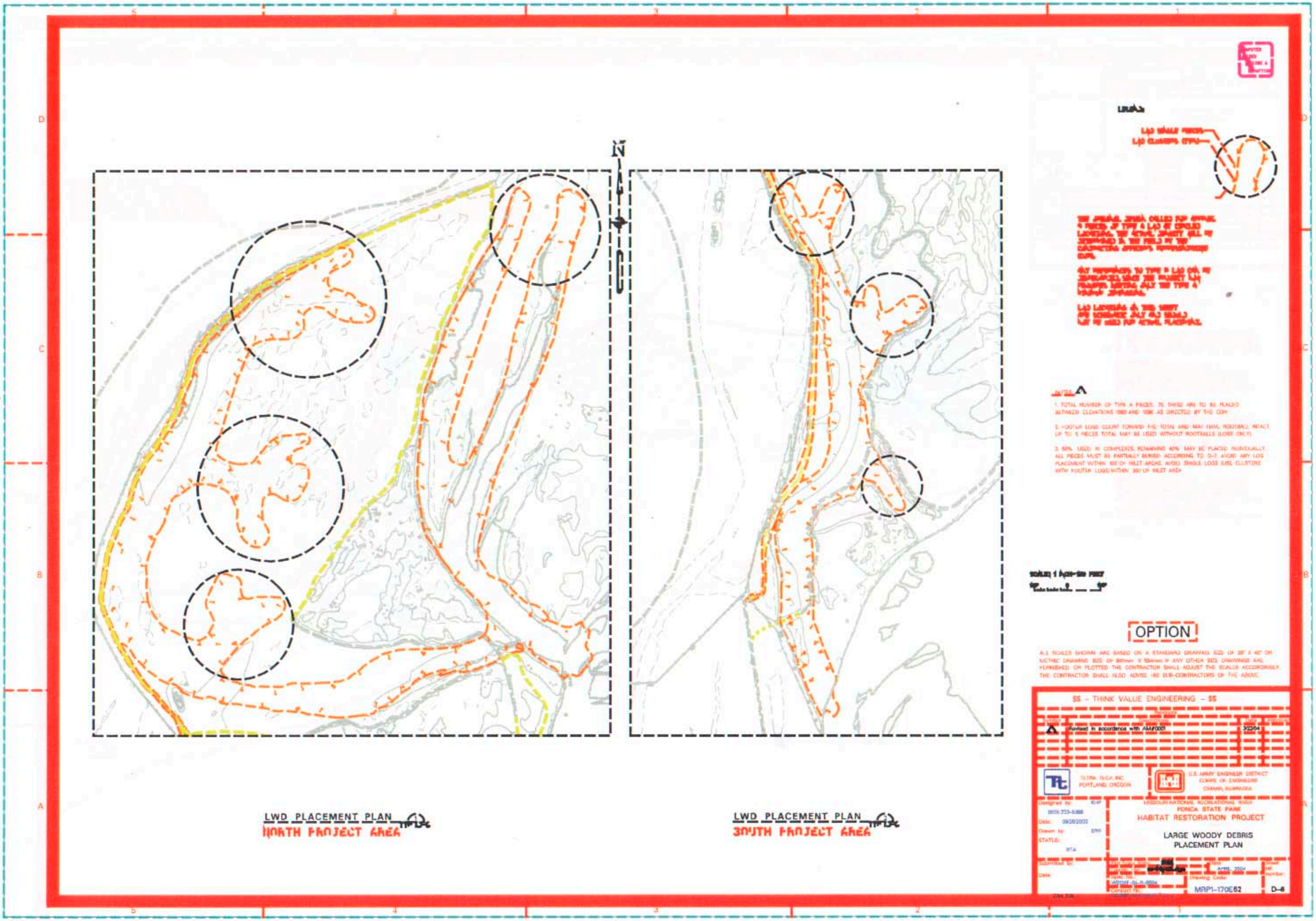
ALIGNMENT CURVE DATA
AND SURVEY CONTROL

Submitted by:
Date:

Date: APRIL 2004
Drawing Code: MRP1-170E06
Sheet ref. number: G-6

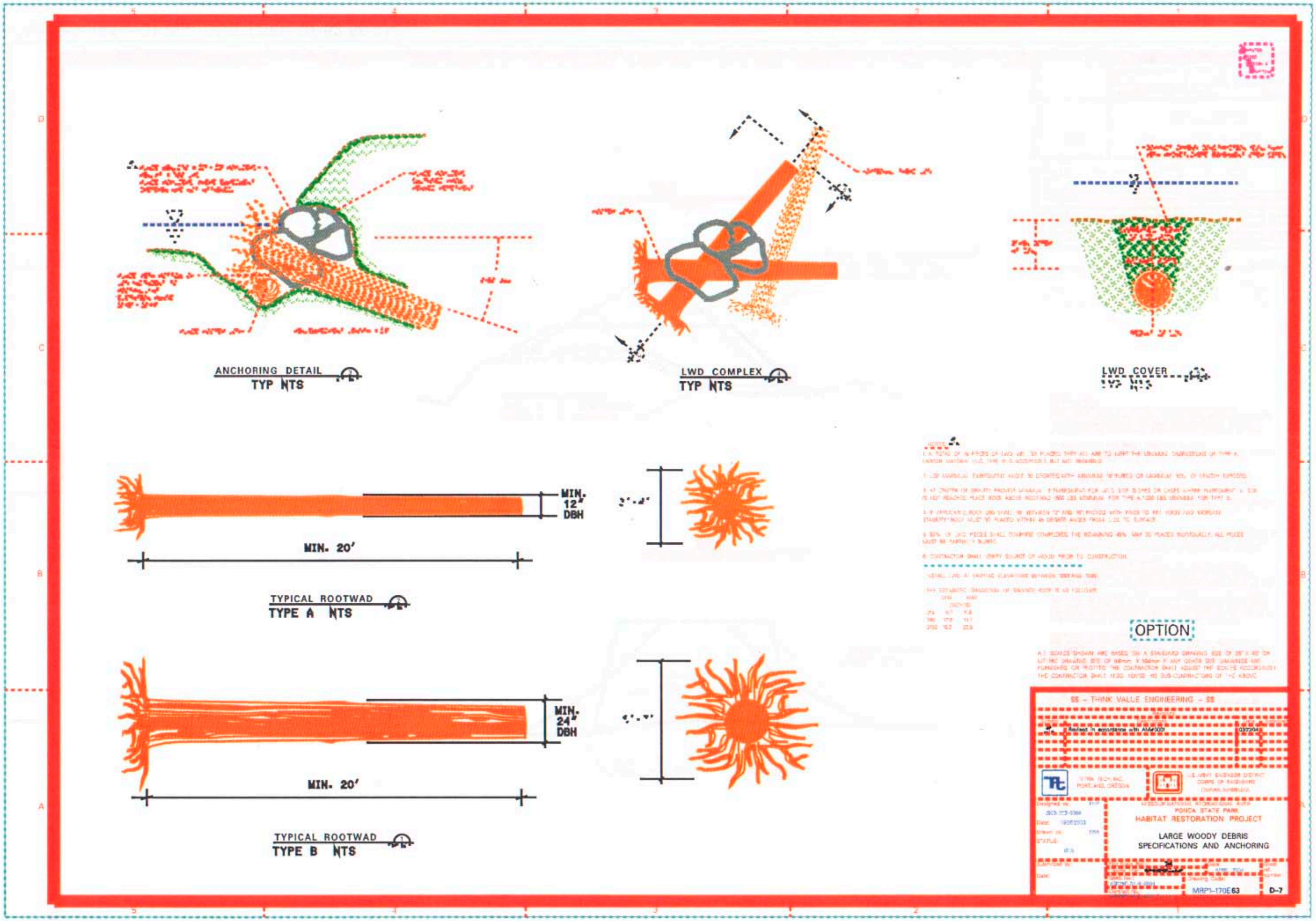


C:\temp\mr44wl03.dgn 06/01/2004 07:58:49 AM

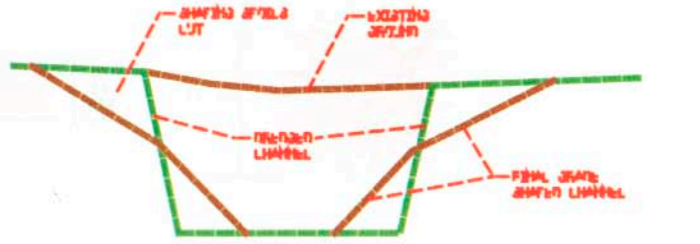


C:\temp\mr44wt01.dgn 06/01/2004 07:44:27 AM

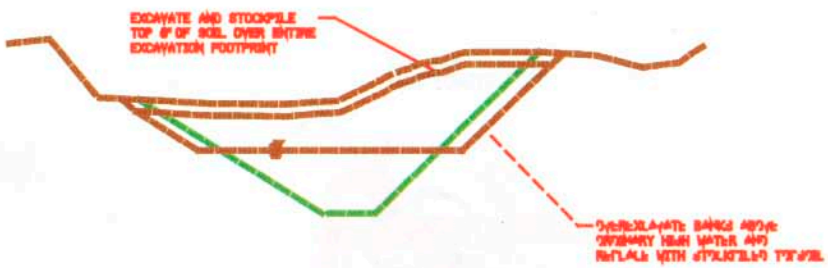
G-7



C:\temp\mr44wt02.dgn 06/01/2004 07:51:40 AM



BANK SHAPING METHOD



TOPSOIL STRIPPING

ALL SCALES SHOWN ARE BASED ON A STANDARD DRAWING SIZE OF 28" X 40" OR METRIC DRAWING SIZE OF 841mm X 594mm IF ANY OTHER SIZE DRAWINGS ARE FURNISHED OR PLOTTED THE CONTRACTOR SHALL ADJUST THE SCALES ACCORDINGLY THE CONTRACTOR SHALL ALSO ADVISE HIS SUB-CONTRACTORS OF THE ABOVE

$$ - THINK VALUE ENGINEERING - $$

TETRA TECH, INC.
PORTLAND, OREGON

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA, NEBRASKA

Designed by: KHP
(503) 223-5388
Date: 08/20/2003
Drawn by:
STATUS:

MISSOURI NATIONAL RECREATIONAL RIVER
PONCA STATE PARK
HABITAT RESTORATION PROJECT

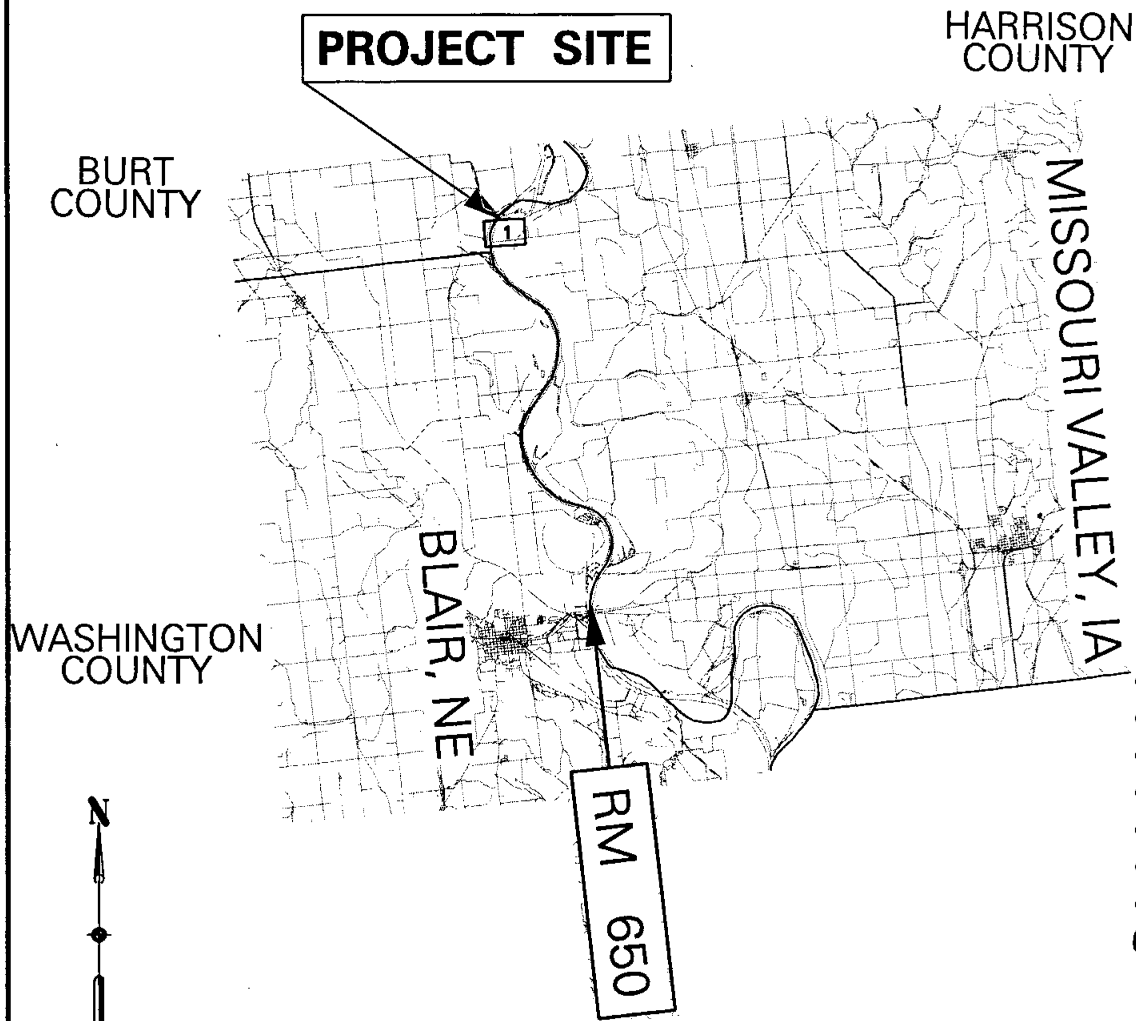
BANK SHAPING AND
TOPSOIL STRIPPING

Submitted by:
Date:

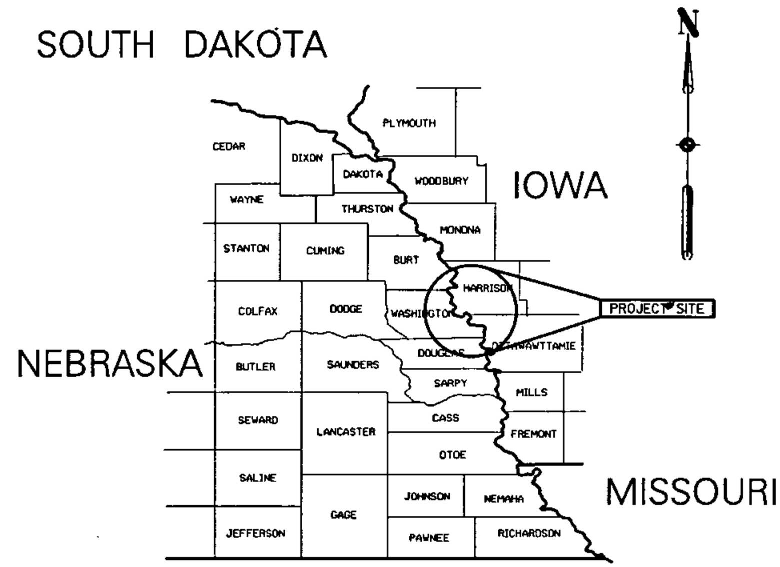
Date: APRIL 2004
Drawing Code: MRP1-170E64
Sheet ref. number: D-8

C:\temp\mr44wv01.dgn 06/01/2004 07:52:58 AM

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



VICINITY MAP
NOT TO SCALE



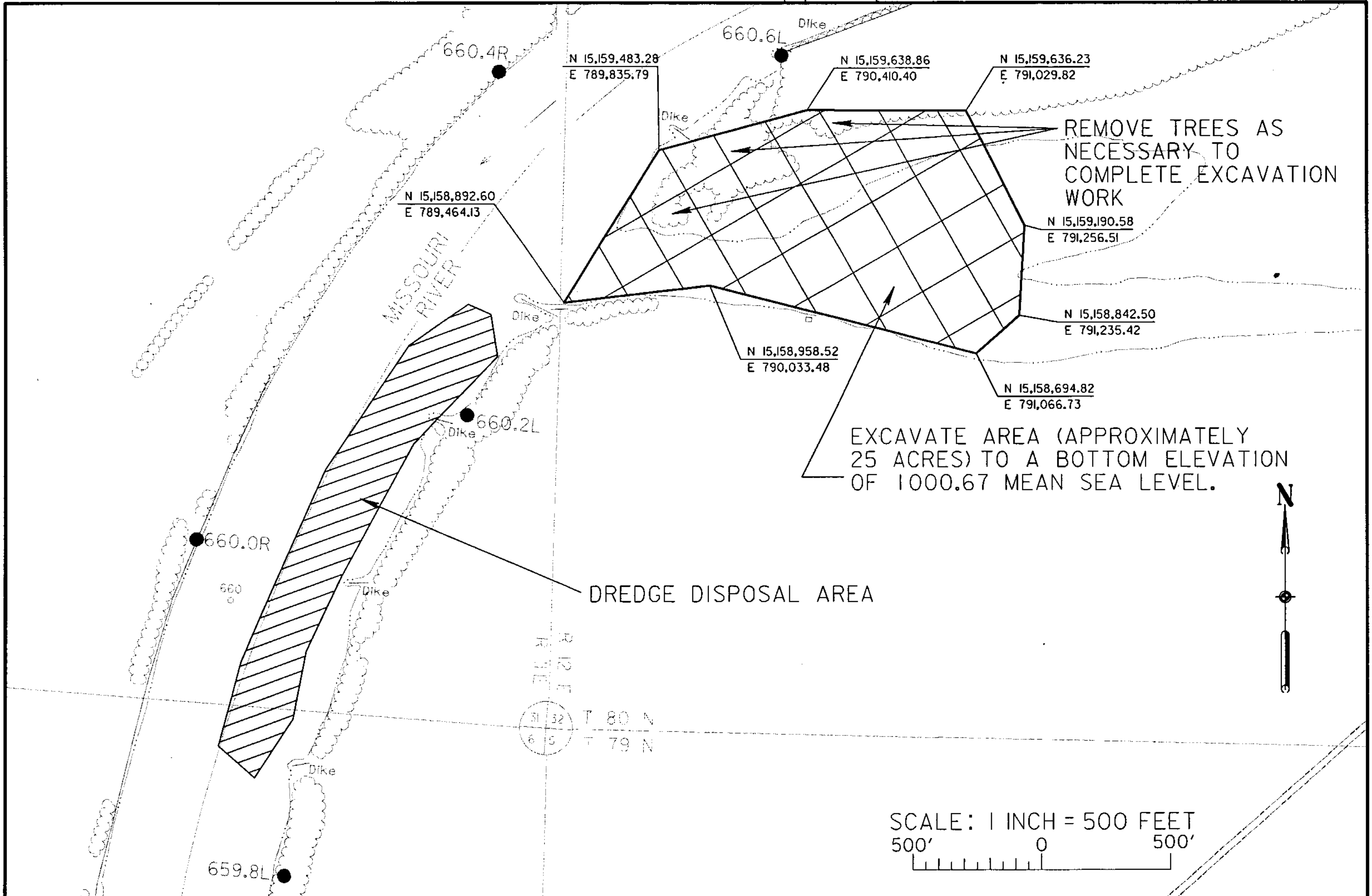
LOCATION MAP
NOT TO SCALE

LEGEND

Symbol	Description
	PILE DIKE
	STONE FILL DIKE OR REVETMENT OR PILE DIKE STONE FILL
	PILE REVETMENT
	PILE REVETMENT, STONE FILL
	TOE TRENCH OR STANDARD REVETMENT OR REINFORCED STD. REVET. OR ACCRETMENT
	ASPHALT REVETMENT
	DESIGNED STABILIZED CHANNEL LINE
	BLUFF LINE
569	1960 CHANNEL MILAGE
580.3	BEND CHANGE
615.8	STRUCTURE NUMBERS ARE BASED ON 1890 MILAGE
CRP	THIS IS THE CONTRUCTION REFERENCE PLANE WHICH REPRESENTS A SYNTHESIZED WATER SURFACE PROFILE OF A STEADY DISCHARGE THAT IS EQUALED OR EXCEEDED 75% OF THE TIME DURING THE NAVIGATION SEASON (APRIL – NOVEMBER).

Sheet No.							
S0	Computer File: SHEETØ.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; IOWA / NEBRASKA BACKWATER DREDGING PROJECT SOLDIER BEND AT RIVER MILE 660.3 SITE MAP	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P.	Checked by: J.I.R.
	Date: APR. 2004	Contract No. W9128F-04-C-000X				Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X						

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



Sheet No.						
S1	Computer File: SHEET1.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; IOWA / NEBRASKA BACKWATER DREDGING PROJECT SOLDIER BEND AT RIVER MILE 660.3 SITE MAP	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P. / Checked by: J.I.R.
	Date: APR. 2004	Contract No. W9128F-04-C-000X				Reviewed by: J.I.R. / Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X					

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED

BENCH MARK INFORMATION
COORDINATE POINT

POINT	BANK	NORTHING	EASTING	ELEVATION
659.8	L	15156718.85570	788434.46899	1008.61000
660.0	R	15158038.89397	788088.14037	1008.32000
660.2	L	15158460.95039	789108.74666	1009.01000
660.4	R	15159846.65980	789282.30591	1010.78000
660.6	L	15159896.07054	790370.87381	1009.12000

CONDITION OF MISSOURI RIVER CONTROL POINTS:

1. NO EFFORT HAS BEEN MADE TO MONITOR THESE POINTS. SOME HAVE ERODED INTO THE RIVER WHILE OTHERS MAY BE BURIED UNDER 1-5 FEET OF SEDIMENT.

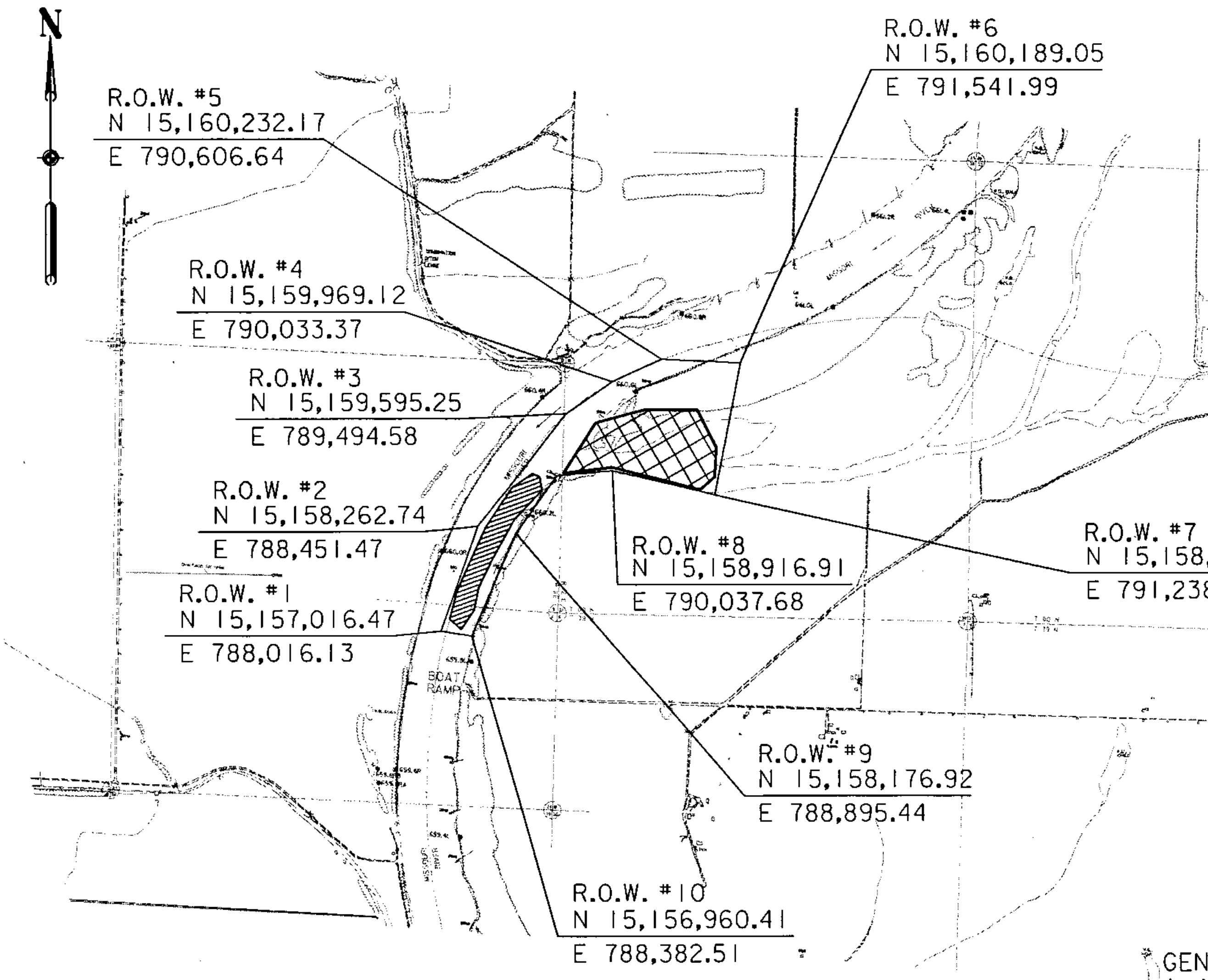
2. EACH CONTROL POINT IS A 3-1/4 INCH DIAMETER CORPS OF ENGINEERS BRASS CAP. THEY ARE STAMPED WITH THE RIVER MILE AND LEFT/RIGHT BANK.

3. THE CONTROL POINTS ARE MARKED WITH ORANGE FIBERGLASS WITNESS POSTS (CARSONITE BRAND). THE POSTS WERE TYPICALLY SET 3-8 INCHES LANDWARD OF THE BRASS CAP.

4. HORIZONTAL CONTROL: UTM ZONE 15, NAD 83
VERTICAL CONTROL: NGVD 29 (ALSO REFERENCED AS "MEAN SEA LEVEL" DATUM)

Sheet No.							
S2	Computer File: Sheet2.DGN Date: APR. 2004 Drawing Code: PUBDATA\RICKP\X	Spec. No. W9128F-04-R-000X Contract No. W9128F-04-C-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; IOWA / NEBRASKA BACKWATER DREDGING PROJECT SOLDIER BEND AT RIVER MILE 660.3 BENCHMARK INFOMATION	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P. Reviewed by: J.I.R.	Checked by: J.I.R. Drawn by: R.G.P.

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



EXCAVATION NOTES:

1. THE CONTRACTOR CAN EXCAVATE THE CHANNEL BY HYDRAULIC DREDGE (PER SPEC 02482) AND DISPOSE THE MATERIAL EXCAVATED FROM THE CHANNEL DIRECTLY INTO THE MISSOURI RIVER (DOWN STREAM OF THE CHANNEL ENTRANCE) BY HYDRAULIC METHODS (PER SPEC 2482).

2. THE CONTRACTOR CAN EXCAVATE THE CHANNEL BY MECHANICAL EXCAVATION AND DISPOSE OF THE MATERIAL EXCAVTED FROM THE CHANNEL OFF SITE IN A GOVERNMENT APPROVED LANDFILL.

GENERAL NOTES:
1. ALL AREAS OUTSIDE OF THE EXCAVATION LIMITS DISTURBED BY CONSTRUCTION AND NOT OTHERWISE PAVED SHALL BE SEEDED (PER APES 02935).
2. THE CONTRACTOR WILL NEED TO PROVIDE THEIR OWN LAND ACCESS AND STAGING AREA.

SCALE: 1 INCH =2000FEET

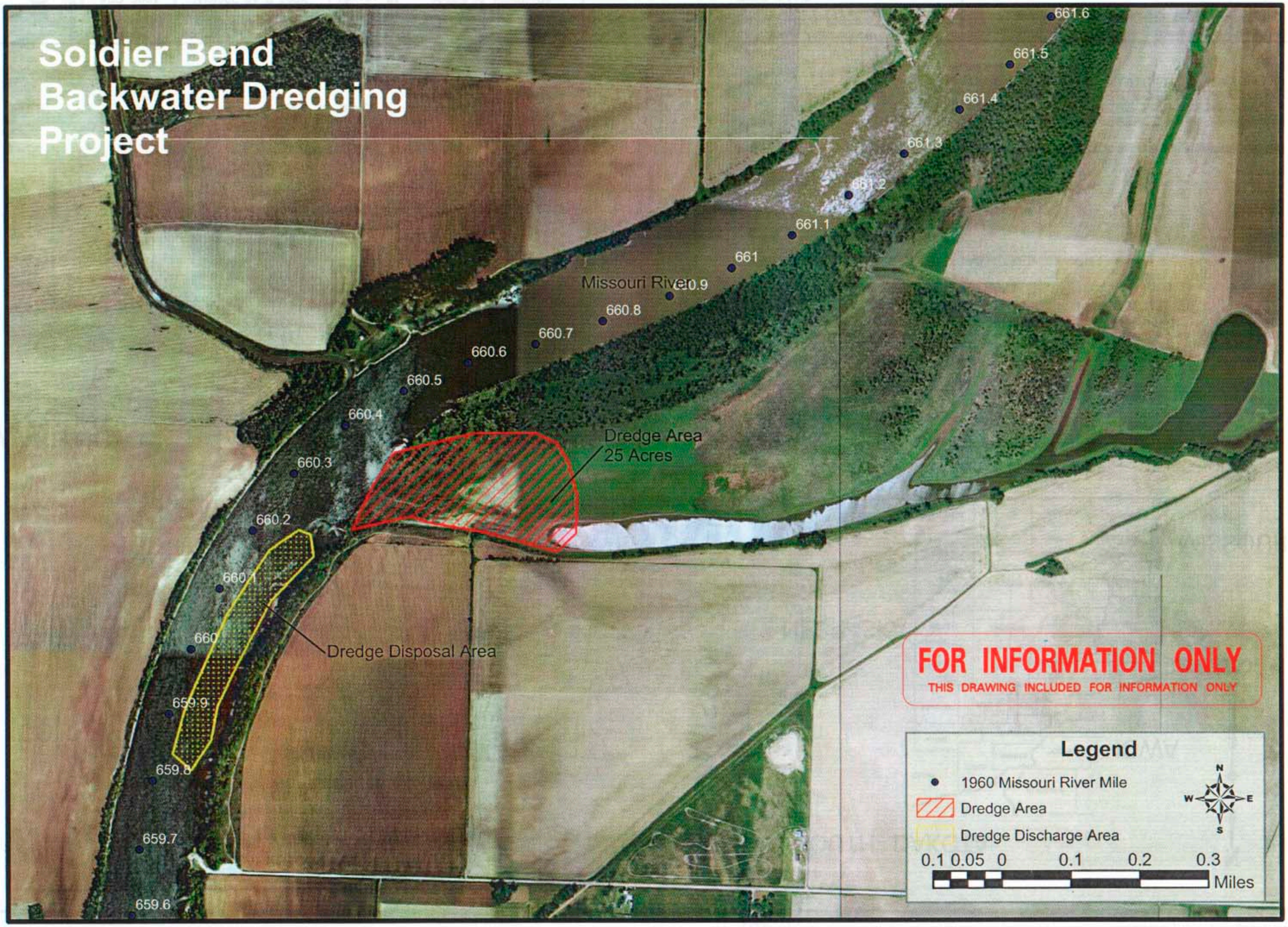
2000' 0 2000'

LEGEND

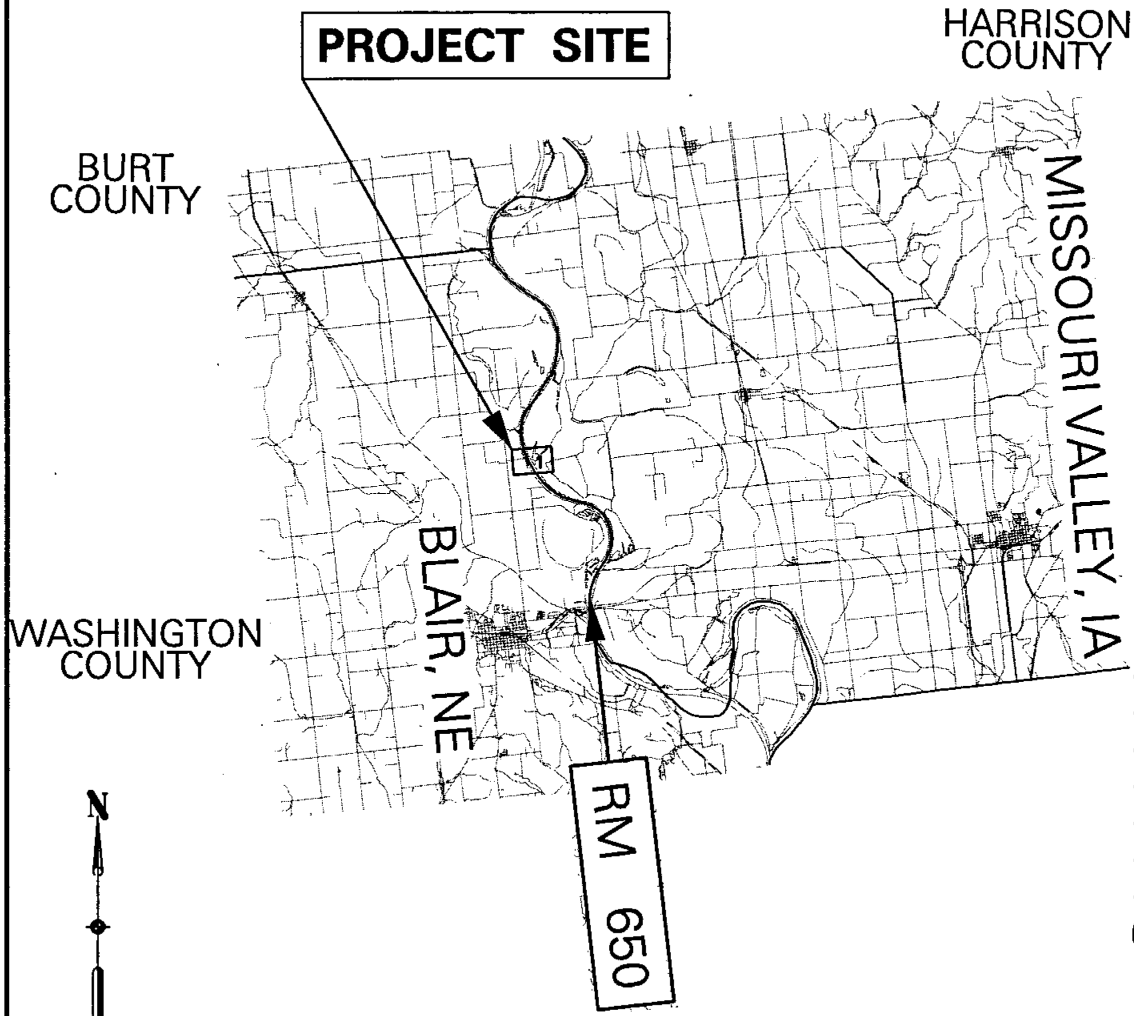
CONSTRUCTION R.O.W. BOUNDARY

G-12

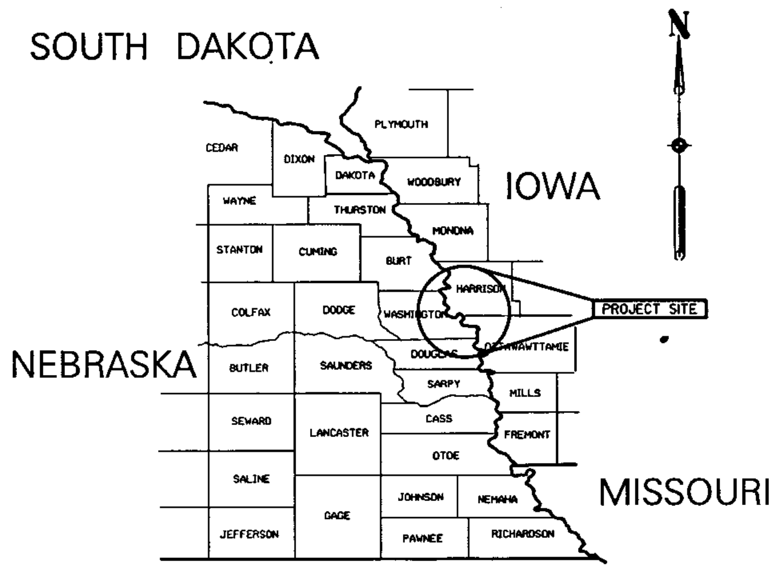
Sheet No.						
S3	Computer File: sheet3.dgn	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; IOWA / NEBRASKA BACKWATER DREDGING PROJECT SOLDIER BEND AT RIVER MILE 660.3 GENERAL PLAN VIEW AND RIGHT-OF-WAY MAP	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P. Checked by: J.I.R. Reviewed by: J.I.R. Drawn by: R.G.P.
	Date: APR. 2004	Contract No. W9128F-04-C-000X				
	Drawing Code: PUBDATA\RICKP\X					


Soldier Bend
Backwater Dredging
Project
661.6
661.5
661.4
661.3
661.2
661.1
661
Missouri River
660.9
660.8
660.7
660.6
660.5
660.4
660.3
660.2
660.1
660
659.9
659.8
659.7
659.6
Dredge Area
25 Acres
Dredge Disposal Area
FOR INFORMATION ONLY
THIS DRAWING INCLUDED FOR INFORMATION ONLY
Legend
1960 Missouri River Mile
Dredge Area
Dredge Discharge Area
N
W
E
S
0.1 0.05 0 0.1 0.2 0.3
Miles

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



VICINITY MAP
NOT TO SCALE



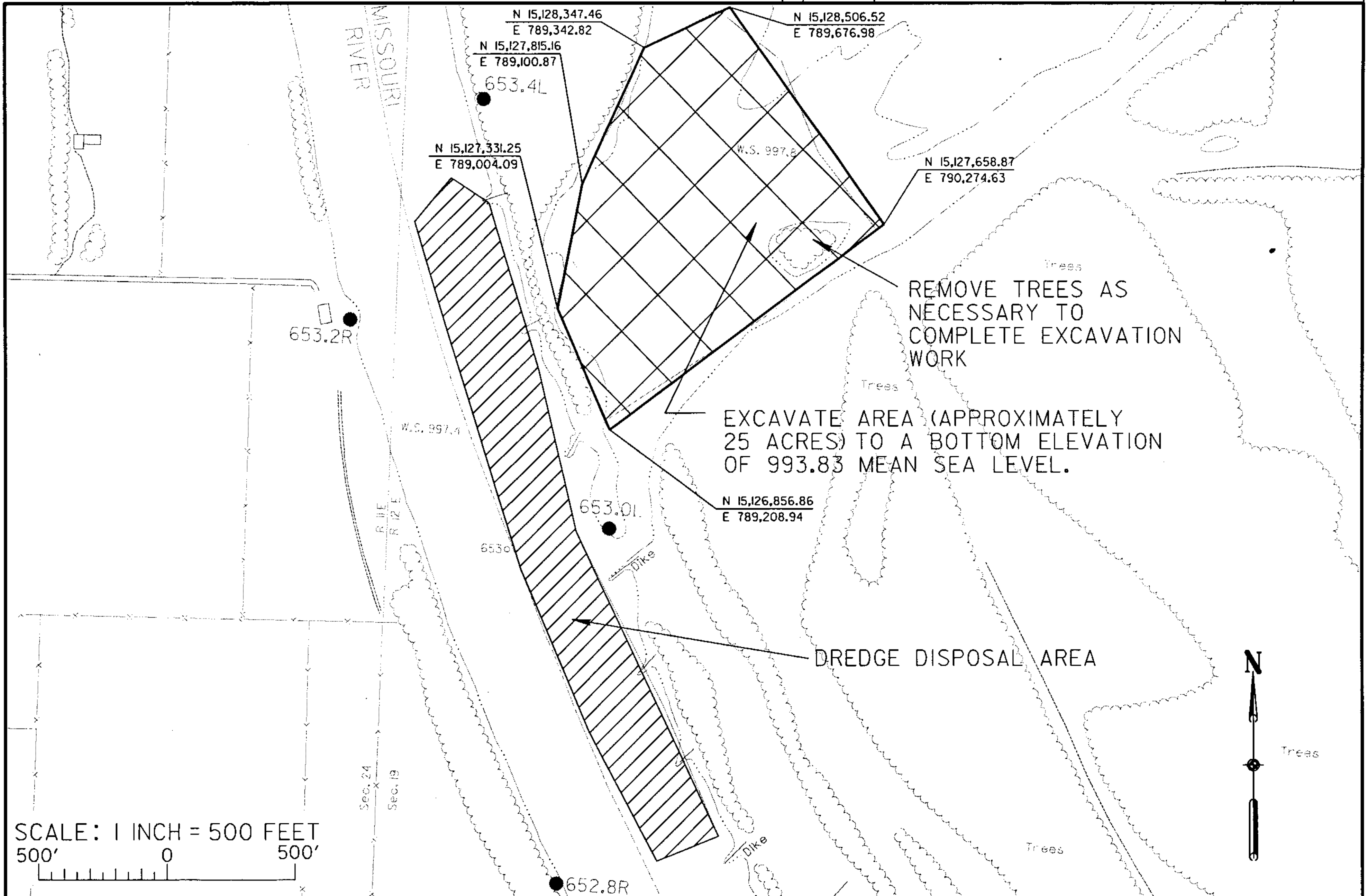
LOCATION MAP
NOT TO SCALE

LEGEND

	PILE DIKE
	STONE FILL DIKE OR REVETMENT OR PILE DIKE STONE FILL
	PILE REVETMENT
	PILE REVETMENT, STONE FILL
	TOE TRENCH OR STANDARD REVETMENT OR REINFORCED STD. REVET. OR ACCRETMENT
	ASPHALT REVETMENT
	DESIGNED STABILIZED CHANNEL LINE
	BLUFF LINE
569	1960 CHANNEL MILAGE
580.3	BEND CHANGE
615.8	STRUCTURE NUMBERS ARE BASED ON 1890 MILAGE
CRP	THIS IS THE CONTRUCTION REFERENCE PLANE WHICH REPRESENTS A SYNTHESIZED WATER SURFACE PROFILE OF A STEADY DISCHARGE THAT IS EQUALED OR EXCEEDED 75% OF THE TIME DURING THE NAVIGATION SEASON (APRIL - NOVEMBER).

Sheet No.	Computer File: SHEET0.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; IOWA / NEBRASKA BACKWATER DREDGING PROJECT SOLDIER BEND AT RIVER MILE 660.3 SITE MAP	Submitted by:	Designed by: R.G.P.	Checked by: J.I.R.
T0	Date: APR. 2004	Contract No. W9128F-04-C-000X			Chief SED. & CHAN. STAB. Section	Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X						

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



Sheet No.	Computer File: SHEET1.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; IOWA / NEBRASKA BACKWATER DREDGING PROJECT TYSON BEND AT RIVER MILE 653.2 SITE MAP	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P.	Checked by: J.I.R.
T1	Date: APR. 2004	Contract No. W9128F-04-C-000X				Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code:	PUBDATA\RICKP\X					

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED

BENCH MARK INFORMATION

COORDINATE POINT

POINT	BANK	NORTHING	EASTING	ELEVATION
652.8	R	15125085.84342	788962.91621	1005.22000
653.0	L	15126788.12046	789063.72177	1002.50000
653.2	R	15127281.90158	788188.34556	1002.26000
653.4	L	15128416.06744	788670.23765	1006.07000

CONDITION OF MISSOURI RIVER CONTROL POINTS:

1. NO EFFORT HAS BEEN MADE TO MONITOR THESE POINTS. SOME HAVE ERODED INTO THE RIVER WHILE OTHERS MAY BE BURIED UNDER 1-5 FEET OF SEDIMENT.

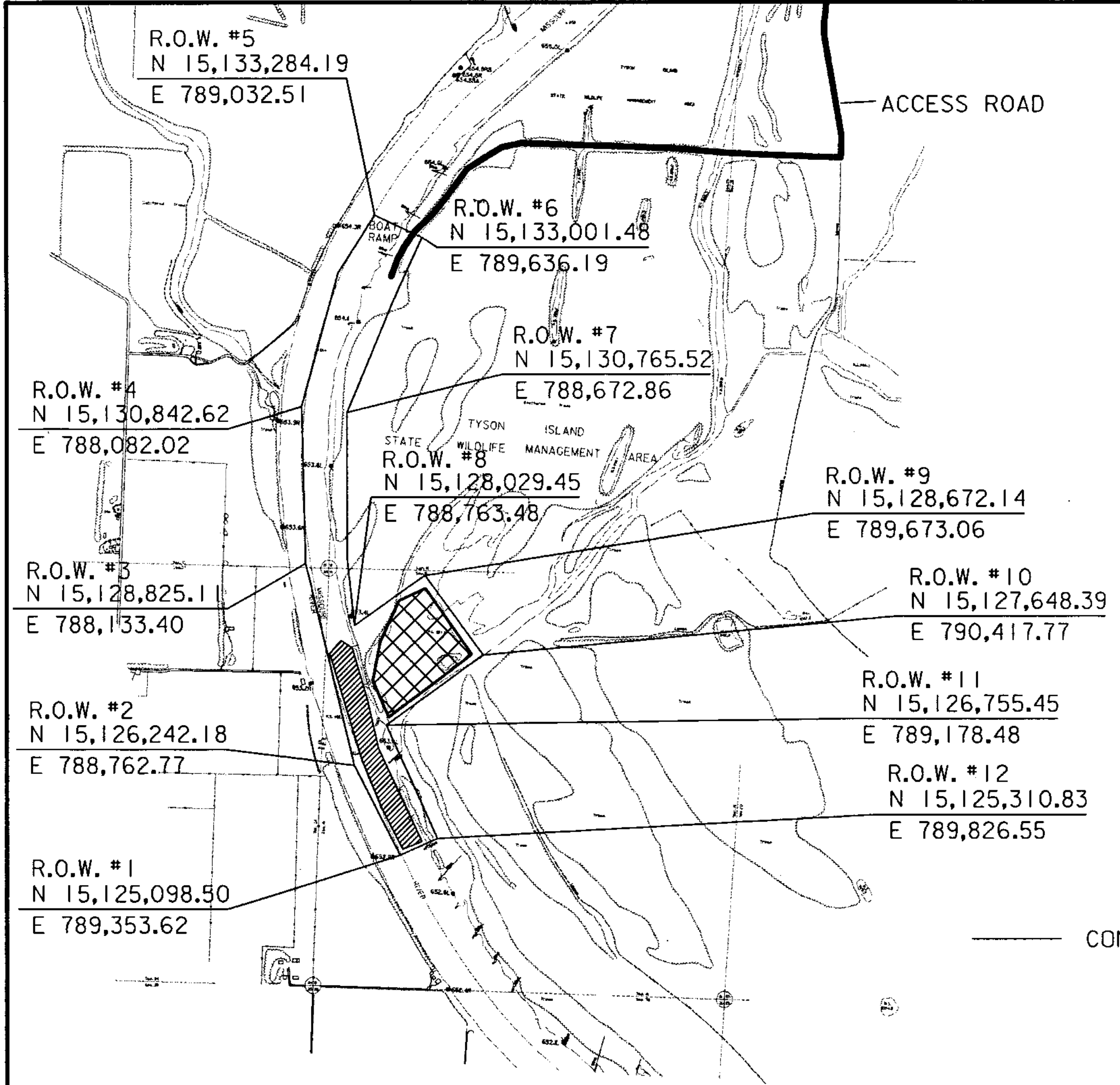
2. EACH CONTROL POINT IS A 3-1/4 INCH DIAMETER CORPS OF ENGINEERS BRASS CAP. THEY ARE STAMPED WITH THE RIVER MILE AND LEFT/RIGHT BANK.

3. THE CONTROL POINTS ARE MARKED WITH ORANGE FIBERGLASS WITNESS POSTS (CARSONITE BRAND). THE POSTS WERE TYPICALLY SET 3-8 INCHES LANDWARD OF THE BRASS CAP.

4. HORIZONTAL CONTROL: UTM ZONE 15, NAD 83
VERTICAL CONTROL: NGVD 29 (ALSO REFERENCED AS "MEAN SEA LEVEL" DATUM)

Sheet No.	Computer File: Sheet2.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; IOWA / NEBRASKA BACKWATER DREDGING PROJECT TYSON BEND AT RIVER MILE 653.2 BENCHMARK INFOMATION	Submitted by:	Designed by: R.G.P.	Checked by: J.I.R.
T2	Date: APR. 2004	Contract No. W9128F-04-C-000X			Chief SED. & CHAN. STAB. Section	Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X						

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



EXCAVATION NOTES:
1. THE CONTRACTOR CAN EXCAVATE THE CHANNEL BY HYDRAULIC DREDGE (PER SPEC 02482) AND DISPOSE THE MATERIAL EXCAVATED FROM THE CHANNEL DIRECTLY INTO THE MISSOURI RIVER (DOWN STREAM OF THE CHANNEL ENTRANCE) BY HYDRAULIC METHODS (PER SPEC 2482).
2. THE CONTRACTOR CAN EXCAVATE THE CHANNEL BY MECHANICAL EXCAVATION AND DISPOSE OF THE MATERIAL EXCAVTED FROM THE CHANNEL OFF SITE IN A GOVERNMENT APPROVED LANDFILL.

GENERAL NOTES:
1. ALL AREAS OUTSIDE OF THE EXCAVATION LIMITS DISTURBED BY CONSTRUCTION AND NOT OTHERWISE PAVED SHALL BE SEEDED (PER APES 02935).
2. THE CONTRACTOR WILL NEED TO PROVIDE THEIR OWN STAGING AREA.

N

LEGEND

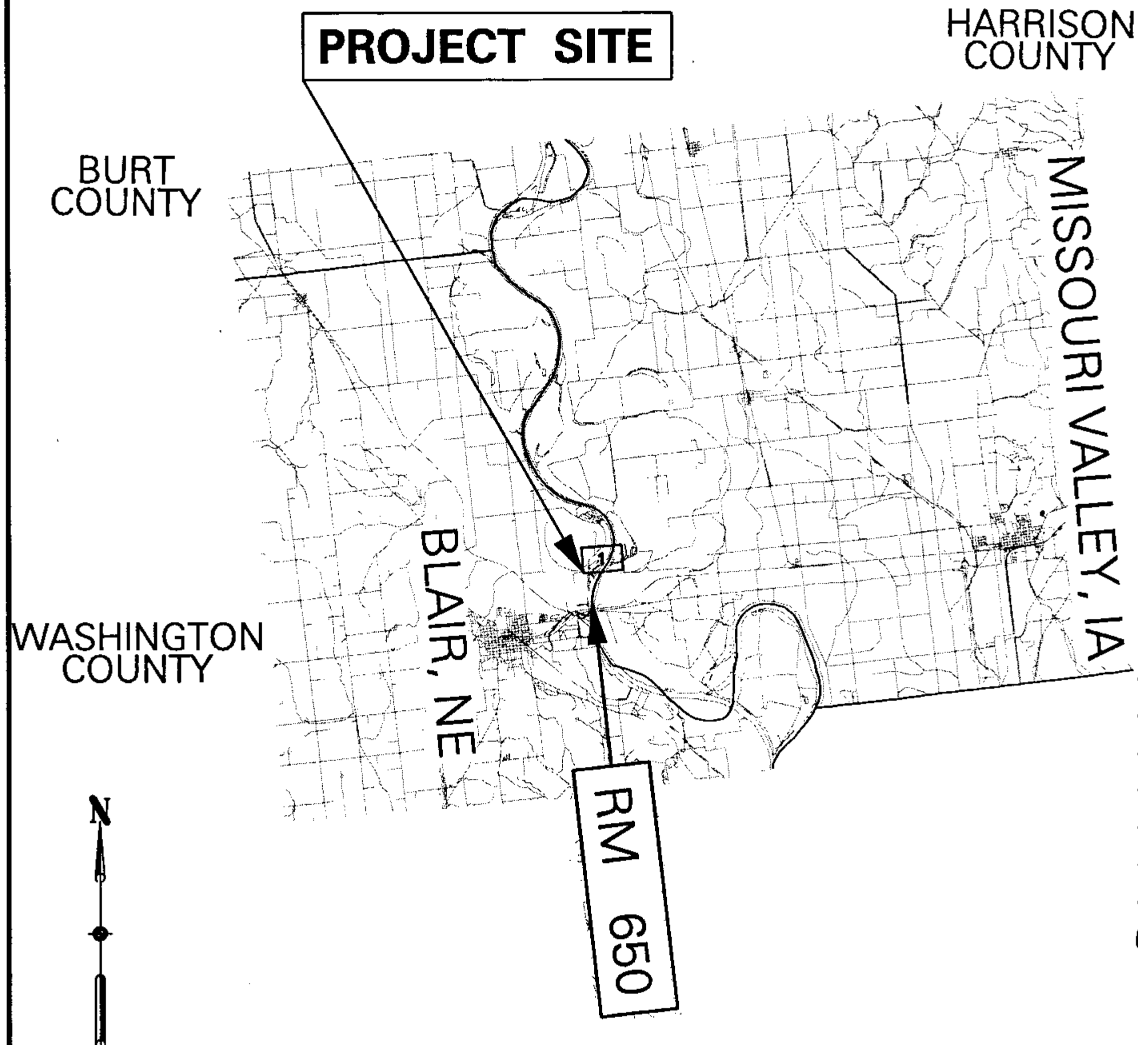
CONSTRUCTION R.O.W. BOUNDARY

SCALE: 1 INCH =2000FEET
2000' 0 2000'

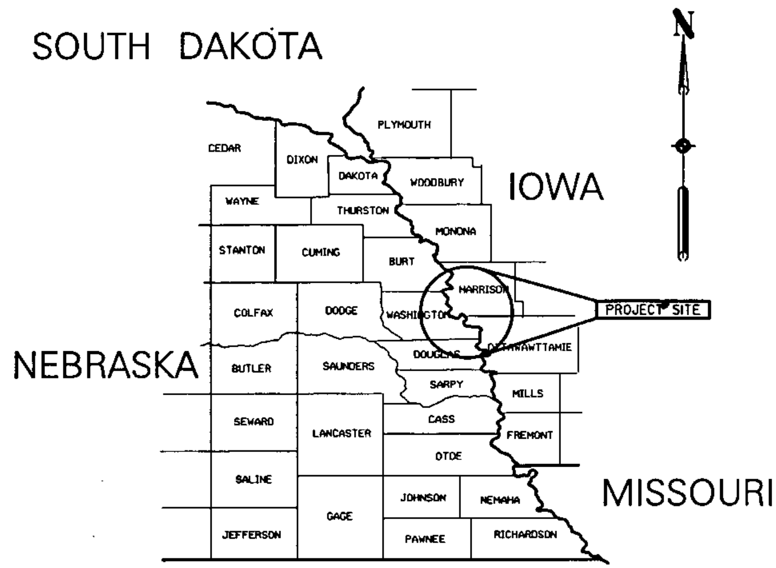
Sheet No.	Computer File: sheet3.dgn	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; IOWA / NEBRASKA BACKWATER DREDGING PROJECT TYSON BEND AT RIVER MILE 653.2 GENERAL PLAN VIEW AND RIGHT-OF-WAY	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P.	Checked by: J.I.R.
T3	Date: APR. 2004	Contract No. W9128F-04-C-000X				Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X						


Tyson Bend
Backwater Dredging
Project
Missouri River
655.1
655
654.8
654.7
654.6
654.5
654.4
654.3
654.2
654.1
654
653.8
653.7
653.6
653.5
653.4
653.2
653.1
653
652.9
652.8
652.7
652.6
Dredge Area
25 Acres
Dredge Disposal Area
FOR INFORMATION ONLY
THIS DRAWING INCLUDED FOR INFORMATION ONLY
Legend
1960 Missouri River Mile
Dredge Area
Dredge Discharge Area
N
W
E
S
0.1
0
0.1
0.2
0.3
Miles

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



VICINITY MAP
NOT TO SCALE



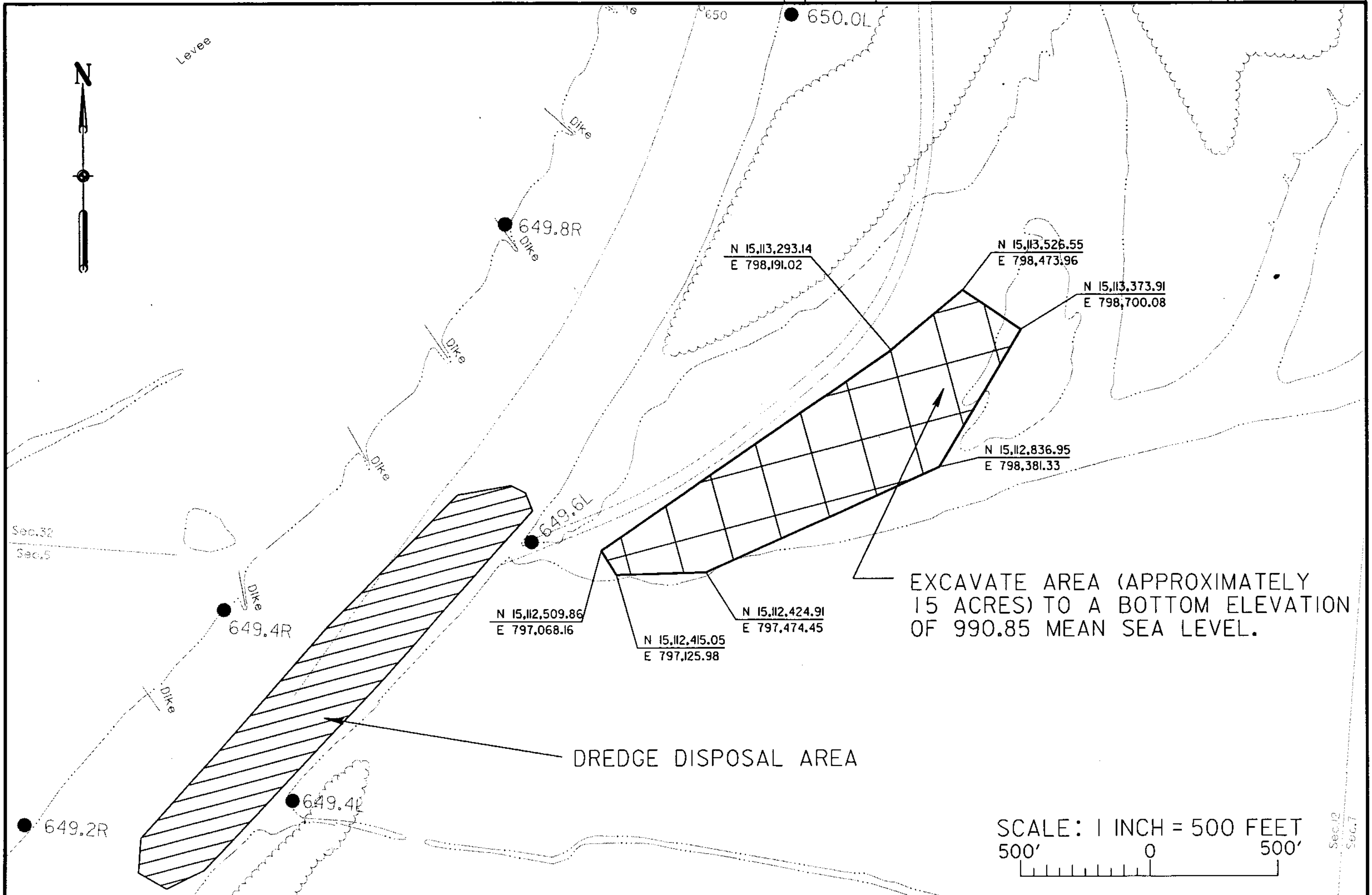
LOCATION MAP
NOT TO SCALE

LEGEND

Symbol	Description
	PILE DIKE
	STONE FILL DIKE OR REVETMENT OR PILE DIKE STONE FILL
	PILE REVETMENT
	PILE REVETMENT, STONE FILL
	TOE TRENCH OR STANDARD REVETMENT OR REINFORCED STD. REVET. OR ACCRETMENT
	ASPHALT REVETMENT
	DESIGNED STABILIZED CHANNEL LINE
	BLUFF LINE
○569	1960 CHANNEL MILAGE
580.3	BEND CHANGE
615.8	STRUCTURE NUMBERS ARE BASED ON 1890 MILAGE
CRP	THIS IS THE CONTRUCTION REFERENCE PLANE WHICH REPRESENTS A SYNTHESIZED WATER SURFACE PROFILE OF A STEADY DISCHARGE THAT IS EQUALED OR EXCEEDED 75% OF THE TIME DURING THE NAVIGATION SEASON (APRIL - NOVEMBER).

Sheet No.						
C0	Computer File: SHEETØ.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; IOWA / NEBRASKA BACKWATER DREDGING PROJECT CALIFORNIA BEND AT RIVER MILE 649.6 SITE MAP	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P. / Checked by: J.I.R.
	Date: APR. 2004	Contract No. W9128F-04-C-000X				Reviewed by: J.I.R. / Drawn by: R.G.P.
	Drawing Code:	PUBDATA\RICKP\X				

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



Sheet No.	Computer File: SHEET1.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; IOWA / NEBRASKA BACKWATER DREDGING PROJECT CALIFORNIA BEND AT RIVER MILE 649.6 SITE MAP	Submitted by:	Designed by: R.G.P.	Checked by: J.I.R.
C1	Date: APR. 2004	Contract No. W9128F-04-C-000X			Chief SED. & CHAN. STAB. Section	Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X						

	REVISIONS		
SYMBOL	DESCRIPTIONS	DATE	APPROVED

BENCH MARK INFORMATION
COORDINATE POINT

POINT	BANK	NORTHING	EASTING	ELEVATION
649.2	R	15111444.86078	794836.98180	1000.31000
649.4	R	15112281.90304	795599.95678	999.19000
649.4	L	15111534.47065	795875.65028	1001.43000
649.6	L	15112551.85100	796790.55178	998.14000
649.8	R	15113773.97709	796688.82443	1002.83000
650.0	L	15114610.39398	797814.51239	1002.04000

G-21

CONDITION OF MISSOURI RIVER CONTROL POINTS:

1. NO EFFORT HAS BEEN MADE TO MONITOR THESE POINTS. SOME HAVE ERODED INTO THE RIVER WHILE OTHERS MAY BE BURIED UNDER 1-5 FEET OF SEDIMENT.

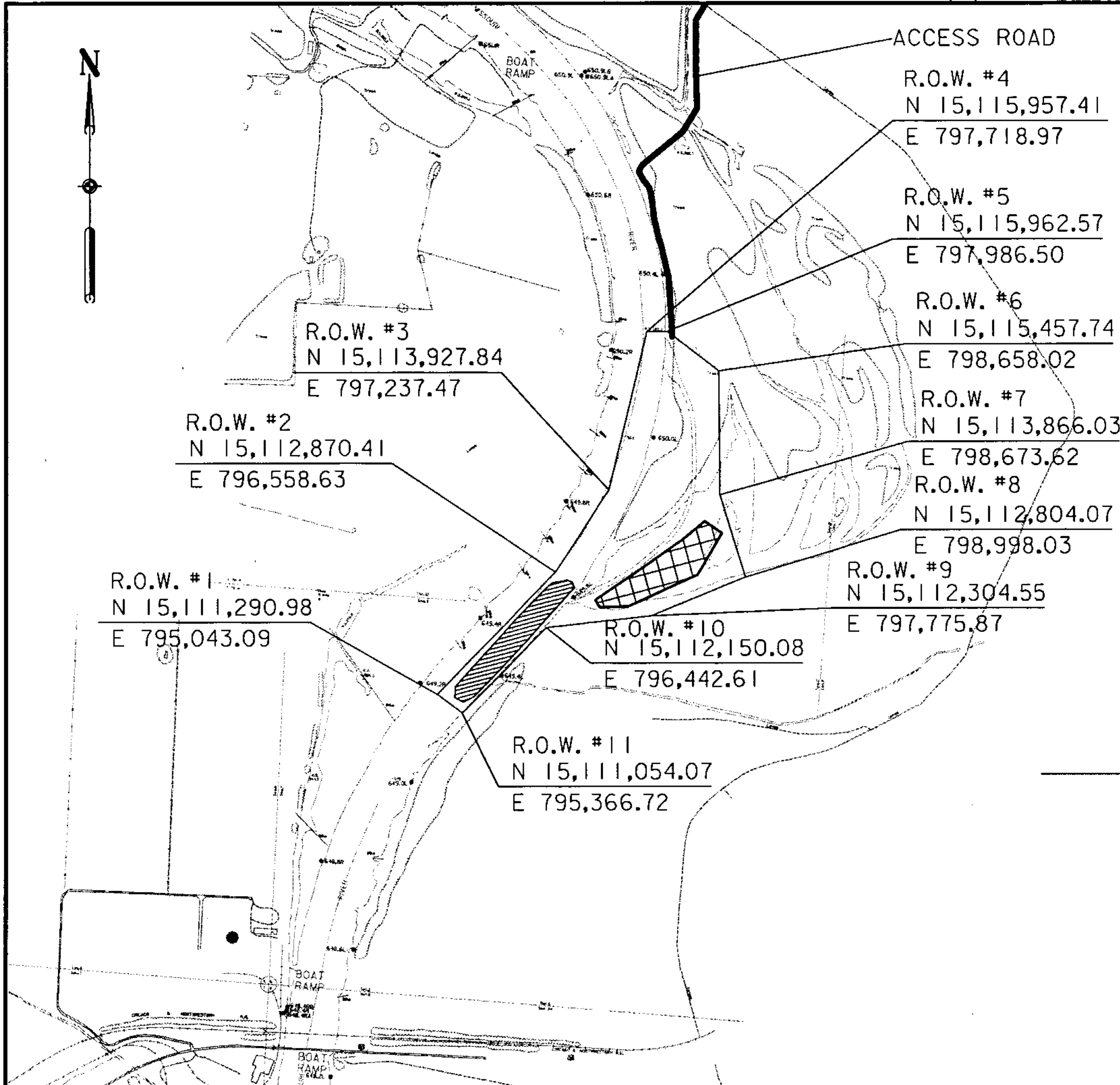
2. EACH CONTROL POINT IS A 3-1/4 INCH DIAMETER CORPS OF ENGINEERS BRASS CAP. THEY ARE STAMPED WITH THE RIVER MILE AND LEFT/RIGHT BANK.

3. THE CONTROL POINTS ARE MARKED WITH ORANGE FIBERGLASS WITNESS POSTS (CARSONITE BRAND). THE POSTS WERE TYPICALLY SET 3-8 INCHES LANDWARD OF THE BRASS CAP.

4. HORIZONTAL CONTROL: UTM ZONE 15, NAD 83
VERTICAL CONTROL: NGVD 29 (ALSO REFERENCED AS "MEAN SEA LEVEL" DATUM)

Sheet No. C2	Computer File: Sheet2.DGN	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; IOWA / NEBRASKA BACKWATER DREDGING PROJECT CALIFORNIA BEND AT RIVER MILE 649.6 BENCHMARK INFOMATION	Submitted by: Chief SED. & CHAN. STAB. Section	Designed by: R.G.P.	Checked by: J.I.R.
	Date: APR. 2004	Contract No. W9128F-04-C-000X				Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code: PUBDATA\RICKP\X						

REVISIONS	SYMBOL	DESCRIPTIONS	DATE	APPROVED



EXCAVATION NOTES:

1. THE CONTRACTOR CAN EXCAVATE THE CHANNEL BY HYDRAULIC DREDGE (PER SPEC 02482) AND DISPOSE THE MATERIAL EXCAVATED FROM THE CHANNEL DIRECTLY INTO THE MISSOURI RIVER (DOWN STREAM OF THE CHANNEL ENTRANCE) BY HYDRAULIC METHODS (PER SPEC 2482).
2. THE CONTRACTOR CAN EXCAVATE THE CHANNEL BY MECHANICAL EXCAVATION AND DISPOSE OF THE MATERIAL EXCAVTED FROM THE CHANNEL OFF SITE IN A GOVERNMENT APPROVED LANDFILL.

GENERAL NOTES:

1. ALL AREAS OUTSIDE OF THE EXCAVATION LIMITS DISTURBED BY CONSTRUCTION AND NOT OTHERWISE PAVED SHALL BE SEEDED (PER APES 02935).
2. THE CONTRACTOR WILL NEED TO PROVIDE THEIR OWN STAGING AREA.

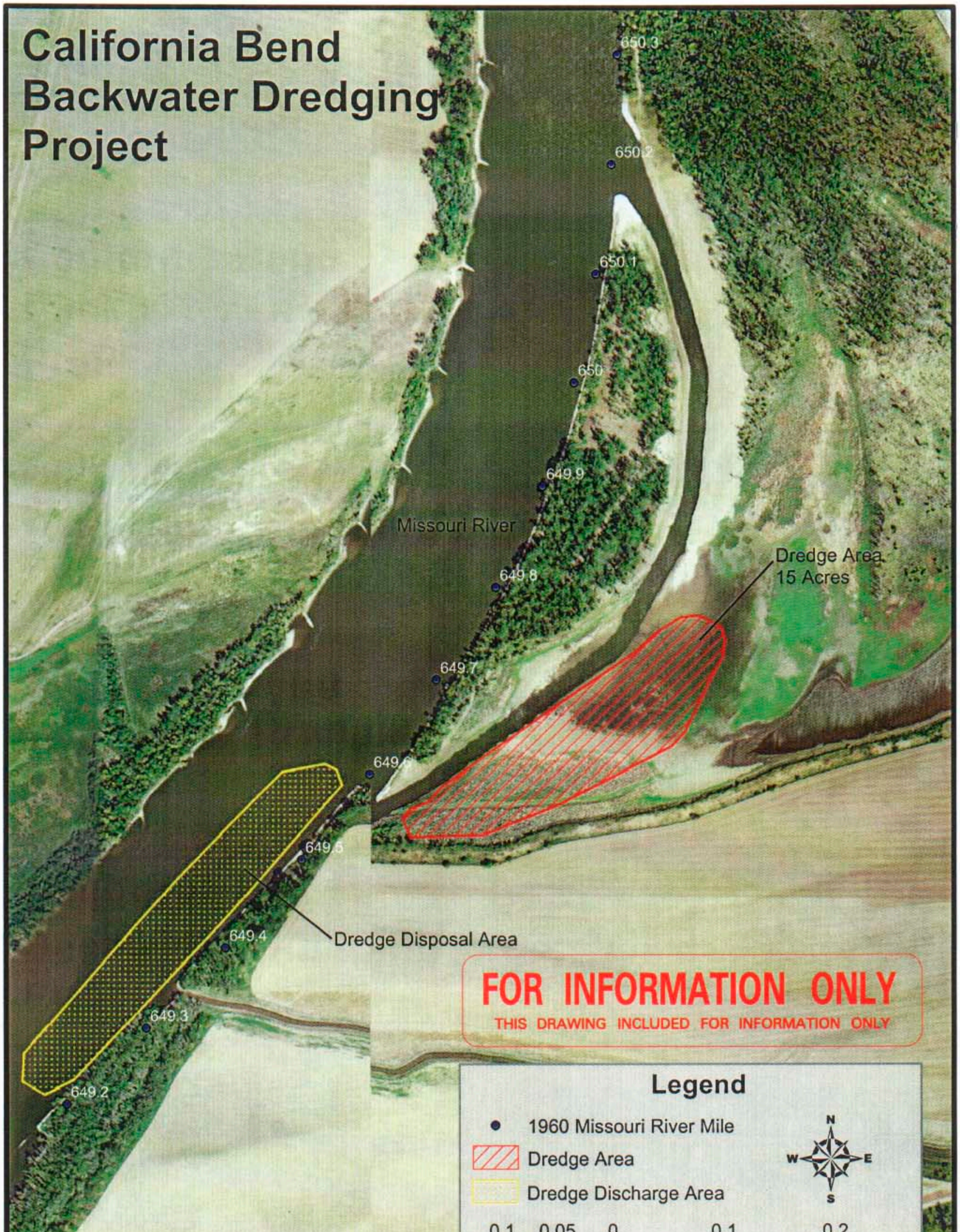
LEGEND

CONSTRUCTION R.O.W. BOUNDARY

SCALE: 1 INCH =2000FEET

2000′ 0 20000′

Sheet No. C3	Computer File: sheet3.dgn	Spec. No. W9128F-04-R-000X	U S ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA	MISSOURI RIVER; IOWA / NEBRASKA BACKWATER DREDGING PROJECT CALIFORNIA BEND AT RIVER MILE 649.6	Submitted by:	Designed by: R.G.P.	Checked by: J.I.R.
	Date: APR. 2004	Contract No. W9128F-04-C-000X		GENERAL PLAN VIEW AND RIGHT-OF-WAY	Chief SED. & CHAN. STAB. Section	Reviewed by: J.I.R.	Drawn by: R.G.P.
	Drawing Code:	PUBDATA\RICKP\X					



California Bend Backwater Dredging Project
650.3
650.2
650.1
650
649.9
Missouri River
649.8
Dredge Area 15 Acres
649.7
649.6
649.5
649.4
Dredge Disposal Area
649.3
649.2
FOR INFORMATION ONLY
THIS DRAWING INCLUDED FOR INFORMATION ONLY
Legend
1960 Missouri River Mile
Dredge Area
Dredge Discharge Area
N
W
E
S
0.1 0.05 0 0.1 0.2
Miles

APPENDIX H

INDIVIDUAL PROJECT DESIGNS

Monkey Mountain Overview

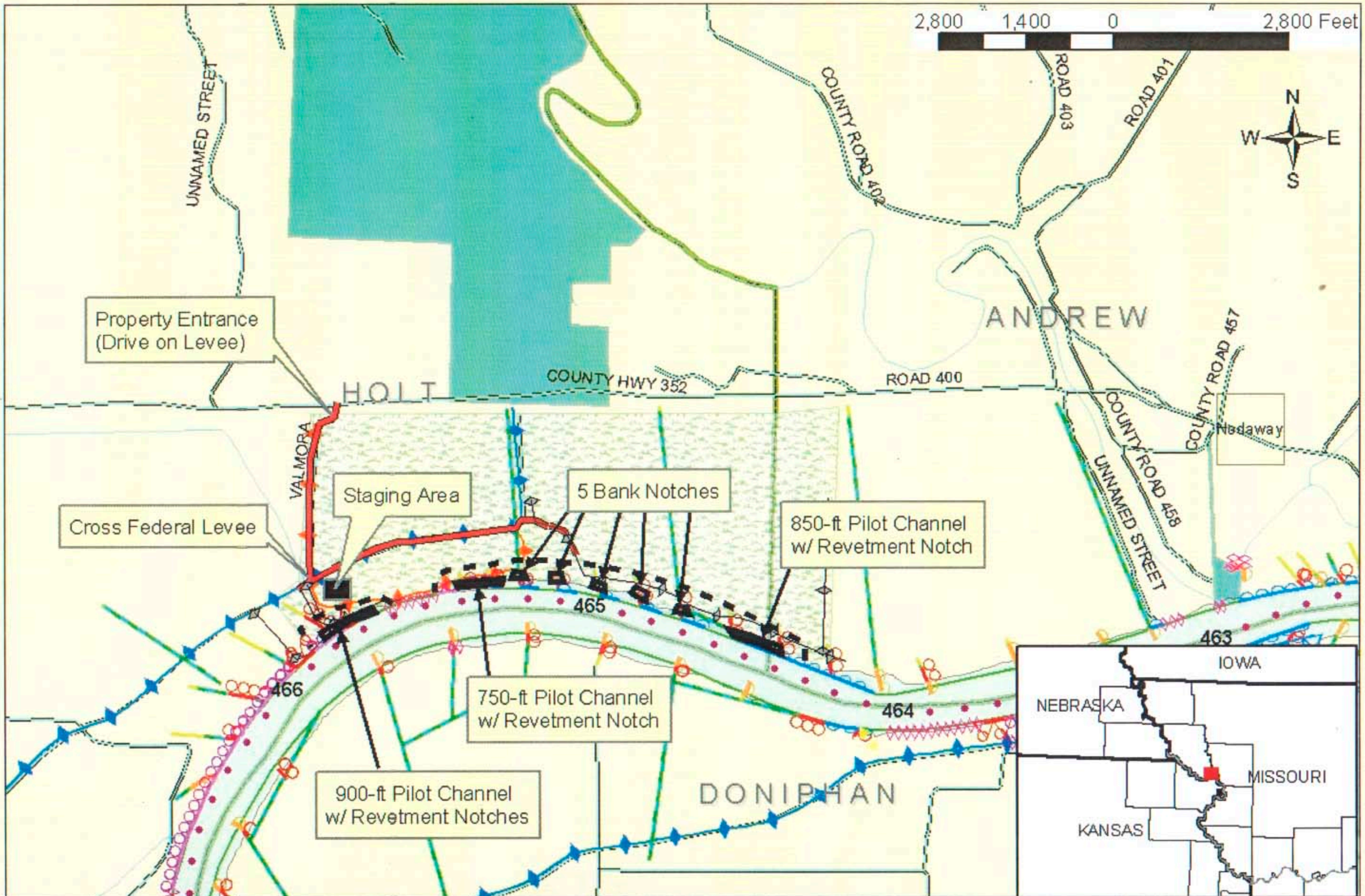
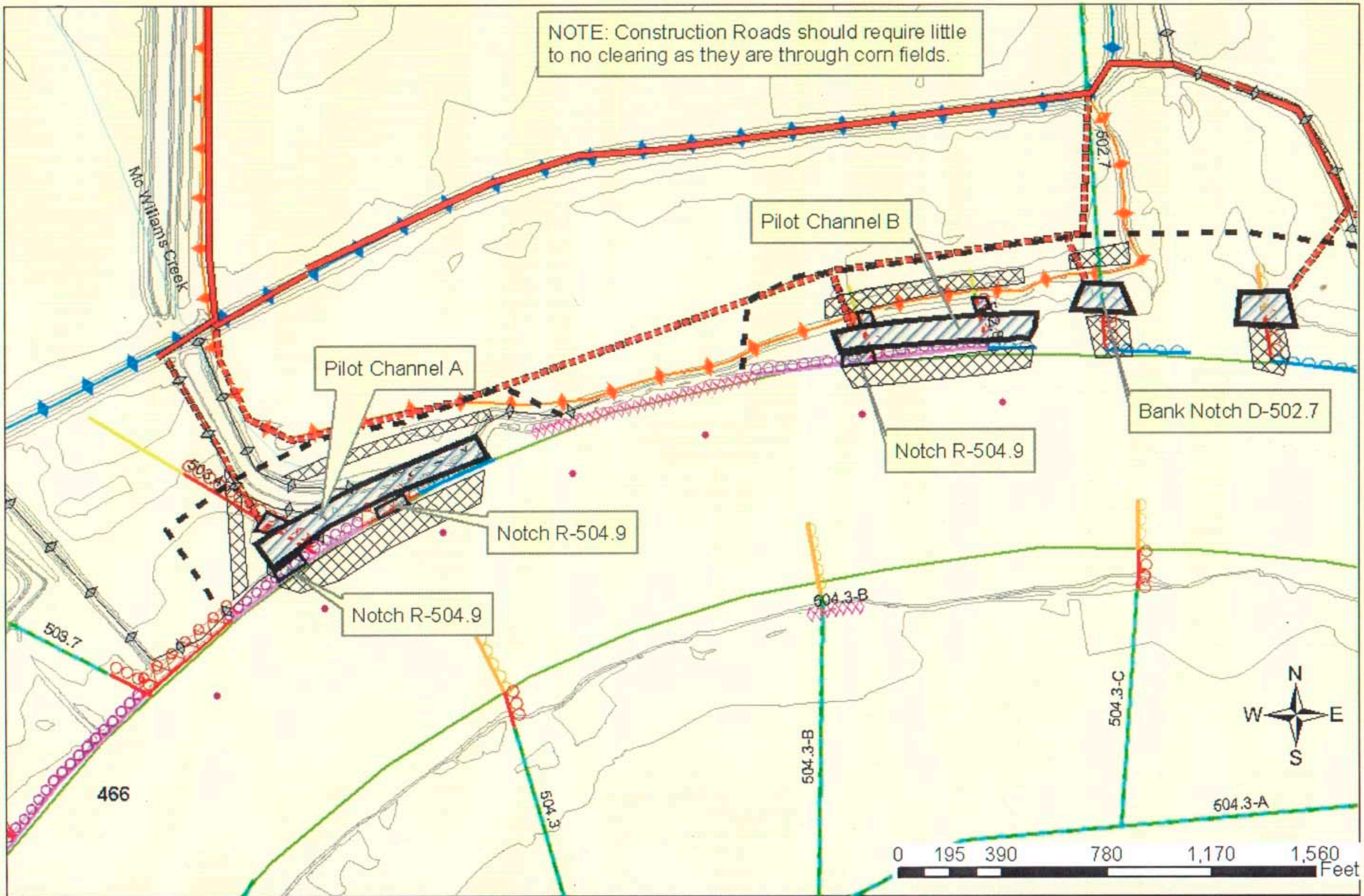


Figure 1. Monkey Mountain Overview
Shallow Water Habitat Restoration

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004



Legend

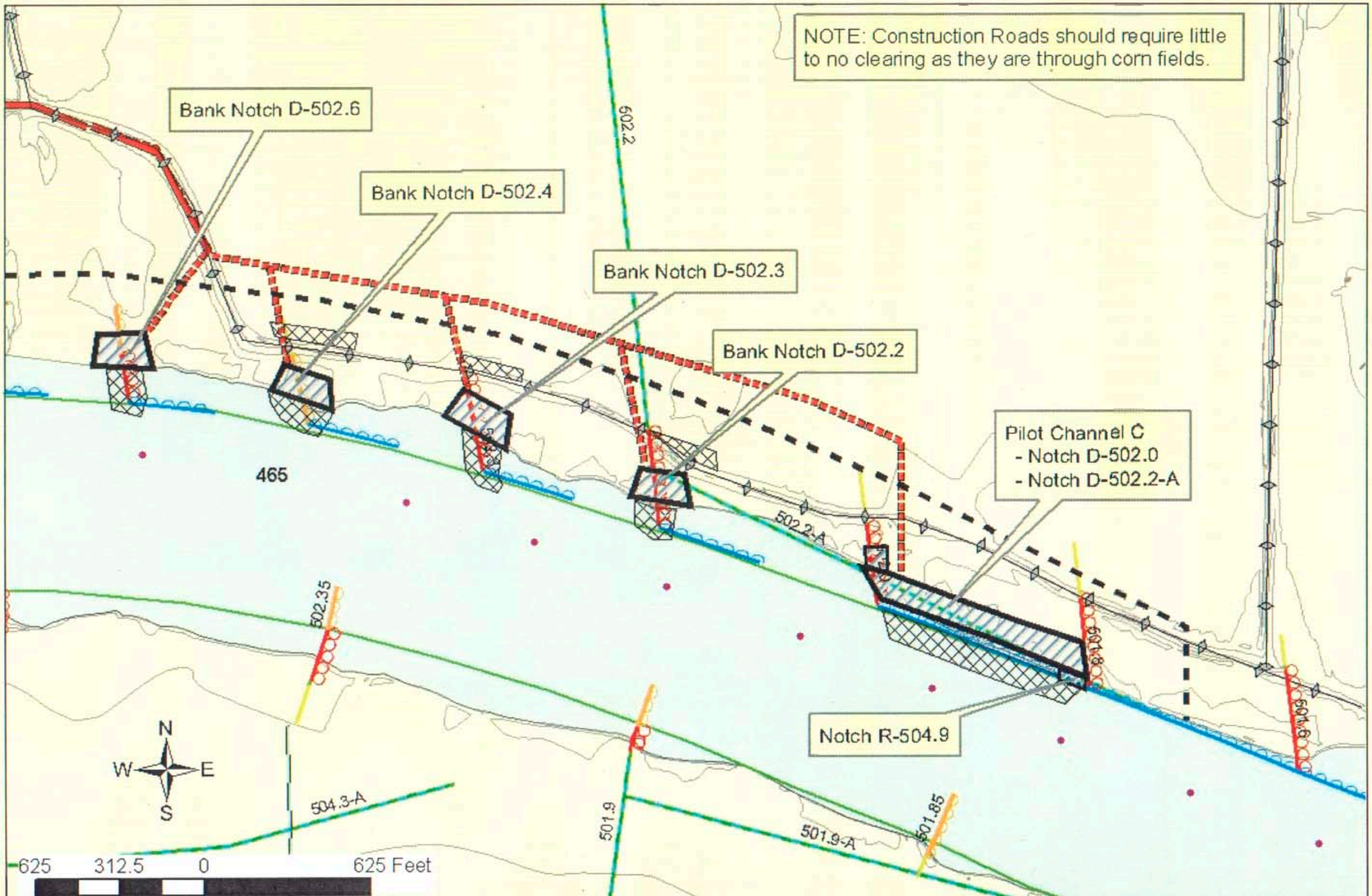
- Excavation
- Spoil
- Easement
- Ag Levee
- Access RD
- Construction RD

Figure 2. Monkey Mountain: Construction Details: RM 465.8 - 465.2

Shallow Water Habitat Restoration

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004

K:\projects\cu\SWH\arcgis\maps\monkey\ltr\monkey_fig2.mxd



Legend

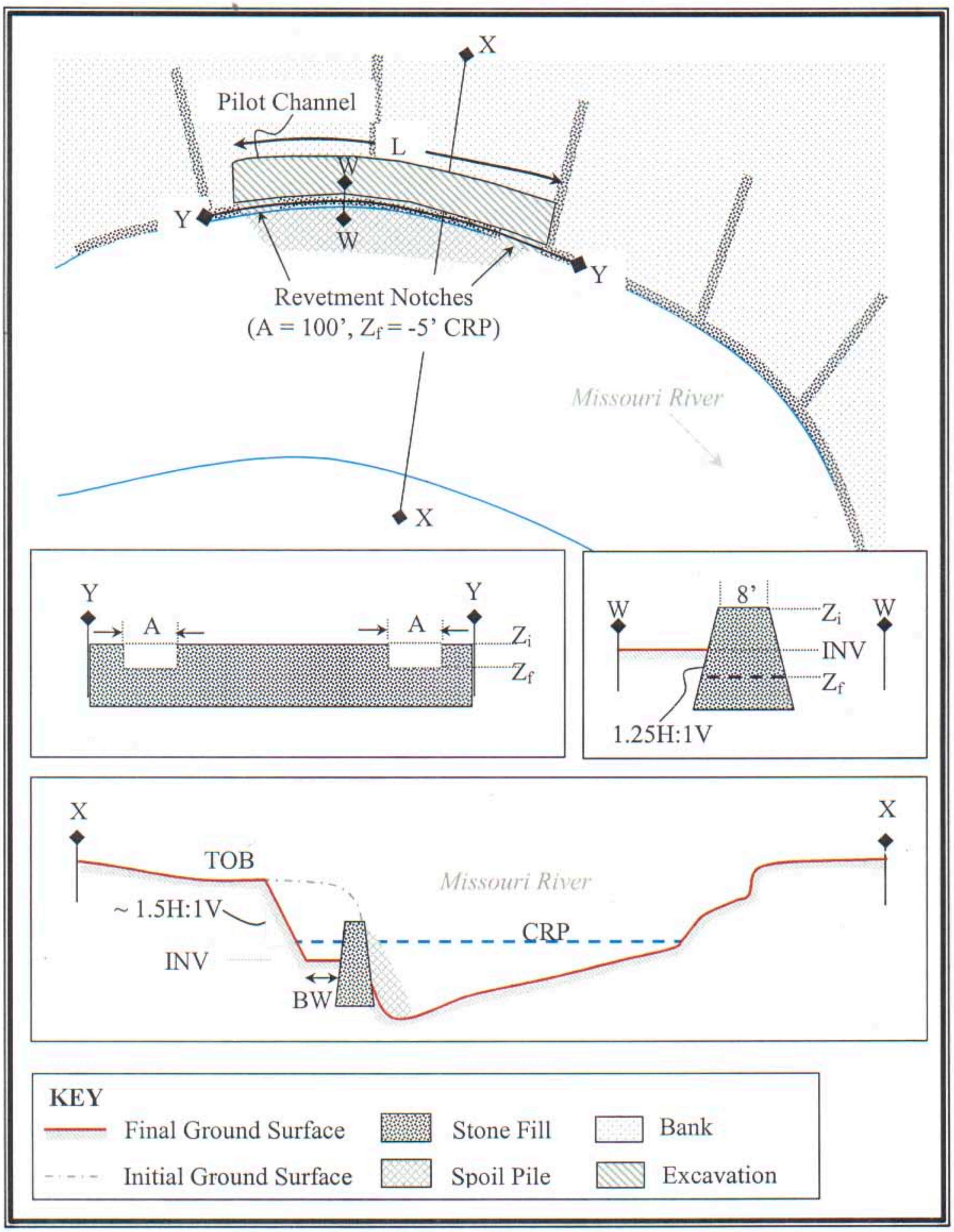
- Excavation
- Spoil
- Easement
- Ag Levee
- Access_RD
- Construction_RD

Figure 3. Monkey Mountain
Construction Details: RM 465.1 - 464.3

Shallow Water Habitat Restoration

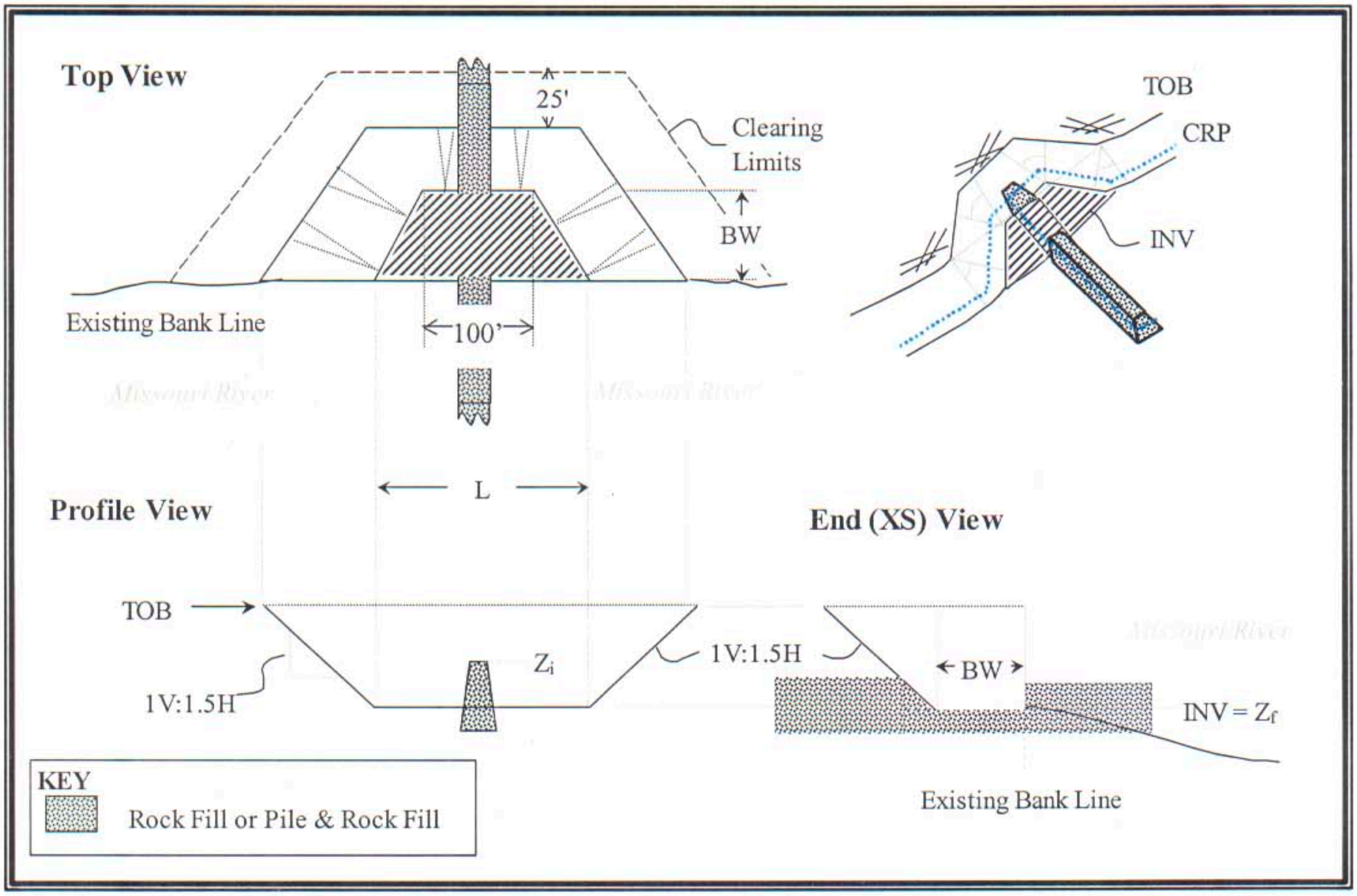
U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004

K:\projects\cu\SWH\arcgis\maps\monkey\mtn\monkey_fig3.mxd



*CRP = Construction Reference Plane = Elevation representing flow exceeded 75% of the time

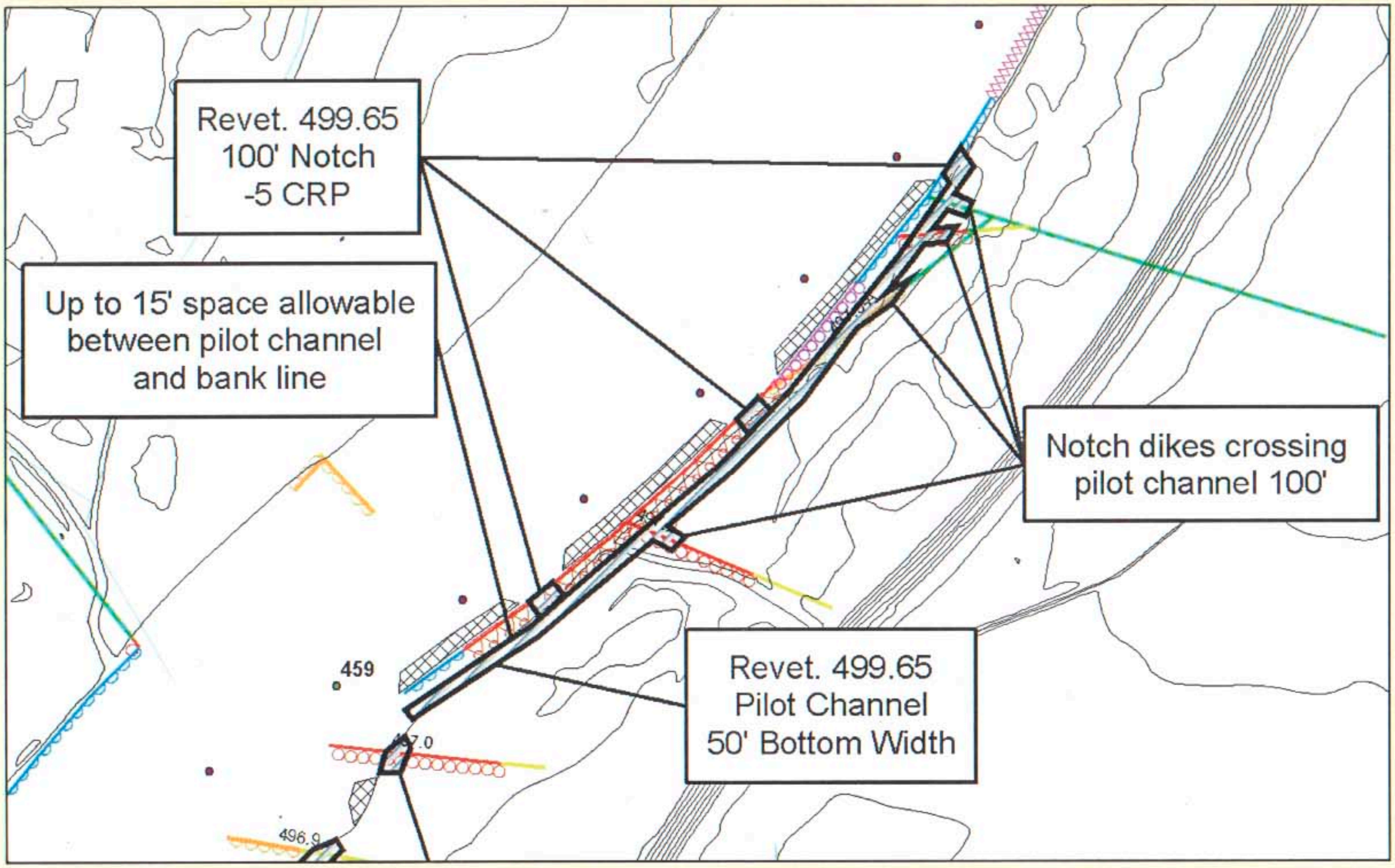
FIGURE 4: PILOT CHANNEL AND REVETMENT NOTCH DETAILS



*CRP = Construction Reference Plane = Elevation Representing Flow Exceeded 75% of the time

FIGURE 5: BANK NOTCH DETAILS

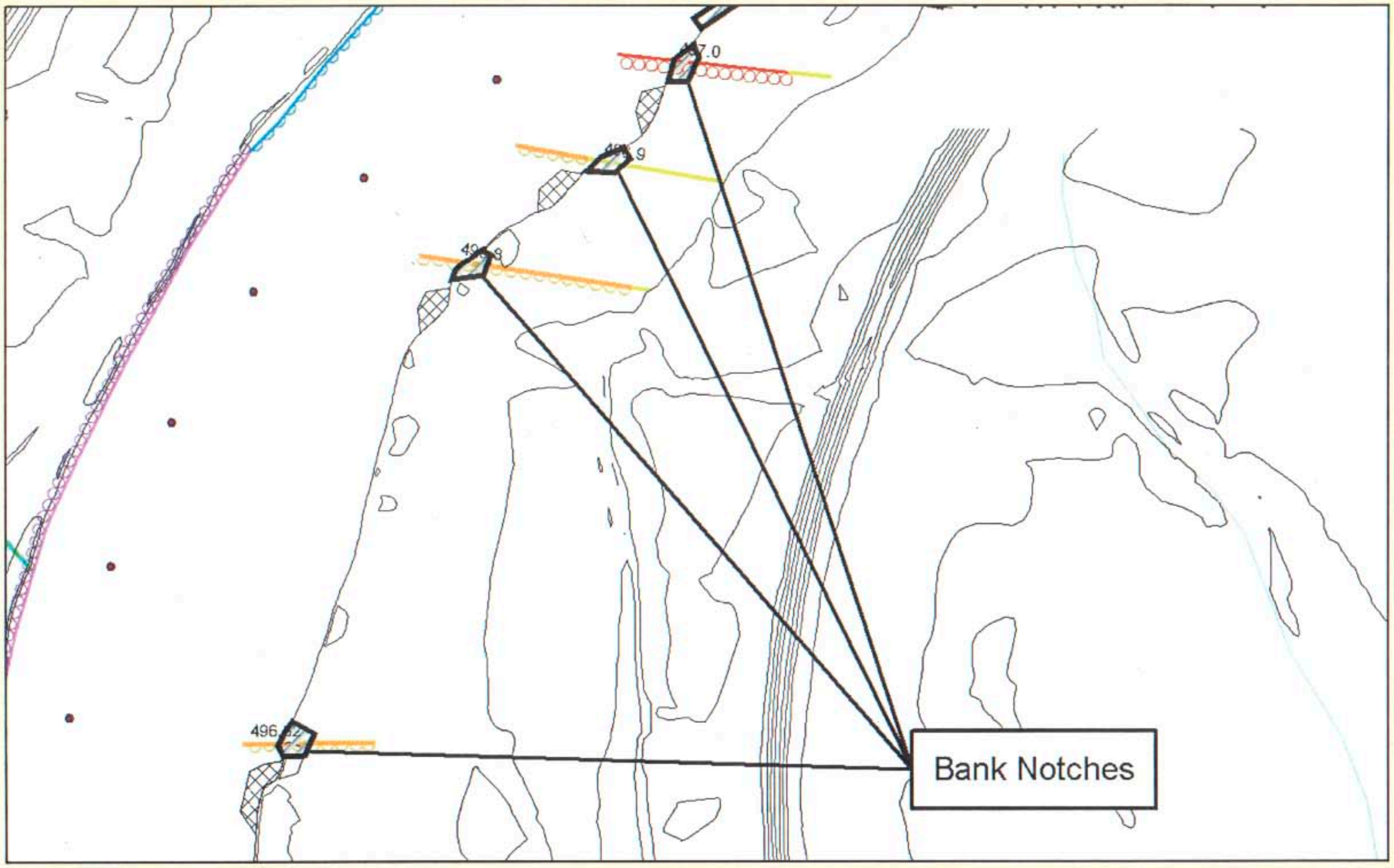
Worthwine Island Conservation Area



Legend
Spoil Locations
Excavation Area

Figure 3a. Worthwine Island Conservation Area
Pilot Channel A

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004



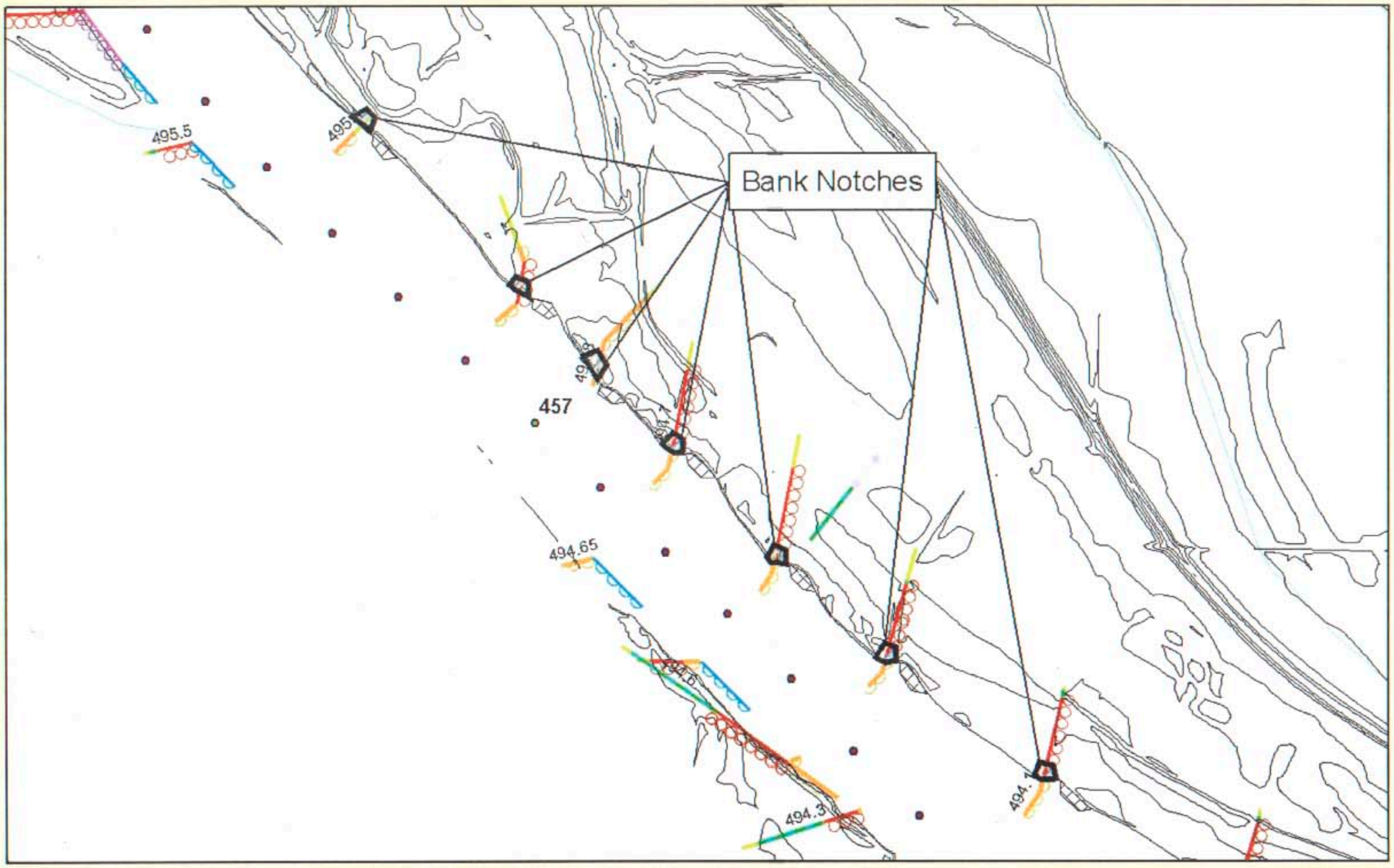
Legend

- Spoil Locations
- Excavation Area

Figure 3b. Worthwine Island Conservation Area

Bank Notches

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004



Legend

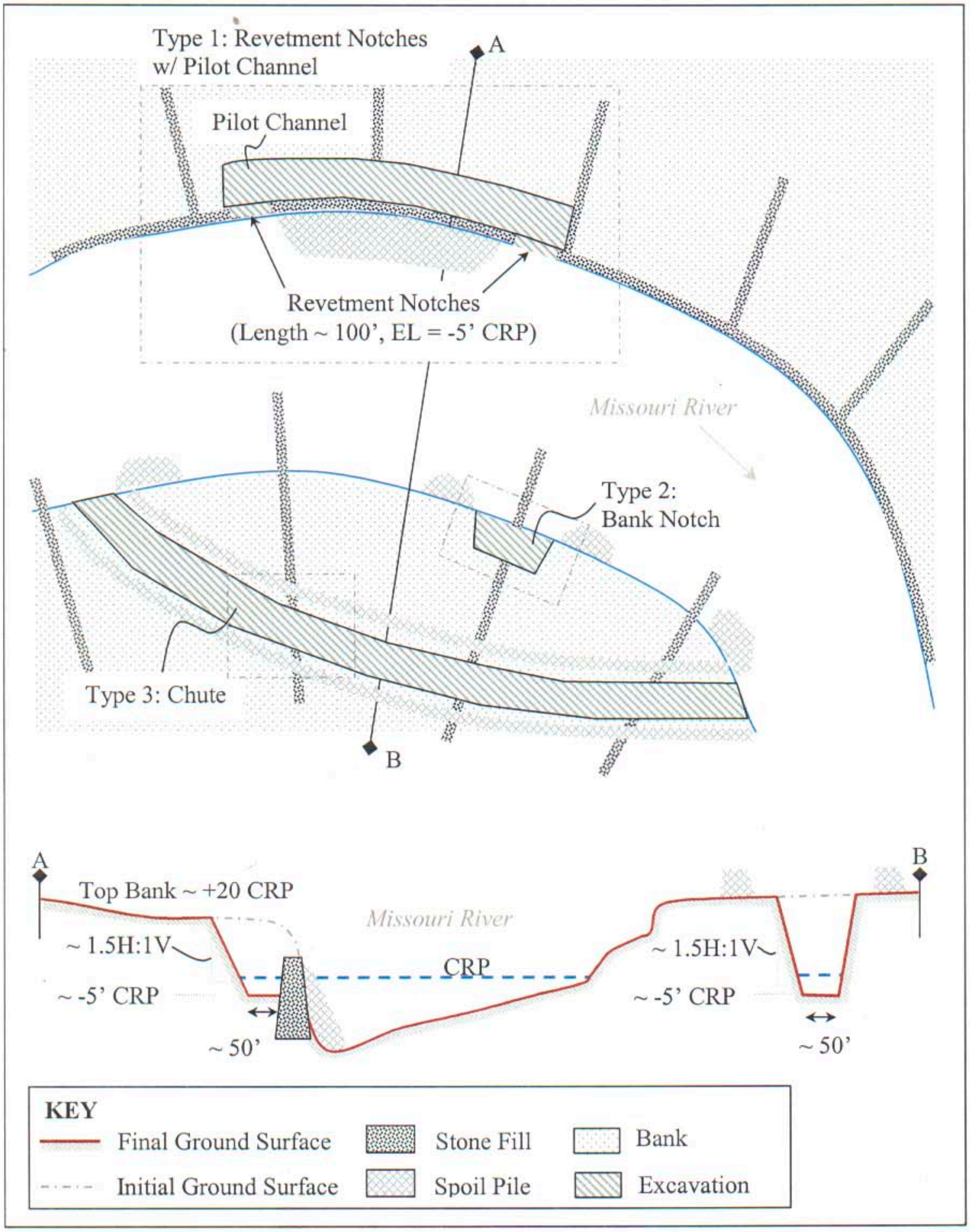
Spoil Locations

Excavation Area

Figure 3c. Worthwine Island Conservation Area

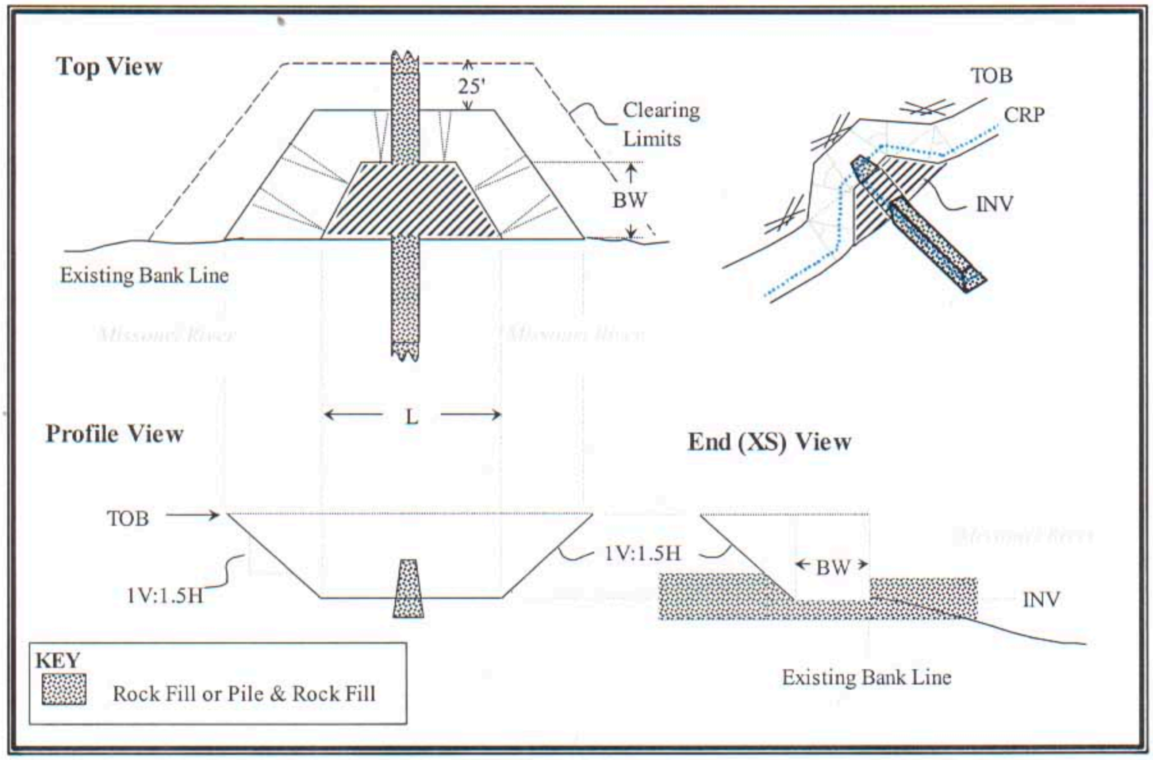
Bank Notches

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004



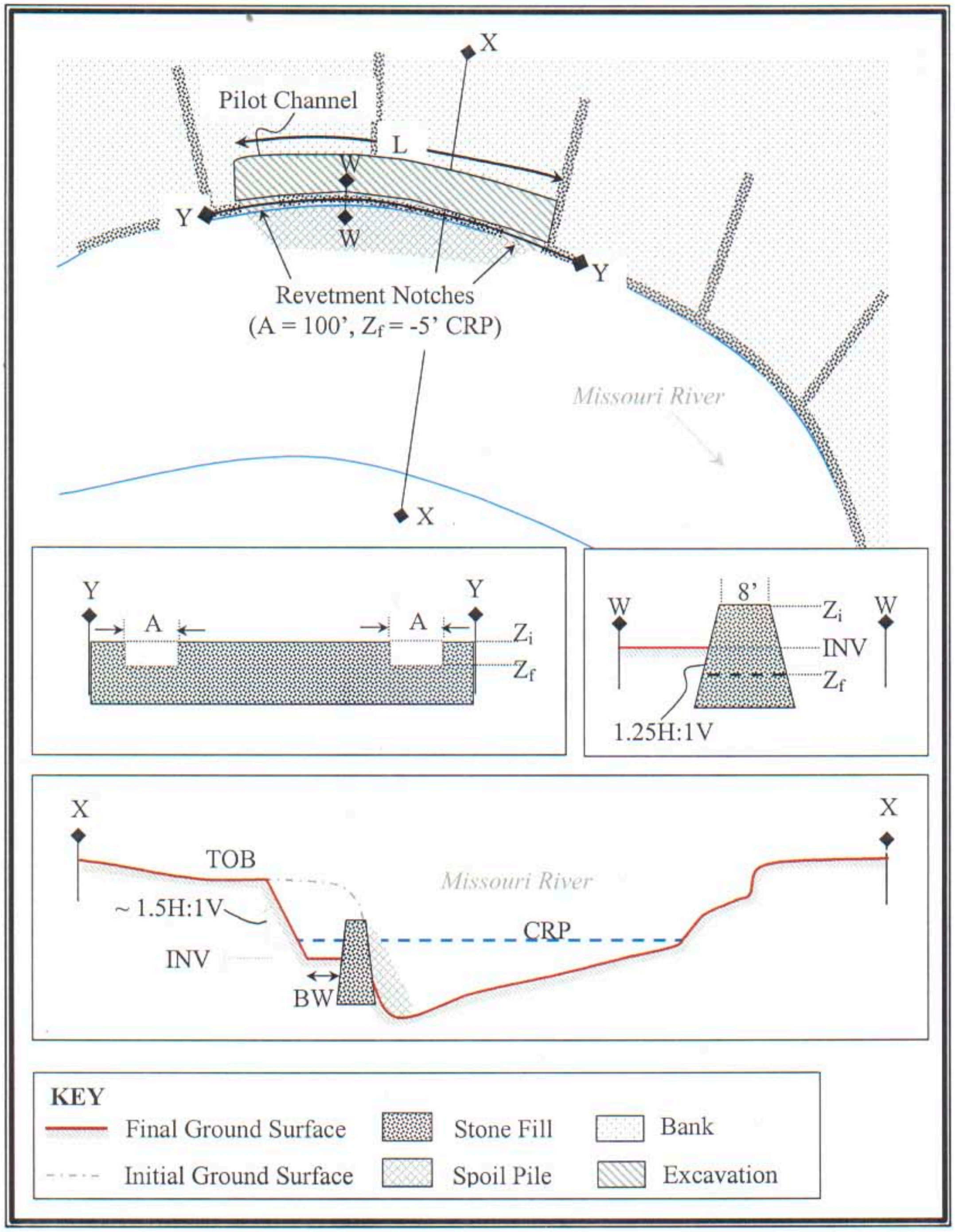
*CRP = Construction Reference Plane = Elevation representing flow exceeded 75% of the time

Figure 2a. Typical Shallow Water Habitat Design



*CRP = Construction Reference Plane = Elevation Representing Flow Exceeded 75% of the time

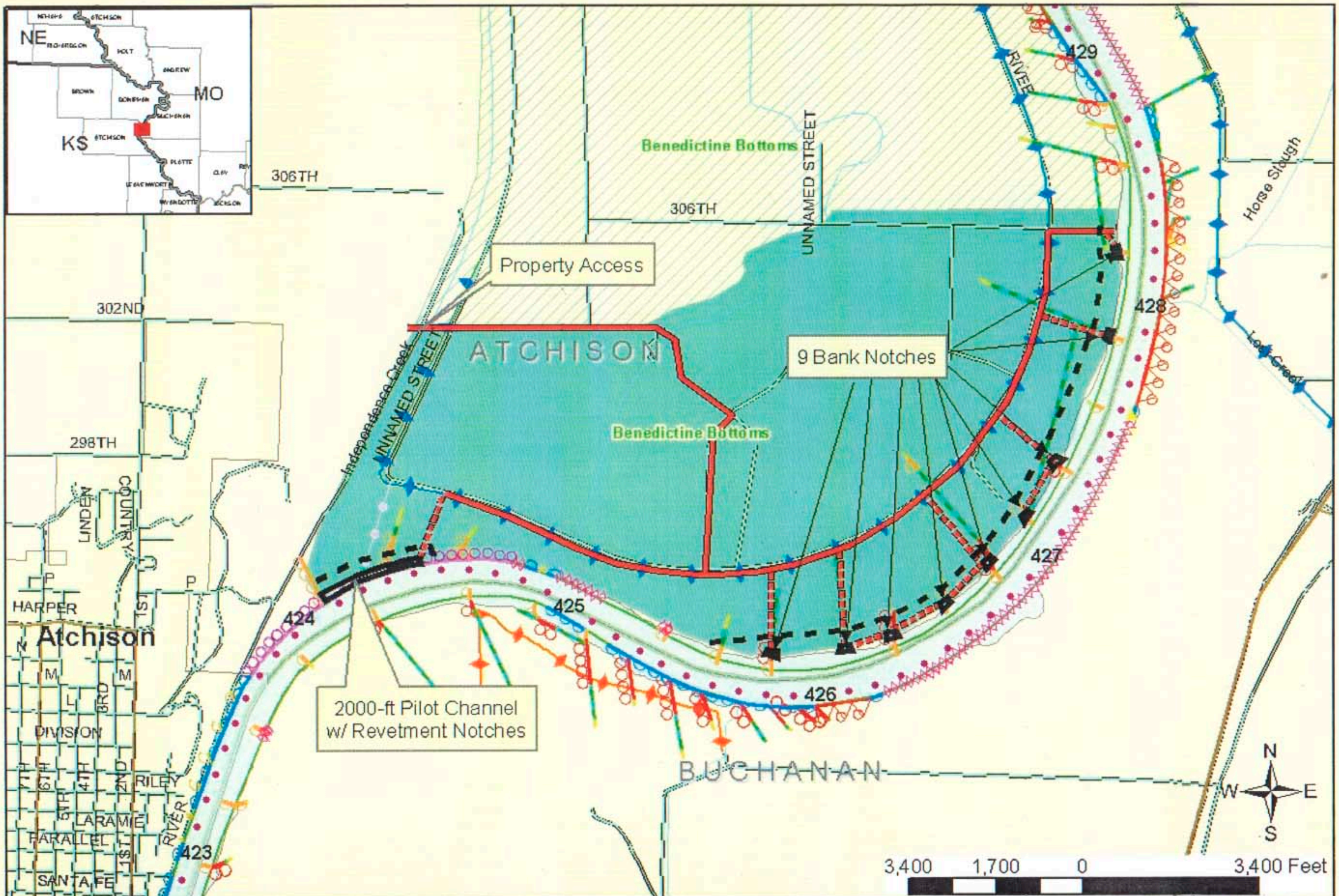
Figure 2b. Typical Bank Notch Detail



*CRP = Construction Reference Plane = Elevation representing flow exceeded 75% of the time

Figure 2c. Typical Pilot Channel Detail

Benedictine Bottoms Overview



Legend

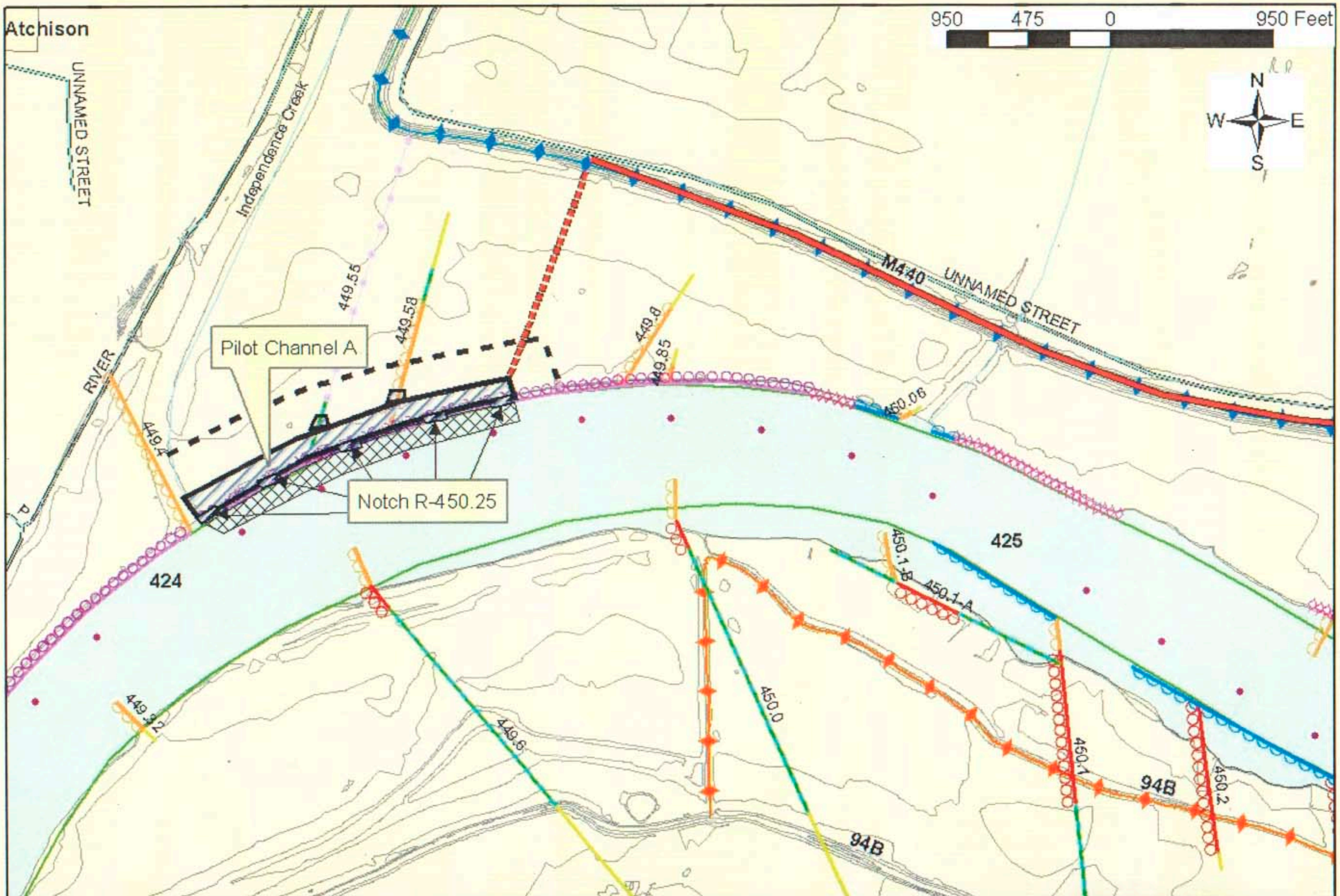
- Excavation
- Easement
- Corps Property
- Access RD
- Construction RD

Figure 1. Benedictine Bottoms Overview

Shallow Water Habitat Restoration

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004

K:\projects\cu\SWH\arcgis\maps\Benedictine\benedictine Btms.mxd



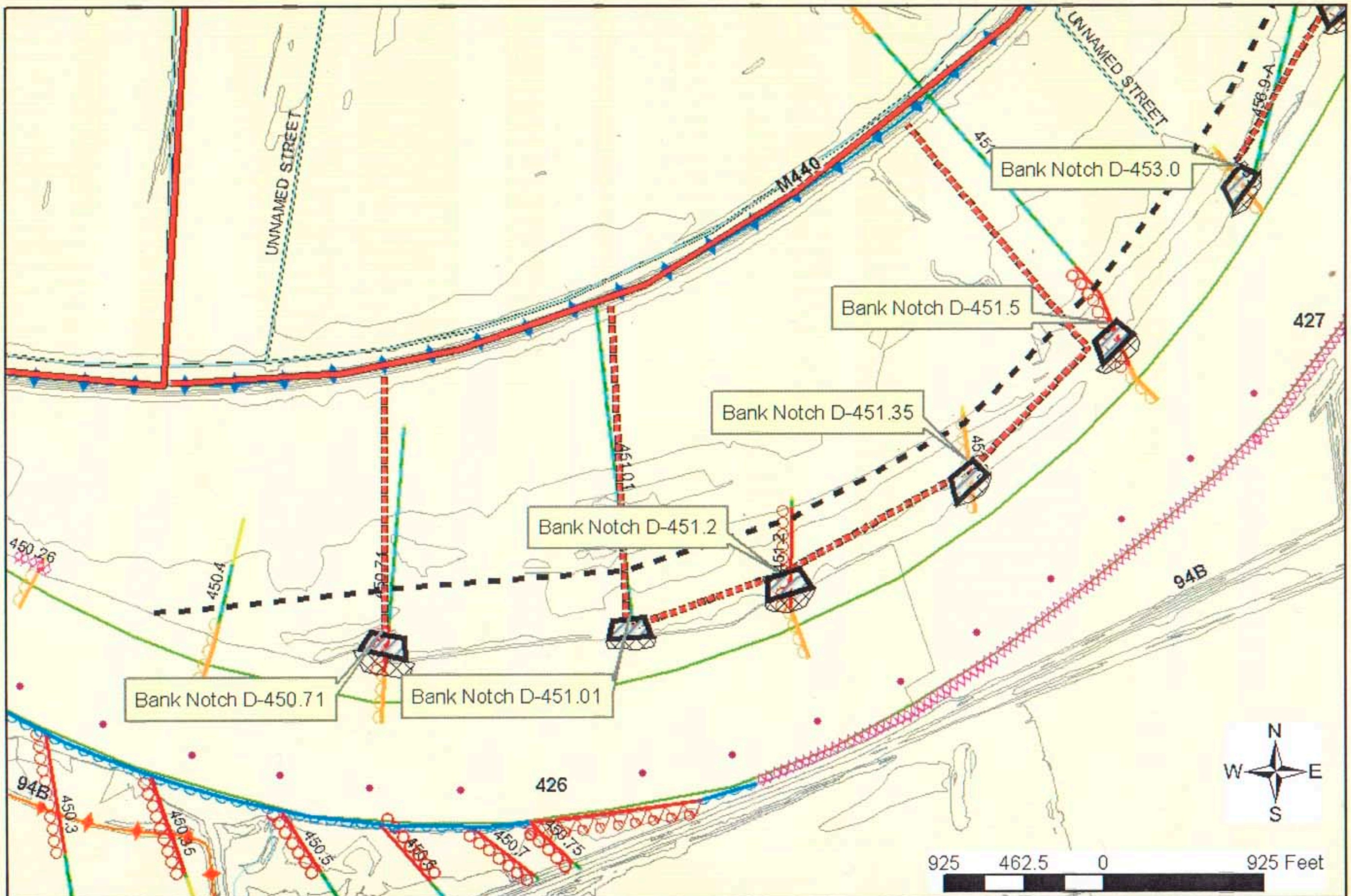
Legend
- Excavation
- Spoil Placement
- Easement
- Access RD
- Construction RD

Figure 2. Benedictine Bottoms: Pilot Channel RM 424.1 - 424.5

Shallow Water Habitat Restoration

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004

K:\projects\cu\SWH\Program aps\Benedictine\Benedictine Fig2.mxd



Legend

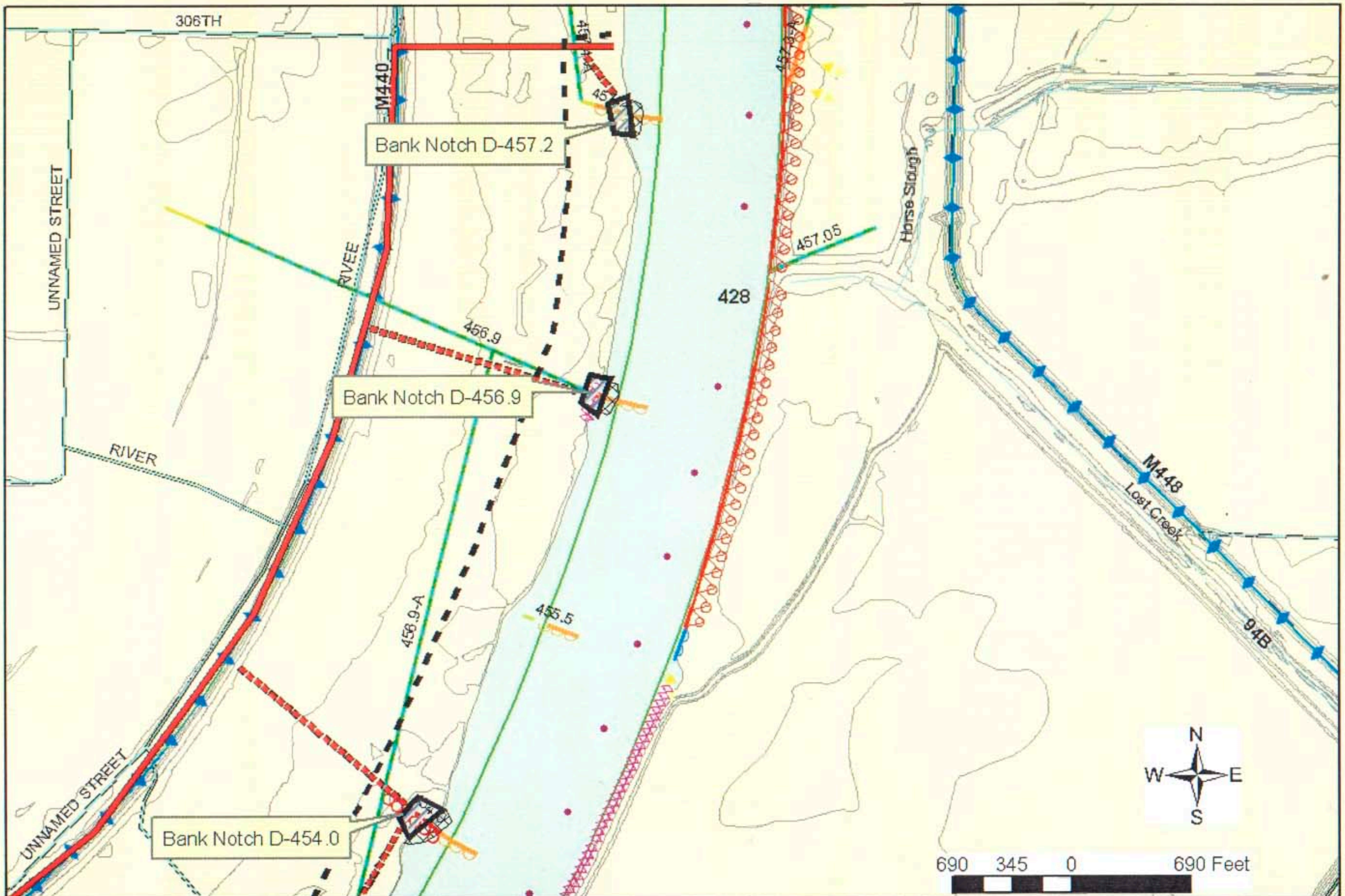
- Excavation
- Spoil Placement
- Easement
- Access_RD
- Construction_RD

Figure 3. Benedictine Bottoms: Bank Notches: RM 425.8 - 427.1

Shallow Water Habitat Restoration

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004

K:\projects\cu\SWH\arcgis\maps\Benedictine\benedictine Fig3.mxd



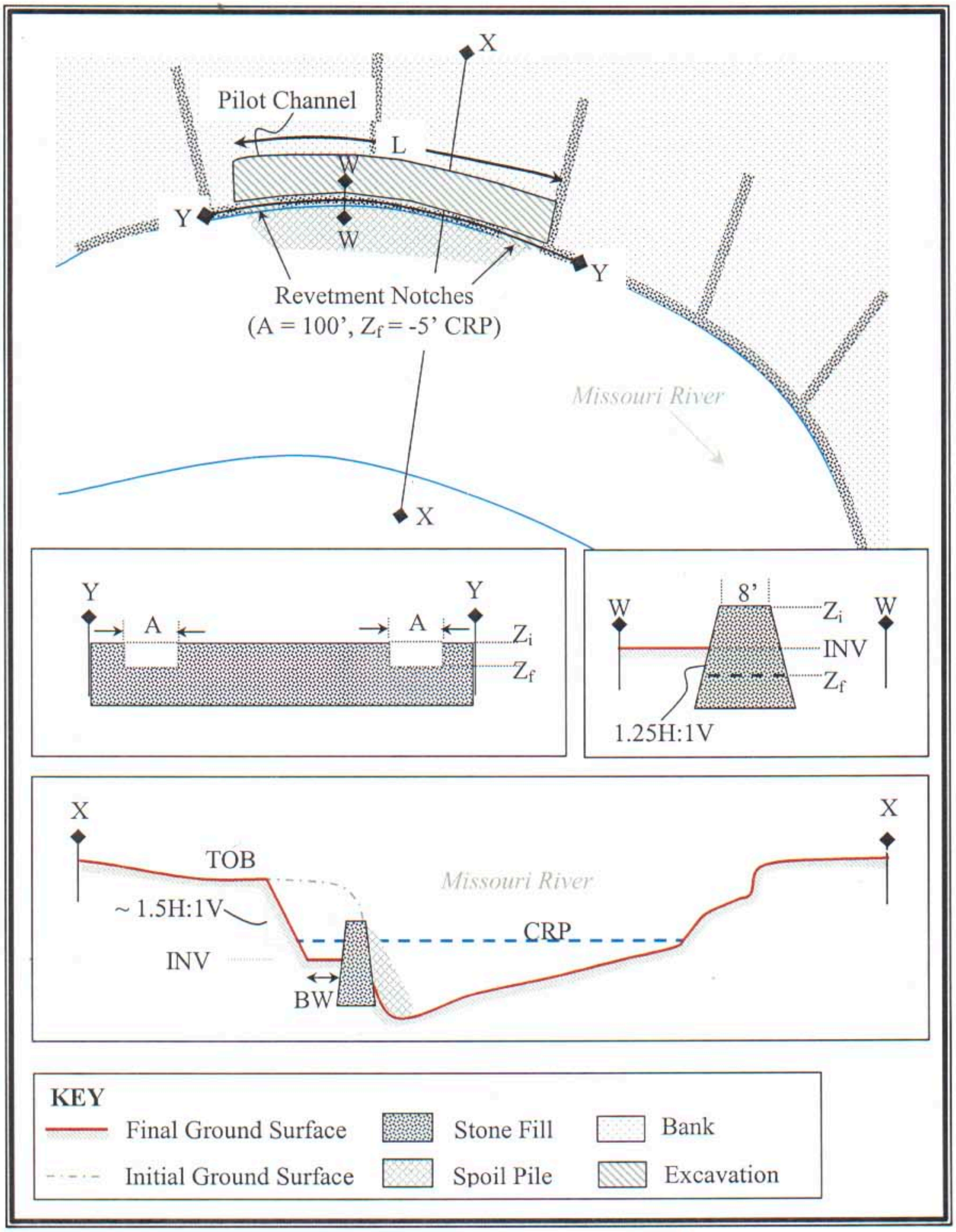
Legend

Excavation
Spoil Placement
Easement
Access_RD
Construction_RD

Figure 4. Benedictine Bottoms: Bank Notches: RM 427.3 - 428.2

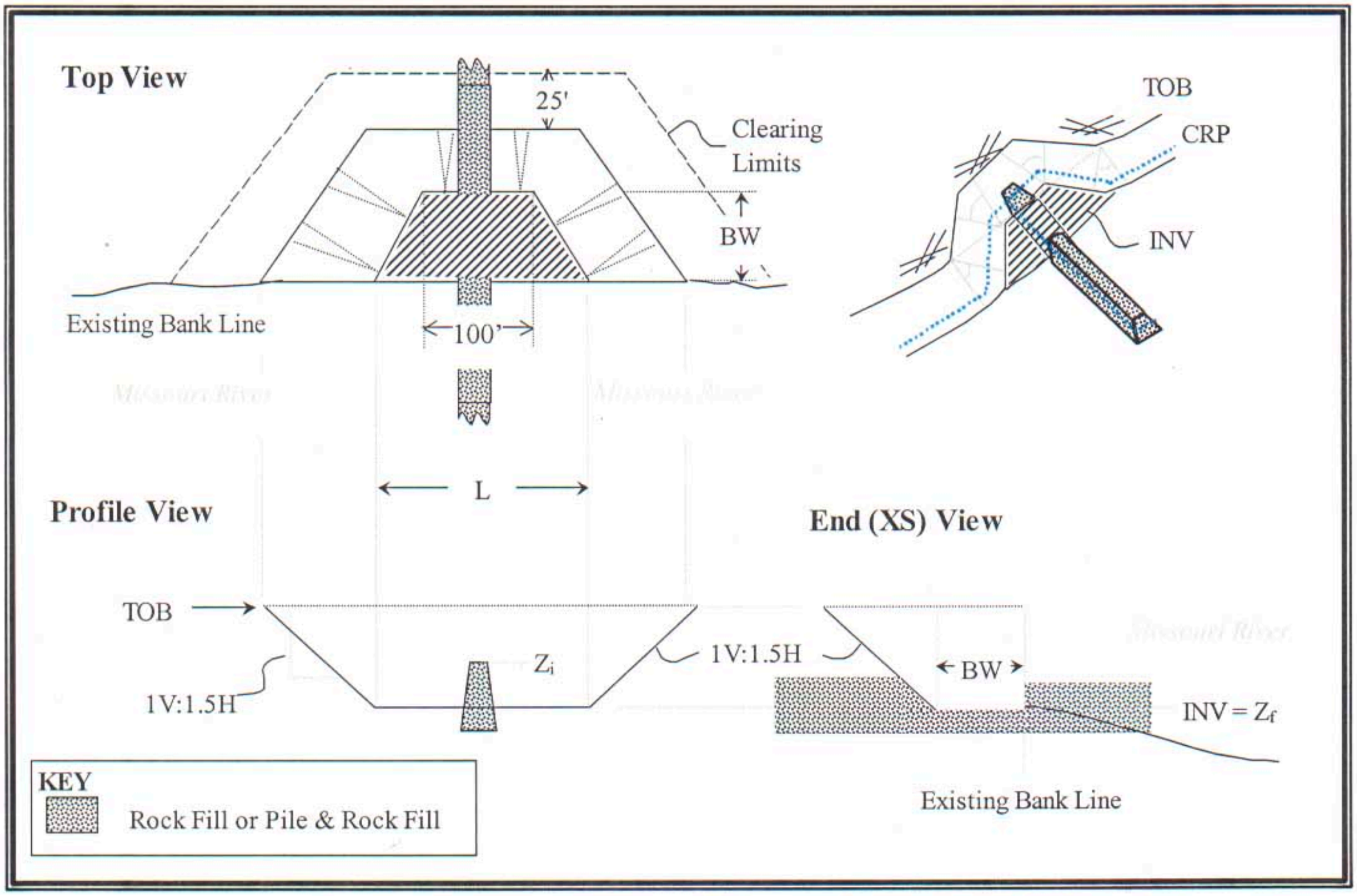
Shallow Water Habitat Restoration

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004



*CRP = Construction Reference Plane = Elevation representing flow exceeded 75% of the time

FIGURE 5: PILOT CHANNEL AND REVETMENT NOTCH DETAILS



*CRP = Construction Reference Plane = Elevation Representing Flow Exceeded 75% of the time

FIGURE 6: BANK NOTCH DETAILS

Weston Bend State Park

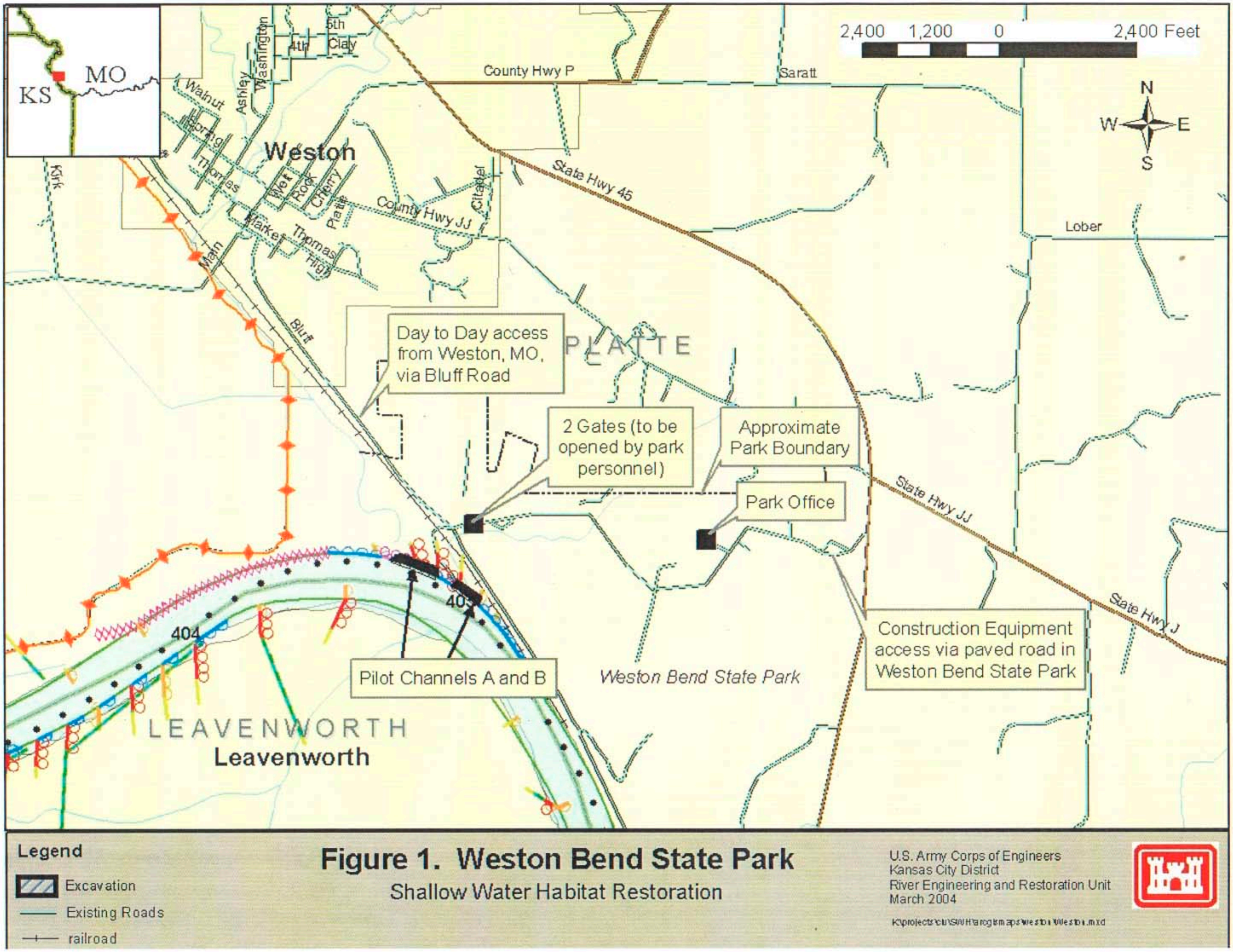


Figure 1. Weston Bend State Park

Shallow Water Habitat Restoration

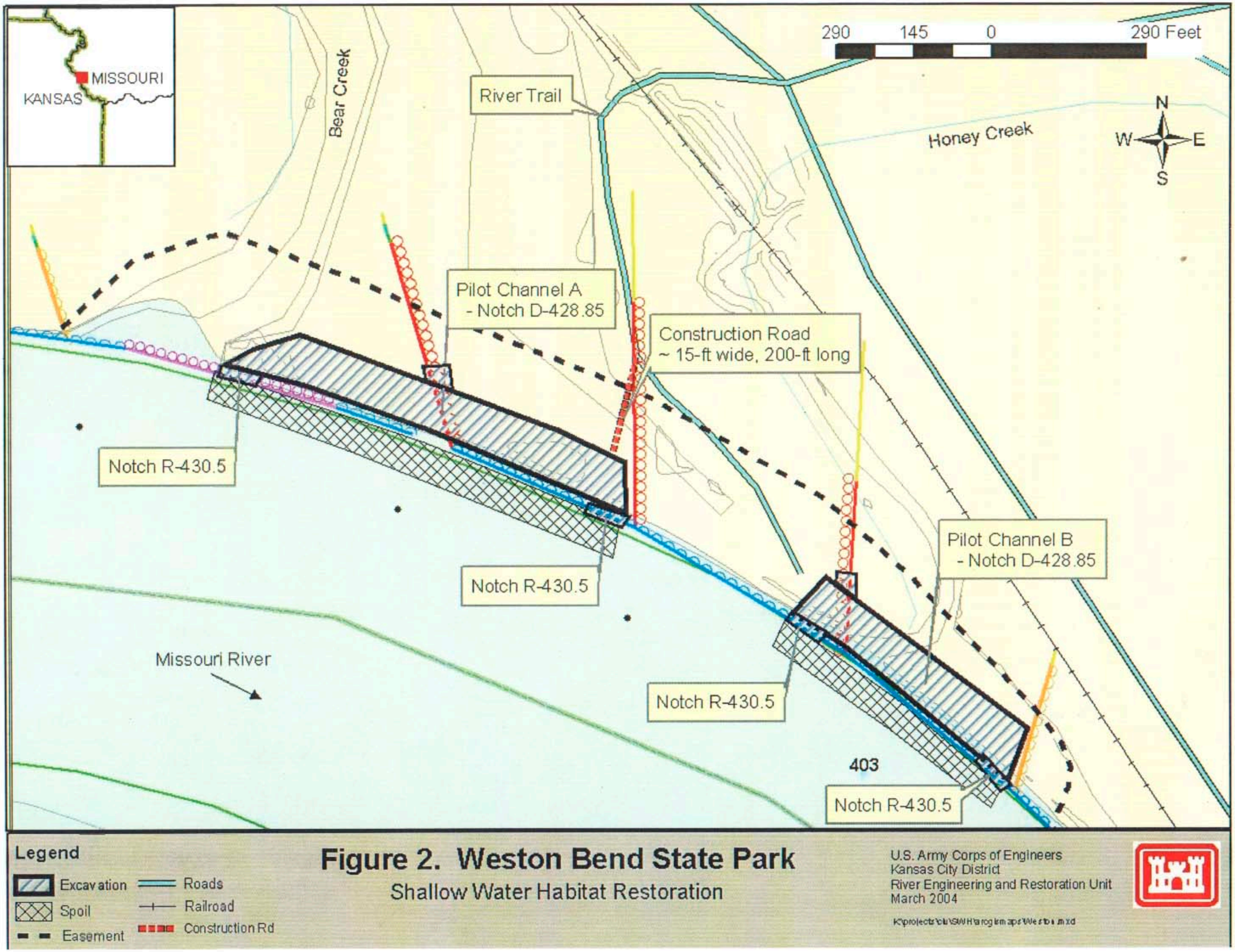
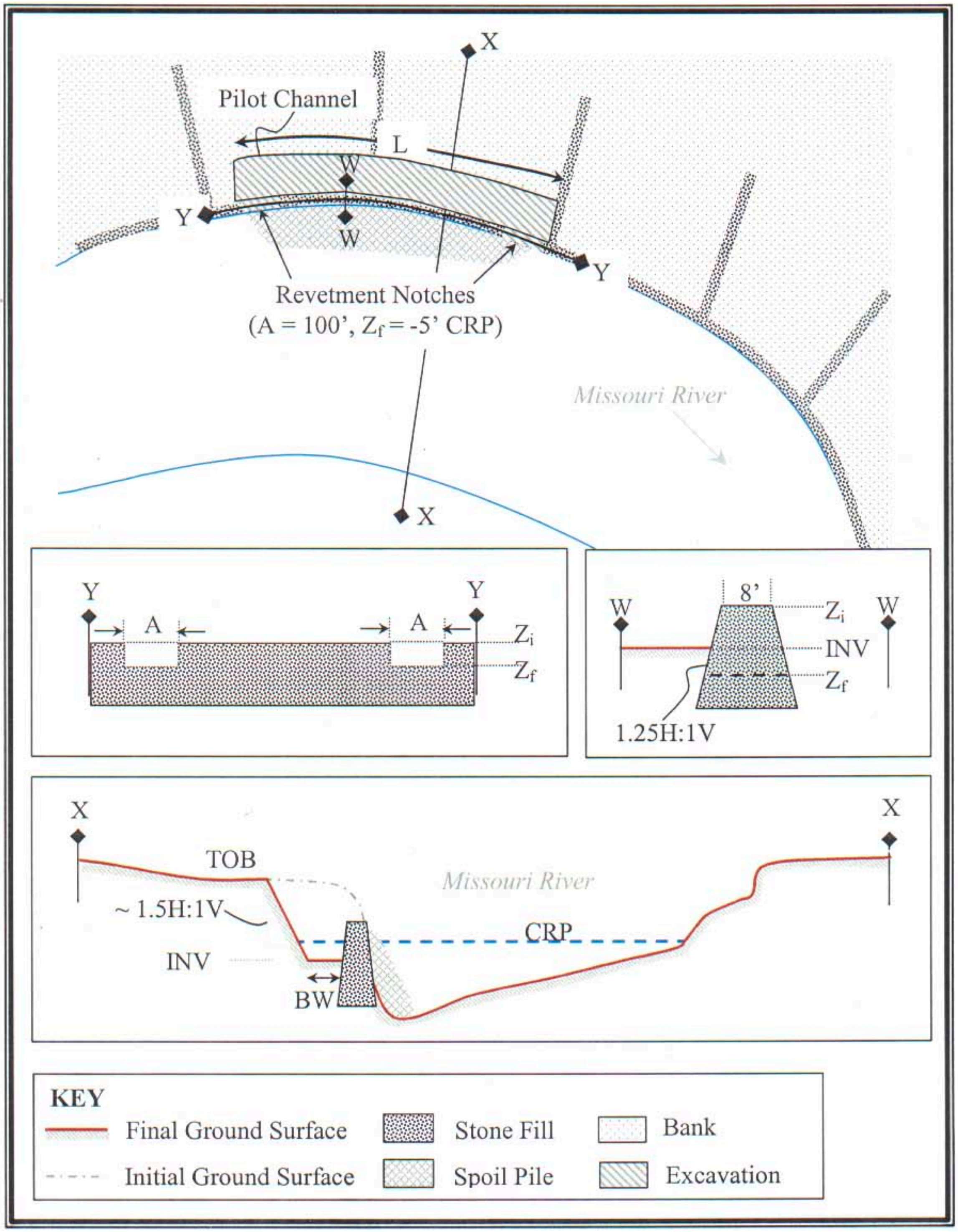


Figure 2. Weston Bend State Park

Shallow Water Habitat Restoration



*CRP = Construction Reference Plane = Elevation representing flow exceeded 75% of the time

FIGURE 3: PILOT CHANNEL AND REVETMENT NOTCH DETAILS

Liberty Bend

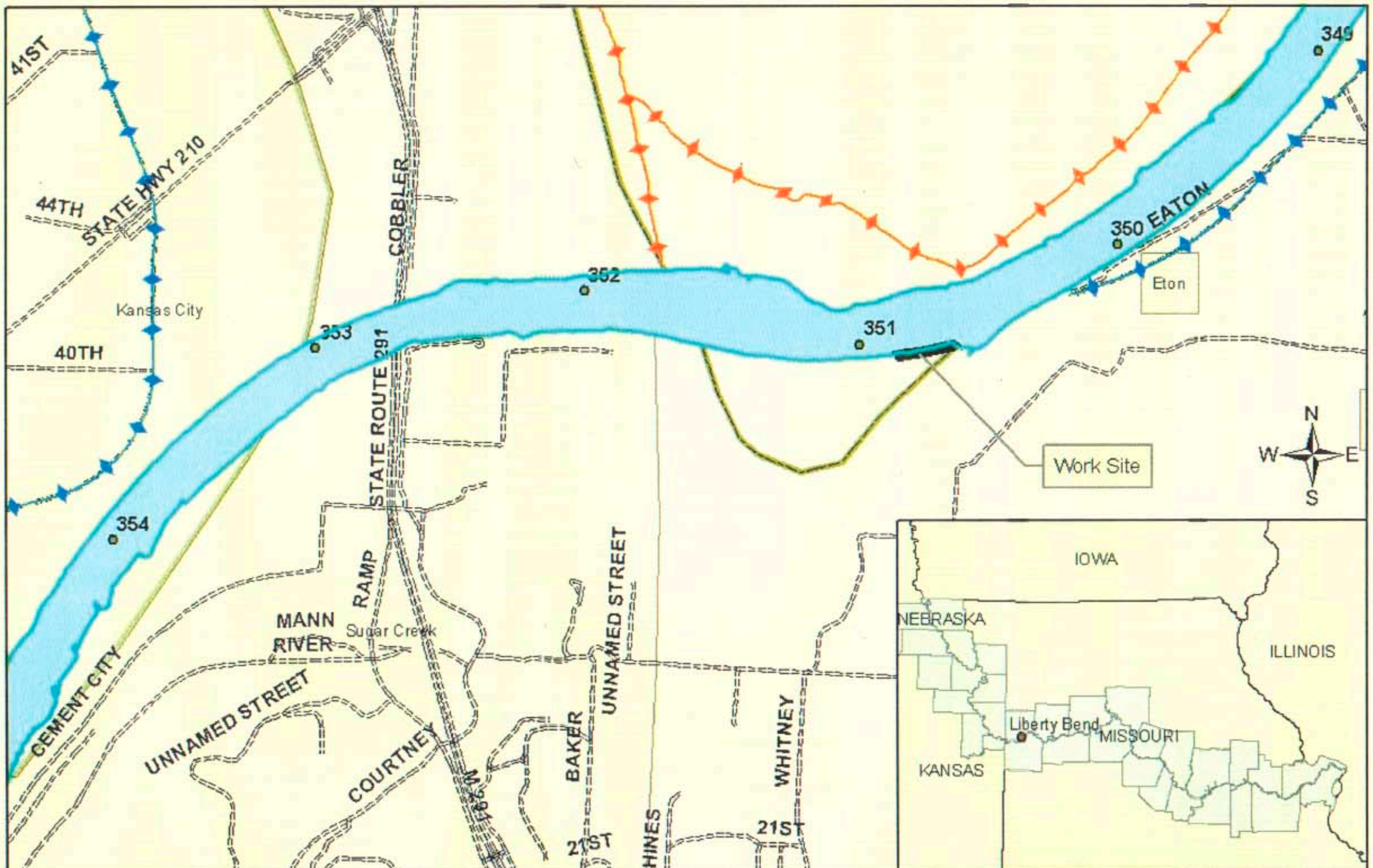


Figure 1. Liberty Bend

Shallow Water Habitat Restoration

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004

K:\projects\cat\SWH\arcgis\maps\Liberty\LibertyFig1.mxd

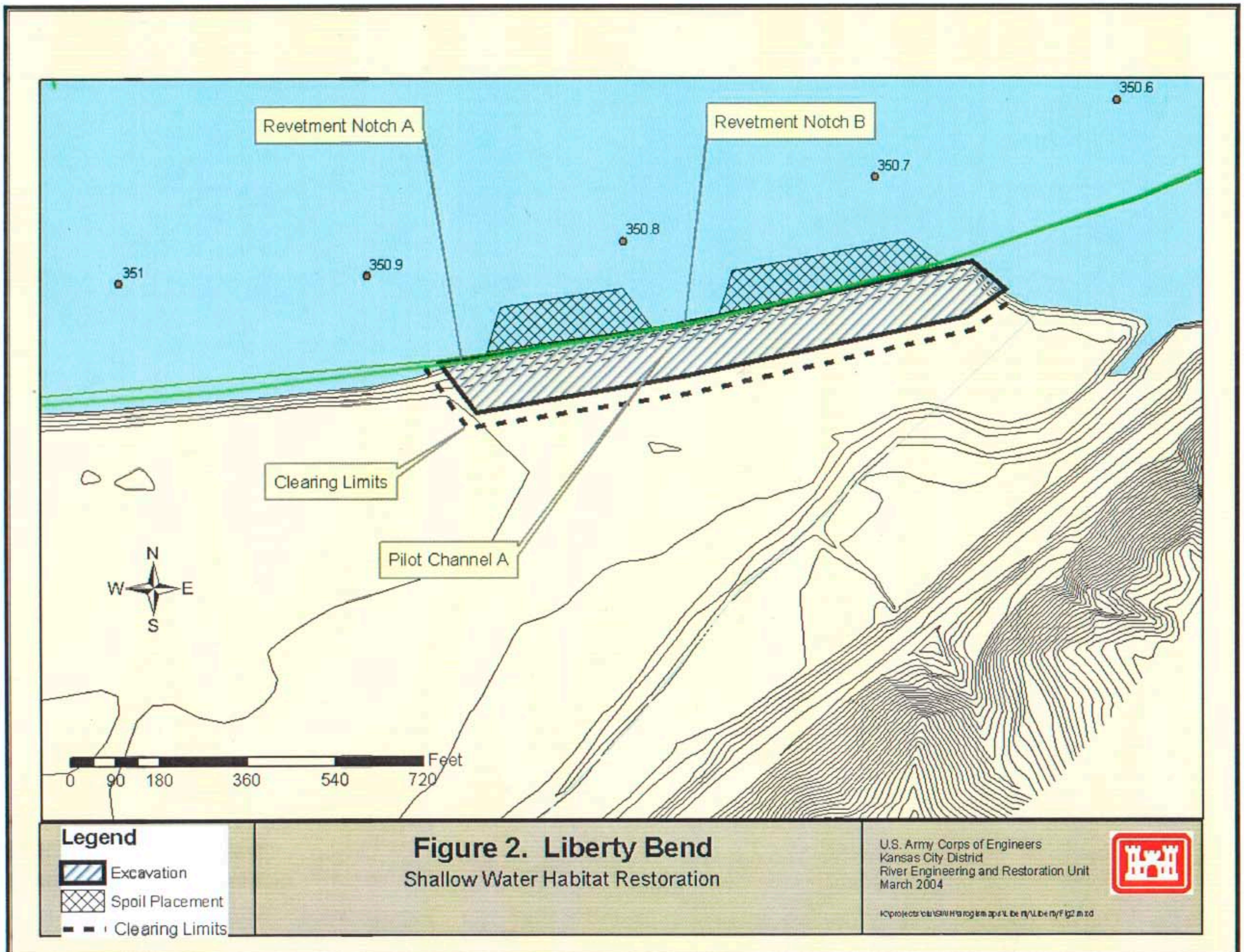
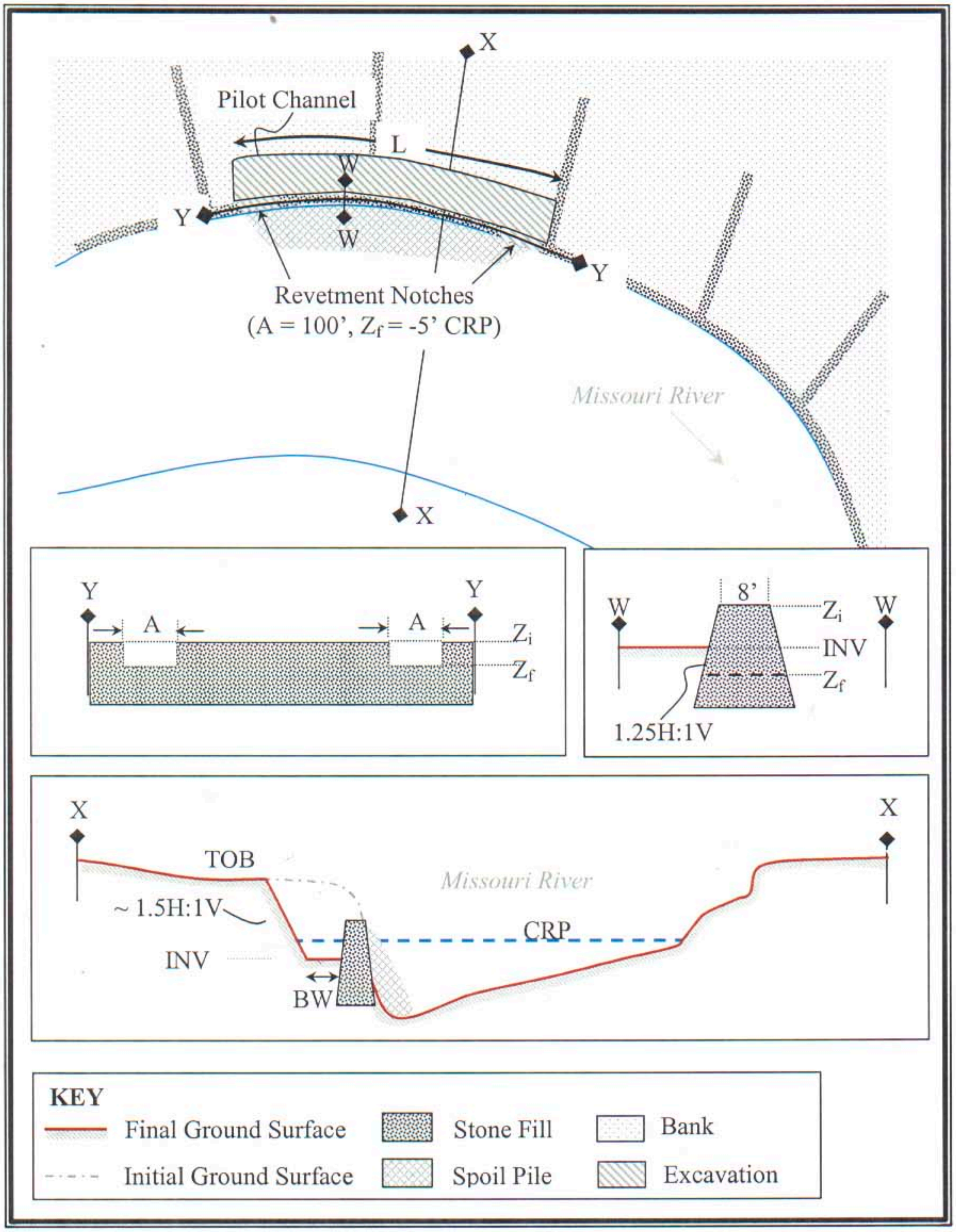


Figure 2. Liberty Bend
Shallow Water Habitat Restoration



*CRP = Construction Reference Plane = Elevation representing flow exceeded 75% of the time

Figure 3: Pilot Channel Details

Baltimore Bend

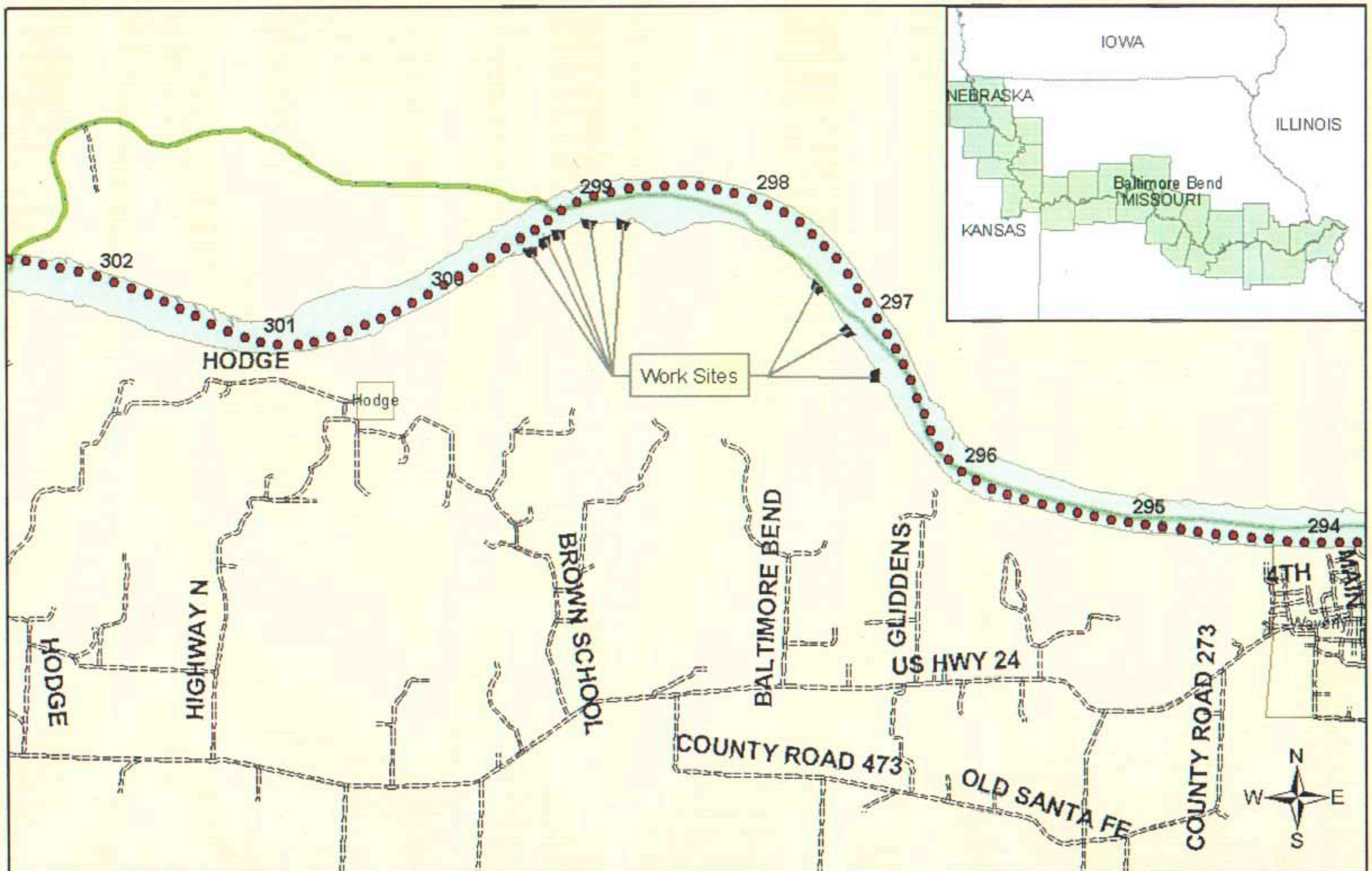
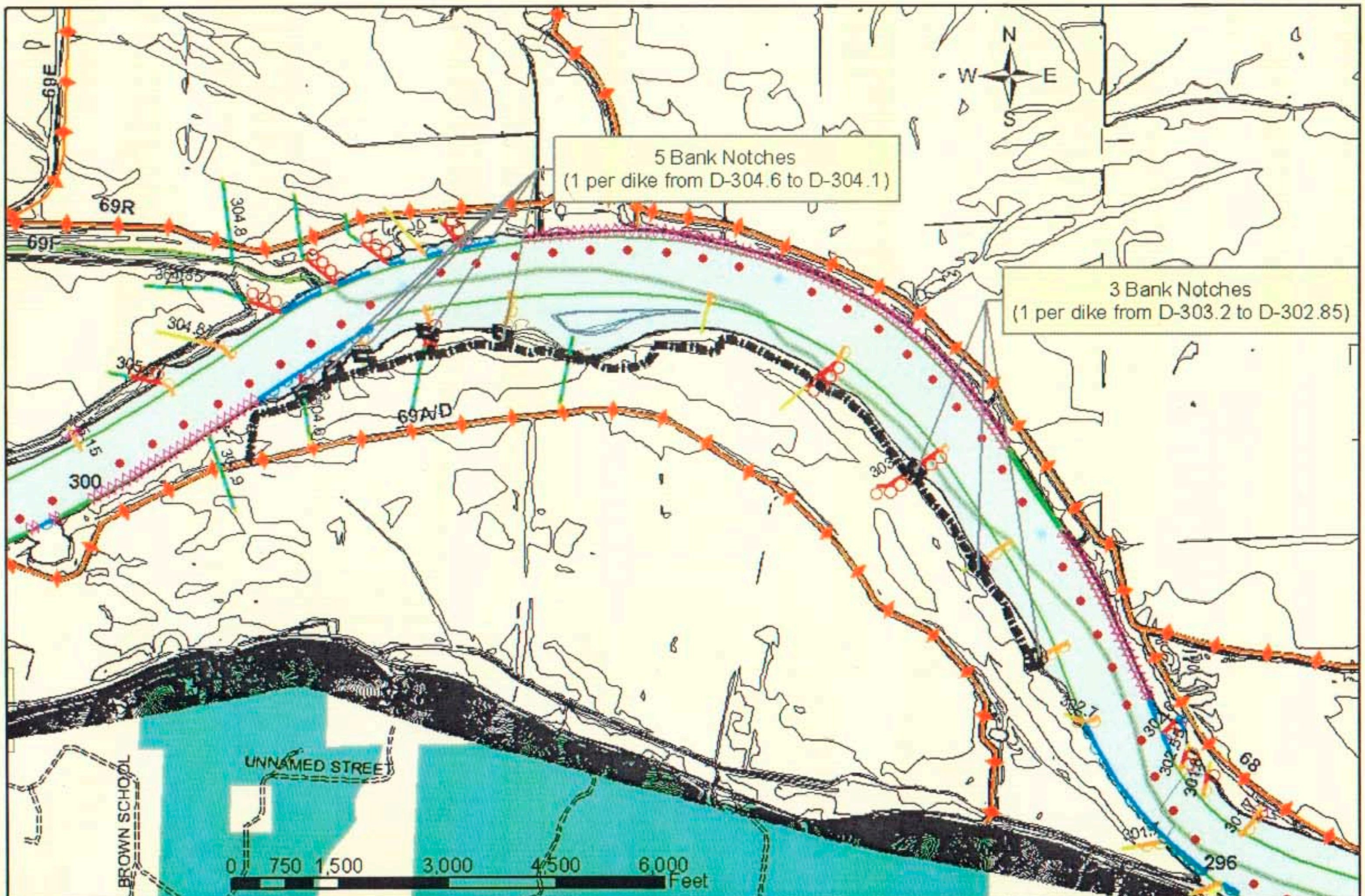


Figure 1. Baltimore Bend
Shallow Water Habitat Restoration

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004



Legend

- Spoil Placement
- Excavation
- Access Route

Figure 2. Baltimore Bend

Shallow Water Habitat Restoration

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004

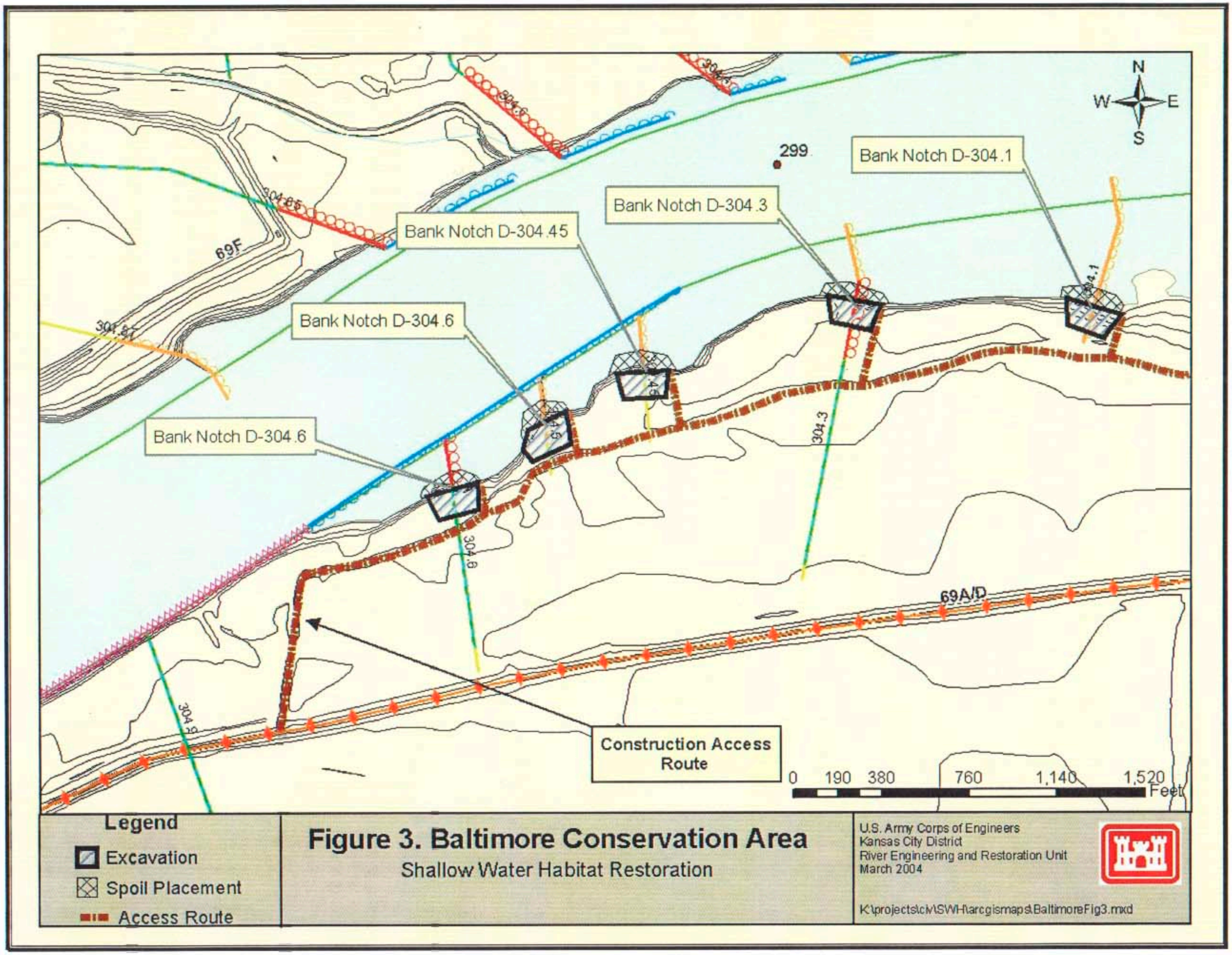
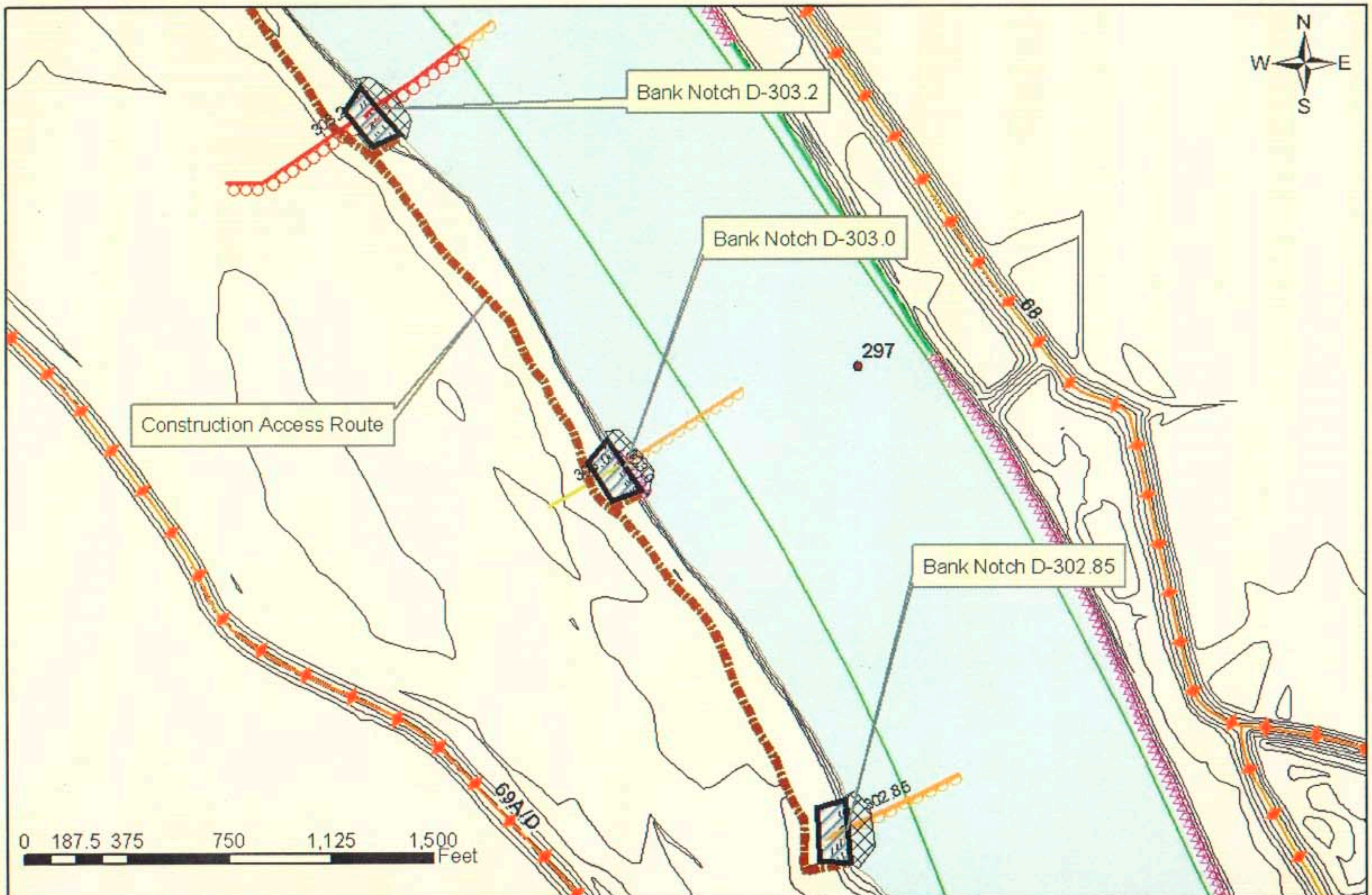


Figure 3. Baltimore Conservation Area
Shallow Water Habitat Restoration



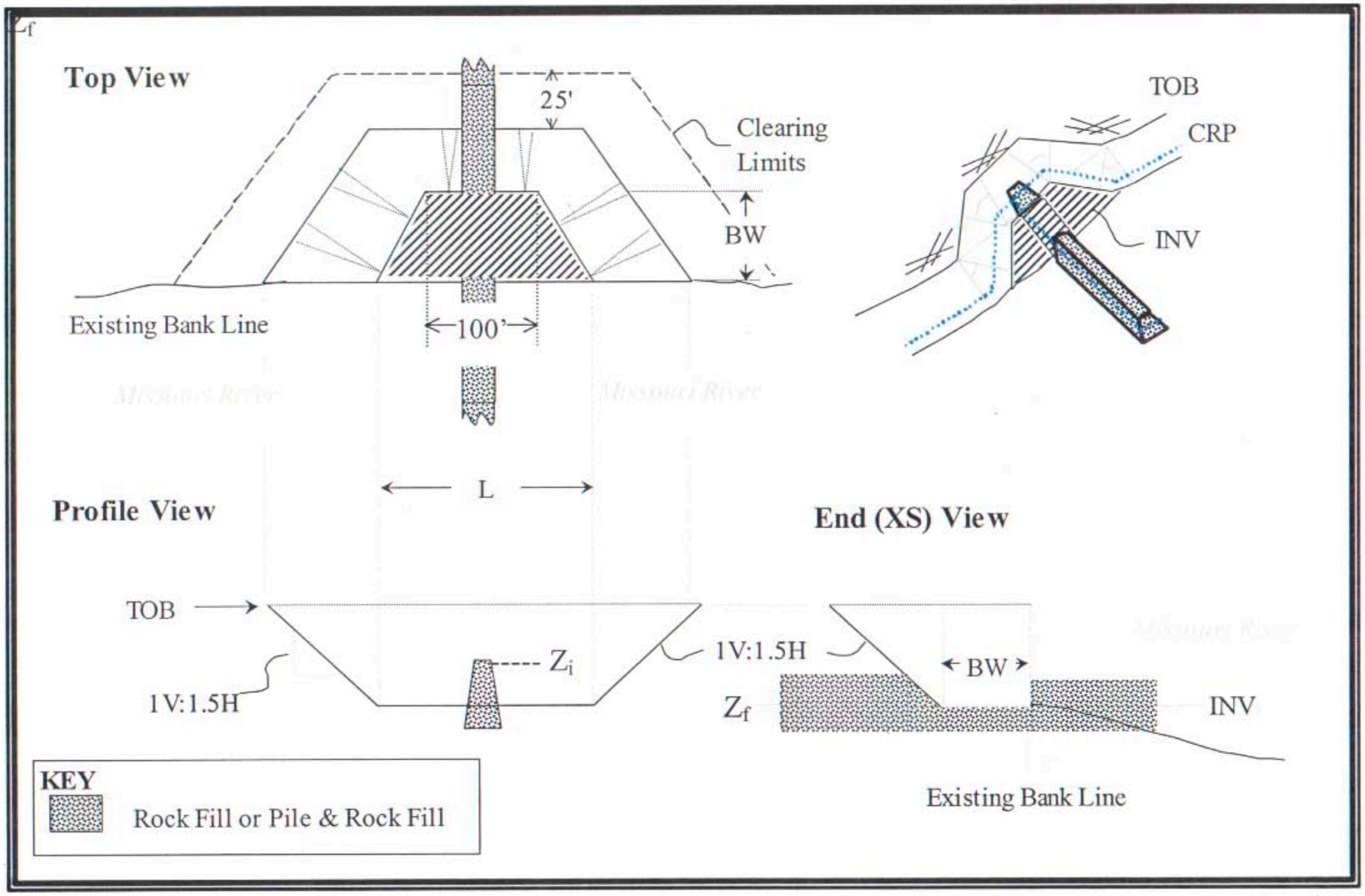
Legend
Excavation
Spoil Placement
Access

Figure 4. Baltimore Conservation Area
Shallow Water Habitat Restoration

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004

K:\projects\cl\SWH\arcgismaps\BaltimoreFig4.mxd

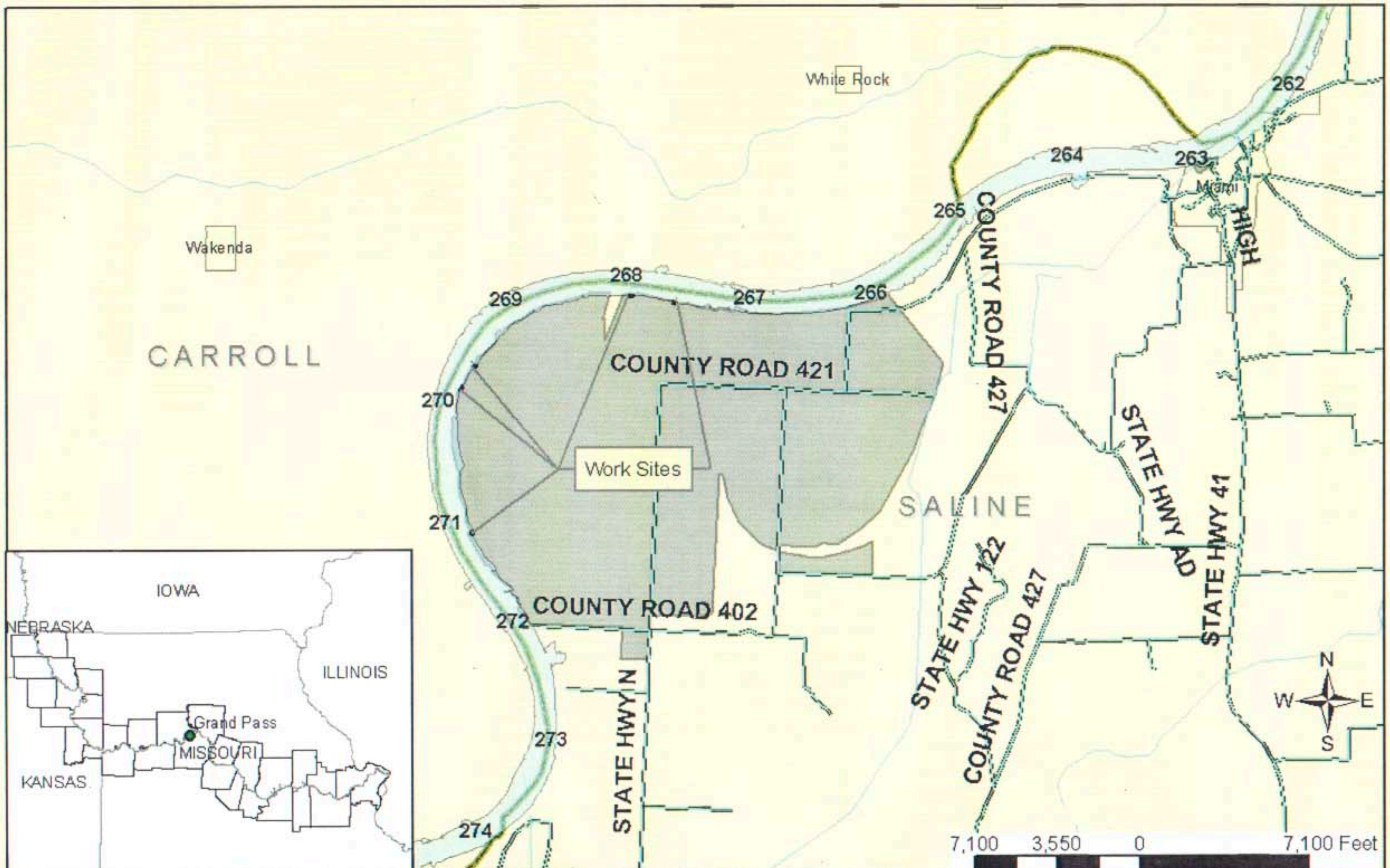
Baltimore Bend



*CRP = Construction Reference Plane = Elevation Representing Flow Exceeded 75% of the time

FIGURE 5: BANK NOTCH DETAILS

Grand Pass Conservation Area



Legend

MDC Property

County Boundaries

Figure 1. Grand Pass Conservation Area Site Location

Shallow Water Habitat Restoration

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004

K:\projects\civ\SWH\arcgismaps\GrandPass\GrandPassFig1.mxd

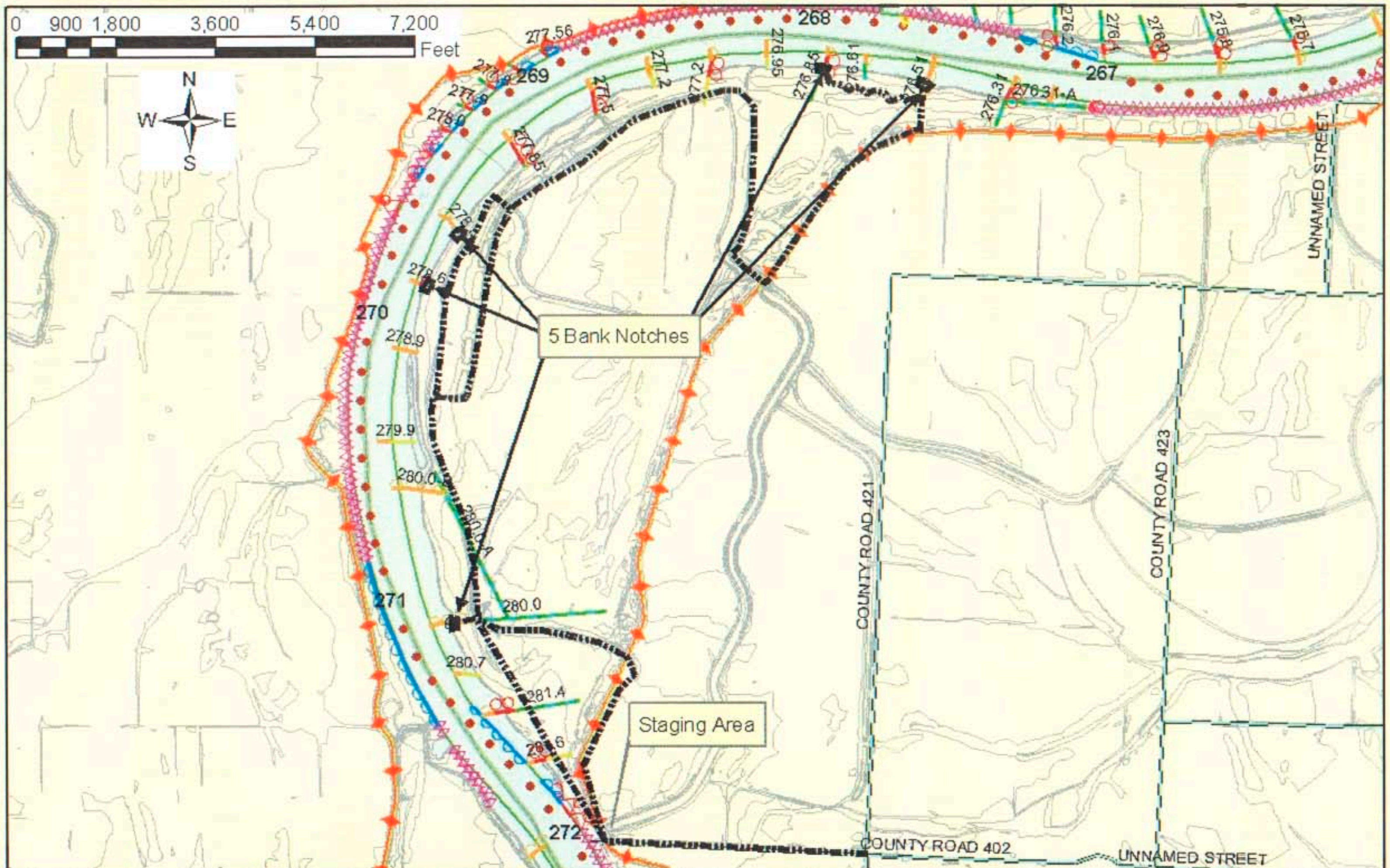


Figure 2. Grand Pass Conservation Area Project Overview

Shallow Water Habitat Restoration

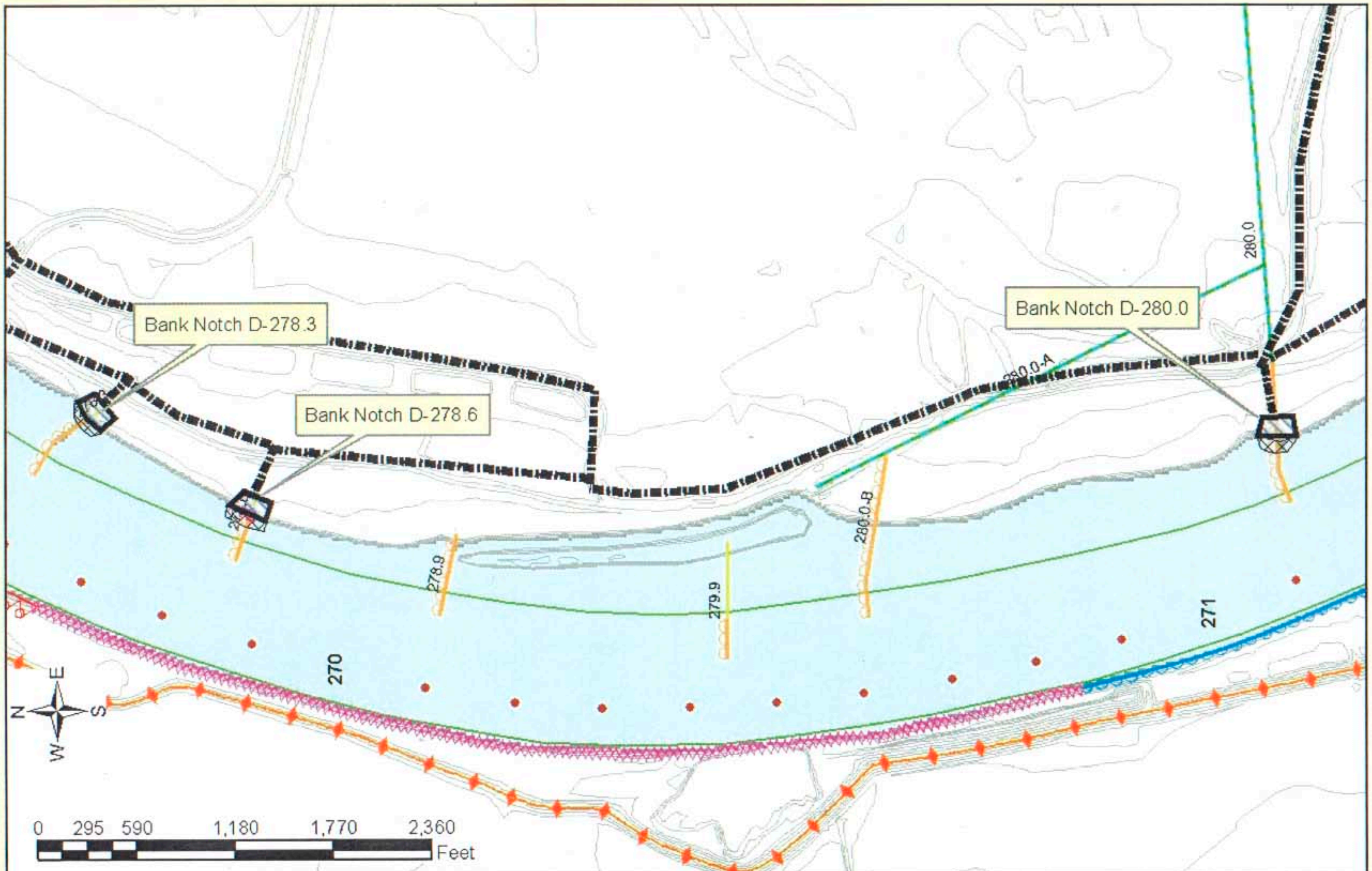
Legend

Excavation

Access Route

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004

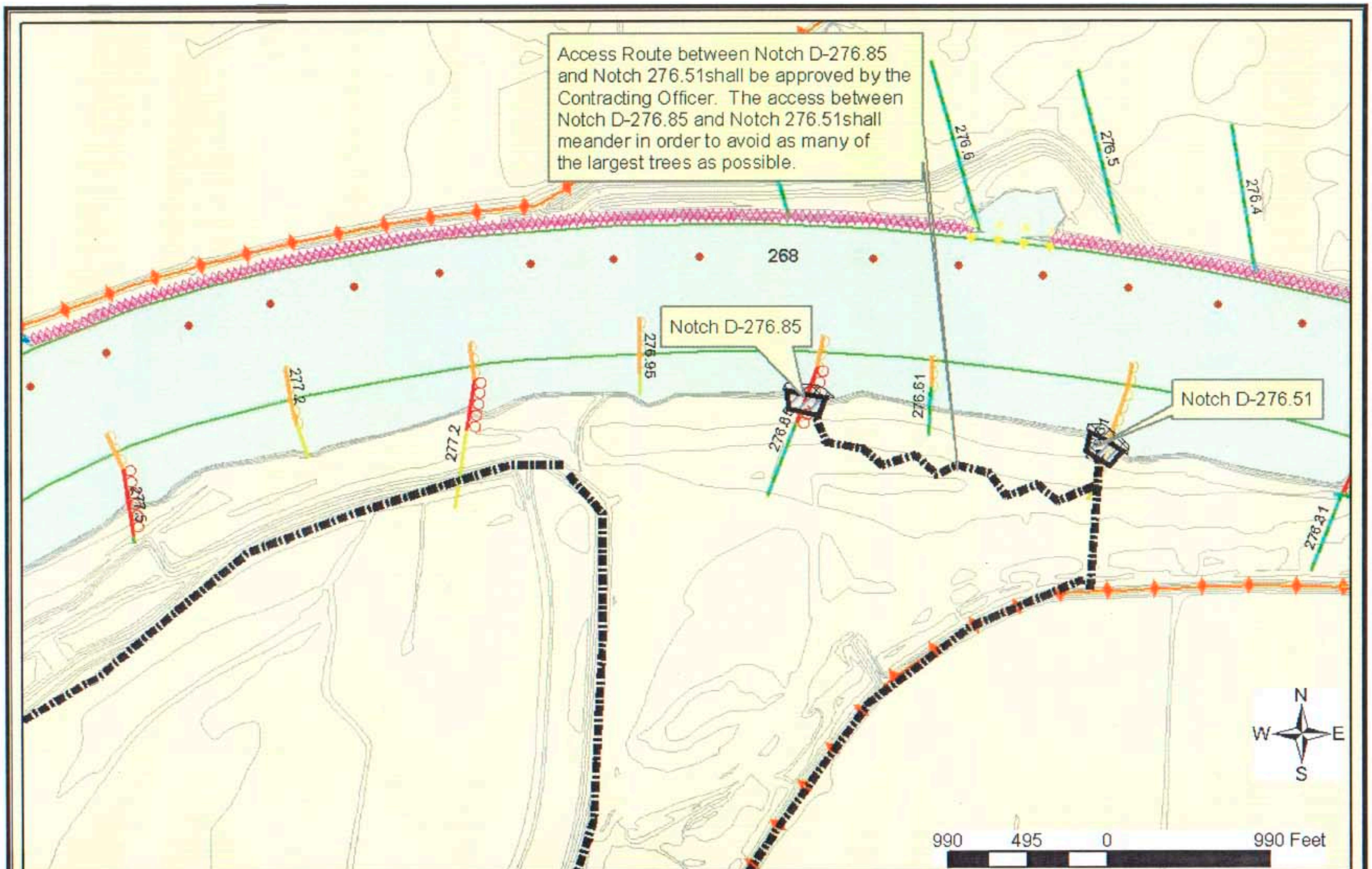
K:\projects\civ\SWH\arcgismaps\GrandPass\GrandPassFig2.mxd



Legend
Excavation
Spoil Placement
Access Route

Figure 3. Grand Pass Conservation Area
3 Bank Notches RM 269.6 - 271.1
Shallow Water Habitat Restoration

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004



Legend

Excavation

Spoil Placement

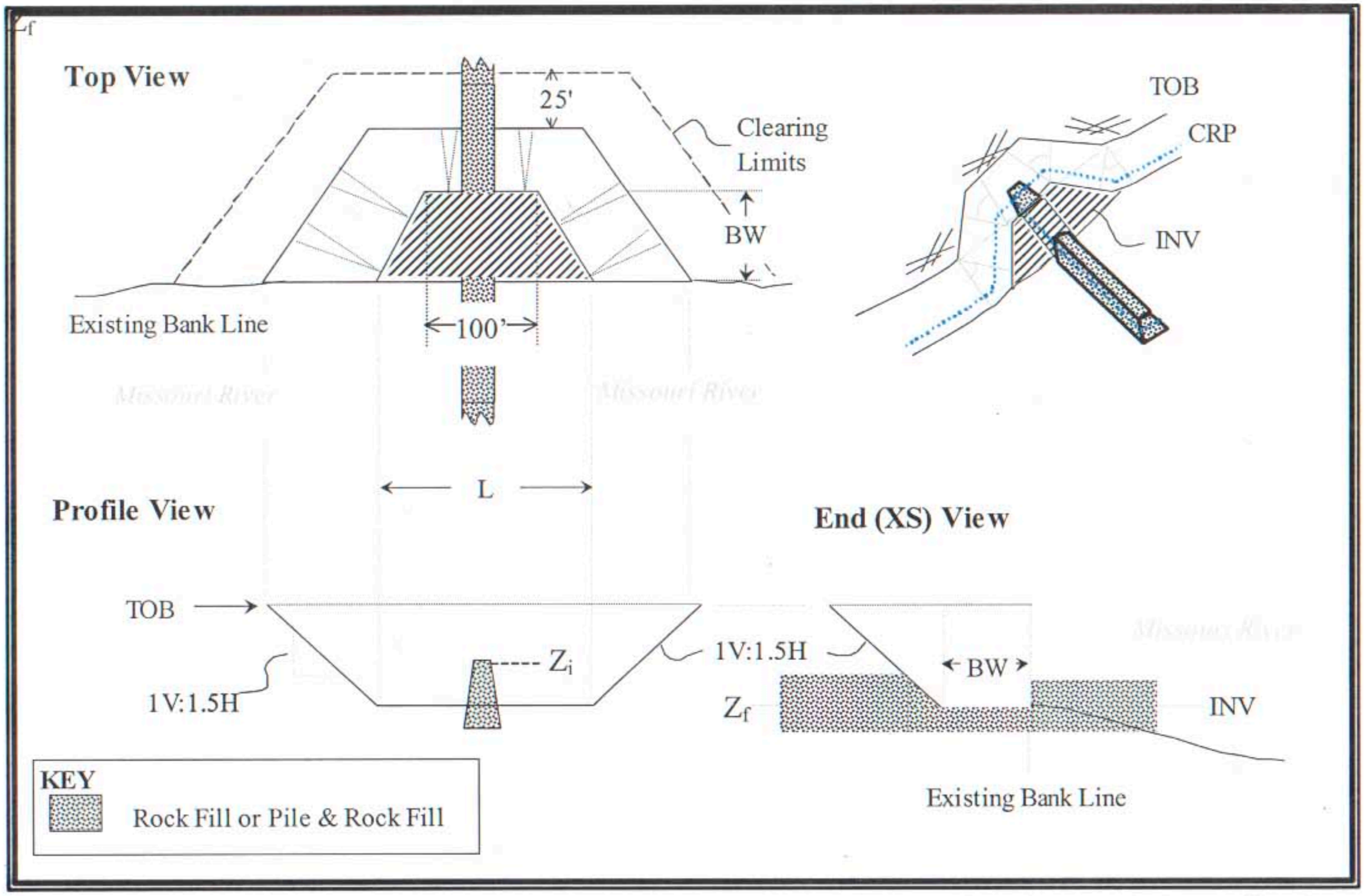
Access Route

Figure 4. Grand Pass Conservation Area
2 Bank Notches RM 267.6 - 268.0

Shallow Water Habitat Restoration

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004

Grand Pass



*CRP = Construction Reference Plane = Elevation Representing Flow Exceeded 75% of the time

FIGURE 5: BANK NOTCH DETAILS

Lisbon Chute

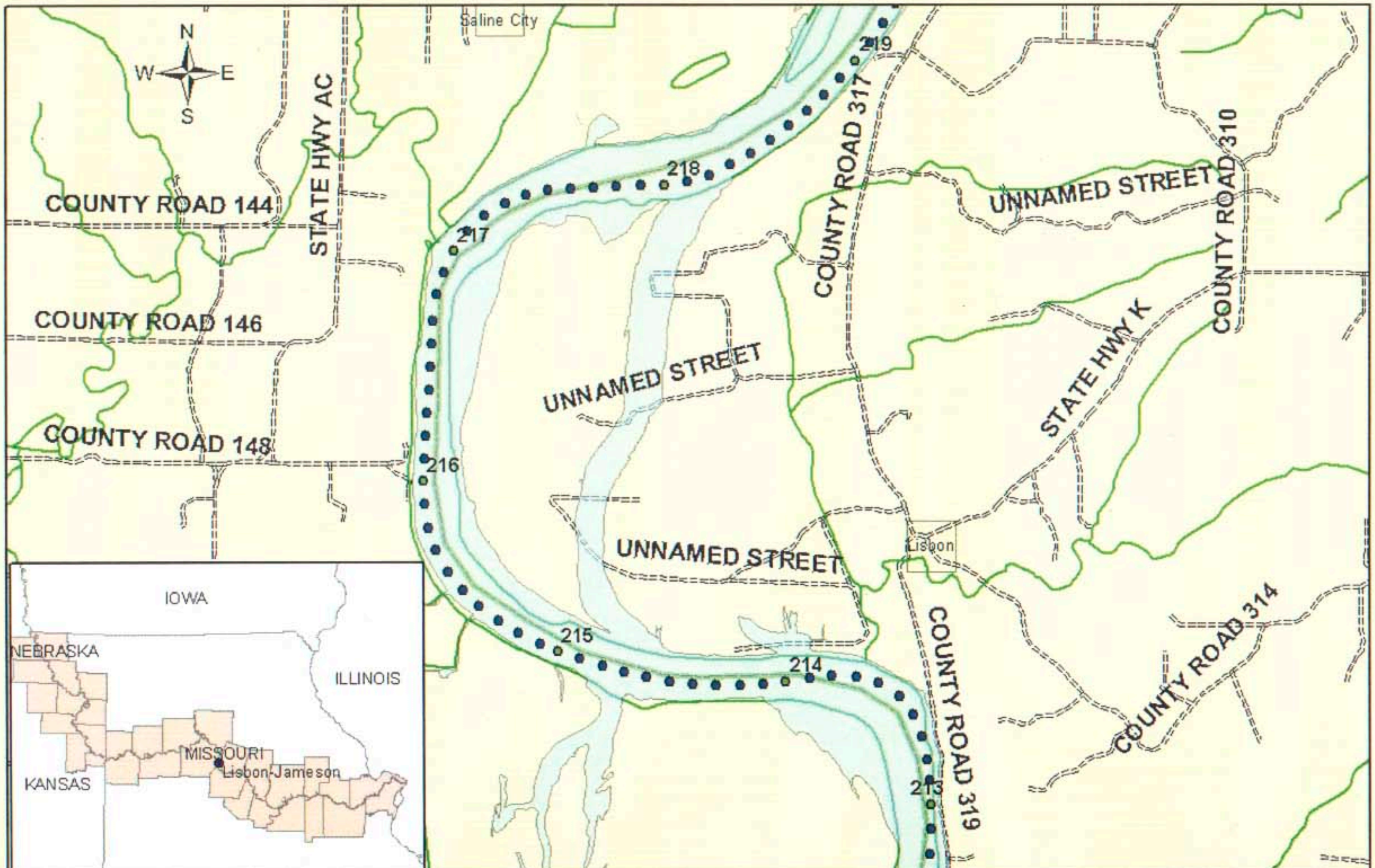


Figure 1. Lisbon Chute

Shallow Water Habitat Restoration

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004

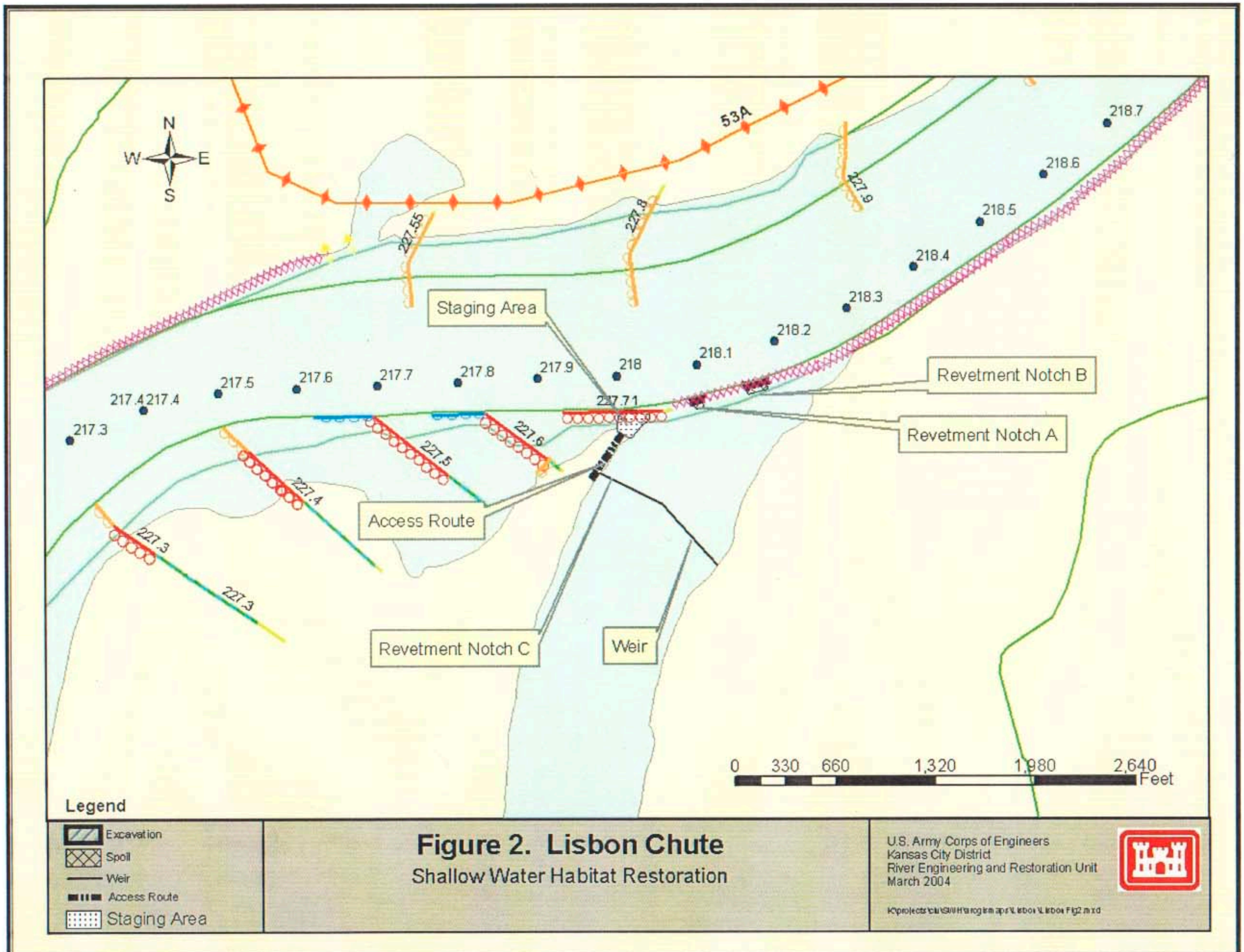


Figure 2. Lisbon Chute
Shallow Water Habitat Restoration

Franklin Island

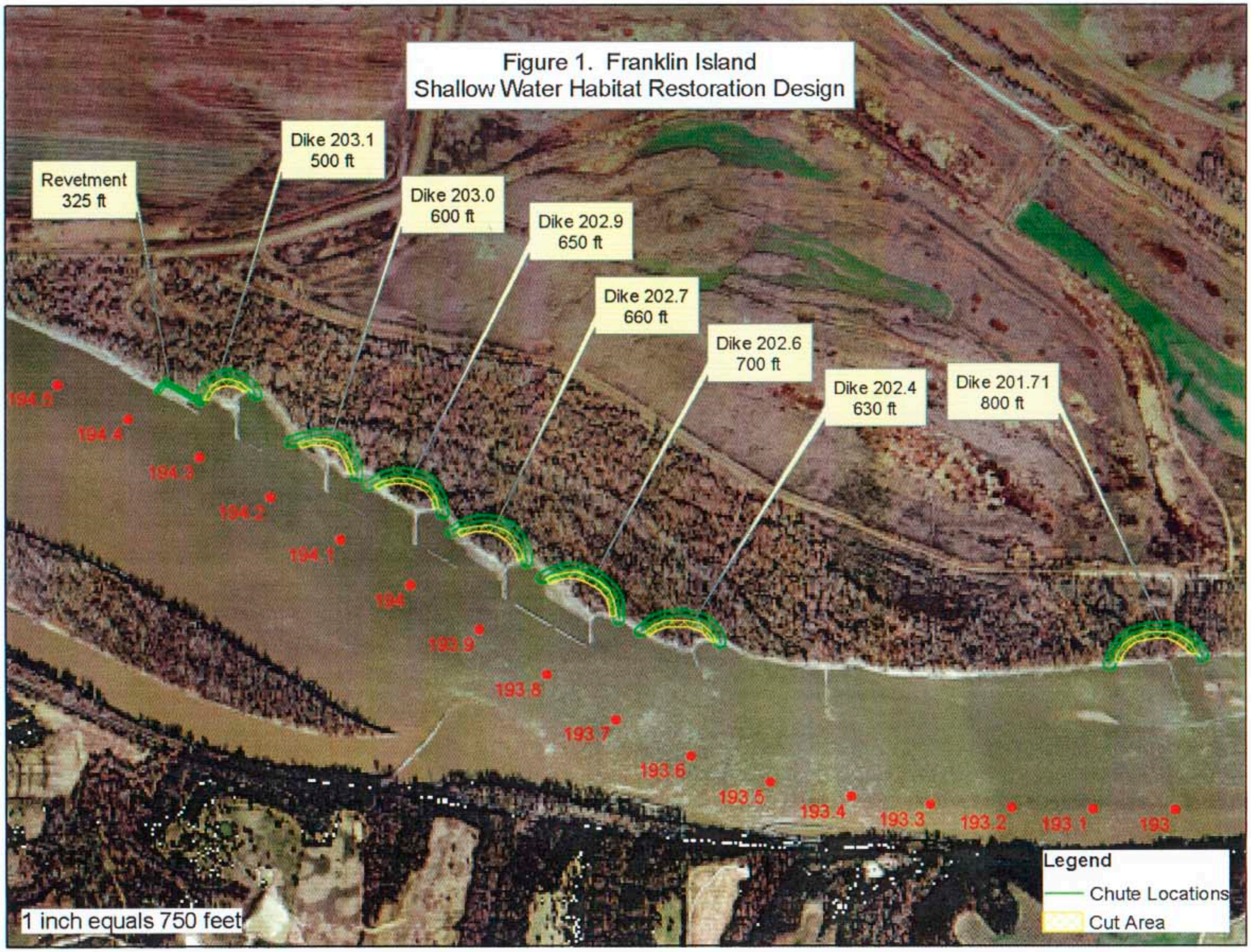


Figure 1. Franklin Island
Shallow Water Habitat Restoration Design
Revetment 325 ft
Dike 203.1 500 ft
Dike 203.0 600 ft
Dike 202.9 650 ft
Dike 202.7 660 ft
Dike 202.6 700 ft
Dike 202.4 630 ft
Dike 201.71 800 ft
194.5
194.4
194.3
194.2
194.1
194
193.9
193.8
193.7
193.6
193.5
193.4
193.3
193.2
193.1
193
Legend
Chute Locations
Cut Area
1 inch equals 750 feet

Figure 2. Franklin Island
Typical Cross-Section

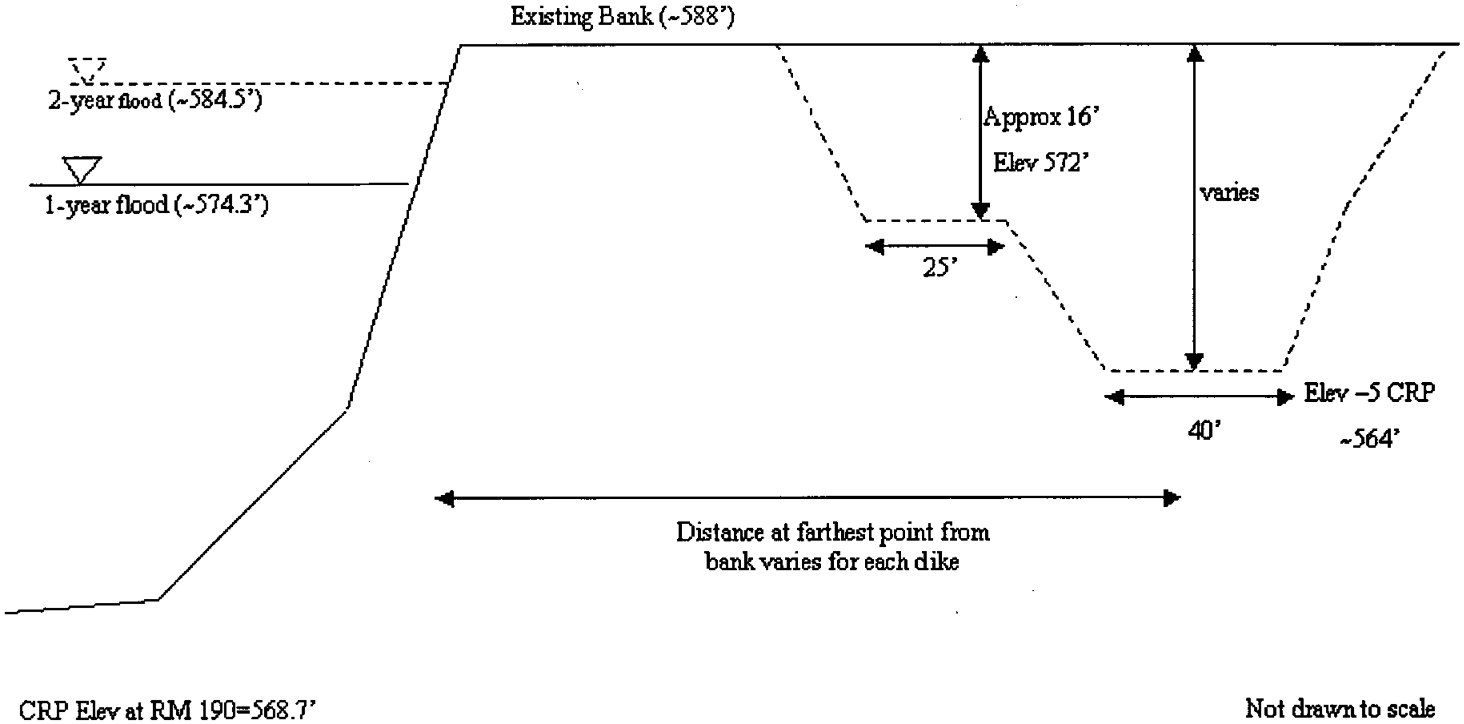
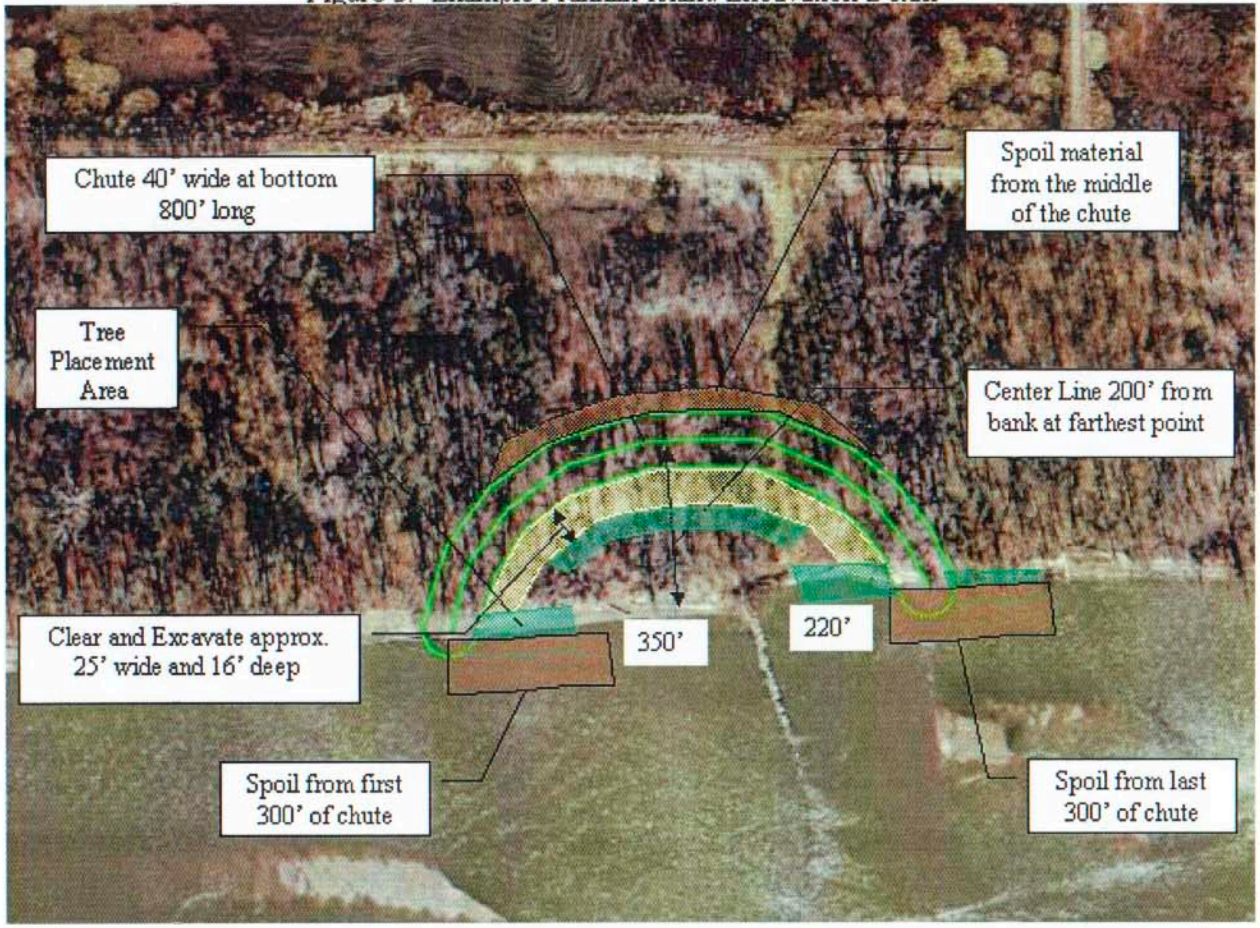


Figure 3. Example Franklin Island Excavation Detail



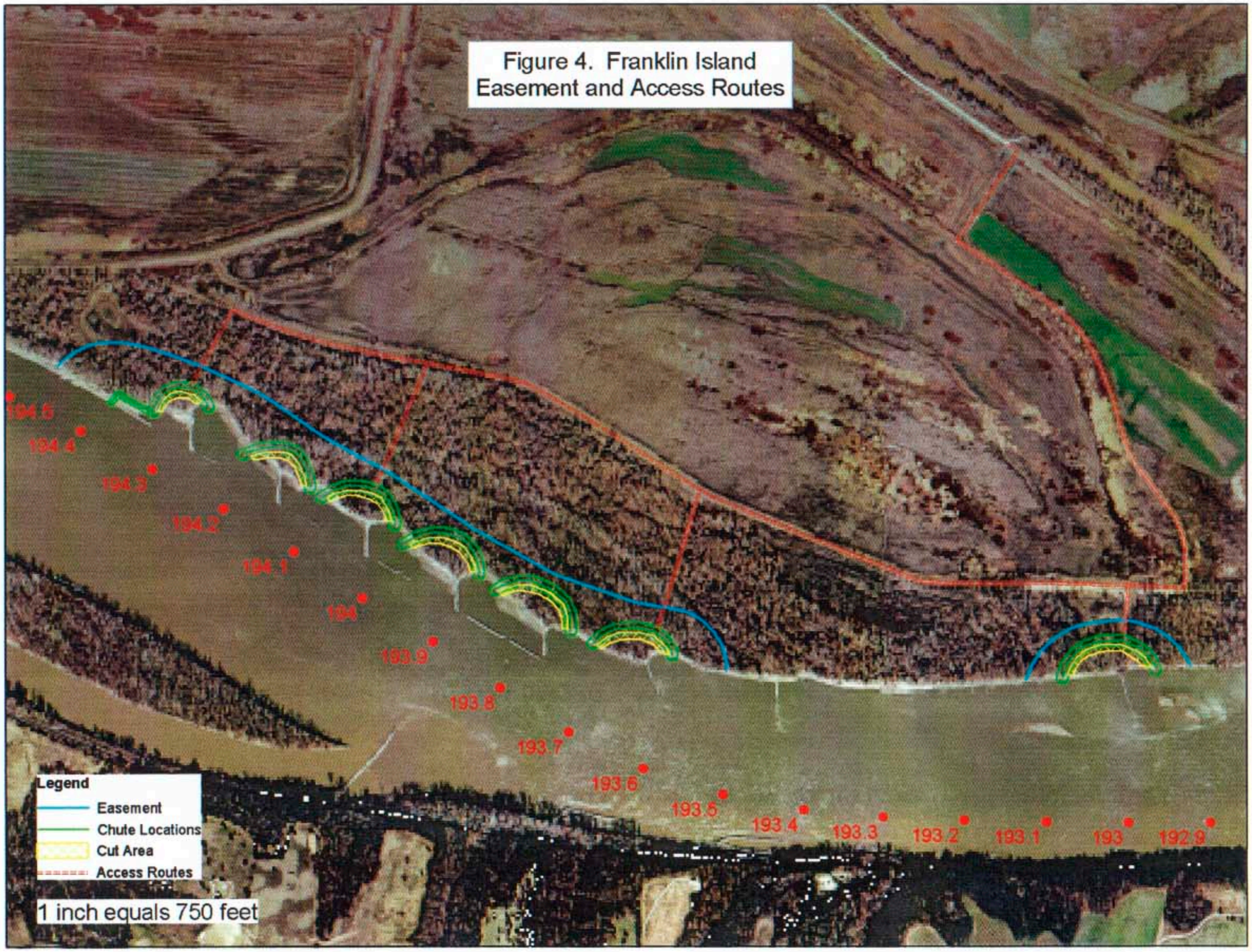
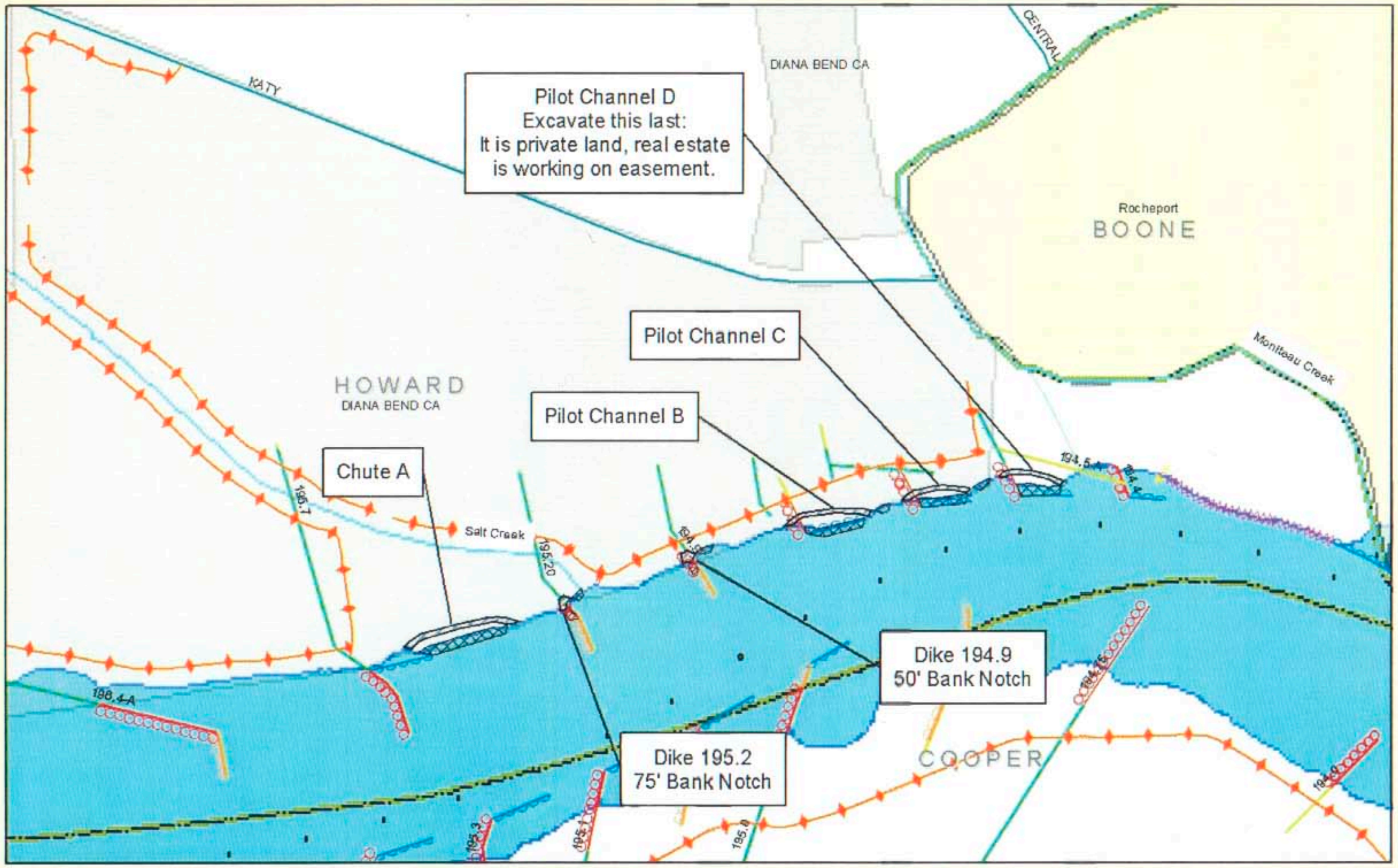


Figure 4. Franklin Island Easement and Access Routes

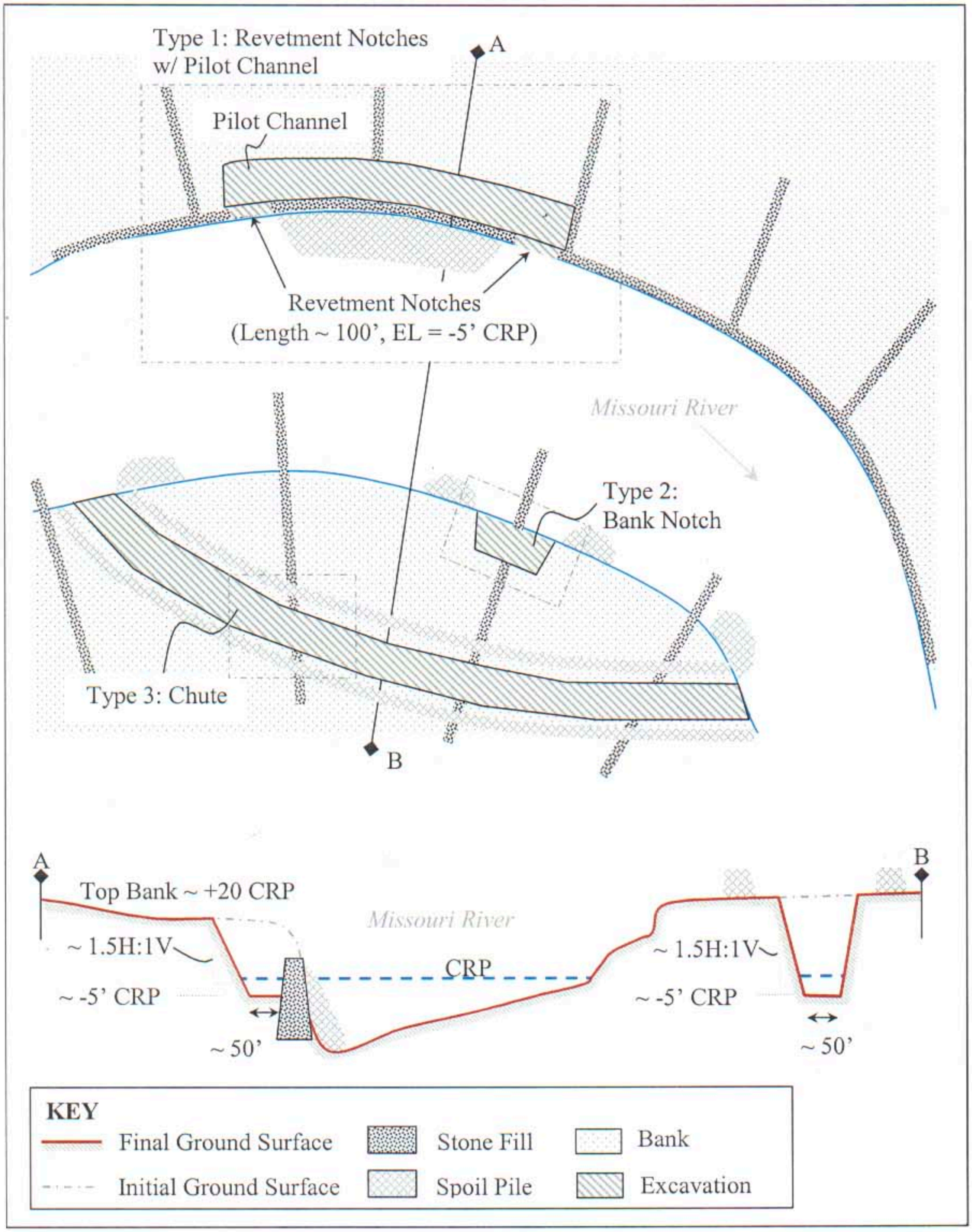
Diana Bend Conservation Area



Spoil Locations
Excavation Area
Property Boundary

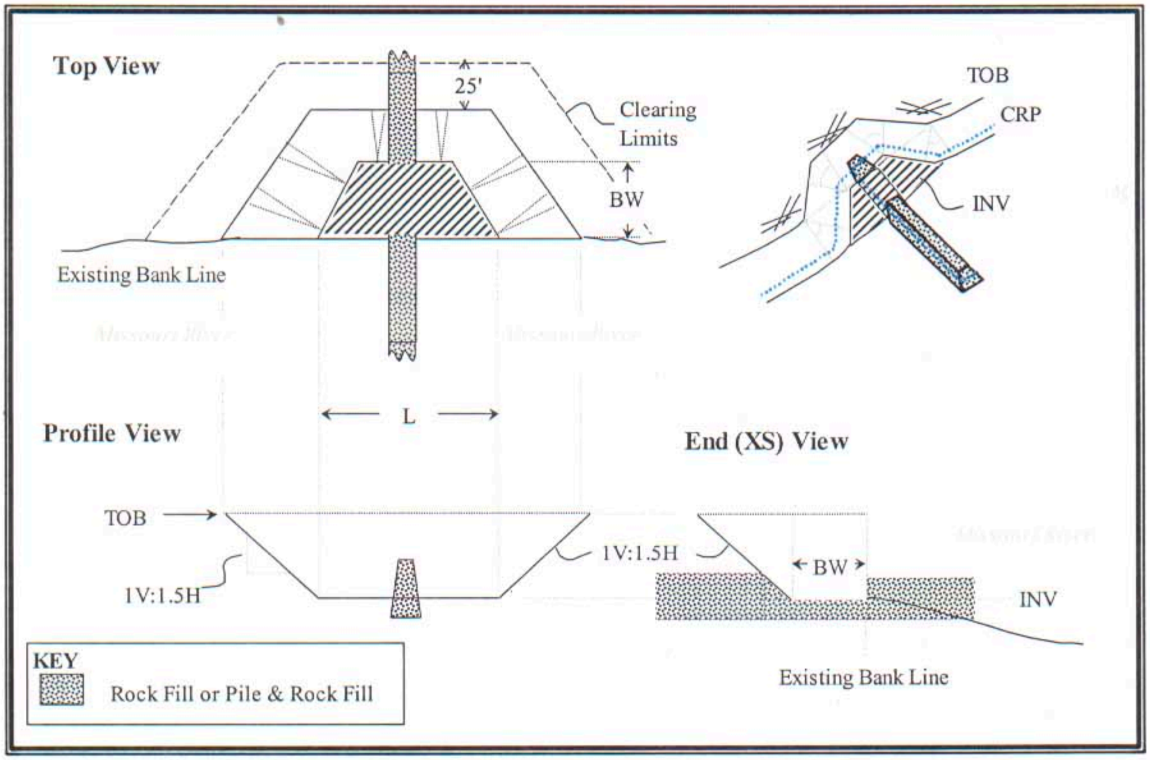
Figure 1. Diana Bend Conservation Area
Site Location

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004
1:12,000



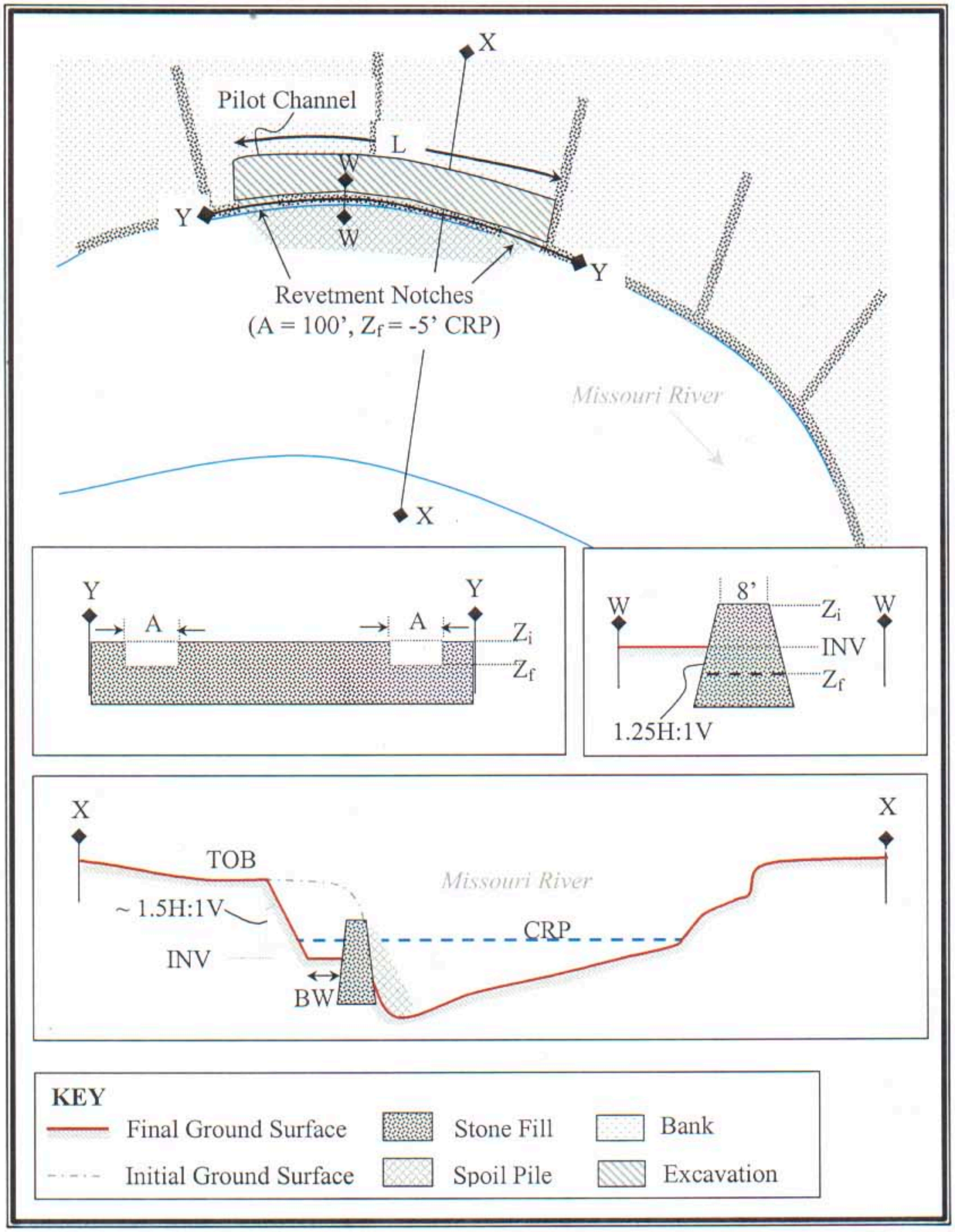
*CRP = Construction Reference Plane = Elevation representing flow exceeded 75% of the time

Figure 2a. Typical Shallow Water Habitat Design



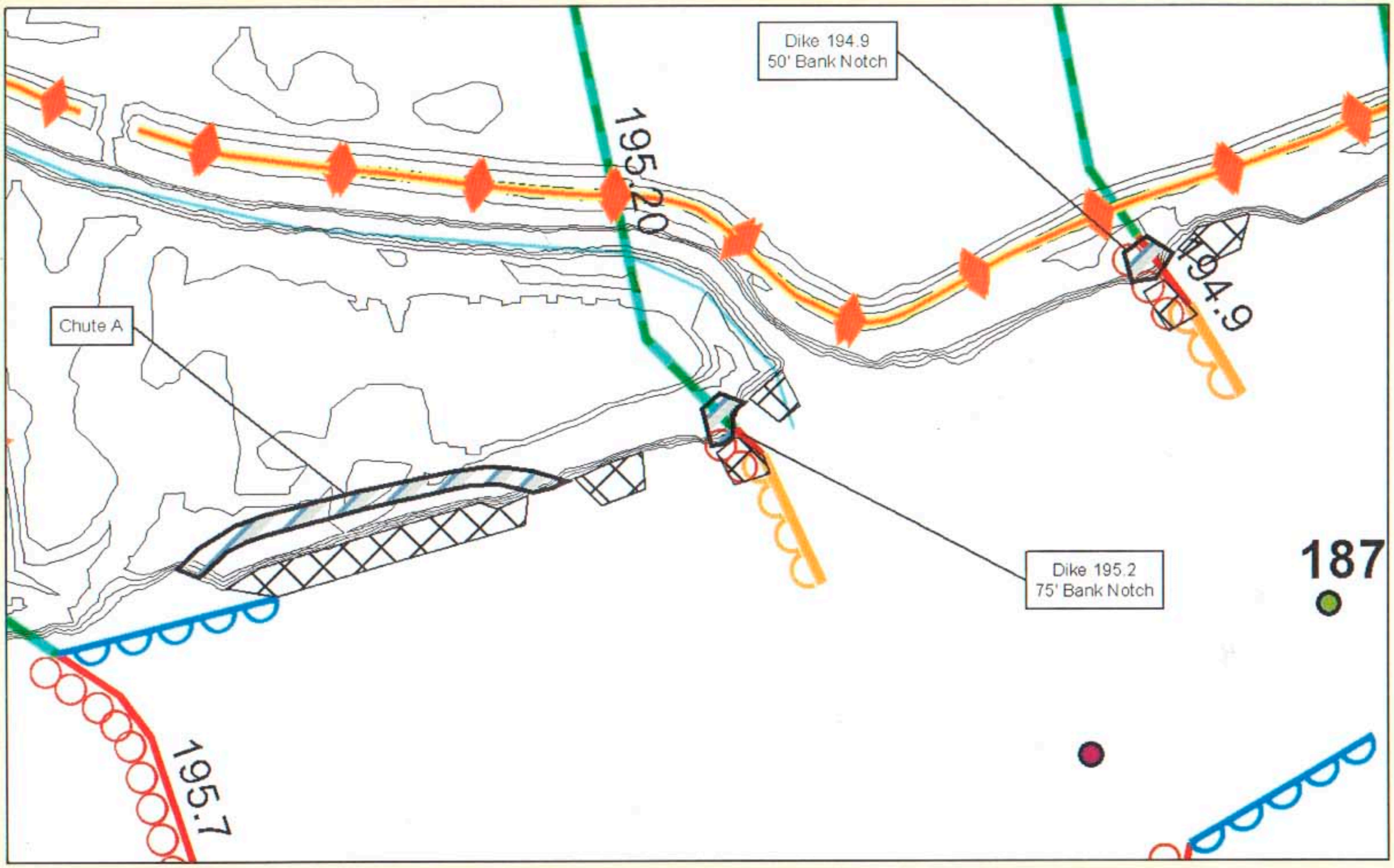
*CRP = Construction Reference Plane = Elevation Representing Flow Exceeded 75% of the time

Figure 2b. Typical Bank Notch Detail



*CRP = Construction Reference Plane = Elevation representing flow exceeded 75% of the time

Figure 2c. Typical Pilot Channel Detail



Excavation Area

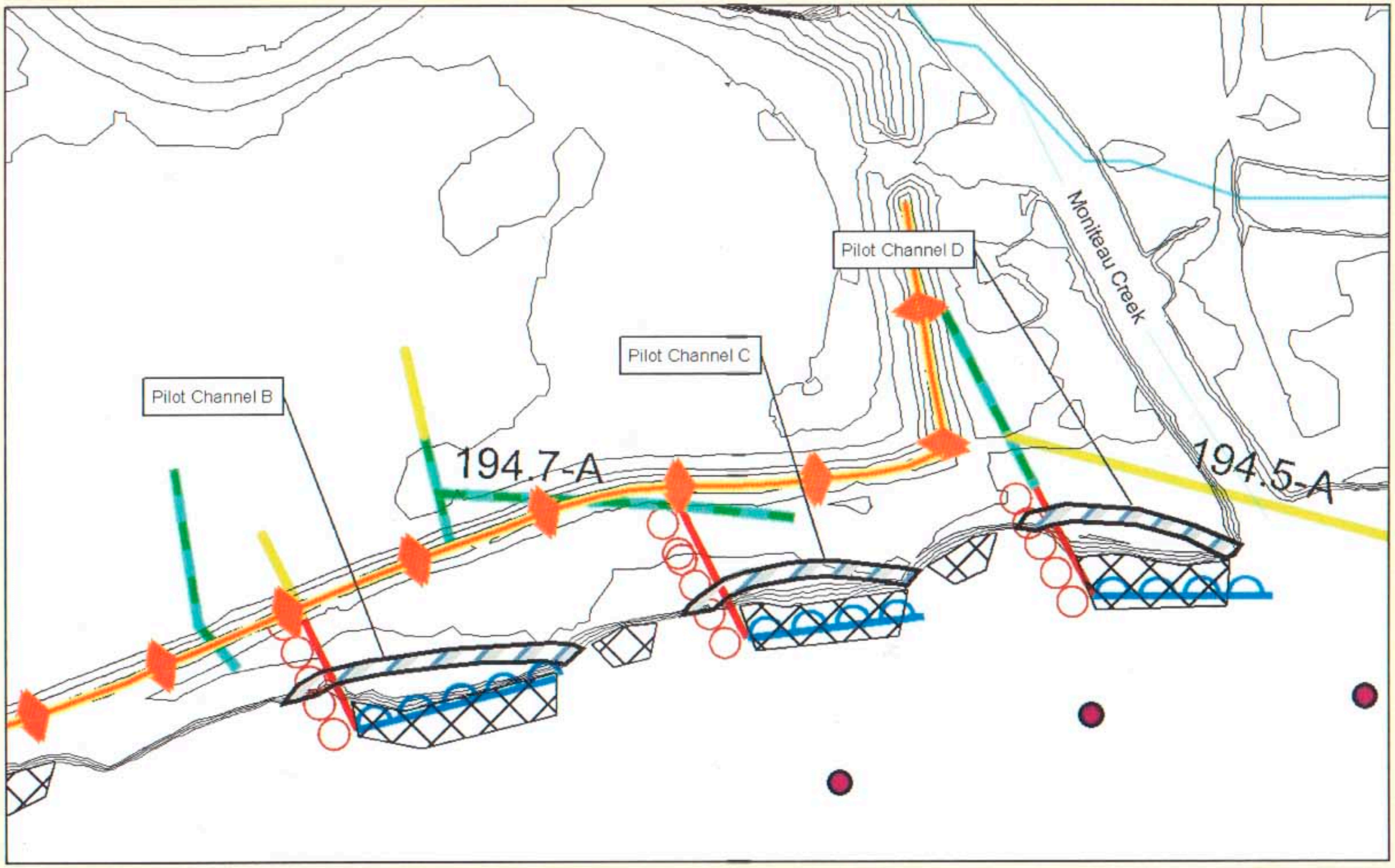
Spoil Locations

1:3,500

Figure 3a. Diana Bend Conservation Area

Shallow Water Habitat Restoration

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004



Excavation Area

Spoil Locations

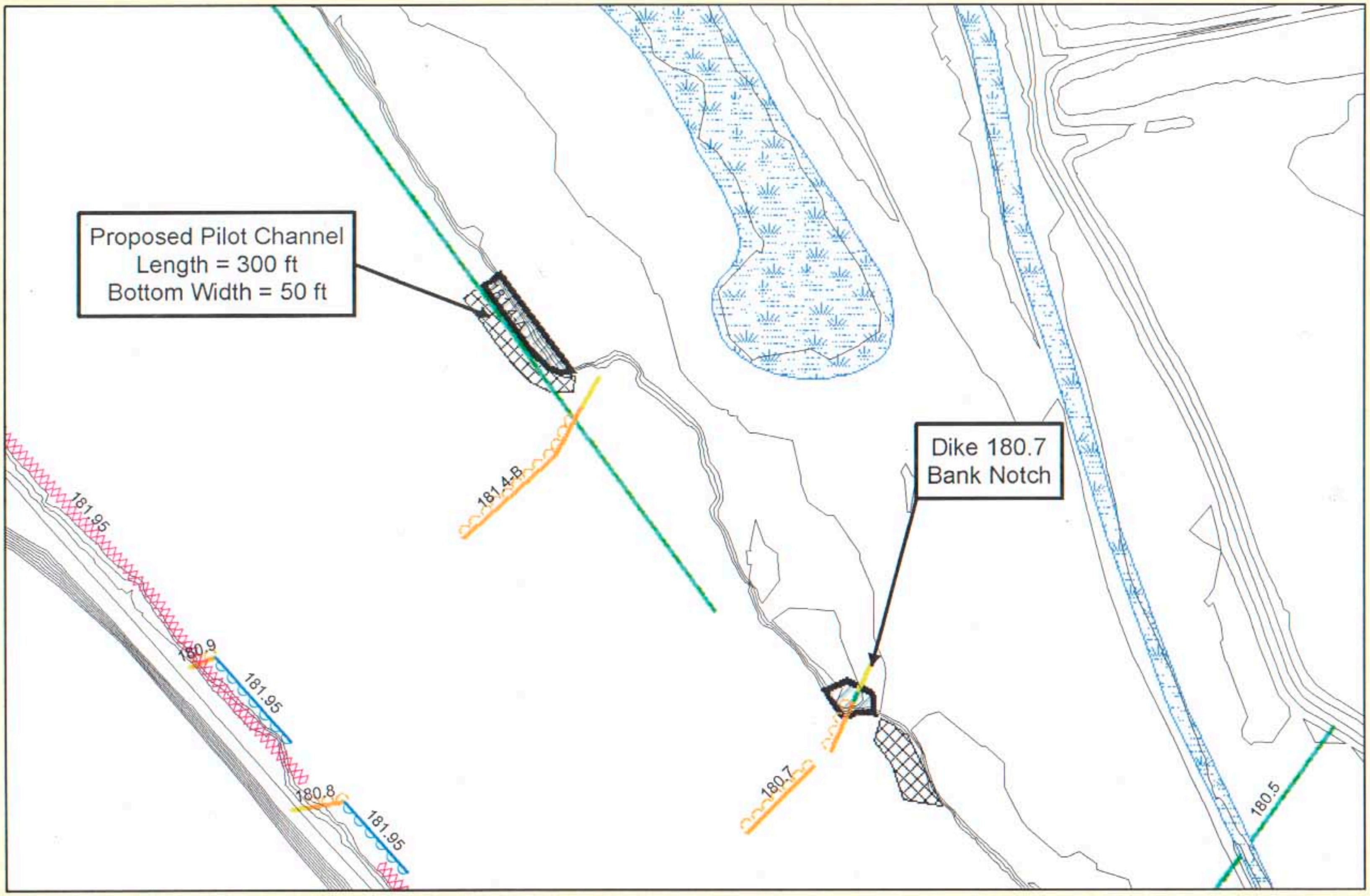
1:3,500

Figure 3b. Diana Bend Conservation Area

Shallow Water Habitat Restoration

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004

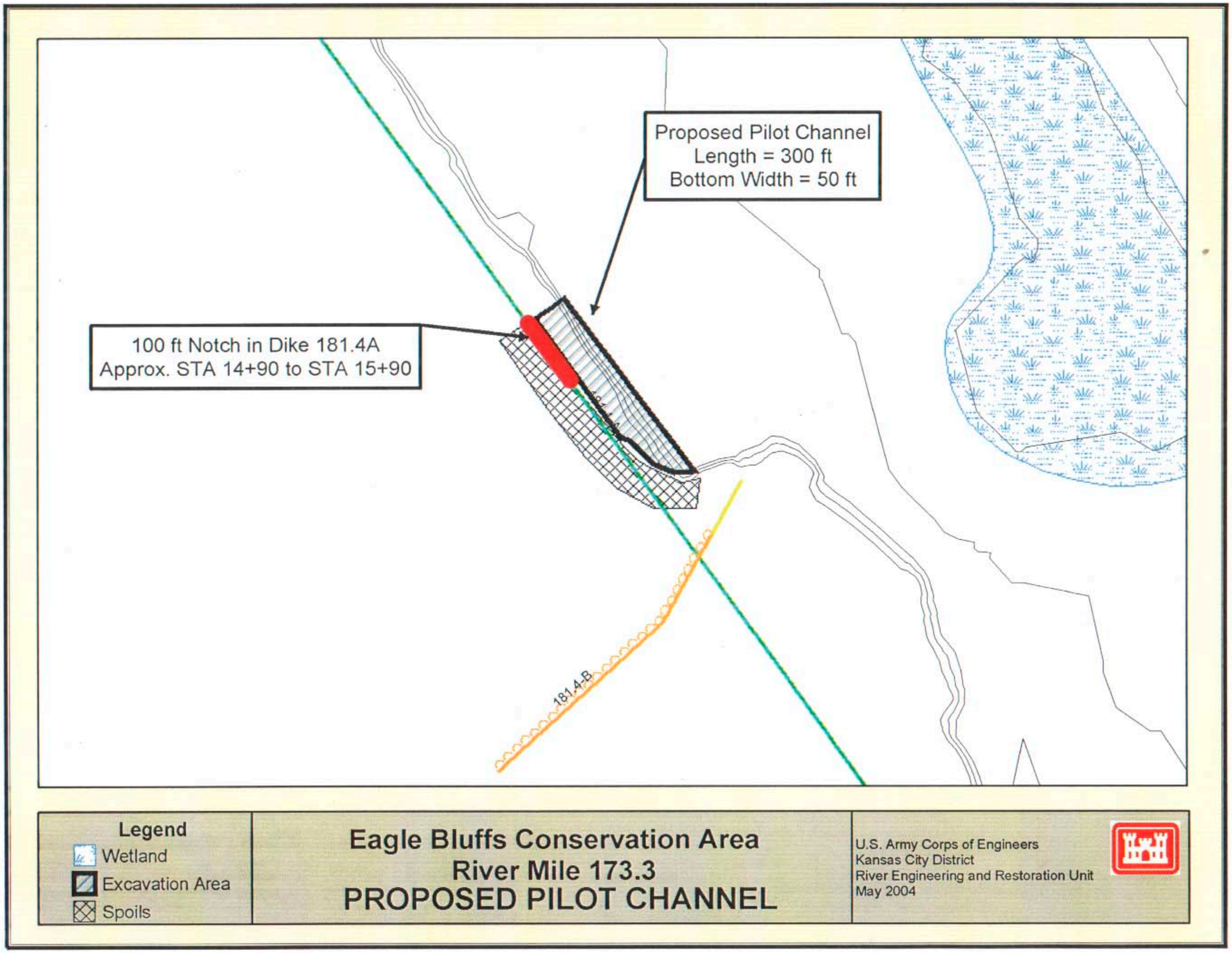
Eagle Bluffs Conservation Area



Legend
- Wetland
- Excavation Area
- Spoils

Eagle Bluffs Conservation Area
River Mile 173.3
PROPOSED PILOT CHANNEL

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
May 2004


Proposed Pilot Channel
Length = 300 ft
Bottom Width = 50 ft
100 ft Notch in Dike 181.4A
Approx. STA 14+90 to STA 15+90
181.4-B
Legend
Wetland
Excavation Area
Spoils
Eagle Bluffs Conservation Area
River Mile 173.3
PROPOSED PILOT CHANNEL
U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
May 2004

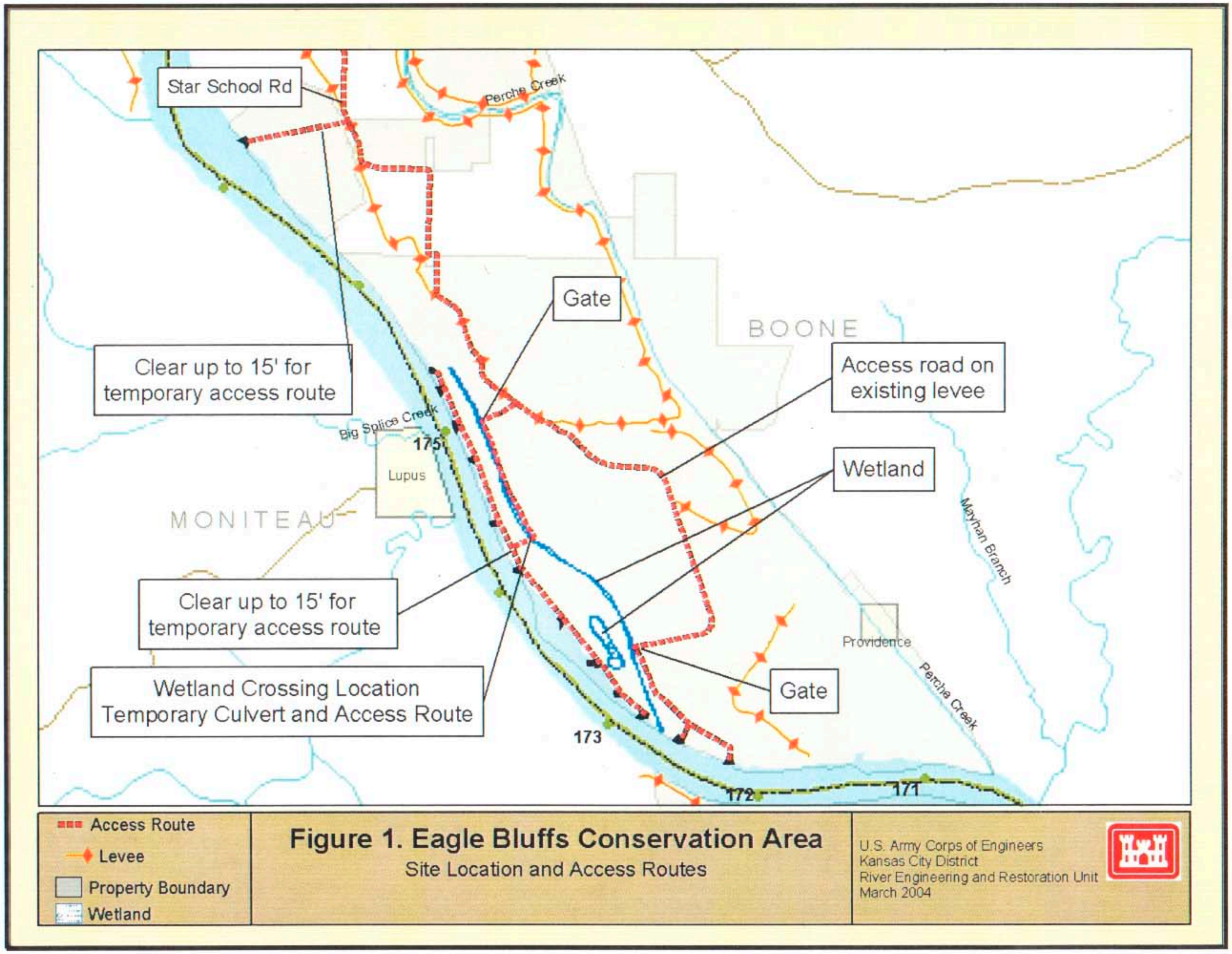
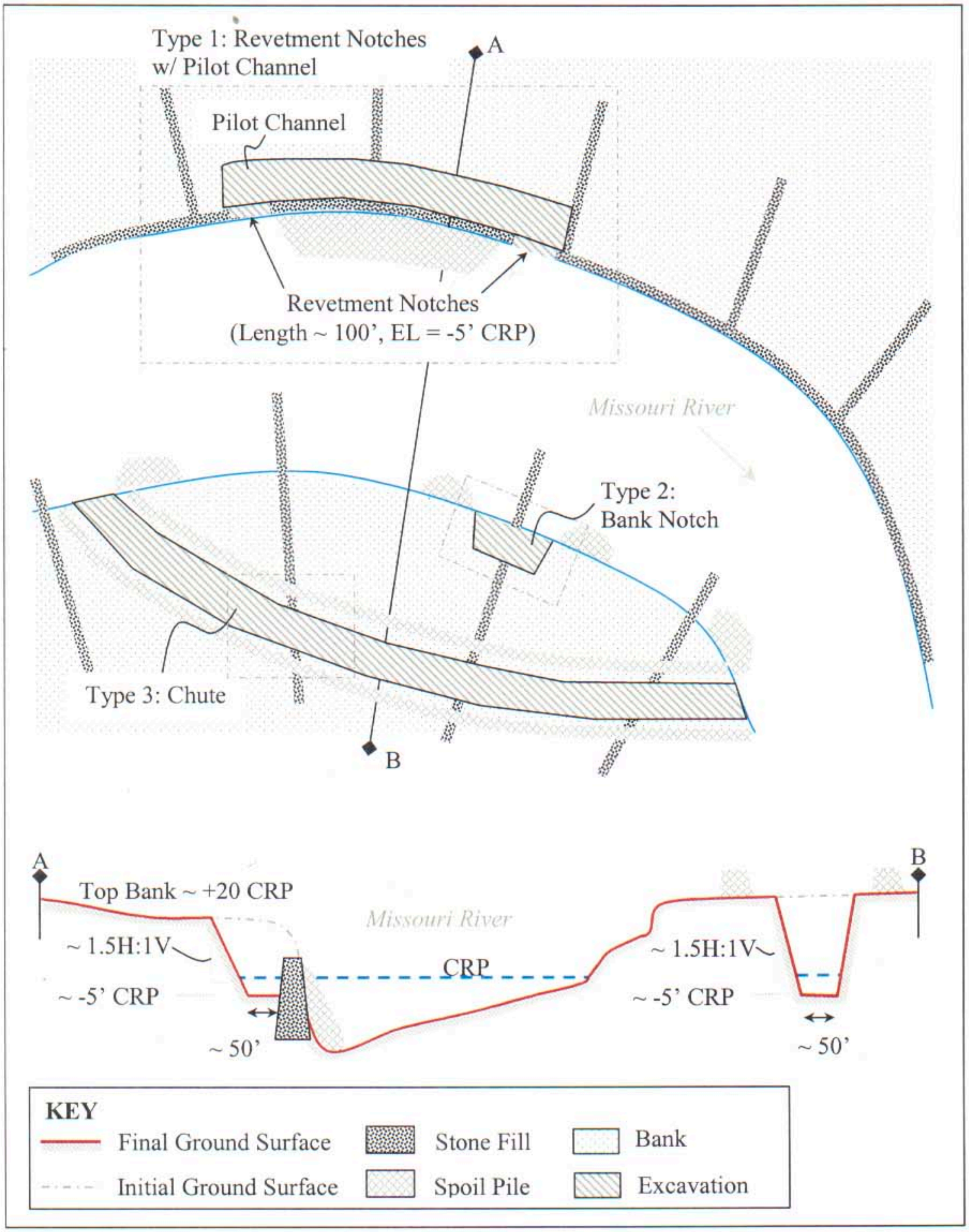
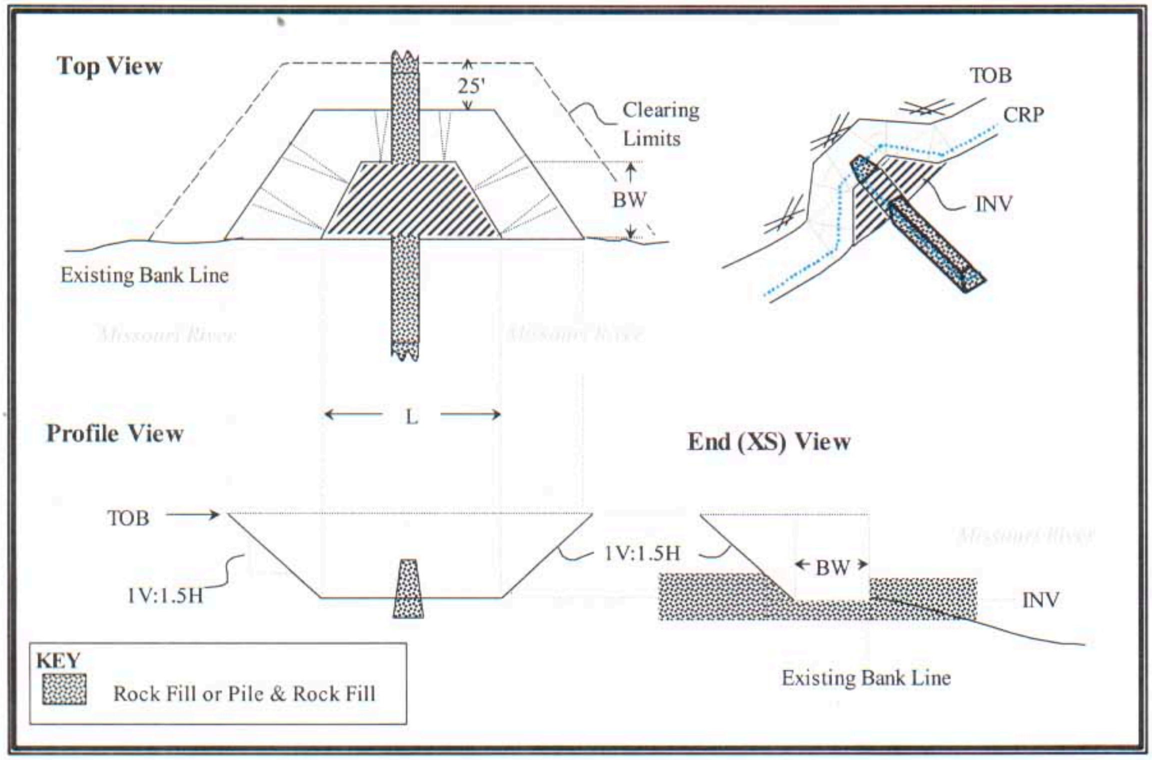


Figure 1. Eagle Bluffs Conservation Area
Site Location and Access Routes



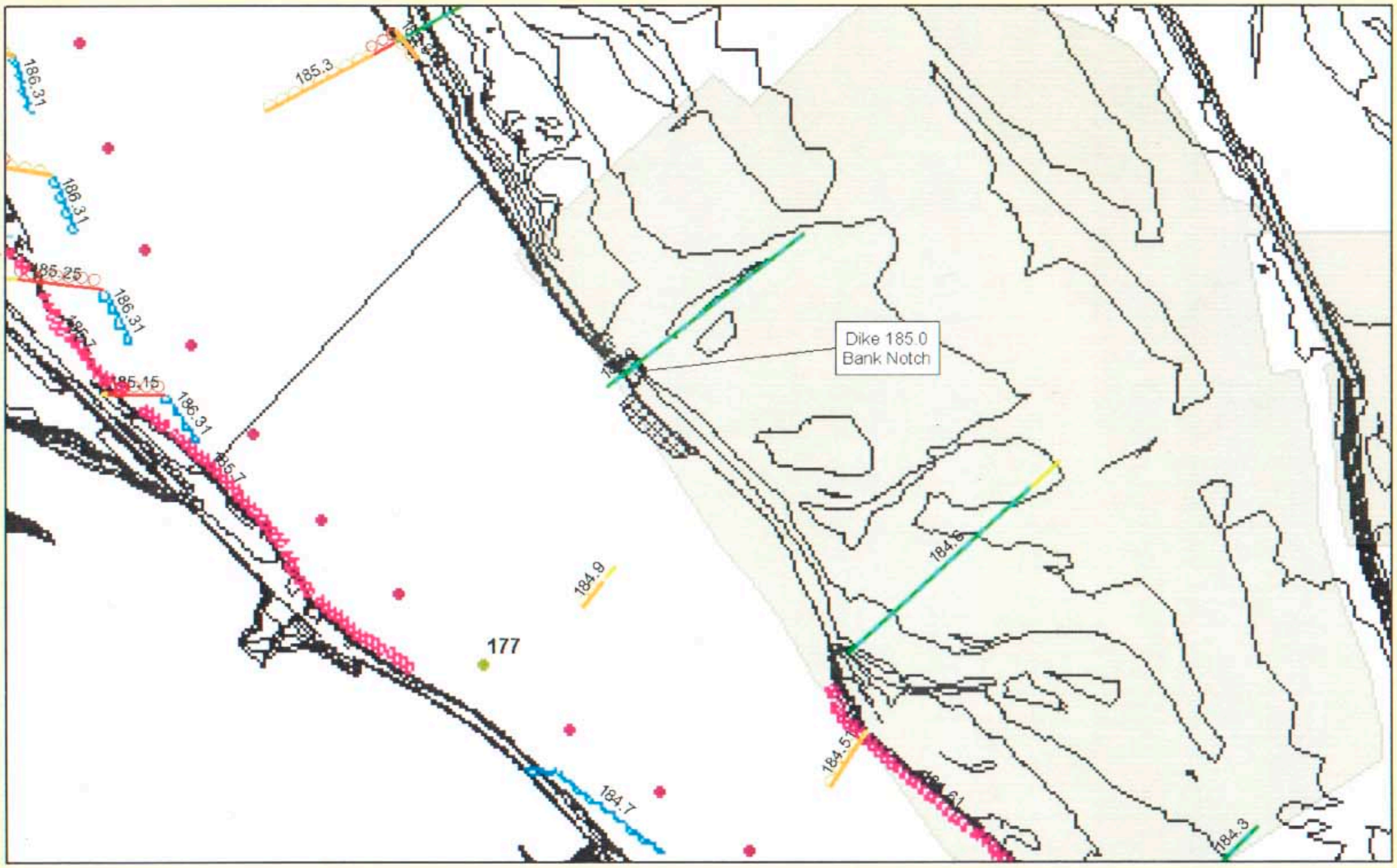
*CRP = Construction Reference Plane = Elevation representing flow exceeded 75% of the time

Figure 2a. Typical Shallow Water Habitat Design



*CRP = Construction Reference Plane = Elevation Representing Flow Exceeded 75% of the time

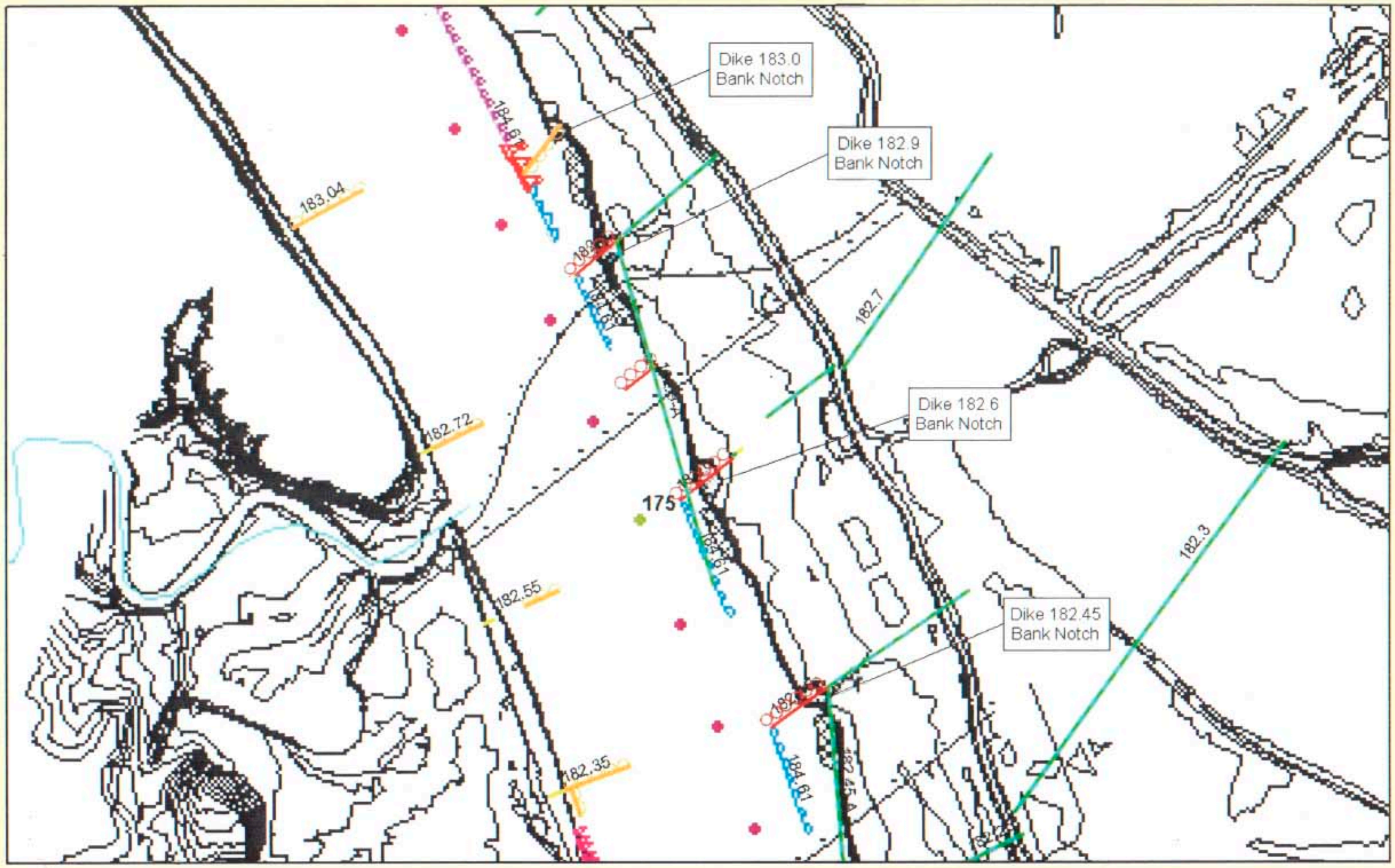
Figure 2b. Typical Bank Notch Detail



Legend
- Excavation Area
- Spoil Locations
- Property Boundary

Figure 3a. Eagle Bluffs Conservation Area
SWH Restoration River Miles 176.7 - 177.7

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004

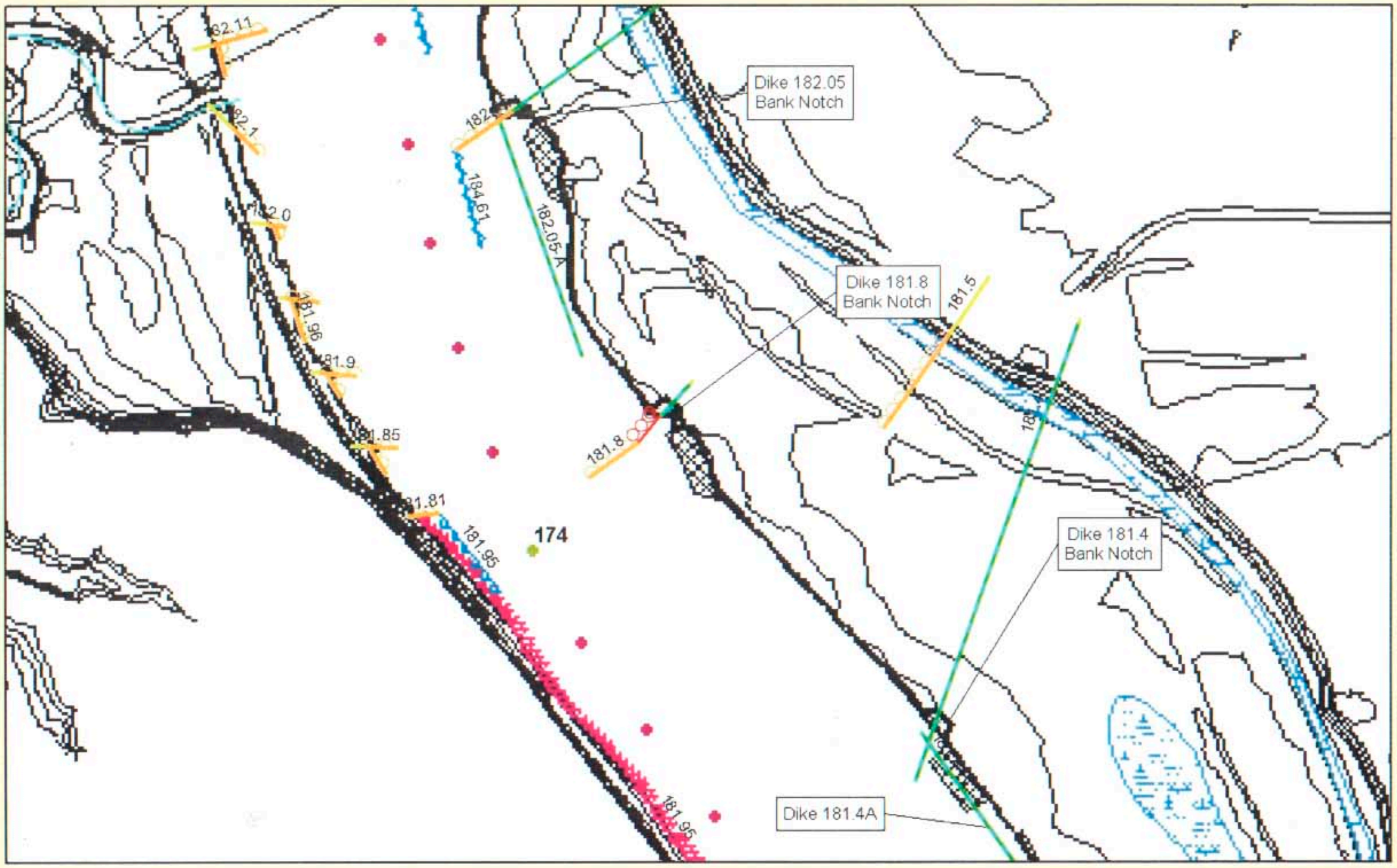


Legend
- Excavation Area
- Spoil Locations
- Pipeline Crossing

Figure 3b. Eagle Bluffs Conservation Area

SWH Restoration River Miles 174.7-175.5

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004

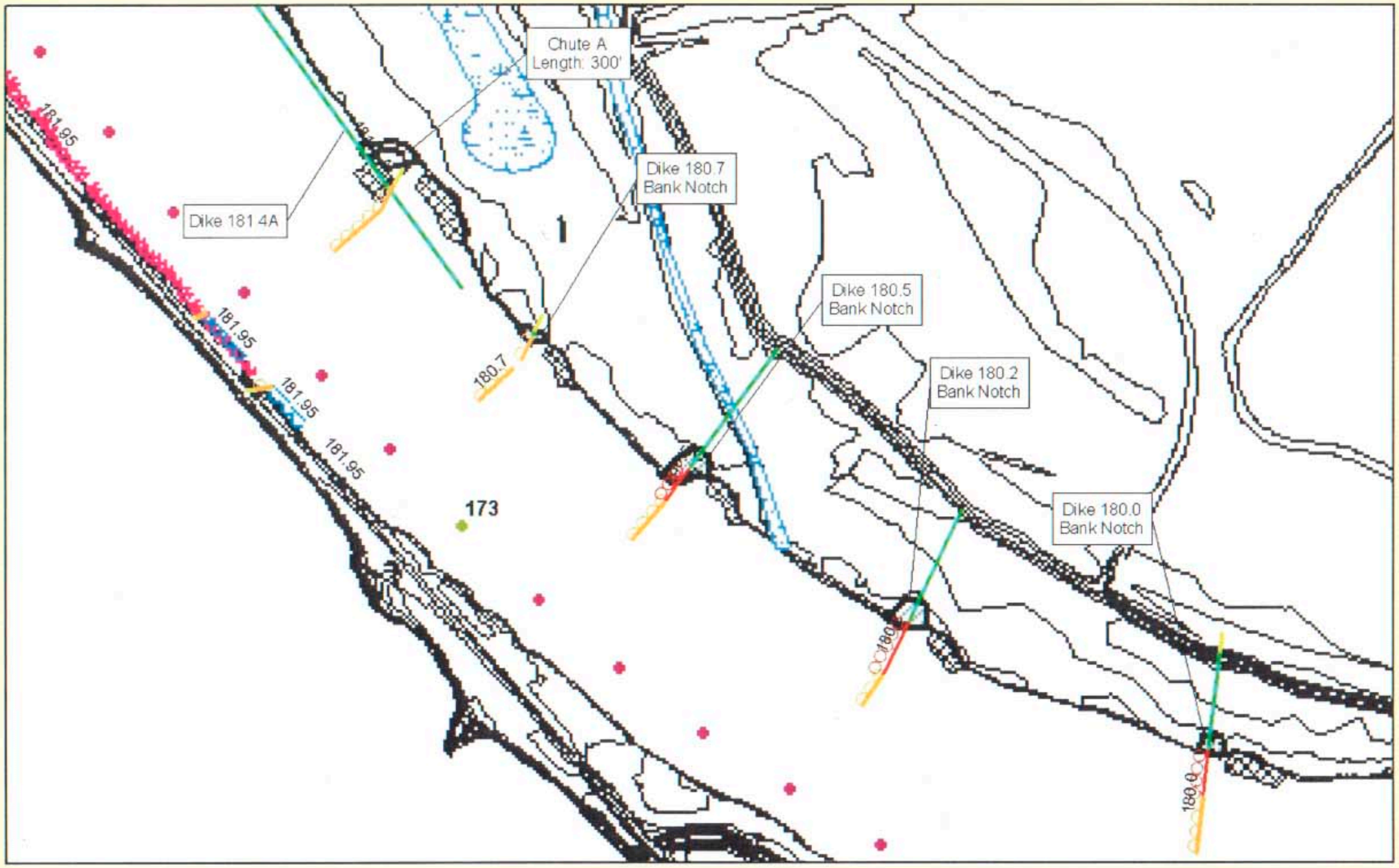


Legend
Excavation Area
Spoil Locations
Wetland

Figure 3c. Eagle Bluffs Conservation Area

SWH Restoration River Miles 173.7-174.5

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004



Legend
- Excavation Area
- Spoil Locations
- Wetland

Figure 3d. Eagle Bluffs Conservation Area

SWH Restoration River Miles 172.2-173.5

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004

Marion Bottoms Conservation Area

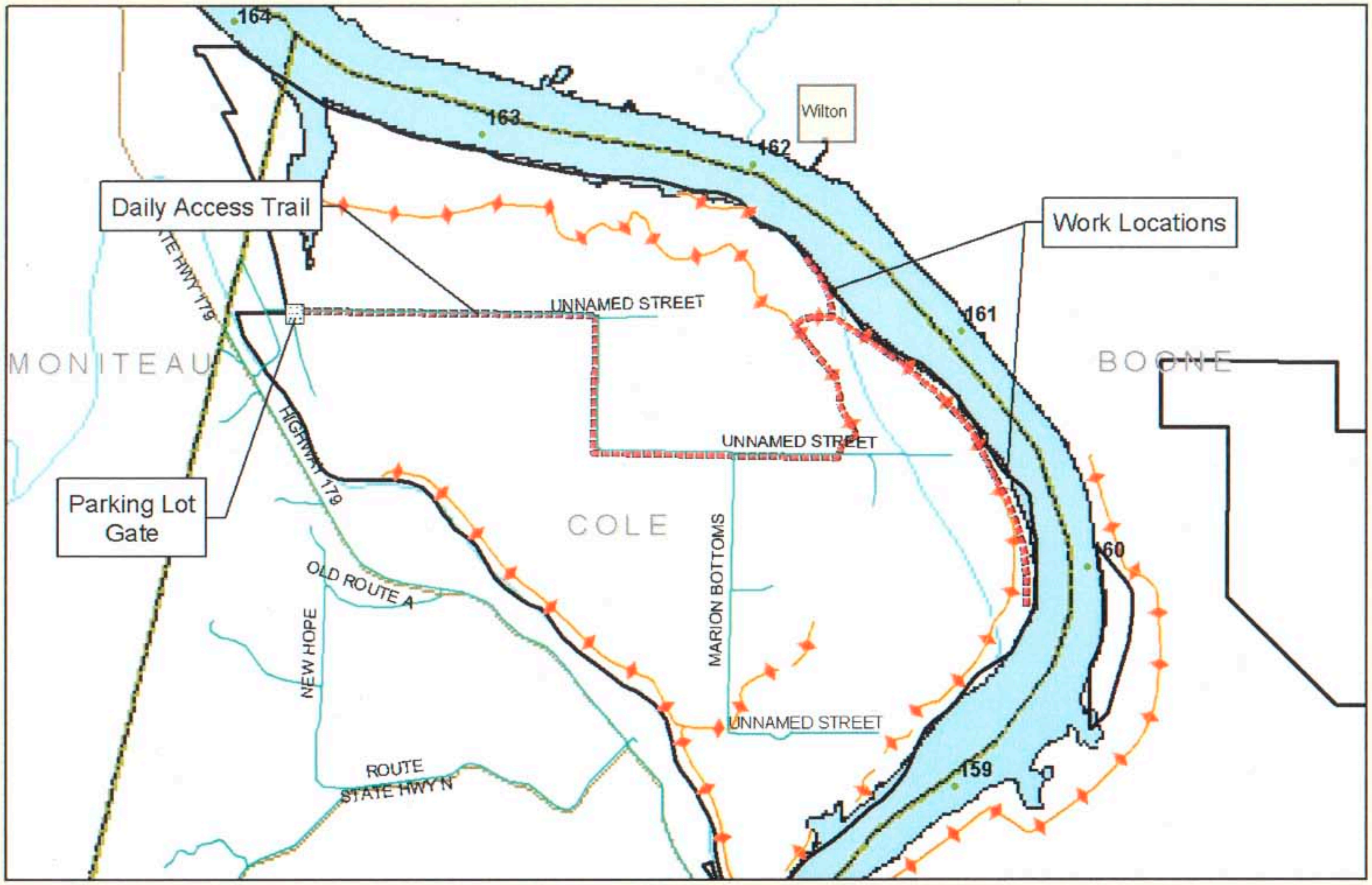
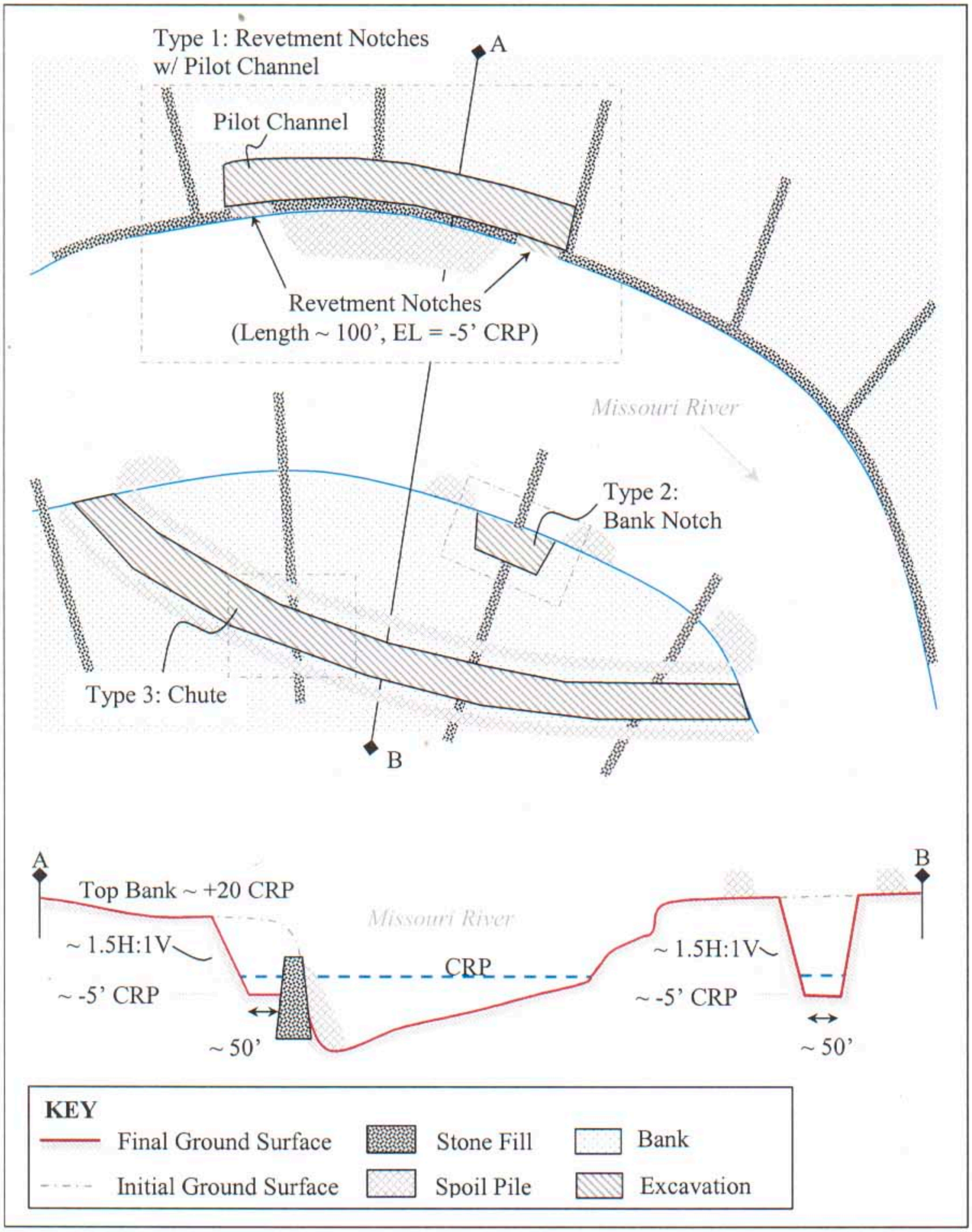


Figure 1. Marion Bottoms Conservation Area
Site Location

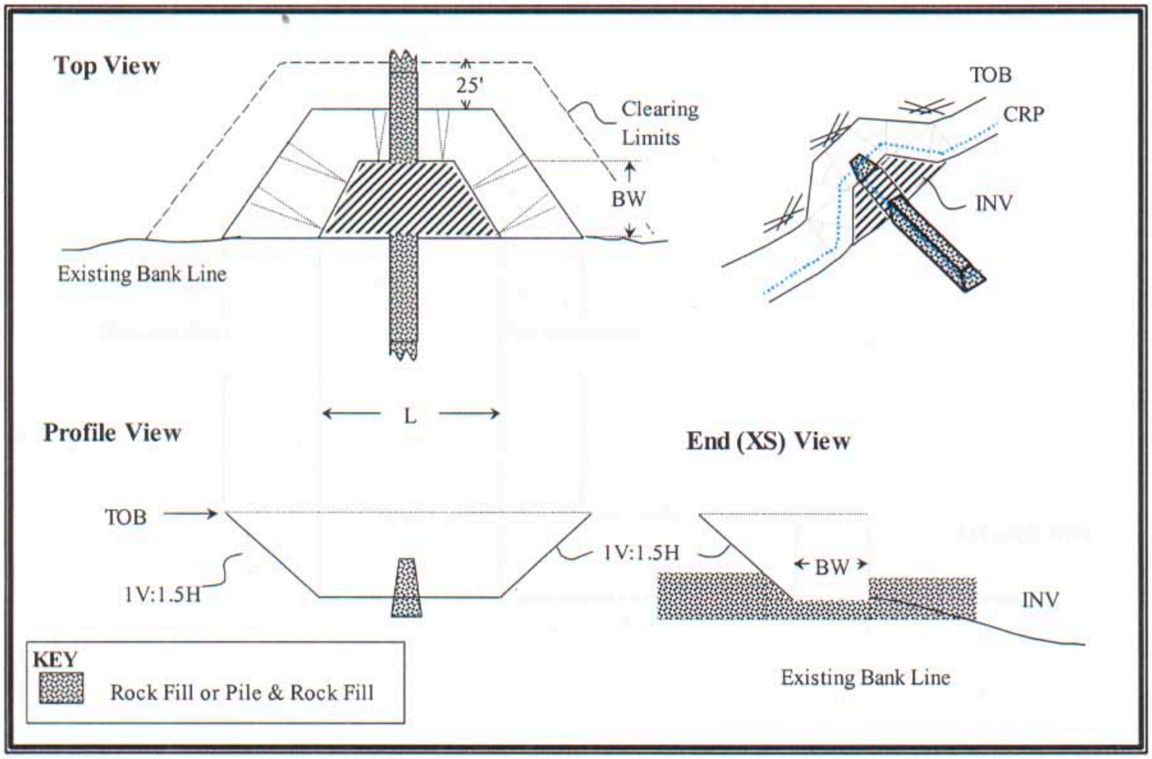
U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004

1:35,000



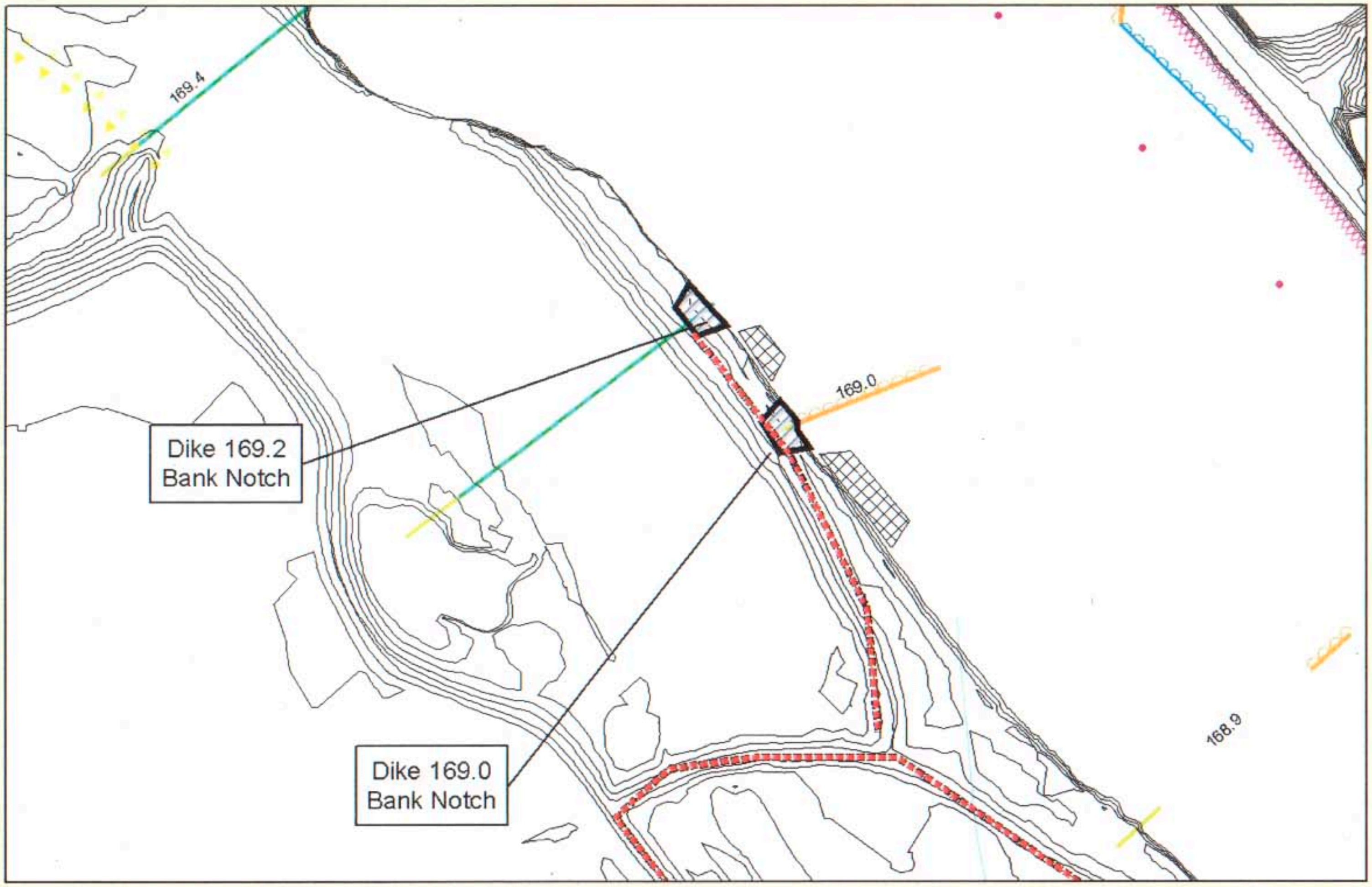
*CRP = Construction Reference Plane = Elevation representing flow exceeded 75% of the time

Figure 2a. Typical Shallow Water Habitat Design



*CRP = Construction Reference Plane = Elevation Representing Flow Exceeded 75% of the time

Figure 2b. Typical Bank Notch

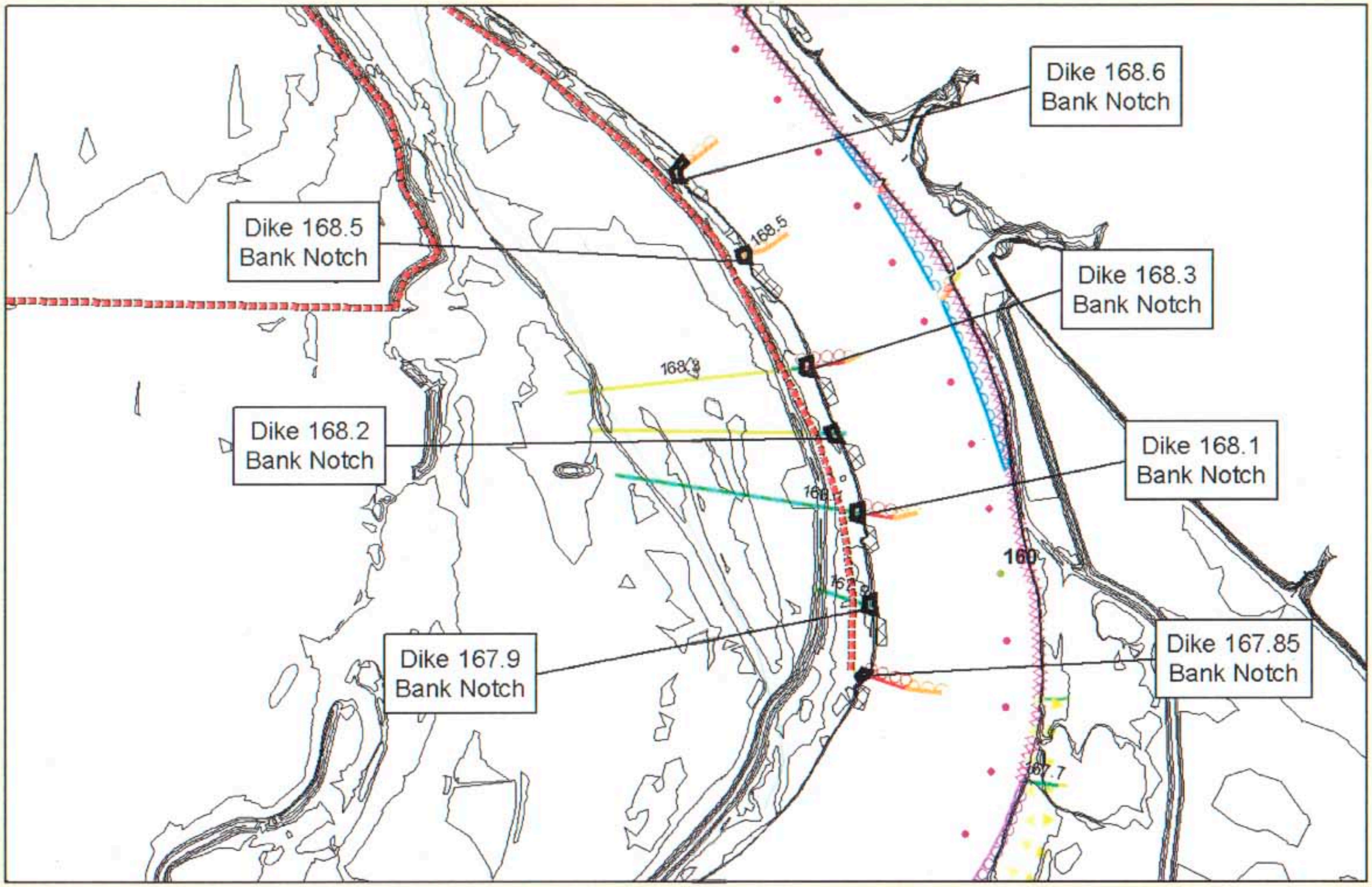


Excavation Area
Spoil Locations
Access Trails

Figure 3a. Marion Bottoms Conservation Area

Shallow Water Habitat Restoration

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004

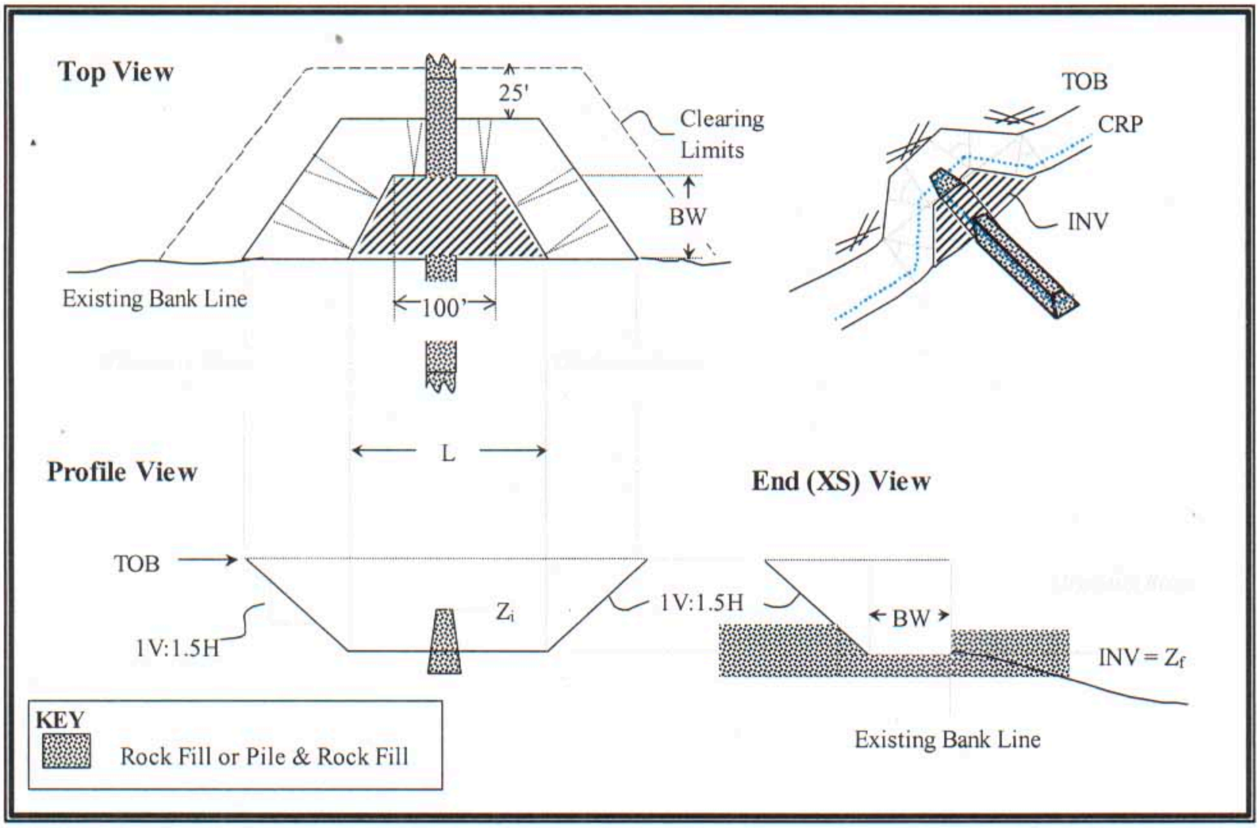


Excavation Area
Spoil Locations
Access Trails

Figure 3b. Marion Bottoms Conservation Area
Shallow Water Habitat Restoration

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004

Smokey Waters Conservation Area



*CRP = Construction Reference Plane = Elevation Representing Flow Exceeded 75% of the time

FIGURE 1: Typical Bank Notching

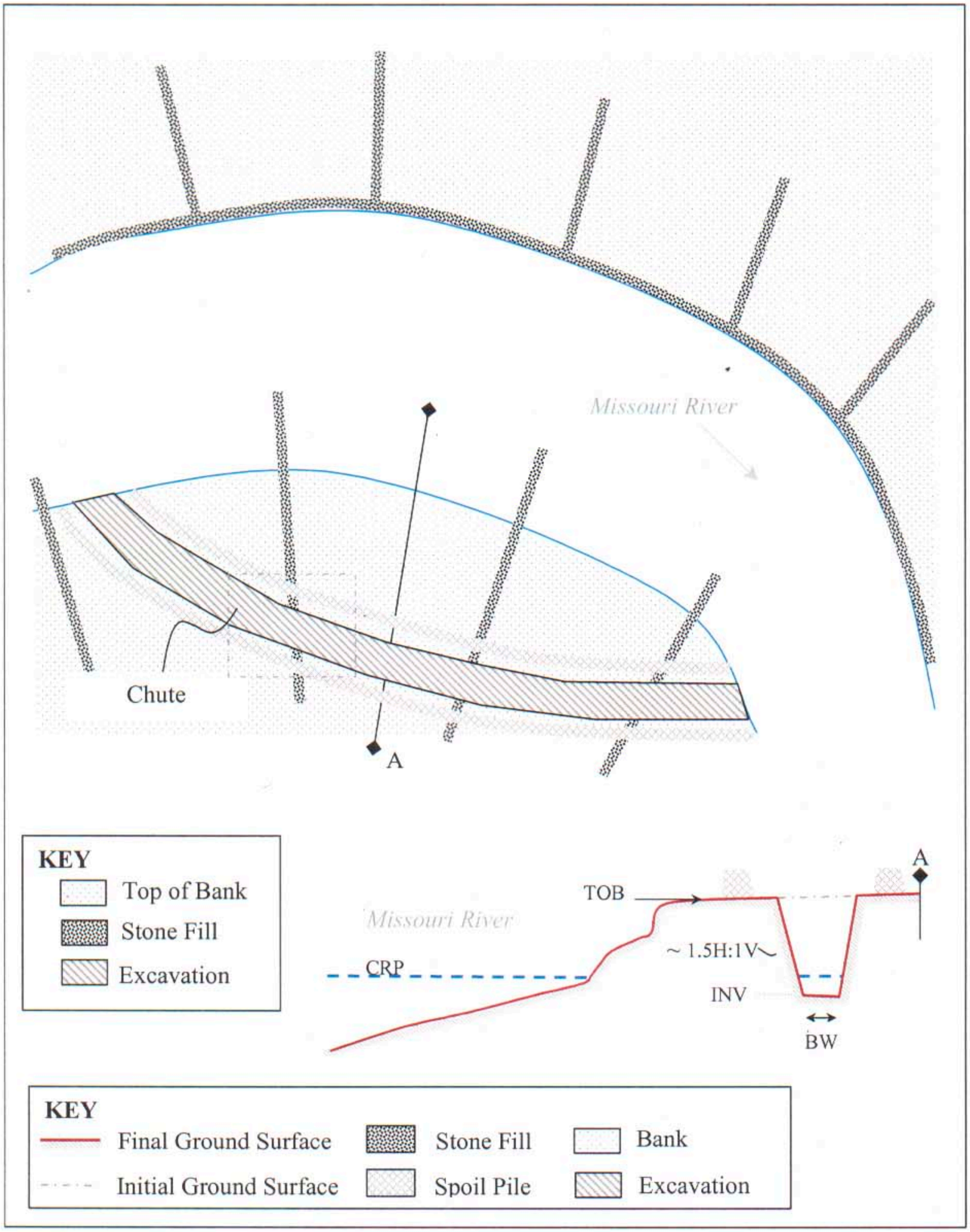
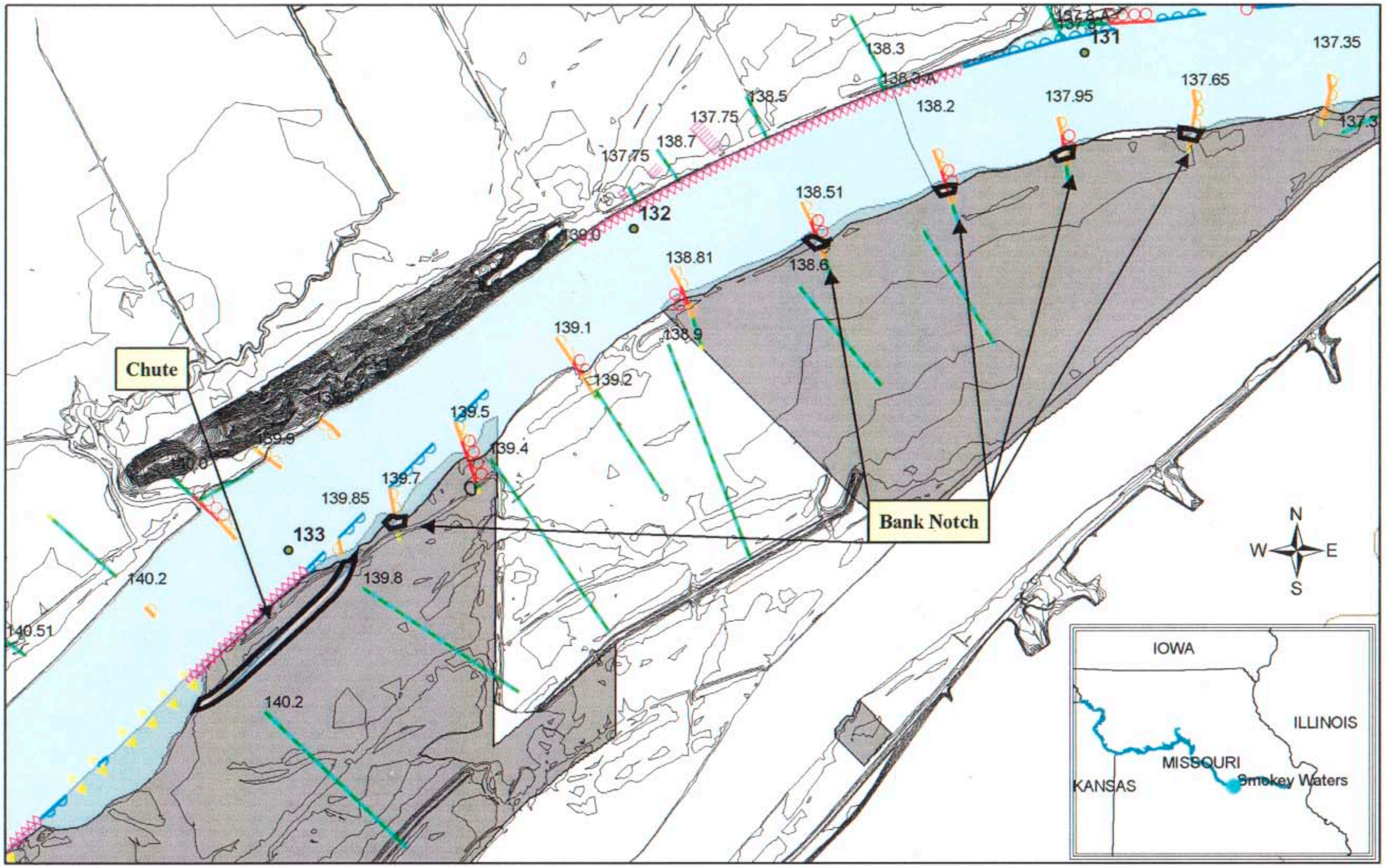


FIGURE 2: Typical Chute Construction



Legend

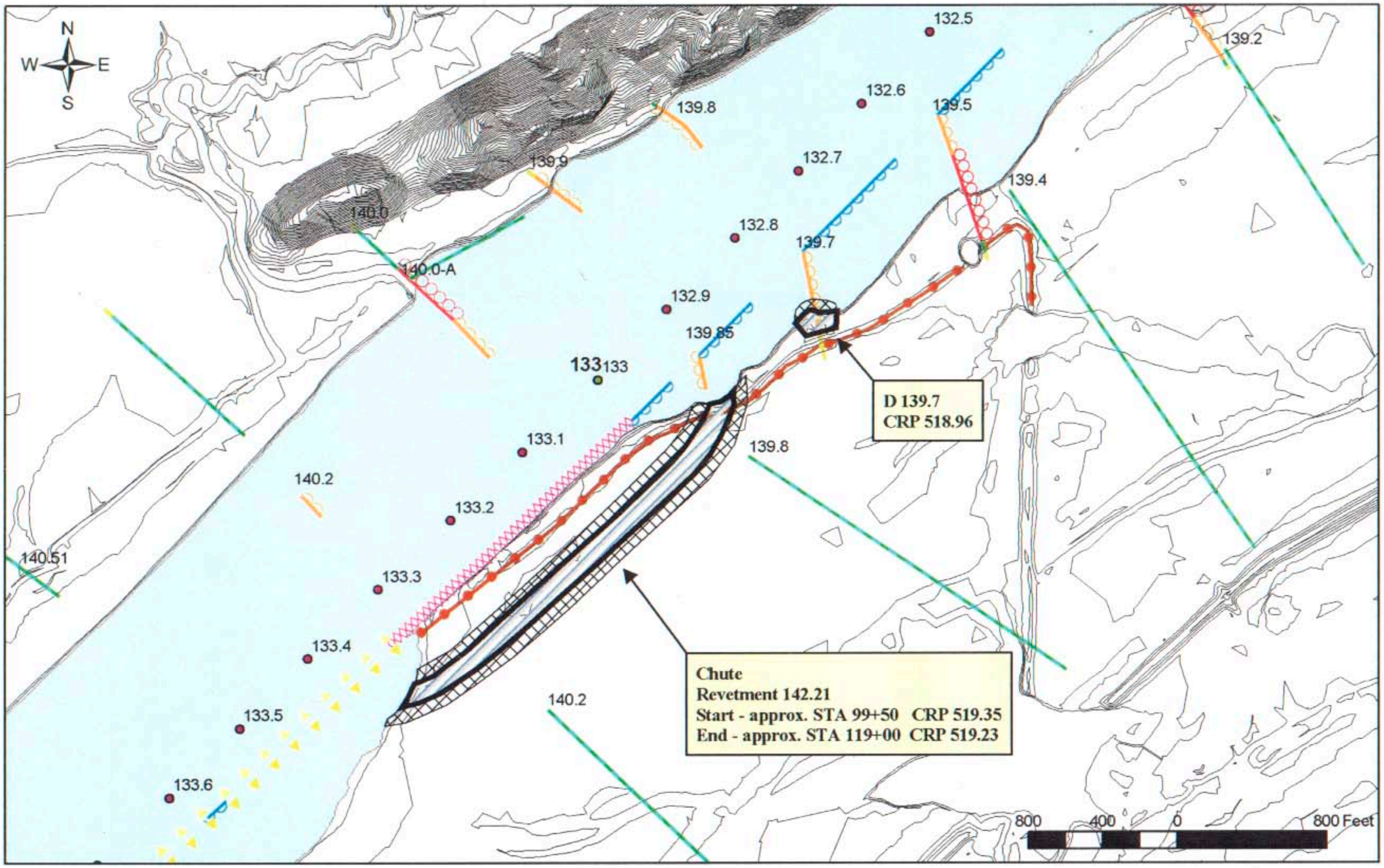
MDC Property

Excavation Area

Figure 3. Project Overview
Smokey Waters Conservation Area
River Miles 130-134

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004

K:\projects\civ\SWH\arcgismaps\SmokeyWaters



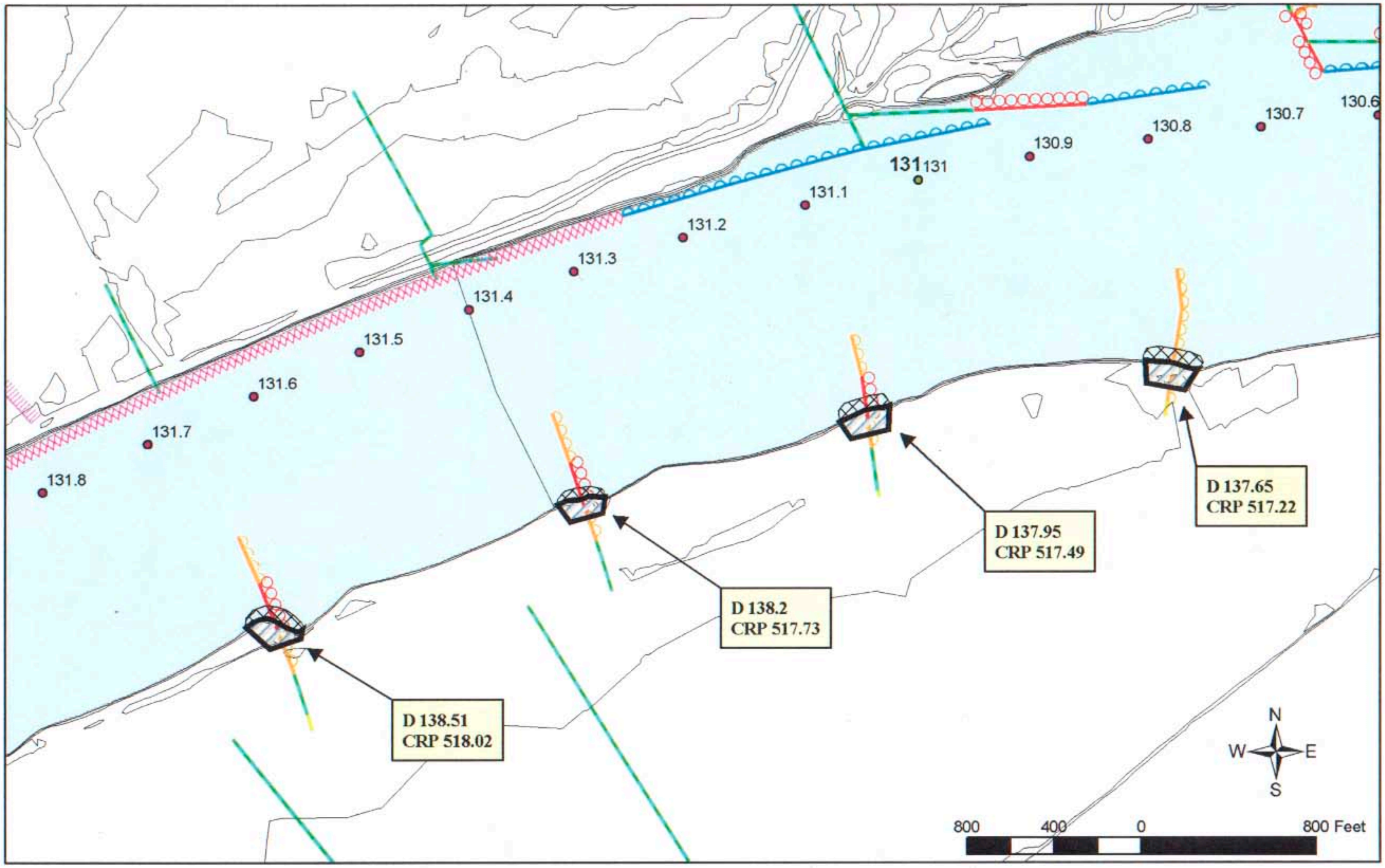
Legend

- Excavation Area
- Spoils
- Old Levee

Figure 4. Chute, Bank Notch D-139.7
Smokey Waters Conservation Area

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004

K:\projects\civ\SWH\arcgismaps\SmokeyWaters\



Legend

- Excavation Area
- Spoils

Figure 5. Bank Notches
Dike Numbers 138.51, 138.2, 137.95, 137.65

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004

K:\projects\civ\SWH\arcgismaps\SmokeyWaters\

Legend

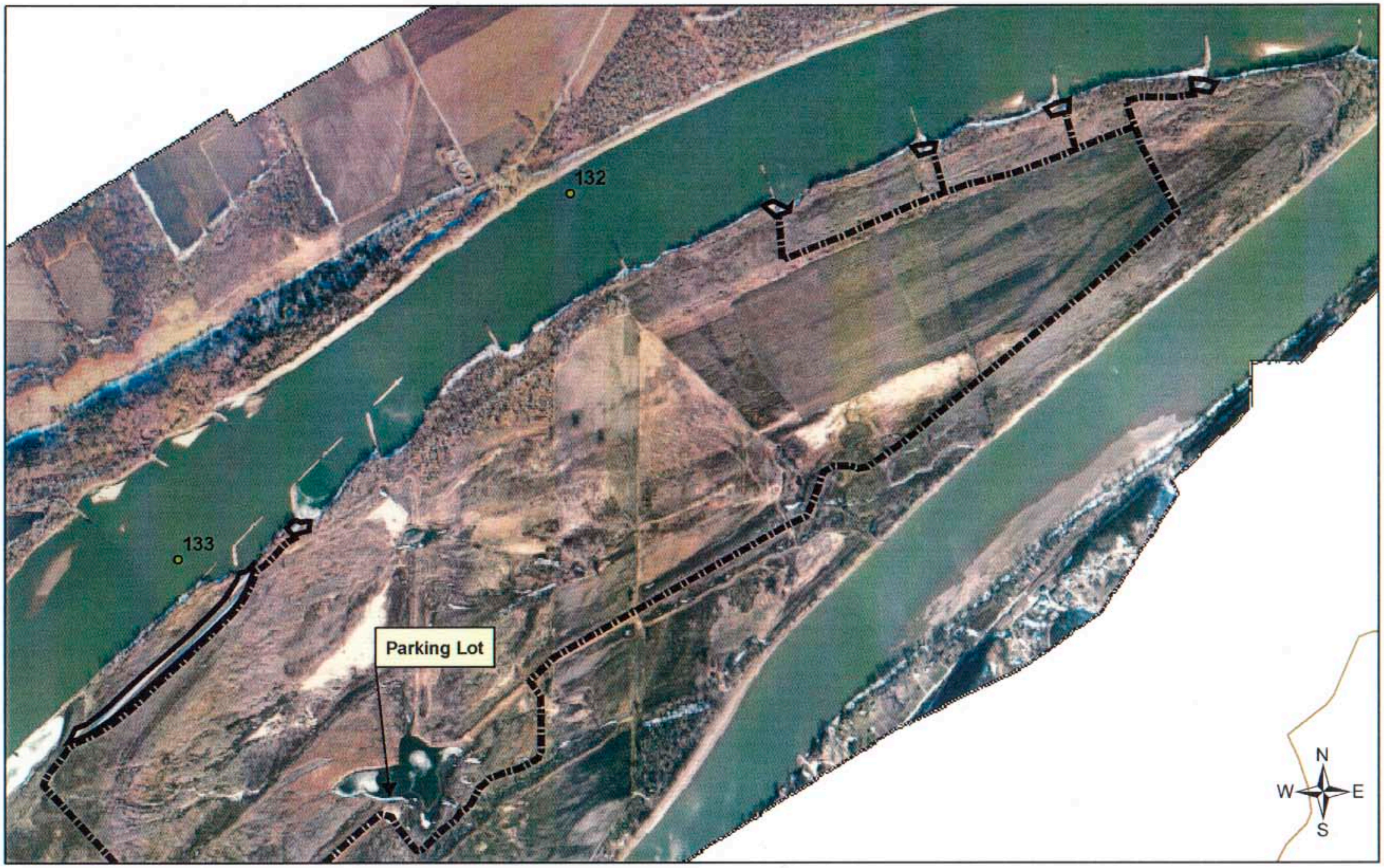
Excavation Area

Access Route

Figure 6. Access Route
Chute, Bank Notch D-139.7
Smokey Waters Conservation Area

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004

K:\projects\civ\SWH\arcgismaps\SmokeyWaters\



Legend

Excavation Area

Access Route

Figure 7. Access Route
Bank Notches
Dike Numbers 138.51, 138.2, 137.95, 137.65

U.S. Army Corps of Engineers
Kansas City District
River Engineering and Restoration Unit
March 2004

K:\projects\civ\SWH\arcgismaps\SmokeyWaters\