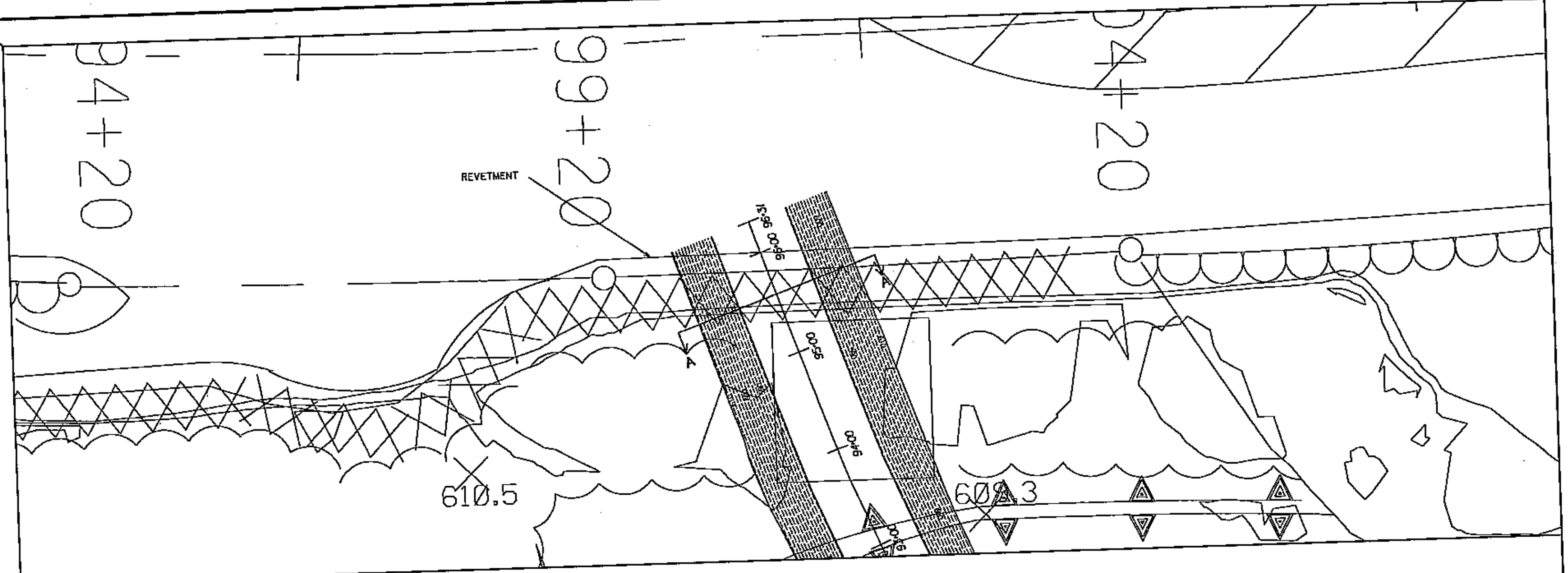
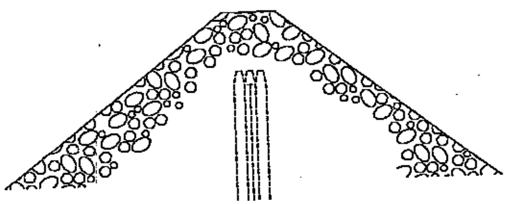
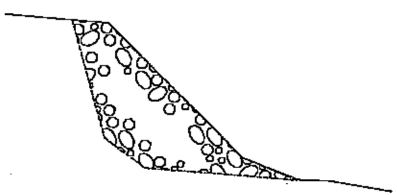


NOTE: THE EXACT LOCATION OF THE REVETMENT AND OTHER RIVER STRUCTURES IS UNKOWN. DRAWINGS SHOW APPROXIMATE LOCATION. DRAWINGS OF RIVER STRUCTURES MAY NOT BE TO SCALE.

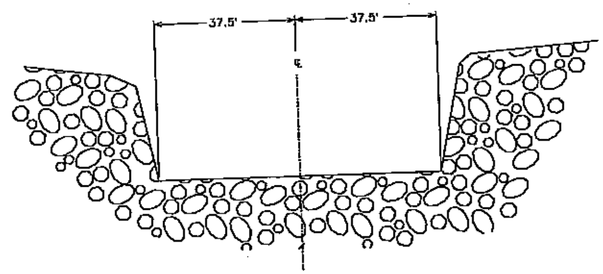


B — CG502 | CG502 — TYPICAL RIVER STRUCTURE
NOT TO SCALE



B — CG502 | CG502 — TYPICAL RIVER STRUCTURE
NOT TO SCALE

NOTE: THESE ARE TYPICAL RIVER STRUCTURES OF WHAT THE CONTRACTOR COULD ENCOUNTER.



A — CG502 | CG502 — TYPICAL CROSS SECTION OF REVETMENT NOTCH
NOT TO SCALE

NOTE: THE EXACT LOCATION OF THE REVETMENT IS UNKNOWN.

US Army Corps of Engineers
Kansas City District

Symbol	Description	Date	Appr.

Designed by: CJB	Date: JULY 2005
Drawn by: CCG	File no.
Checked by:	Plot scale:
Submitted by:	CADD File Name:

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
KANSAS CITY, MISSOURI

DRAFT

MISSOURI RIVER
JAMESON ISLAND
MITIGATION PROJECT

REVETMENT MODIFICATION

Sheet reference number:
CG502

Vandenberg, Matthew D NWK

From: Bitner, Chance J NWK
Sent: Thursday, December 01, 2005 11:34 AM
To: Vandenberg, Matthew D NWK
Subject: RE: Jameson Island
Attachments: 13Jun05_ConferenceCall_minutes.doc

Matt,

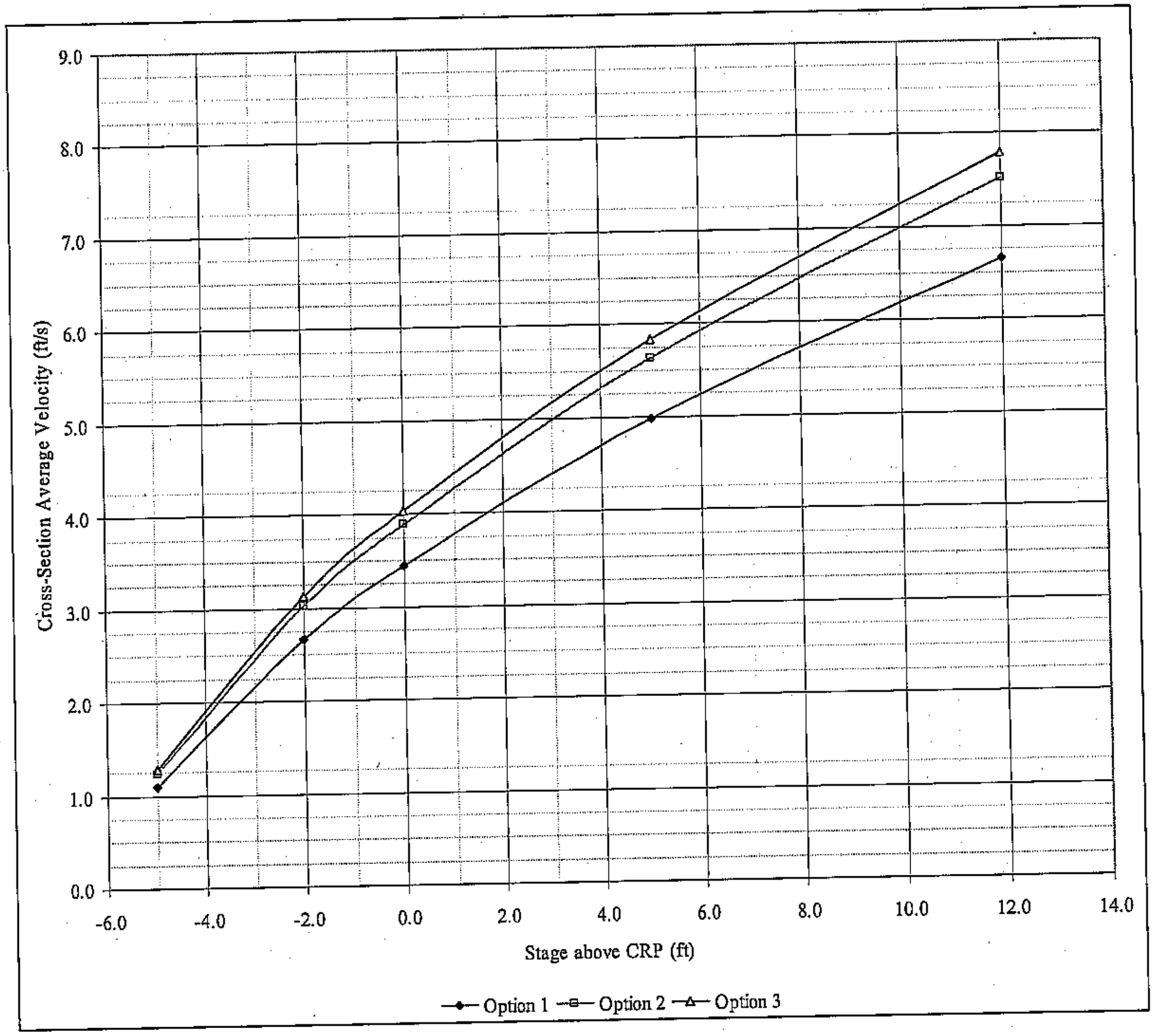
I found where I had written up the alignment, it was in meeting minutes from a conference call last June. I attached the minutes in case you need them, but here is the statement.

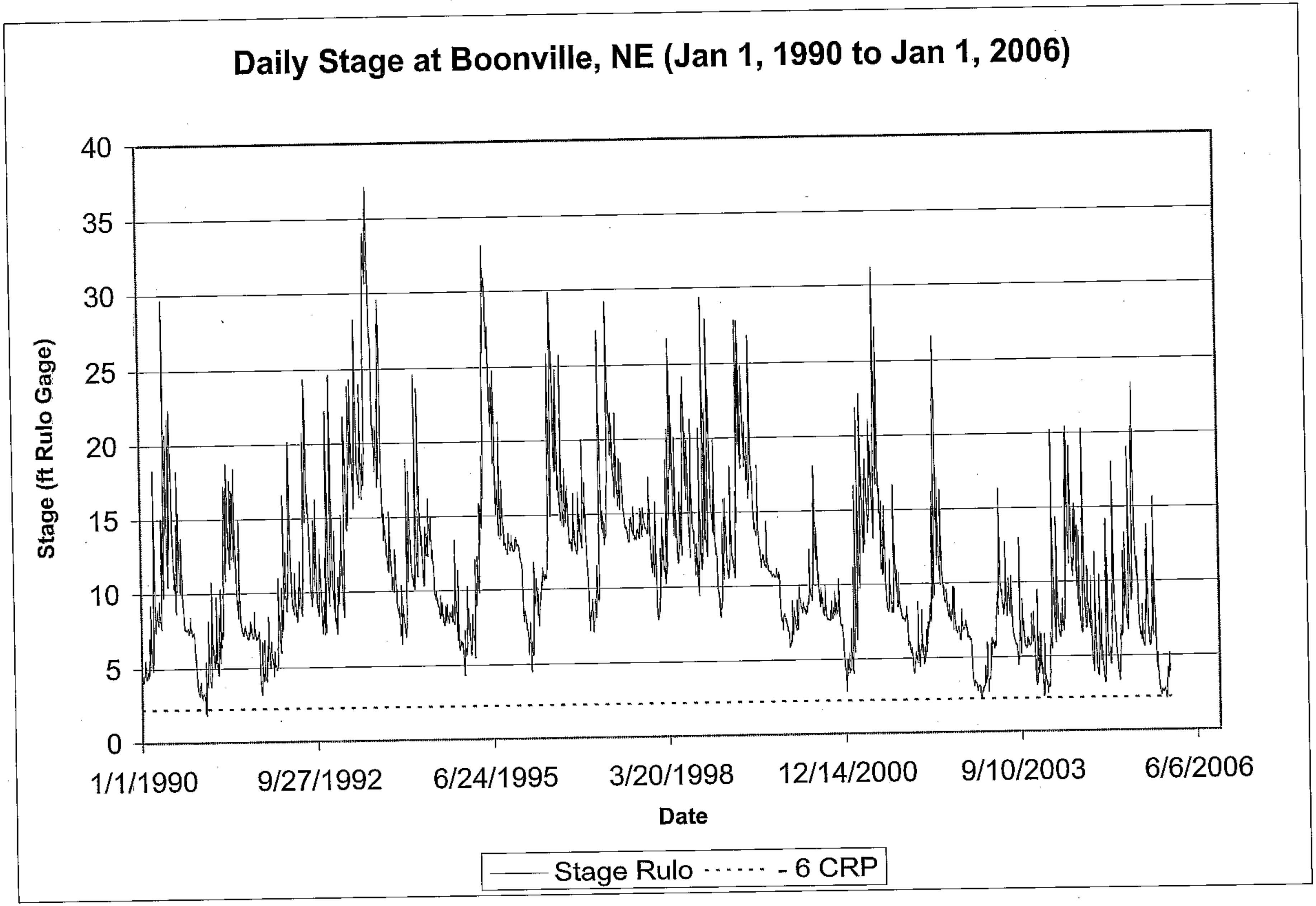
Chance

Jameson Island Alignment. The group approved of all three concept alignments. Barbara Moran (FWS - Big Muddy Refuge) preferred Option 1, or the alignment closest to the river to leave more land accessible to the public. Option 4 crosses private land (Barbara provided the Corps a more recent land boundary file). Options 2 and 3 follow the historic alignment, but are not preferred because they would wipe out mature trees and existing wetlands that have developed in the area.

-----Original Message-----
From: Vandenberg, Matthew D NWK
Sent: Thursday, December 01, 2005 11:17 AM
To: Bitner, Chance J NWK
Subject: Jameson Island

Chance,
Just a reminder that you were going to send me some information you had on why the Jameson Island Preferred alternative was selected.
Thanks
Matthew


9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Cross-Section Average Velocity (ft/s)
-6.0
-4.0
-2.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
Stage above CRP (ft)
Option 1
Option 2
Option 3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Stage (ft Rulo Gage)
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35
30
25
20
15
10
5
0
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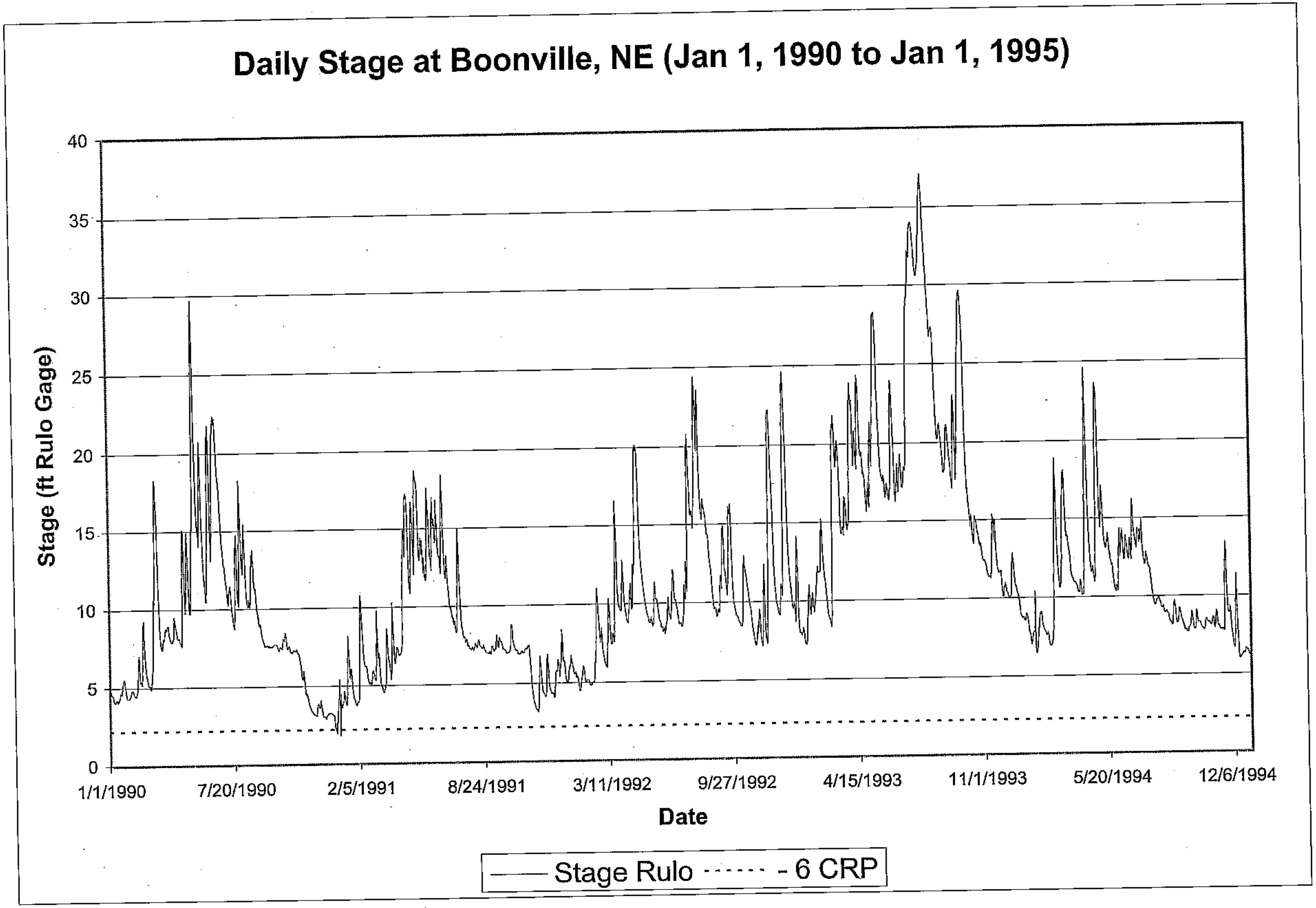
6/24/1995
3/20/1998
12/14/2000
9/10/2003
6/6/2006
Date
Stage Rulo
- 6 CRP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Stage (ft Rulo Gage)
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5
10
15
20
25
30
35
40
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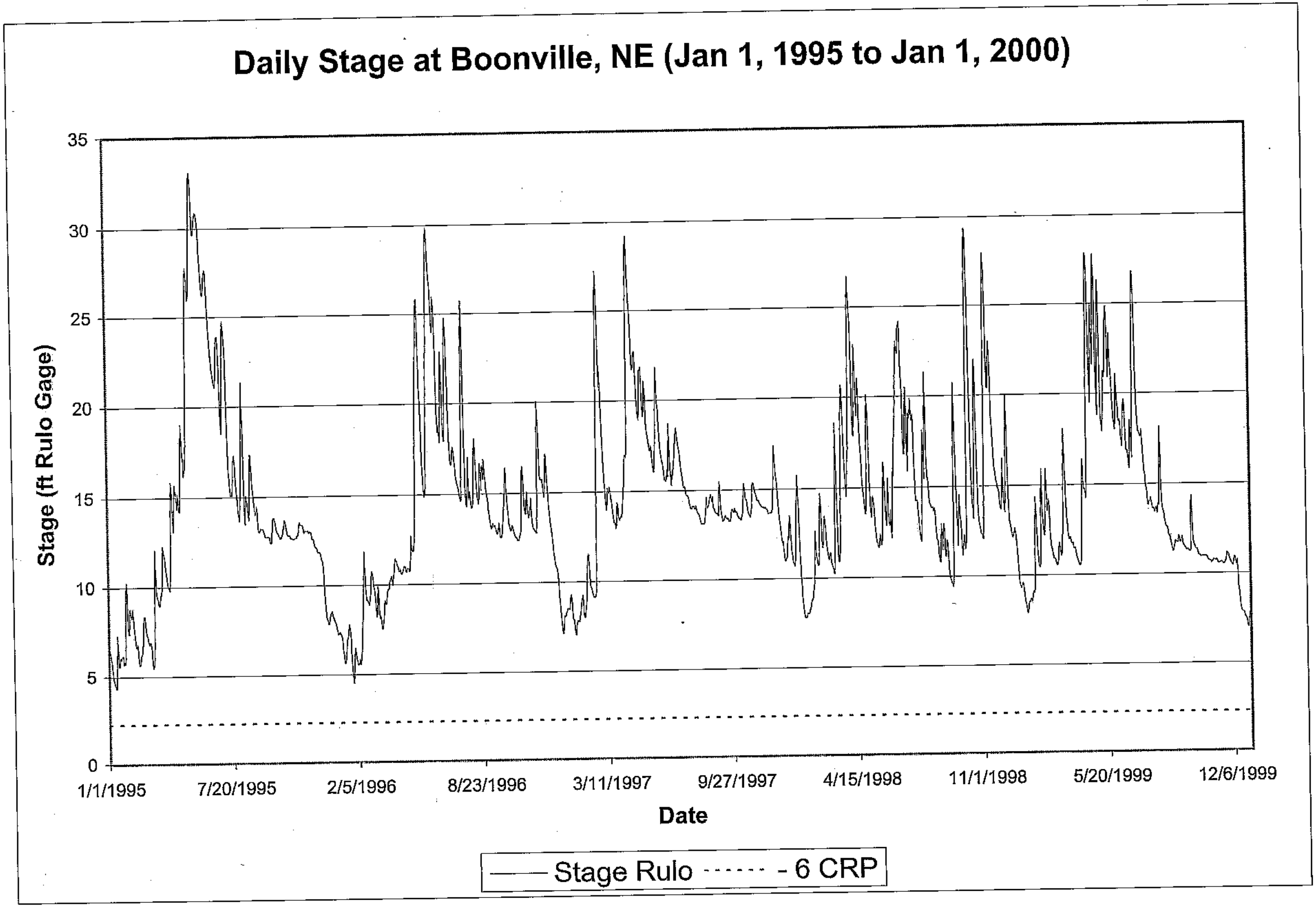
7/20/1990
2/5/1991
8/24/1991
3/11/1992
9/27/1992
4/15/1993
11/1/1993
5/20/1994
12/6/1994
Date
Stage Rulo
- 6 CRP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Stage (ft Rulo Gage)
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30
25
20
15
10
5
0
1/1/1995
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2/5/1996
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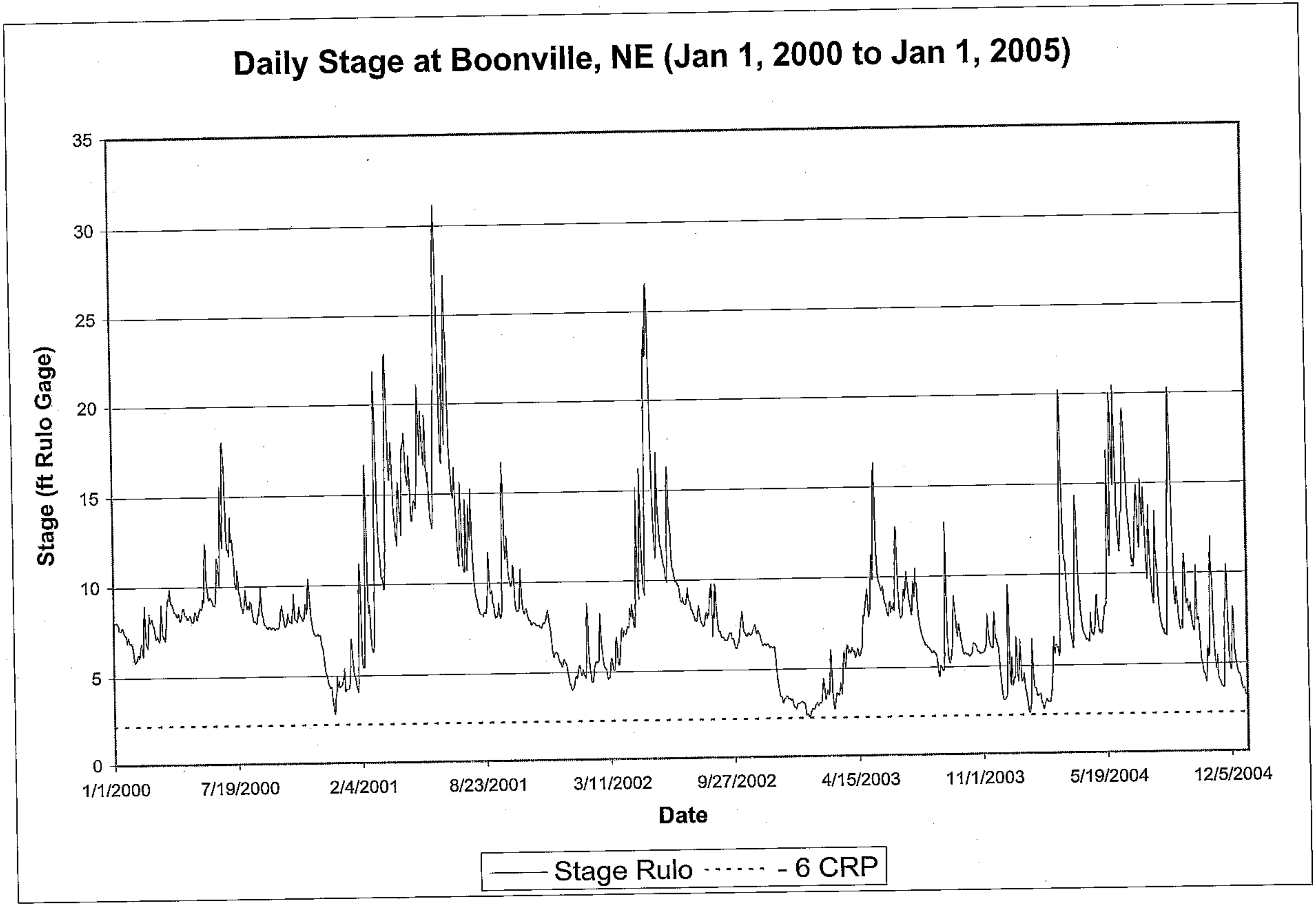
12/6/1999
Date
Stage Rulo
- 6 CRP


Daily Stage at Boonville, NE (Jan 1, 2000 to Jan 1, 2005)
Stage (ft Rulo Gage)
35
30
25
20
15
10
5
0
1/1/2000
7/19/2000
2/4/2001
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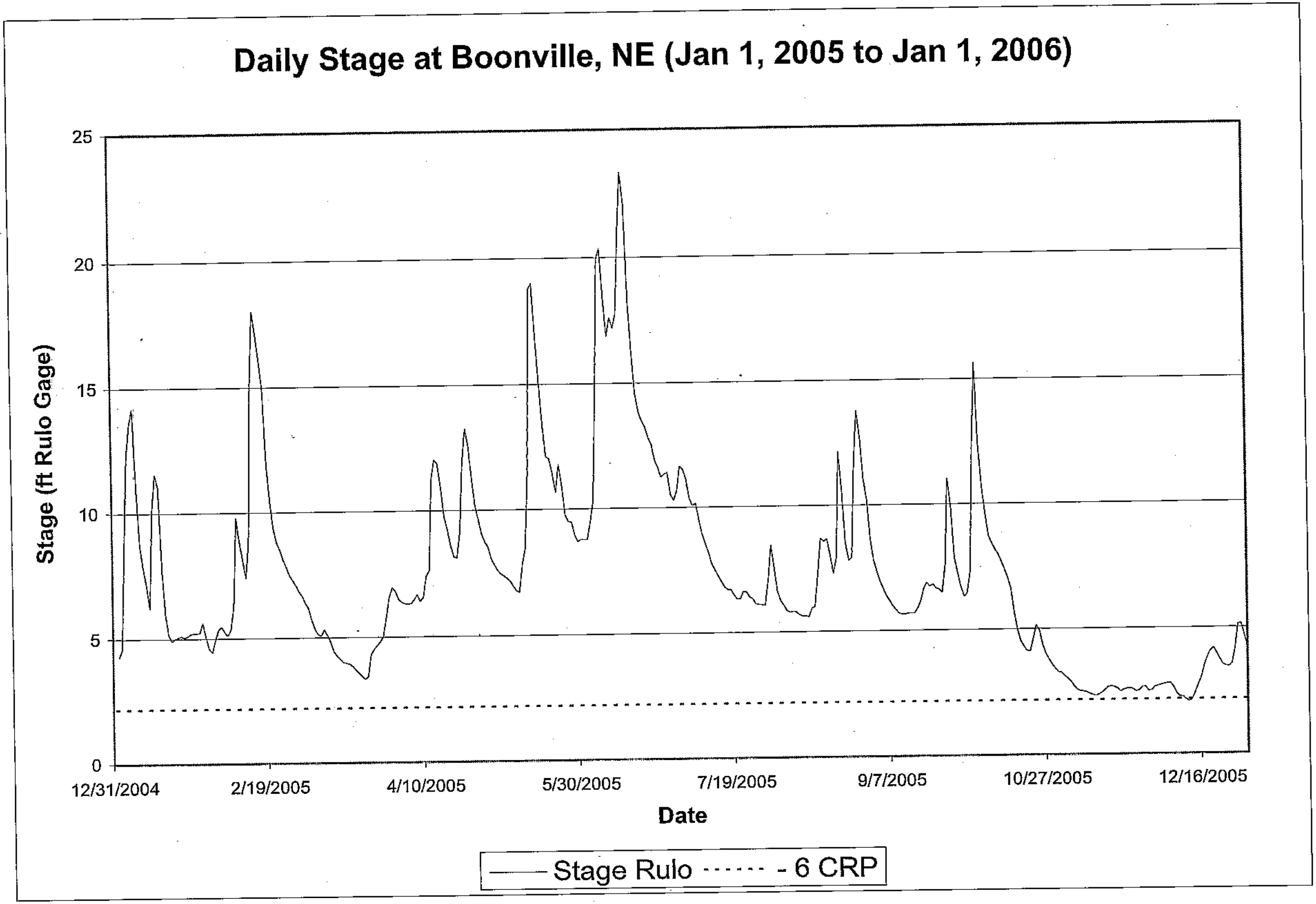
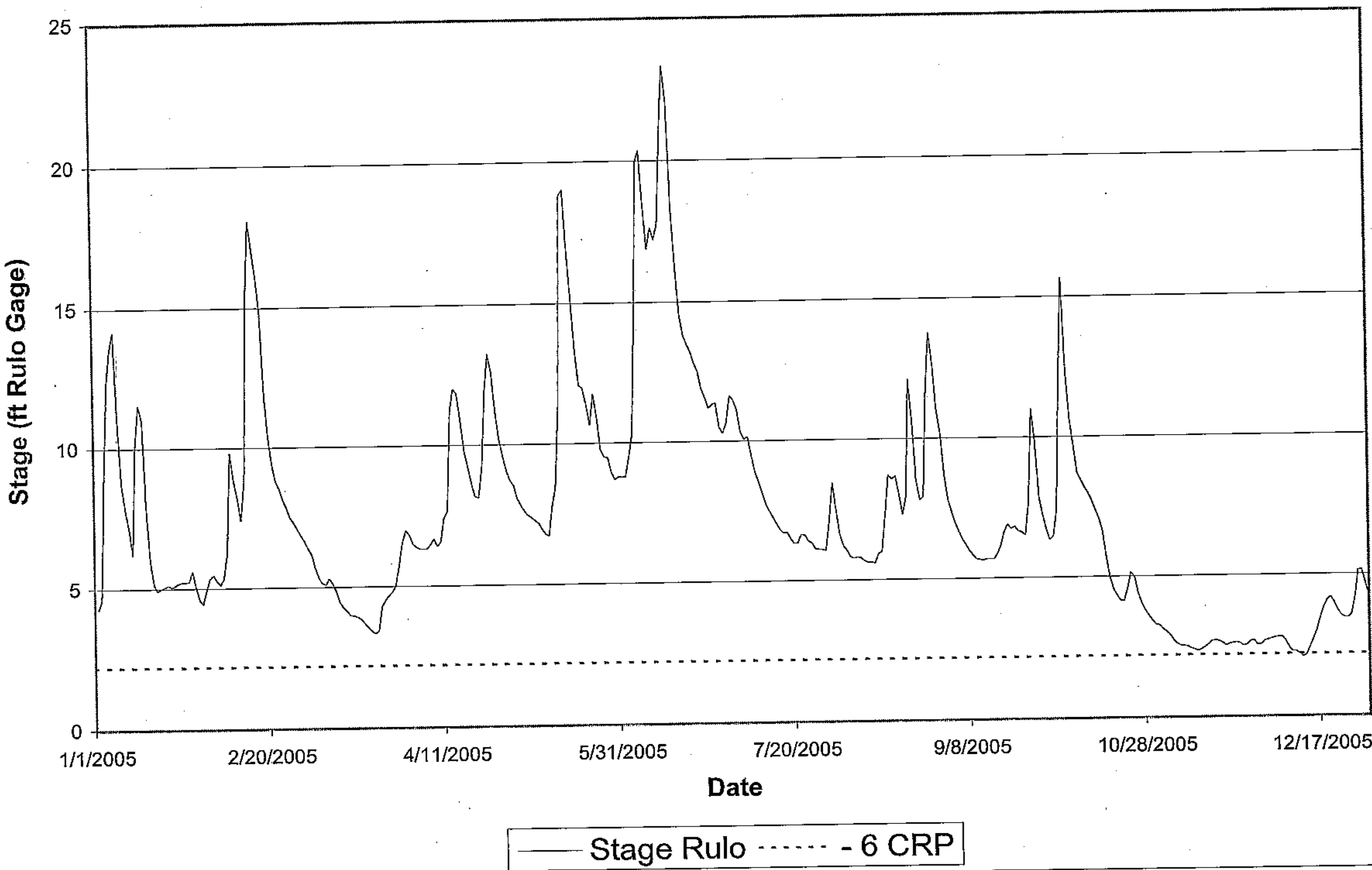
9/27/2002
4/15/2003
11/1/2003
5/19/2004
12/5/2004
Date
Stage Rulo
- 6 CRP


Daily Stage at Boonville, NE (Jan 1, 2005 to Jan 1, 2006)
Stage (ft Rulo Gage)
0
5
10
15
20
25
12/31/2004
2/19/2005
4/10/2005
5/30/2005
7/19/2005
9/7/2005
10/27/2005
12/16/2005
Date
Stage Rulo
- 6 CRP

Daily Stage at Boonville, NE (Jan 1, 2005 to Jan 1, 2006)



Jameson Island Chute Construction Project
Missouri River Recovery Program

A Shallow Water Habitat Project to be constructed on

Big Muddy Refuge, US Fish and Wildlife Service
Jameson Island Site

Saline County, Missouri
Missouri River Miles 211.3 to 214.2

Design Analysis Report
65% Draft
December 2005

US Army Corps of Engineers
Kansas City District

Chance Bitner
Hydraulic Engineer

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MISSOURI RIVER MITIGATION
JAMESON ISLAND CHUTE

1.0 Overview

Jameson Island is located in Saline County, Missouri, on the right bank of the Missouri River between river miles 210 and 216. The site is owned by the US Fish and Wildlife Service (USFWS), Big Muddy Refuge. Additionally, the Natural Resources Conservation Service (NRCS) has a permanent Wetland Reserve Program (WRP) easement on the property. Current management of the site has allowed natural succession of vegetation to occur since USFWS took ownership of the property following the 1993 flood. As part of the effort to restore native aquatic habitats along the Missouri River, especially for the endangered pallid sturgeon, the USFWS has agreed to allow the Corps of Engineers to construct a flow through chute across the Jameson Island Site. Funding for the project is to be 100% Missouri River Mitigation. An Environmental Assessment is to be completed for the site in February 2006, with the preferred alternative of a chute constructed riverward of the historic slough. The entrance and exit of the chute are to be located at Missouri River Miles 214.2 and 211.3, respectively, with a sinuous alignment consisting of four bends of variant curvature radius, and a chute length to river length ratio of 0.63. Design analysis of the Jameson Island Chute is presented herein.

2.0 Constraints

The project should not affect other congressionally authorized projects such as flood control or commercial navigation, nor should the project adversely affect existing infrastructure or private property.

No active levees exist on the Jameson Island site. Flood levels will remain little changed, if not reduced as the chute project will convert approximately 45 acres of terrestrial habitat to aquatic habitat thus increasing conveyance in the right bank. No utilities are known to exist in the project vicinity.

Impacts to commercial navigation will be minimized by ensuring the project will divert no more than 10% of the Missouri River flow through the chute at construction reference plane stage (CRP). CRP is defined as the water surface elevation equaled or exceeded 75% of the time during navigation season, corresponding to a gage reading of 8.2 feet and discharge of approximately 48,300 cfs at Boonville, Missouri, as revised in 2005. Additionally, the main channel will be monitored during construction to ensure no build up of spoil material is occurring in the navigation channel.

Site access is to be 100% by boat. The Glasgow quarry is located at river mile 219.1, five miles upstream of the chute entrance on the left bank, and may be utilized for river access, parking, and rock purchase. County Rd 319 across the river from Jameson Island could be utilized to refuel boats (see Figure A.1.1). Private property will not be affected by the project, as the closest point between the chute and private lands is approximately 3400 feet. The site has a permanent WRP easement. Chutes are typically considered a compatible use for Mitigation and the WRP; however, designs should be coordinated with NRCS.

3.0 Construction Details

The constructed base width of the chute will be a minimum of 75 feet, with side slopes 1.5H on 1V. However, if the chute is constructed by dredge, a rectangular section will be dredged, with the base width increased to approximately 110-feet to match the excavation volume of the trapezoidal cross section. After excavating a 110-foot width, a dredge contractor would not be required to shape or maintain the banks. Currently, the chute is stationed from 0+00 at the downstream end to 96+32 at the upstream end. While the river near the chute entrance is deep, approximately 17-ft below the chute invert, minor excavation may be required at the chute exit for approximately 275-ft riverward of Station 0+00, or to Station –2+75.

Elevation of the chute invert is set relative to the 2005 CRP. Design objectives when determining the chute invert elevation are to 1) create shallow water habitat in the chute, 2) be deep enough to encourage bank erosion and allow the chute to erode over time, and 3) minimize the bedload entering the chute from the main channel. Initially, the chute will be constructed to –6 CRP or deeper depending on river stage to allow a dredge to operate in at least 5-feet depth of water. One rock grade control structure will be placed at –6 CRP to control the final invert elevation and width near upper 1/3 point location along the chute length as sketch in Figure 1 and the construction drawings. Existing stone toe trench revetment at the chute inlet will be notched to a depth of –6 CRP and width of 250-ft. Details of the inlet revetment notch and grade control structure are provided in the construction drawings.

Spoil material from the chute excavation will be discharged adjacent to the main river channel between river miles 214.2 to 214.1 and 211.3 to 211.2 as shown in Figure 1 and the construction drawings. The discharge pipe from the dredge should be placed 4-6 feet from the channel bottom to ensure sediments will be immediately washed downstream. Pumping and access lanes will be allowed only along the chute alignment. A total of approximately 900,000 cubic yards of material will be excavated and placed in the river, where 866,500- and 33,500- cubic yards would be excavated for the chute and grade control structure, respectively. Trees removed from the chute alignment will be placed in mounds along the chute alignment, or in habitat areas marked on the construction drawings. A total of approximately 7000 tons of quarry-run rock will be placed in the grade control structure. Rock spoils from the existing revetment at the chute inlet will be stockpiled in a windrow set back 100-ft from the chute centerline on the left bank of the chute as marked in the construction drawings.

Figure 1 presents an aerial photograph along the chute. Figures 3 and 4 present photographs of the chute inlet and outlet, respectively. See construction drawings and specifications for additional construction details.

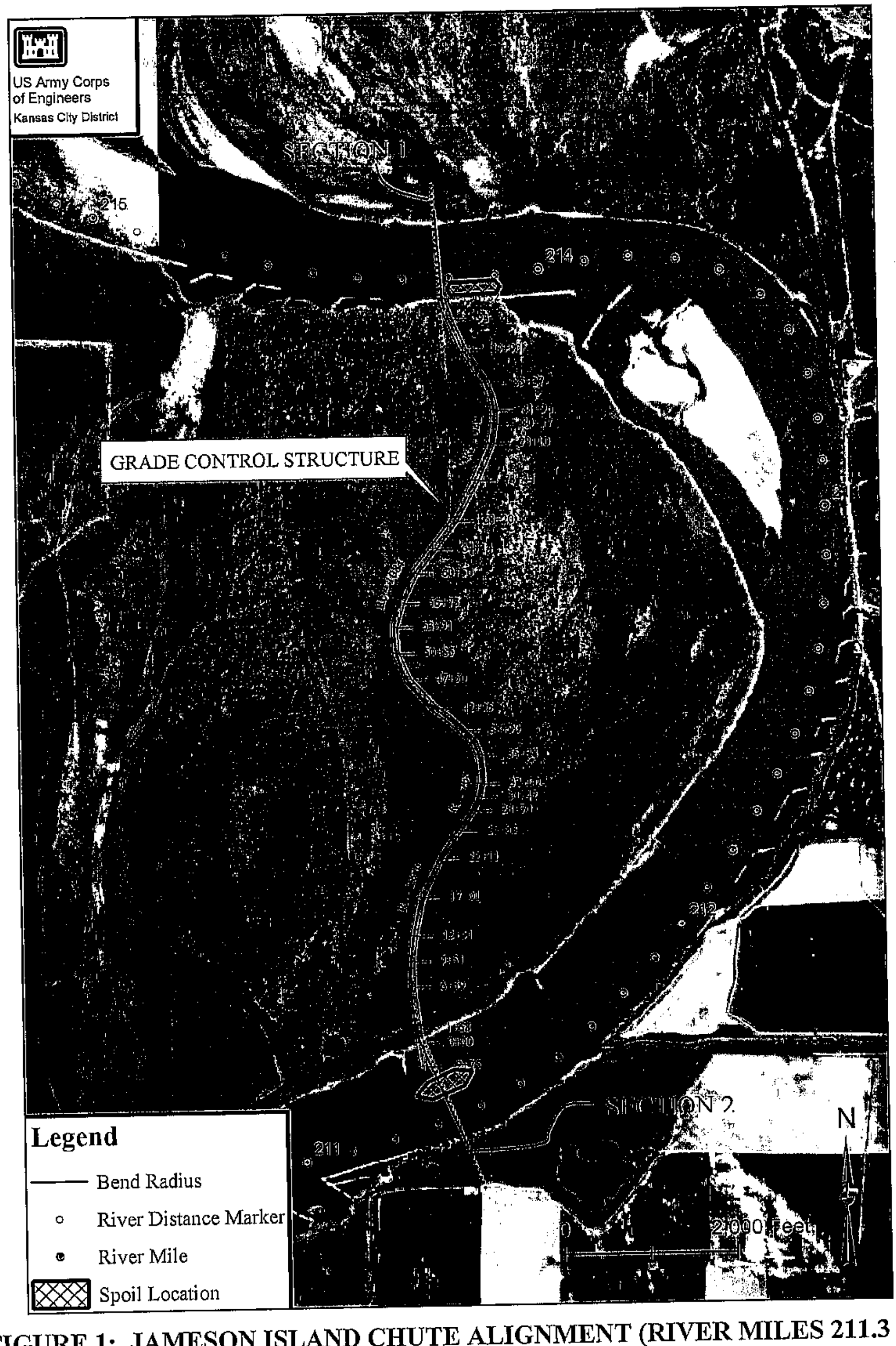

FIGURE 1: JAMESON ISLAND CHUTE ALIGNMENT (RIVER MILES 211.3 TO 214.2) VIEWED ON A JULY 2003 COLOR INFRARED AERIAL PHOTOGRAPH

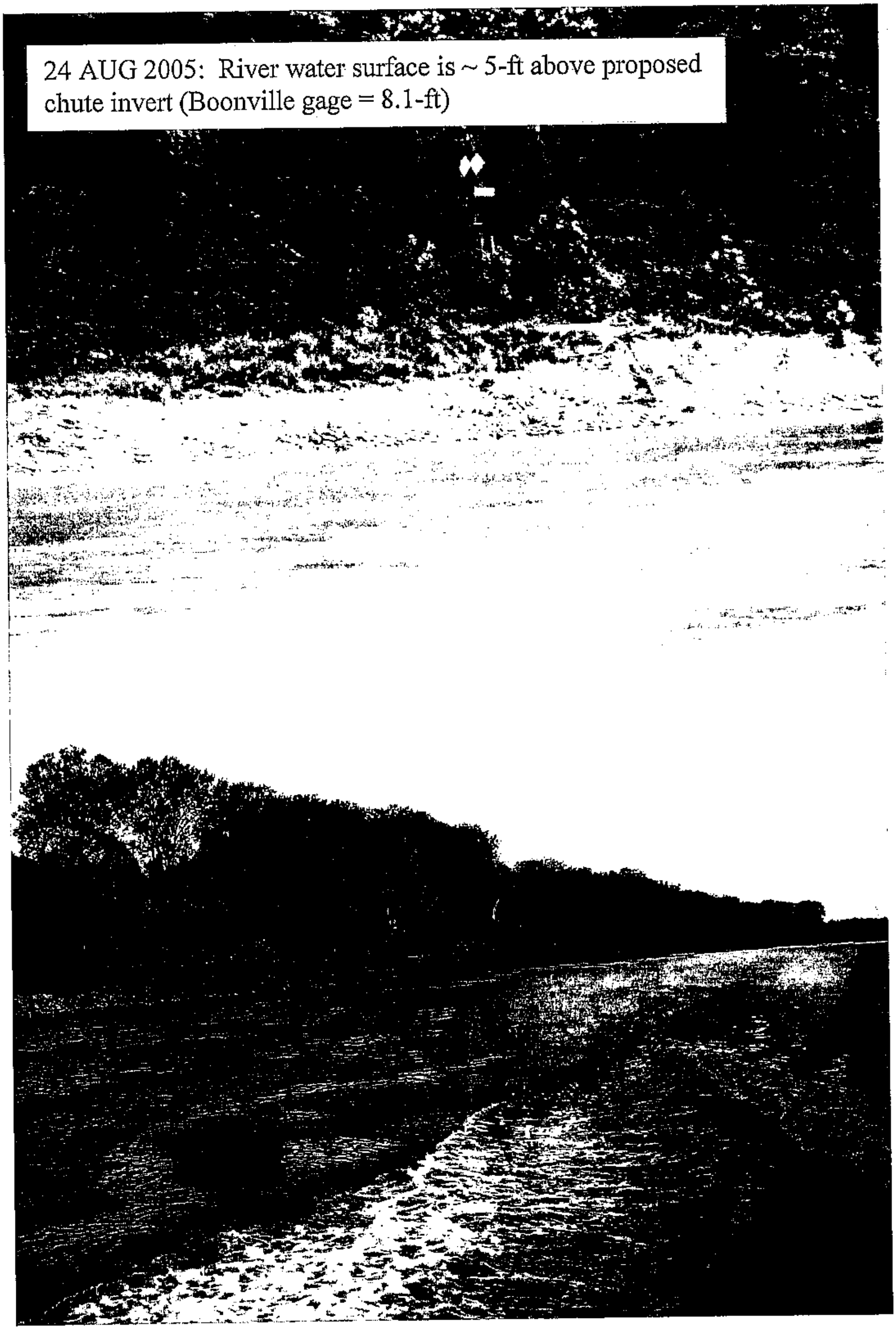

FIGURE 3: PHOTOGRAPHS OF REVETMENT AT CHUTE ENTRANCE

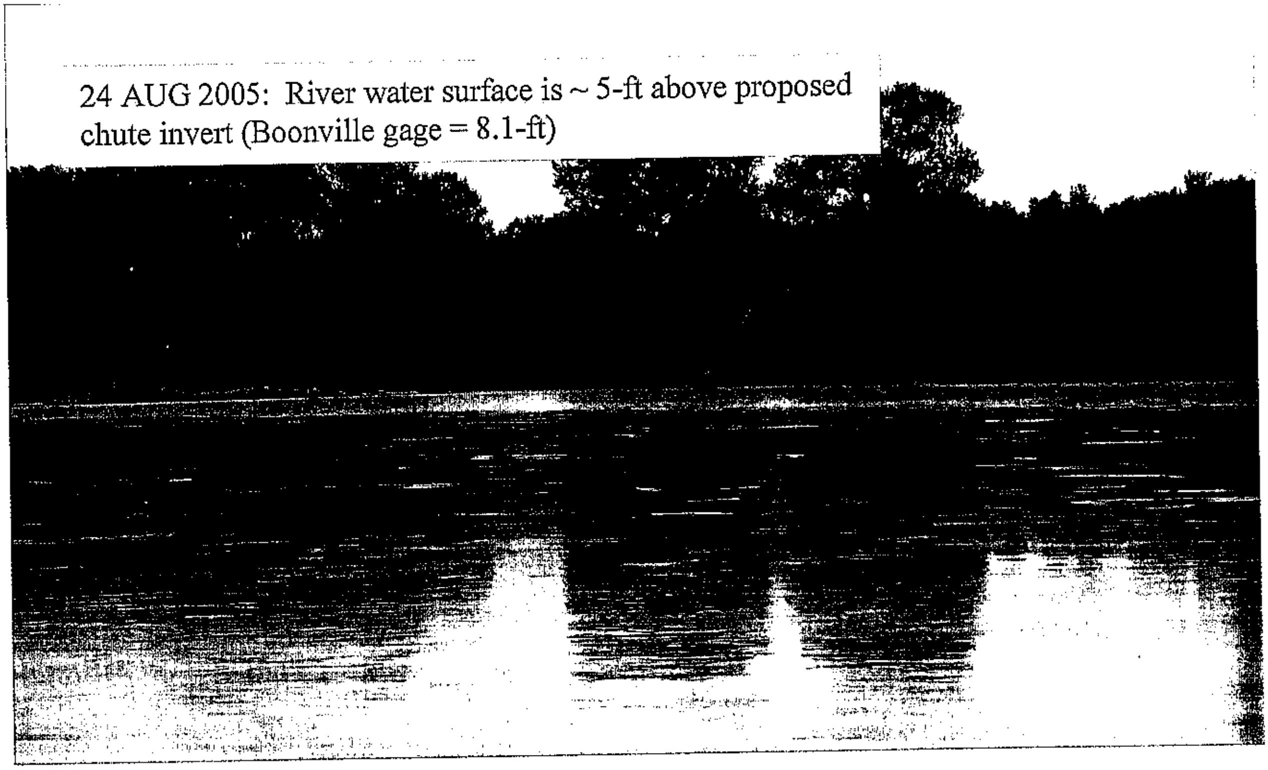

FIGURE 4: PHOTOGRAPH OF CHUTE EXIT

4.0 Construction Schedule

Flows during 2006 will be modified to facilitate a spring rise out of Gavins point dam. While the normal Navigation Season at Rulo would begin around March 26th (see Table 1), the 2006 hydrograph could rise at Rulo by the 13th of March (see Figure 1). Accordingly, construction by dredge should begin around March 13th and be completed by October 29th in 2006. A relatively low-water period will occur from April 8th to April 19th, and may require over-dredging by approximately 1 or 2-foot depth.

TABLE 1: NORMAL NAVIGATION SEASON OPENING/CLOSING DATES

Location	River Mile	Opening	Closing
Sioux City, IA	732.3	23 March	22 November
Omaha, NE	615.9	25 March	24 November
Nebraska City, NE	562.6	26 March	25 November
Kansas City, MO	366.1	28 March	27 November
Mouth near St Louis	0	1 April	1 December

TABLE 2: MISSOURI RIVER NAVIGATION FLOW TARGETS

Location	River Mile	Full Service Target Flows in cfs	Minimum Service Target Flows in cfs
Sioux City, IA	732.3	31,000	25,000
Omaha, NE	615.9	31,000	25,000
Nebraska City, NE	562.6	37,000	31,000
Kansas City, MO	366.1	41,000	35,000

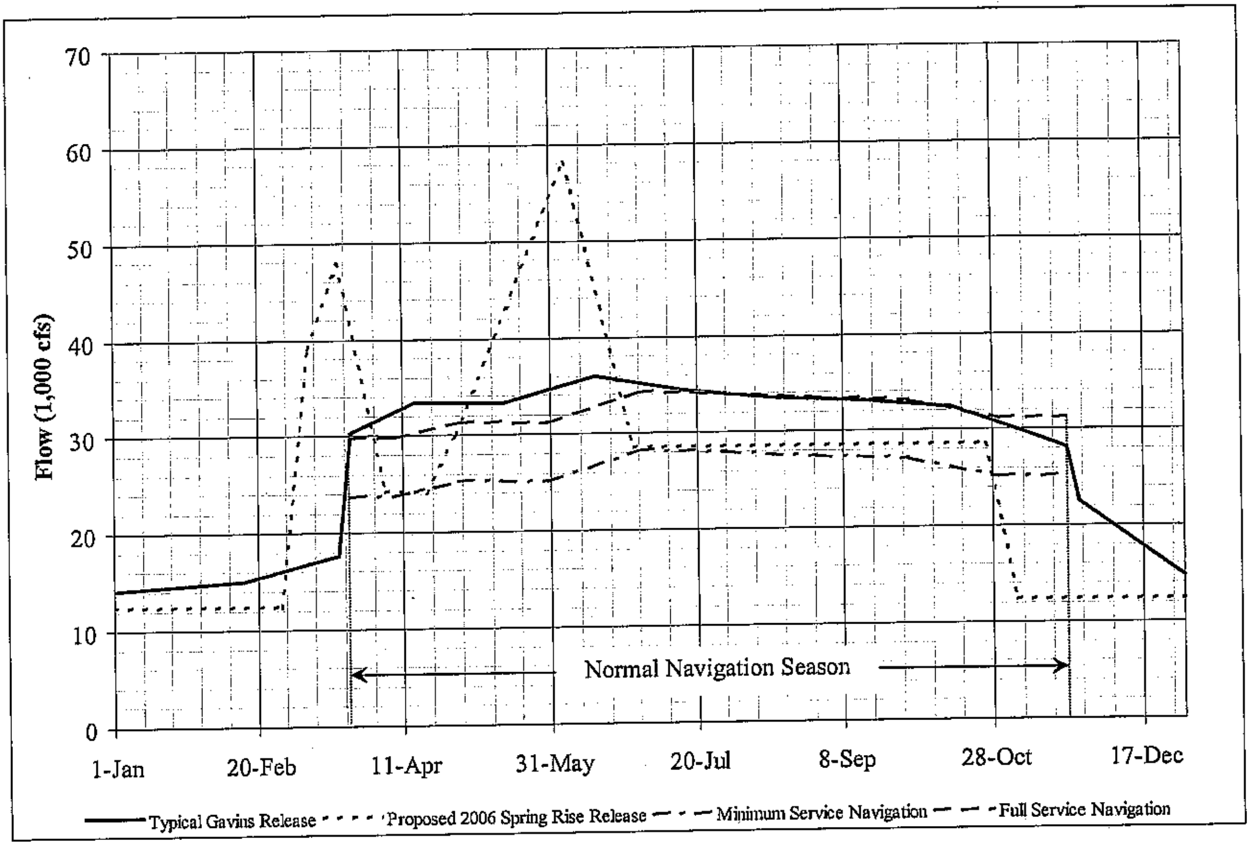

FIGURE 5: POSSIBLE 2006 GAVINS POINT DAM FLOW RELEASES COMPARED TO NORMAL

5.0 Hydraulic Computations

To estimate depth, velocity, and discharge in the chute, a one-dimensional flow split model is required. Accordingly, a one-dimensional flow split model was constructed in Microsoft Excel utilizing the governing equations of conservation of energy (Bernoulli's Equation), conservation of mass, and flow resistance (Manning's Equation).

From conservation of mass, discharge upstream and downstream of the chute will be equal to Q_{total}, discharge in the chute will be equal to Q_{split}, and flow in the river along the chute will be equal to Q_{mc} where Q is discharge in cubic feet per second (cfs). Accordingly, the following equation may be written:

$$Q_{total} = Q_{mc} + Q_{split} \tag{1}$$

The continuity equation is written below for the chute:

$$Q_{split} = V_{split} A_{split} \tag{2}$$

$$\text{and } A = (BW + Zh)\,h\,,$$

where A = flow area in square feet, V = velocity in ft/s, h = chute flow depth in feet, BW = chute base width in feet, and Z = chute side slopes in feet. By conservation of energy, energy in the river must equal energy in the chute at Sections 1 and 2 marked on Figure 1 as:

$$BED_{mc} + h_{mc} + \frac{V_{mc}^{\,2}}{2g} = BED_{split} + h_{split} + \frac{V_{split}^{\,2}}{2g} + hl = EGL = WS_{split} + \frac{V_{split}^{\,2}}{2g} + hl \tag{3}$$

where BED = the channel invert elevation in feet, WS = hydraulic grade line or the water surface elevation in feet, EGL = Energy Grade Line Elevation in feet, and hl = energy losses other than friction losses in feet (entrance, exit, losses at structures, etc.). Assuming energy losses other than friction are minimal, Equation (3) may be written as:

$$BED_{split} + h_{split} + \frac{V_{split}^{\,2}}{2g} - EGL = WS_{split} + \frac{V_{split}^{\,2}}{2g} - EGL = 0 \tag{4}$$

With all of the energy losses attributed to friction, energy slope equals the water surface slope of the chute, or river elevation at the chute entrance minus the river elevation at the chute exit divided by the chute length, and Manning's equation applies:

$$Q_{split} = \frac{1.49}{n} A_{split} R_{split}^{\;2/3} S_{chute}^{\;1/2} \tag{5}$$

$$\text{and } R = \frac{A}{P} = \frac{(BW + Zh)\,h}{BW + 2h\sqrt{1+Z^2}}\,,$$

where R is the hydraulic radius in feet, S_{chute} is slope of the chute, and P is wetted perimeter in feet. With a known chute cross-section, energy loss, and EGL elevation, Equations 2, 4, and 5 may be solved simultaneously to compute depth, discharge, and velocity in the chute. Water surface elevation in the chute is also computed as the chute invert elevation plus the computed flow depth. In the flow split model, discharge was adjusted utilizing the bisection method until Equation 4 was true to 0.0001 feet, where the maximum possible discharge for split flow would be equal to the bankfull discharge, and minimum split discharge is zero cfs. The above equations are written for a prismatic cross section; however, the flow split model is set up to handle irregular cross sections, similar to HEC-RAS.

River slope reported from 2005 CRP is 0.89 feet per mile along Jameson Island. CRP elevations range from 588.9 to 586.3 at the chute inlet and exit, respectively.

Stages, chute-invert elevation, and high bank elevation were expressed relative to CRP. The chute invert elevation is –6 CRP, high bank elevation is approximately +18 CRP. The chute base width and side slope after construction is 75-ft and 1.5H:1V, respectively, unless constructed by dredge where the cross section would be 100-ft wide and rectangular in shape. Control structures will represent the final chute dimensions after erosion of the chute has reached the design width, or 200-ft base width with 2H:1V side slopes. Accordingly, both possible constructed geometries and the final geometry were analyzed. Manning's n was estimated at 0.028 from field measurements of discharge in the Overton Bottoms Chute (by Szynskie in 2003). Flow splits were computed for EGL values of -2 CRP, 0 CRP, +2 CRP, and +9 CRP, and +18 CRP. These stages were equated to a discharge in the main channel utilizing the nearest stream gage, located 14.2 miles downstream of the chute at Boonville, Missouri. To compute total flow, the current USGS Rating Curve was adjusted to the 2005 CRP Elevation (see Table 8), the curve was transposed to the chute location, and values were interpolated from the rating curve. Percent flow in the chute may be expressed as:

$$\text{Percent flow} = 100 * Q_{split} / Q_{total} \qquad (6)$$

To minimize differences between the EGL and actual water surface elevation in the main river channel, the water surface elevation in the main channel was assumed equal to the water surface elevation in the chute for the Q_{total} calculation. Water surface elevations in the chute are expected to be slightly higher than in the main channel, however this difference should be small, and, given the variability in stage/discharge measurements in the Missouri River plotted in Figure 3, negligible in the percent flow analysis. Some minimal hydrologic error exists due to the inflow of the Lamine River near river mile 202.5. From the UMRSFFS study, the Lamine River contributes 2400 cfs, or roughly 3% of 82,100 cfs during a 1-yr flood. Normal Lamine River flow contributions during navigation season range from 0.5% to 2.5% of the Missouri River flow. To double check percent flow calculations, the stream gage located 12.1 miles upstream of the chute invert at Glasgow, Missouri, was also utilized. For Glasgow, the COE UNET rating curve was utilized, last updated in 1999. Total flow calculations at Glasgow varied from 4% to 14% from the Boonville values, and percent flow calculations were within 0.2% to 0.9% between the different gages. Therefore, due to the small differences in percent flow calculations; the Boonville Gage percent flow analysis seems acceptable.

Some model validation data is provided in Table 11 comparing field measurements of discharge in constructed and natural chutes to the calculated model values. Additional data is available by contacting the undersigned.

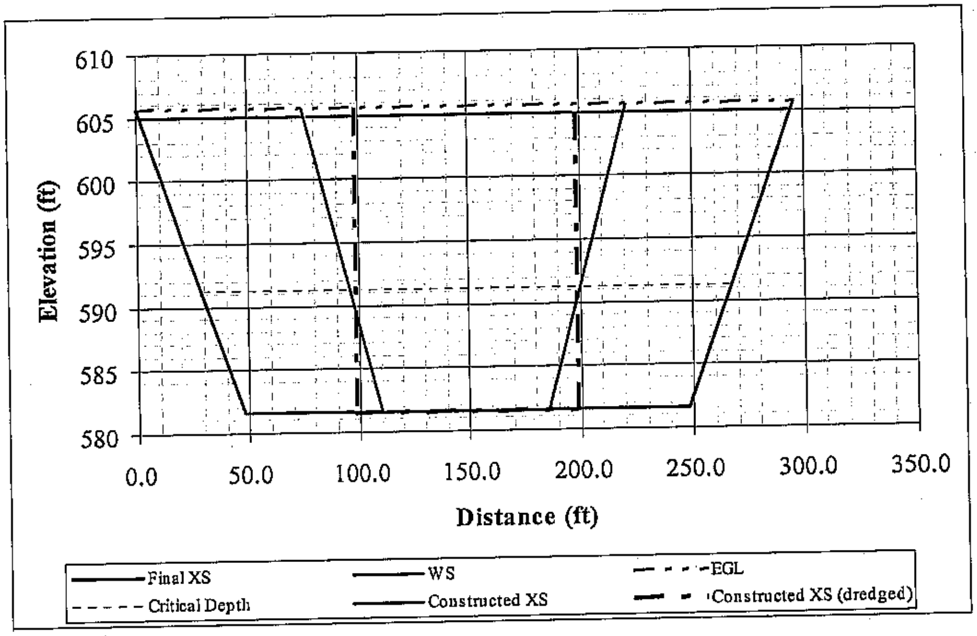

FIGURE 6: JAMESON ISLAND CHUTE BANK-FULL CROSS-SECTIONAL PLOTS, CONSTRUCTED AND DESIGNED (NEAR THE MIDPOINT)

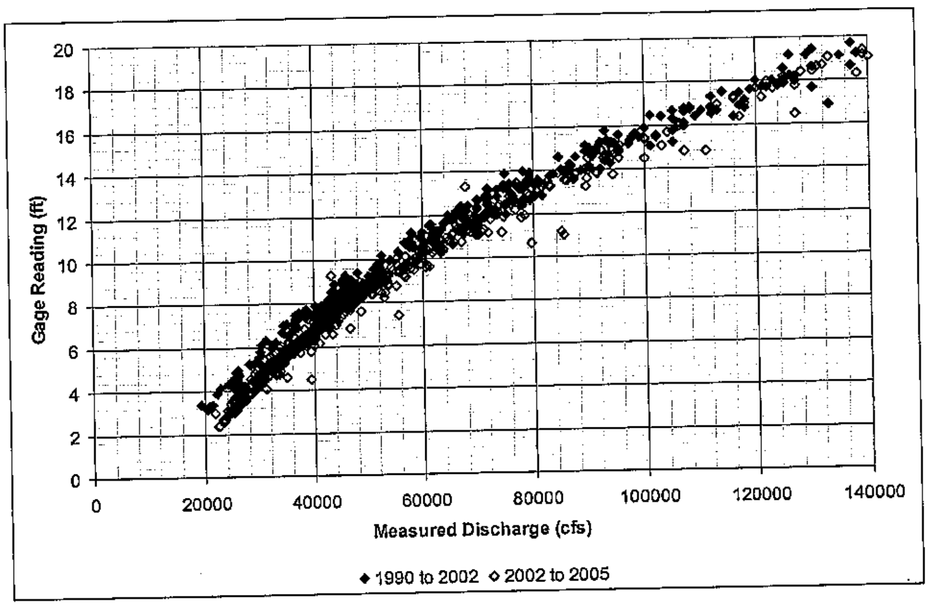

FIGURE 7: RECENT VARIATIONS IN STAGE / DISCHARGE MEASUREMENTS AT BOONVILLE, MO

Missouri River daily flow statistics were computed (Szynskie, 2003) for the period of 1967 to 2003 as posted in Table 3. Tables 4 and 5 covert these flows to stages using current USGS rating curves, and the 2005 CRP elevations. As seen in Table 5, stages at Boonville are greater than –3.2 CRP ninety percent of the time, and the median elevation is 1.6 CRP. Therefore, the chute is expected to convey water at least 3.2-ft deep 90 percent of the time, with a median depth of approximately 7.6-feet. From Table 10, Run ID Jameson 12 and 13, mean velocity at CRP and +2 CRP stage will be approximately 2.7 ft/s and 3.2 ft/s, respectively, meaning velocities will be less than 3.2 ft/s at least 50 percent of the time. From the UMRSFFS study elevations; bankfull flow is approximately a 5-yr flood event.

TABLE 3: MISSOURI RIVER DAILY FLOW STATISTICS 1967-2003

Gage	Flows Equaled or Exceeded (cfs)				
	Q_{90}	Q_{75}	Q_{50}	Q_{25}	Q_{10}
Nebraska City	21,930	32,400	39,600	51,400	64,300
Rulo	23,300	34,000	41,700	55,200	69,700
St. Joseph	24,700	35,300	44,500	58,800	75,800
Kansas City	27,400	38,700	51,100	70,600	97,700
Waverly	28,400	39,700	52,100	72,600	102,000
Boonville	31,800	42,370	58,200	83,800	128,000
Hermann	39,600	50,400	72,700	112,000	172,000

TABLE 4: MISSOURI RIVER DAILY STAGE STATISTICS 1967-2003

Gage	Elevations Equaled or Exceeded (ft)				
	Q_{90}	Q_{75}	Q_{50}	Q_{25}	Q_{10}
Nebraska City	911.4	913.8	915.5	918.0	920.5
Rulo	842.4	845.1	847.0	849.7	851.9
St. Joseph	792.9	795.7	798.0	800.6	803.4
Kansas City	712.5	715.5	718.3	721.9	725.7
Waverly	653.4	656.0	658.2	661.1	664.3
Boonville	570.4	572.6	575.2	578.7	583.5
Hermann	485.9	487.8	491.1	495.4	500.4

*Note: Utilized USGS rating curves from July 11, 2005

TABLE 5: MISSOURI RIVER DAILY 2005 CRP STAGE STATISTICS 1967-2003

Gage	2005 CRP Elevations Equaled or Exceeded (ft)				
	Q_{90}	Q_{75}	Q_{50}	Q_{25}	Q_{10}
*Nebraska City	-2.6	-0.2	1.5	4.0	6.5
Rulo	-4.1	-1.4	0.5	3.2	5.4
St. Joseph	-4.1	-1.3	1.0	3.6	6.4
Kansas City	-4.3	-1.3	1.5	5.1	8.9
Waverly	-3.7	-1.1	1.1	4.0	7.2
Boonville	-3.2	-1.1	1.6	5.1	9.9
Hermann	-2.8	-0.9	2.4	6.7	11.7

*Note: Nebraska City is 2002 CRP from Omaha District

6.0 Hydraulic Computations, Sediment Analysis

Additional parameters were computed to give some indication of sediment transport capabilities of the chute at each of the analyzed stages, including sediment size at incipient motion, stream power, unit stream power, shear stress, critical shear stress, and Froude Number. With the above parameters, it is possible to compute sediments sizes that will be in motion, compare them to sediment sizes moving in the river, and predict whether the chute will be aggredational or degradational in nature. Additionally, sediment transport parameters were related to transport regime, and an approximation of the bedforms expected in the chute was conducted.

Critical velocity for beginning of motion, or V_c, of the median, or D_{50} size of the bed material being considered for movement was calculated from the following equation:

$$V_c = Ku\, y^{1/6} D^{1/3} \tag{7}$$

where V_c = critical velocity above which bed material of size D and smaller which will be transported in ft/s, y = average depth of flow in feet, D = particle size for V_c, in feet, D_{50} = particle size in a mixture of which 50 percent are smaller in feet, Ku = 11.17 English units. The D_{50} was utilized in the sediment analysis as a characteristic size of the bed material that will be transported by the stream. Normally this would be the bed material size in the upper 1 ft of the streambed (HEC-18).

Stream power is calculated as

$$StreamPower = \gamma QS \tag{8}$$

$$UnitStreamPower = \gamma QS/W \tag{9}$$

where γ = unit weigh of water or 62.4 lbs/ft^3 (9810 N/m^3), Q = discharge in cfs (cms), and W = width of the channel in ft (m) taken as the average width for this analysis (average of top width, T_w, and base width, BW). Shear stress, or τ, is calculated as

$$\tau = \gamma RS \tag{10}$$

Shields Parameter, or τ_*, is calculated as

$$\tau_* = \frac{\tau}{(\gamma_s - \gamma)D} \tag{11}$$

where γ_s is the unit weight of the sediment (2.65*γ). Froude number is calculated as

$$\mathrm{Fr} = \frac{V}{\sqrt{gA/T_w}}. \tag{12}$$

Critical depth, plotted in Figure 2, is the condition where Fr = 1. Inputs and outputs from the flow split model are presented in Tables 9 and 10, respectively.

Sedimentation in the chute may be approximated utilizing existing sediment transport relationships. A relationship utilized here is from Simons and Richardson, and was developed for sand sizes less than 1.0 mm in average diameter as presented in Figure 4.

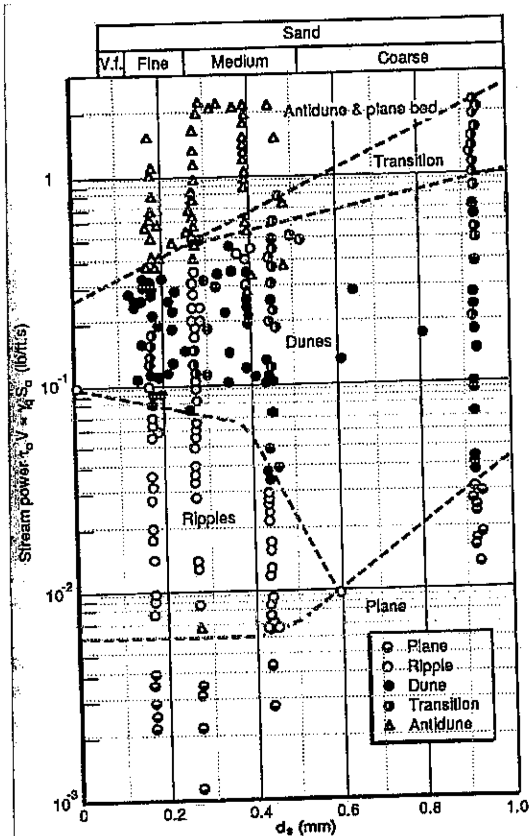

Figure 8.8. Bedform classification (after Simons and Richardson, 1963, 1966)

FIGURE 8: BEDFORM CLASSIFICATION (FROM JULIEN, 1999)

After a chute is constructed, sediment will wash into the chute from the flowing river and mobilize from the channel bed and banks as erosion occurs. Depths in the main river channel from a 1999 hydrographic survey are 23-feet below CRP at the chute inlet leaving the chute invert at least 17-feet above the bed of the Missouri River. Accordingly, sediment sizes in the chute will not likely experience armoring, or because of the relatively high elevation of the channel invert, aggredation of the courser particles moving in the lower portion of the water column in the main Missouri River Channel. Sediment size measured by

Kansas City District EC-HH-R (Stark, 2004) between River Miles 225 and 200 varied between a D_{50} of 0.24 and 0.86 mm, with an average of 0.45 mm. Similarly, D_{90} ranged between 18.39 and 0.39 mm, with an average of 1.88 mm. Sediment sizes in chutes at Lisbon and Overton Bottoms were coarser, 0.85 and 0.82 mm, respectively, where the chute length is less than the river length. Sediment sizes at Tate Island, a stable natural chute, were an average 0.42 mm. Sediment sizes at Franklin Island, where all of the chutes are longer than the river, were an average of 0.12 on two chutes that were filling with sediment, and an average of 0.25 mm on two chutes that were remaining open. Accordingly, an average size of 0.5 mm was analyzed, but error bars were included as sizes ranging between 0.25 and 0.85 mm are expected to occur (see Figure 5). In general, dunes with ripples are expected at stages less than CRP, and dunes are expected at the higher stages.

As seen in Table 10, sediment size (D) in motion in the chute will range between 1.6 mm and 11.7 mm between CRP and bankfull flows, respectively. Average bed grain sizes in the Missouri River are typically less than 1.0 mm, and accordingly, the chute is expected to be degradational in nature. Bedforms will most likely range between ripples and dunes at low flows, dunes during normal flows, and transition to plane bed / antidunes at bankfull flow.

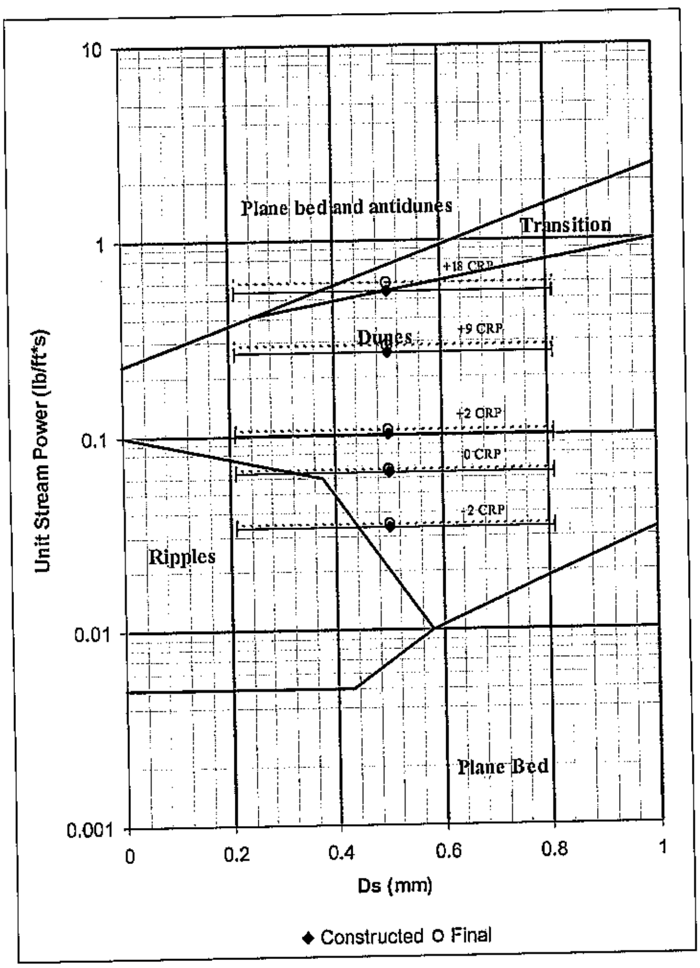

FIGURE 9: BEDFORMS EXPECTED IN THE JAMESON ISLAND CHUTE

7.0 Future Conditions and Meander Geometry

Chute slope and the grade control structure geometry was set to divert less than 10 percent of the main channel discharge at a stage of +0 CRP. As seen in Table 10, Run ID Jameson 10, the model computed a 7.1% flow split at CRP, reserving roughly 3% for the existing habitat area along the right bank. Over time, length of the chute may increase slightly due to natural meander migration. Sinuosity, or chute length / valley length of natural and fully developed constructed chutes in the Missouri River ranged between 1.0 and 1.4, with little to no correlation to river slope (see Tables 6 and 7, Figure 6), and a median value of 1.2. The Jameson Island Chute has a sinuosity of approximately 1.1; accordingly, the length of the chute could be expected to increase by roughly 8 percent over time. Additionally, at lower flows, slope of the chute may decrease between grade control structures due to bed degradation, creating some energy loss as water falls over the control structure. As seen in Equation 5, both of these future conditions, increased length of the chute, and energy loss at the grade control structures, will reduce slope, and as a result, discharge in the chute. Accordingly, the flow diverted from the main channel is expected to be somewhat less than the predicted values once the chute erodes to design width.

TABLE 6: EXISTING CHUTE GEOMETRY SUMMARY

	Min Radius Curvature (feet)	Chute Sinuosity	Meander Wavelength (feet)
max	12943	1.4	14667
min	159	1.0	2200
average	2785	1.1	5203
75%	2927	1.2	6333
50%	2002	1.2	4300
25%	990	1.1	3267

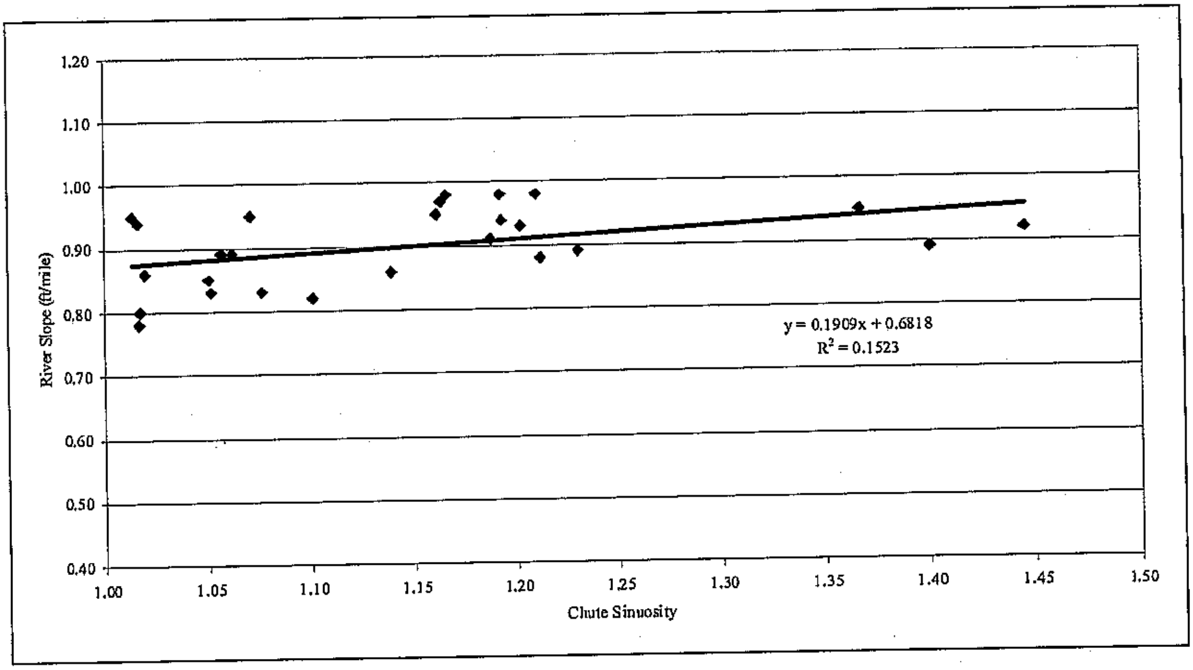

FIGURE 10: CHUTE SINUOSITY VERSUS RIVER SLOPE FROM NATURAL AND SELECT CONSTRUCTED CHUTES

As seen in Figure 1, the chute alignment has four bends of various curvature radiuses (Rc). From upstream to downstream, the bend Rc is 940-, 1085-, 770-, and 2875-feet, respectively. Compared to the minimum Rc measurements taken in natural and fully developed constructed chutes in the Missouri River, summarized in Table 6 and reported in Table 7, these curvature radius correspond to 22%, 31%, 15%, and 71% percentiles. Accordingly, three of the four bends are rather sharp compared to existing chute geometries. Meander migration rates are greatest for Rc/W in the range of 2.3 to 3.5, and begin to reduce from 4 to 5 (Nanson and Hickin 1983, Williams 1986). Following construction, Rc/W values will be 9, 11, 8, and 29 in the 4 bends, respectively. At design width, Rc/W values will be approximately 3.2, 3.7, 2.6, and 9.8 from upstream to downstream, respectively. Accordingly, meander migration should be highly accelerated in the upper three bends once the chute erodes to design width, and should create highly diverse aquatic habitat with point bars, pools, riffles, and undercut banks. Additionally, as meander erosion occurs, trees and other debris should fall into the chute to further diversify the aquatic habitat.

8.0 Hydraulic Summary

In summary, the Jameson Island chute is designed to divert 7% of the flow at a stage of CRP once the chute has eroded to the control structures set at a 200-ft base width, 2H to 1V side slopes, and invert at –6 CRP. The chute to river length ratio is 0.63, meaning the chute is much shorter than the river. Median flow depth in the chute will be approximately 7.6-ft, and velocity will be less than 3.2 ft/s at least 50 percent of the time. The chute will be capable of transporting material sizes ranging from 1.9 to 11.7 mm at CRP stage and bankfull stage, respectively, much coarser than material particles expected to enter the chute from the main river channel where the bed elevation is 17 feet lower than the chute invert near the chute entrance. Median bed material size is expected to be coarse sand, and bedforms should be dunes for stages less than bankfull, with some ripples at lower stages. Once the chute erodes to the design width, meanders are expected to form causing the length of the chute to increase, possibly by as much as 10 to 20 percent.

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CENWK-EC-HH-R

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Williams, G.W. (1986). River meanders and channel size. Journal of Hydrology 88: 147-164.

TABLE 7: EXISTING CHUTE GEOMETRY MEASUREMENTS

Site	State	Chute Length (ft)	River Mile	No. Bends	Min Rad Curve (ft)	Chute Sinuosity	Meander Wavelenth (ft)	River Length (ft)	Chute / River	River Slope (ft/mile)
Columbia Bottom	MO	6200	000	1	2673	1.0		8700	0.71	0.94
Brickhouse-Pelican	MO	15393	008-011	6	1448	1.2	4300	14500	1.06	0.94
Brickhouse	MO	5782	009-010	3	1203	1.1	3600	6300	0.92	0.95
Car of Commerce Chute	MO	19666	010-016	2	5060	1.0		29000	0.68	0.95
Cul de Sac Bend	MO	6734	022	3	821	1.2	3867	6200	1.09	0.95
Bryan Island	MO	21874	022-026	7	1409	1.4	4571	22400	0.98	0.95
Jane Dowing Island	MO	6892	033	2	909	1.2	5600	8000	0.86	0.89
Catfish Island	MO	5177	036-037	3	1387	1.1	3267	5500	0.94	0.89
Bonhomme Chute	MO	19890	039-042	1	5547	1.4		15500	1.28	0.89
Johnson Island	MO	11892	041-043	3	2002	1.1	7467	13500	0.88	0.89
Centaur Chute	MO	26622	045-050	3	2102	1.2	14667	26000	1.02	0.98
Augusta Bend	MO	5130	057-058	1	442	1.2		5280	0.97	0.98
Hinkles Bend	MO	8374	060-061	4	903	1.2	3600	8400	1.00	0.97
Hinkles - South Point Bend	MO	25620	060-065	5	1374	1.2	8520	24130	1.06	0.93
Lunch Island	MO	6062	092-092	1	2544	1.2		7400	0.82	0.88
Tate Island	MO	13119	110-113	1	3340	1.0		13170	1.00	0.78
Mollie Dozier Chute	MO	16088	116-119	1	12943	1.1		17000	0.95	0.83
St. Aubert Chute	MO	27321	120-125	7	297	1.2	6571	25620	1.07	0.91
Franklin Island	MO	6119	194-195	0	9695	1.0		6100	1.00	0.86
Lisbon Chute	MO	10821	215-218	3	2089	1.1	6333	18360	0.59	0.86
Saline City Bend	MO	3663	219	0	4564	1.0		3800	0.96	0.80
Grand Pass	MO	2626	270-271	2	159	1.1	2500	2625	1.00	0.85
Cranberry Bend	MO	4480	281-282	2	2801	1.4	3100	5220	0.86	0.92
Moberly Bend	MO	2422	298-299	2	990	1.1	2200	2380	1.02	0.82
Hodge Bend	MO	3013	300-301	2	2927	1.1	2800	2990	1.01	0.83
Hamburg Bend	NE	16362	552-556	5	-	1.2	5488	18950	0.86	0.98

TABLE 8: USGS RATING TABLE AT BOONVILLE, MO

2005 CRP stage	8.2	ft gage
gage datum:	565.42	ft NGVD 29

Q (cfs)	Elevation (ft)	Gage ht (ft)	Stage 2005 CRP
21000	567.42	2.0	-6.20
24000	568.42	3.0	-5.20
27900	569.42	4.0	-4.20
31900	570.42	5.0	-3.20
36500	571.42	6.0	-2.20
41500	572.42	7.0	-1.20
47000	573.42	8.0	-0.20
48300	573.62	8.2	0.00
52900	574.42	9.0	0.80
59400	575.42	10.0	1.80
66100	576.42	11.0	2.80
73400	577.42	12.0	3.80
81300	578.42	13.0	4.80
89600	579.42	14.0	5.80
98300	580.42	15.0	6.80
107000	581.42	16.0	7.80
117000	582.42	17.0	8.80
127000	583.42	18.0	9.80
138000	584.42	19.0	10.80
149000	585.42	20.0	11.80
160000	586.42	21.0	12.80
173000	587.42	22.0	13.80
186000	588.42	23.0	14.80
200000	589.42	24.0	15.80
214000	590.42	25.0	16.80
228000	591.42	26.0	17.80
243000	592.42	27.0	18.80
259000	593.42	28.0	19.80
275000	594.42	29.0	20.80
292000	595.42	30.0	21.80
315000	596.42	31.0	22.80
340000	597.42	32.0	23.80
368000	598.42	33.0	24.80
398000	599.42	34.0	25.80
450000	600.42	35.0	26.80
550000	601.42	36.0	27.80
720000	602.42	37.0	28.80

TABLE 9: FLOW SPLIT INPUTS, JAMESON ISLAND CHUTE

Run ID	River Length (ft)	Energy Loss (ft)	Chute Length (ft)	Chute Slope (ft/ft)	EGL Stage (ft CRP)	n	Base width (ft)	Z	2005 CRP EL (ft)	invert (ft CRP)	HB (ft CRP)	Gage
Jameson 01	15212	2.58	9632	0.000268	-2.0	0.028	75.00	1.5	587.6	-6.0	18.0	Boon
Jameson 02	15212	2.58	9632	0.000268	0.0	0.028	75.00	1.5	587.6	-6.0	18.0	Boon
Jameson 03	15212	2.58	9632	0.000268	2.0	0.028	75.00	1.5	587.6	-6.0	18.0	Boon
Jameson 04	15212	2.58	9632	0.000268	9.0	0.028	75.00	1.5	587.6	-6.0	18.0	Boon
Jameson 05	15212	2.58	9632	0.000268	18.0	0.028	75.00	1.5	587.6	-6.0	18.0	Boon
Jameson 06	15212	2.58	9632	0.000268	-2.0	0.028	100.00	0	587.6	-6.0	18.0	Boon
Jameson 07	15212	2.58	9632	0.000268	0.0	0.028	100.00	0	587.6	-6.0	18.0	Boon
Jameson 08	15212	2.58	9632	0.000268	2.0	0.028	100.00	0	587.6	-6.0	18.0	Boon
Jameson 09	15212	2.58	9632	0.000268	9.0	0.028	100.00	0	587.6	-6.0	18.0	Boon
Jameson 10	15212	2.58	9632	0.000268	18.0	0.028	100.00	0	587.6	-6.0	18.0	Boon
Jameson 11	15212	2.58	9632	0.000268	-2.0	0.028	200.00	2	587.6	-6.0	18.0	Boon
Jameson 12	15212	2.58	9632	0.000268	0.0	0.028	200.00	2	587.6	-6.0	18.0	Boon
Jameson 13	15212	2.58	9632	0.000268	2.0	0.028	200.00	2	587.6	-6.0	18.0	Boon
Jameson 14	15212	2.58	9632	0.000268	9.0	0.028	200.00	2	587.6	-6.0	18.0	Boon
Jameson 15	15212	2.58	9632	0.000268	18.0	0.028	200.00	2	587.6	-6.0	18.0	Boon

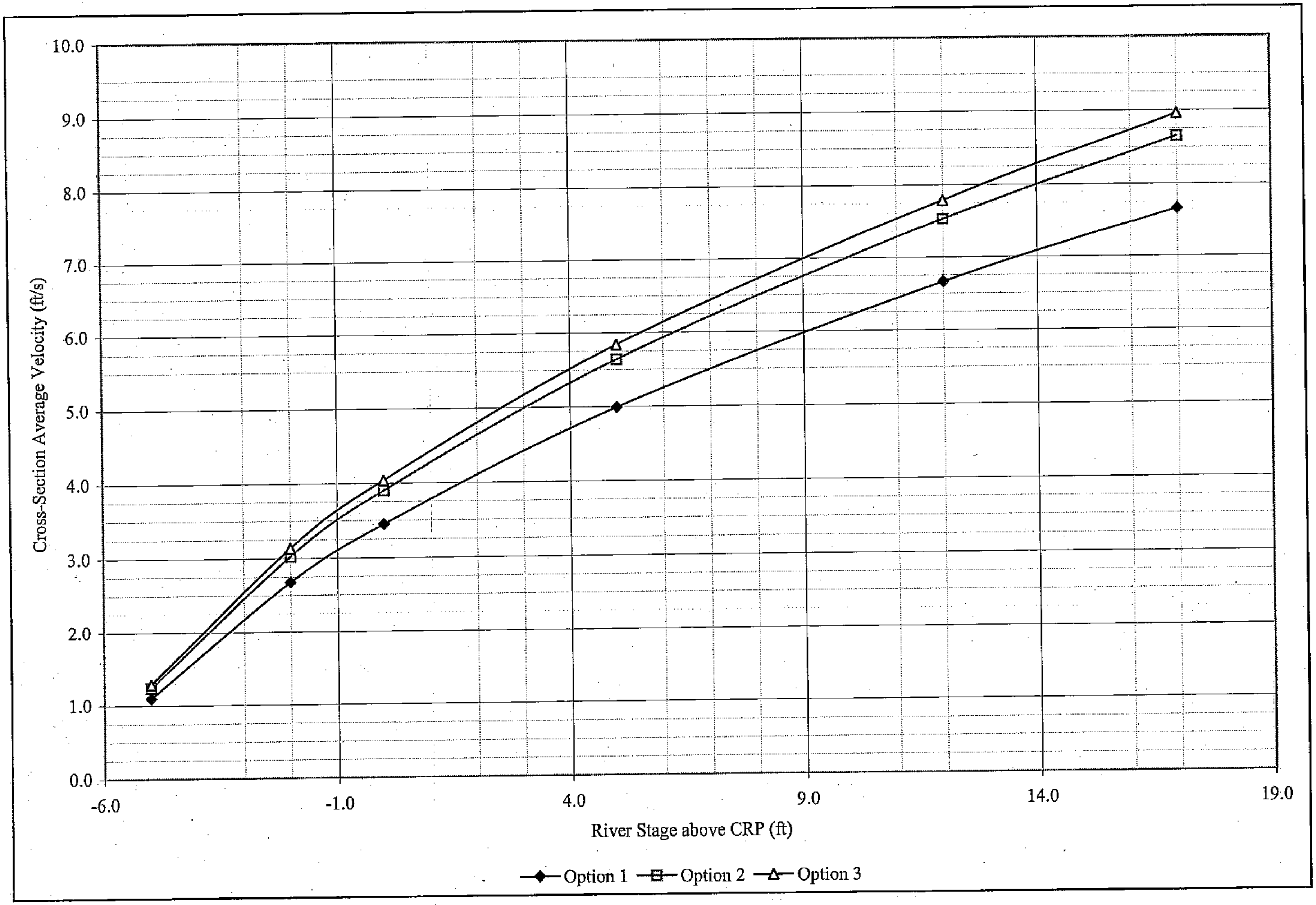
TABLE 10: FLOW SPLIT OUTPUTS: JAMESON ISLAND CHUTE

Run ID	Q_{split} (cfs)	V_{split} (ft/s)	D (mm)	τ (Pa)	Average Depth (ft)	Q_{total} (cfs)	Percent Flow	Top Width	Fr	Stream Power (W/m)	Unit Stream Power (W/m^2)	Unit Stream Power (lb/ft*s)	Critical Shear (τ_*)
Jameson 01	648	2.0	1.0	2.9	3.7	37180	1.7%	87	0.19	48	0.6	0.03	0.18
Jameson 02	1281	2.6	1.6	4.1	5.3	47562	2.7%	93	0.20	95	1.1	0.06	0.15
Jameson 03	2088	3.1	2.4	5.3	6.9	59765	3.5%	99	0.21	155	1.8	0.10	0.14
Jameson 04	6205	4.3	5.2	8.9	12.0	116070	5.3%	119	0.22	462	4.8	0.27	0.11
Jameson 05	14478	5.6	9.0	13.0	17.8	224032	6.5%	146	0.23	1078	9.8	0.55	0.09
Jameson 06	812	2.1	1.0	2.9	3.9	37169	2.2%	100	0.18	60	0.6	0.03	0.19
Jameson 07	1554	2.6	1.7	4.2	5.9	47545	3.3%	100	0.19	116	1.2	0.06	0.16
Jameson 08	2450	3.1	2.4	5.4	7.8	59726	4.1%	100	0.20	182	1.8	0.10	0.14
Jameson 09	6470	4.4	4.9	9.1	14.7	115997	5.6%	100	0.20	482	4.8	0.27	0.12
Jameson 10	13009	5.5	7.6	12.8	23.5	224155	5.8%	100	0.20	968	9.7	0.54	0.10
Jameson 11	1720	2.1	1.0	3.0	3.8	37156	4.6%	216	0.19	128	0.6	0.03	0.18
Jameson 12	3385	2.7	1.9	4.4	5.6	47504	7.1%	224	0.20	252	1.2	0.07	0.15
Jameson 13	5483	3.2	2.8	5.8	7.3	59642	9.2%	231	0.21	408	1.9	0.11	0.13
Jameson 14	15891	4.7	6.4	10.1	13.0	115528	13.8%	259	0.23	1183	5.2	0.29	0.10
Jameson 15	35772	6.2	11.7	15.2	19.7	222474	16.1%	294	0.25	2663	10.8	0.61	0.08

TABLE 11: MODEL VALIDATION DATA AT OVERTON BOTTOMS CHUTE

Run ID	Chute Length (ft)	Chute Slope (ft/ft)	EGL (ft CRP)	n	Base width (ft)	Z	invert (ft CRP)	Gage	Q_{split} (cfs)	Meas Q_{split} (cfs)	Diff (cfs)
Overton 12 June 2003	8300	0.000188	-0.9	0.028	45.00	2.00	-5	Boon	292	288	4
Overton 07 May 2003	8300	0.000188	1.6	0.028	45.00	2.00	-5	Boon	713	756	-43

NOTE: At Overton, the minimum width section (just upstream of the lower grade control structure) was selected for the analysis. Measured Q_{split} values in Table 11 are an average of 4 measurements taken on both days.


10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Cross-Section Average Velocity (ft/s)
-6.0
-1.0
4.0
9.0
14.0
19.0
River Stage above CRP (ft)
Option 1
Option 2
Option 3

SECTION 02921

SEEDING
11/02

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AGRICULTURAL MARKETING SERVICE (AMS)

AMS-01	(Aug 95) Federal Seed Act Regulations Part 201

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 602	(1995a) Agricultural Liming Materials
ASTM D 977	(1991) Emulsified Asphalt
ASTM D 2028	(1976; R 1992) Cutback Asphalt (Rapid-Curing Type)
ASTM D 4972	(1995a) pH of Soils
ASTM D 5268	(1992; R 1996) Topsoil Used for Landscaping Purposes
ASTM D 5883	(1996) Standard Guide for Use of Rotary Kiln Produced Expanded Shale, Clay or Slate (ESCS) as a Mineral Amendment in Topsoil Used for Landscaping and Related Purposes

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Equipment; G, RE

The contractor shall submit for approval the equipment to perform all operations relating to seeding.

Delivery

The Contractor shall submit for approval prior to the delivery of materials to be used for seeding and mulching

SD-03 Product Data

Quantity Check; G, RE

Bag count or bulk weight measurements of material used compared with area covered to determine the application rate and quantity installed.

Seed Establishment Period; G, RE

Calendar time period for the seed establishment period. When there is more than one seed establishment period, the boundaries of the seeded area covered for each period shall be described.

SD-04 Samples

Mulch; G, RE

A 10 pound sample.

SD-07 Certificates

Seed; G, RE

Prior to the delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following:

a. Seed. Classification, botanical name, common name, percent pure live seed, minimum percent germination and hard seed, maximum percent weed seed content, and date tested.

c. Mulch: Composition and source.

Seed Classification; G, RE

1.3 DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.3.1 Delivery

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery.

1.3.2 Inspection

Seed shall be inspected upon arrival at the job site for conformity to species and quality. Seed that is wet, moldy, or bears a test date five months or older, shall be rejected. Unacceptable materials shall be removed from the job site.

1.3.3 Storage

Materials shall be stored in designated areas. Seed shall be stored in cool, dry locations away from contaminants. Chemical treatment material shall be stored according to manufacturer's instructions and not with seeding operation materials.

1.3.4 Handling

Except for bulk deliveries, materials shall not be dropped or dumped from vehicles.

1.4 SCOPE

This section covers seeding, mulching, and sodding complete.

1.2 AREAS

Cleared area along the chute, access road, and temporary storage facility shall be seeded and mulched. The interior slopes and bottoms of the chute and graveled portions of the access road will not be seeded or mulched. Disturbed areas other than required for construction work shall be held to the minimum practicable to perform the work. Where areas are disturbed solely for the convenience of the Contractor, as determined by the Contracting Officer, such areas shall be seeded and mulched and will be considered as protection of the environment.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Mulch

Mulch shall be wheat straw.

2.1.2 Deleterious Materials

Materials containing objectionable weed seeds or other species detrimental to the planting will not be acceptable.

2.1.3 Labels

Seed shall be labeled in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act. Seed shall be furnished in sealed, standard containers unless approved by the Contracting Officer. Seed that is wet or moldy or that has been otherwise damaged in transit or storage will not be acceptable. All seed shall be blended by supplier prior to delivery.

2.1.3.1 Seed Mixtures

The seed mixture to be used shall be as follows:

Kinds of Seed	Pounds Pure Live Seed (PLS)/Acre
Virginia Wild Rye (Elymus virginicus)	8 lbs.
River Oats (Chasmanthium latifolium)	8 lbs.

Total Pounds Pure Live Seed/Acre	16 lbs.

2.1.4 Bulk Seed

All grass seed will meet minimum of 98% purity and 85% germination, as indicated on the labels.

2.1.5 Soil for Repairs

Soil for repairs shall be of at least equal quality to that which exists in areas adjacent to the area to be repaired. Any soil used shall be free from roots, stones, and other materials that hinder grading, planting, and maintenance operations and that is free from objectionable weed seed and toxic substances.

PART 3 EXECUTION

3.1 QUALITY CONTROL

3.1.1 Seed

Seed shall be Missouri Ecotype. The Contractor shall furnish signed copies of statement from the suppliers, certifying that each container of seed delivered complies with specified requirements and is labeled in accordance with the Federal Seed Act and is at least equal to the requirements previously specified. This certification shall be furnished on or with all copies of seed invoices.

3.1.2 Mulch

At least 30 days prior to commencing seeding operations, the Contracting Officer shall be notified of sources from which mulch materials are available and the quantities thereof, and representative samples of the materials proposed for use shall be submitted for approval.

3.2 PREPARATION OF GROUND SURFACE

3.2.1 General

Equipment, in good condition, shall be provided for the proper preparation of the ground and for handling and placing all materials. Equipment shall be approved before work is started.

3.2.2 Clearing

Prior to grading and tilling, vegetation that may interfere with operations shall be mowed, grubbed, and raked. The surface shall be cleared of stumps, roots, cable, wire, and other materials that might hinder the work, or interfere with future mowing.

3.2.3 Grading

Previously established grades shall be maintained on the areas to be seeded in a true and even condition; necessary repairs shall be made by adding soil as necessary to previously graded areas. All surfaces shall be left in an even and properly compacted condition to prevent formation of depressions.

3.2.4 Tillage

Two tillage operations shall be conducted to destroy pre-existing vegetation prior to seeding. During the first tillage the seeding sites shall be tilled to an average depth of 3.0 inches. Two weeks should be allowed to elapse between tillage operations so that weed seeds and perennial plant parts may have time to germinate or regrow, and so be destroyed by the second tilling. During the second tillage the seeding sites shall be tilled to an average depth of 3.0 inches. After the second tillage, should dead vegetation at the soil surface be in excess of 1.5 inches in thickness, the soil shall be retilled to a suitable depth, so that most of the vegetation is incorporated into the soil. Seeding sites shall be rolled and firmed with a corrugated metal roller or cultipacker immediately following tilling operations and prior to planting. After tillage, all stones larger than 3 inches in diameter, clumps or clods and other materials that might hinder the work or subsequent maintenance shall be cleared. The work shall be performed only during periods when, in the opinion of the Contracting Officer, beneficial results are likely to be obtained. When drought, excessive moisture, or other unsatisfactory conditions prevail, the work shall be stopped when directed.

3.2.5 Leveling

Surface irregularities, resulting from tillage or other operations before seeding, shall be leveled prior to seeding.

3.3 PLANTING SEED - TIME AND CONDITIONS

3.3.1 Seeding Periods

Seed mixture shall be sown only between dates of March 15 to May 15, August 20 to September 30, or December 1 to January 31, unless otherwise approved by the Contracting Officer. When delays in operations extend the work beyond the most favorable planting season for species designated or when conditions are such by reason of drought, high winds, excessive moisture, or other factors that satisfactory results are not likely to be obtained, work shall be halted as directed and resumed only when conditions are favorable or when approved alternate or corrective measures and procedures have been effected. If inspection during seeding operations, or after there is show of green, indicates that areas have been left unplanted, additional seed shall be sown as directed.

3.3.2 Seeding Method

Seeding method shall be drill seeding. The use of a standard grain drill is allowed provided that a standard legume box is provided for the seed, otherwise a native grass drill or rangeland grass drill of the "TruaxTM-type/like" shall be used. The drill shall be equipped with double coulter furrow openers, depth bands, press wheels and agitators in the seed box. The seed shall be uniformly spread in two directions at right angles to each other, using one half of the total seed to be distributed in each direction, unless extreme slopes interfere with the safe or practical use of the seeding equipment, in which case one or more passes in the same direction shall be an acceptable substitute.

3.3.2.1 Depth of Seeding

The seed shall be incorporated into the soil to an average depth of 1/8 to

1/4 inch below the soil surface.

3.3.2.2 Seeding Rate

The grass seed mixture shall be drilled at the rate specified.

3.3.3 Mulching

3.3.3.1 Hay or Straw Mulch

Mulch shall be spread uniformly at the rate of 2 tons per acre. Mulch shall be spread by hand, blower-type mulch spreader, or other approved method. Mulching shall be started on the windward side of relatively flate areas or on the upper part of steep slopes, and continued uniformly until the area is covered. The mulch shall not be bunched or clumped. Sunlight shall not be completely excluded from penetrating to the ground surface. All areas installed with seed shall be mulched on the same day as the seeding. Mulch shall be anchored immediately following spreading.

3.3.3.2 Mechanical Anchor

Mechanical anchor shall be a V-type-wheel land packer; a scallope-disk land packer designed to force mulch into the soil surface; or other suitable equipment.

3.4 PROTECTION

Protection shall be provided against traffic or other use by erecting barricades immediately after treatment is completed, and by placing warning signs as directed, on various areas.

3.5 REPAIRING AND RESEEDING

The Contractor is not required to guarantee a cover crop; however, the Contractor shall be fully responsible for any damage or lack of cover caused by elements under his control. The Contracting Officer may direct that areas that do not attain the required cover or areas that become damaged be repaired and reseeded to specification requirements.

-- End of Section --

TEMPORARY CONSTRUCTION ACCESS EASEMENT

The undersigned, M. Troy Gordon and Janine N. Gordon, husband and wife, of the County of Boone, State of Missouri, title holders to land located in Section Twenty-five (25), Township Fifty (50) North of the base line, Range (19) West of the Fifth Principal Meridian, Saline County, Missouri, hereinafter the "Gordon's", for valuable consideration, do hereby grant unto the United States of America, by and through the Secretary of the Army, hereinafter the "Government", and its representatives, agents, contractors and assigns, a temporary easement and right-of-way for access utilized for ingress and egress by foot and with equipment and vehicles in, on, over and across the property shown on Exhibit "A", for a term of 60 months from the date of this document.

Any resurfacing and maintenance necessary to the access road over the easement area shown on Exhibit "A" shall be the responsibility of, and at the discretion of, the Government; reserving however, to the Gordon's, their heirs and assigns, all such rights and privileges in the land as may be used without interfering with or abridging the rights and easement hereby acquired; subject however to existing easements for public roads and highways, public utilities, railroads, and pipelines.

To Have and to Hold, this temporary easement is granted to the Government for a term of 60 months from the date of this document. The Gordon's covenant they are vested with good title to the premises and have the lawful power and legal authority to convey the rights herein granted over the property shown in Exhibit "A".

In Witness Whereof, the Gordon's have hereunto set their hands this ______ day of ________________, 2006.

____
M. Troy Gordon

____
Janine N. Gordon

STATE OF ____________________)
) SS.
COUNTY OF ___________________)

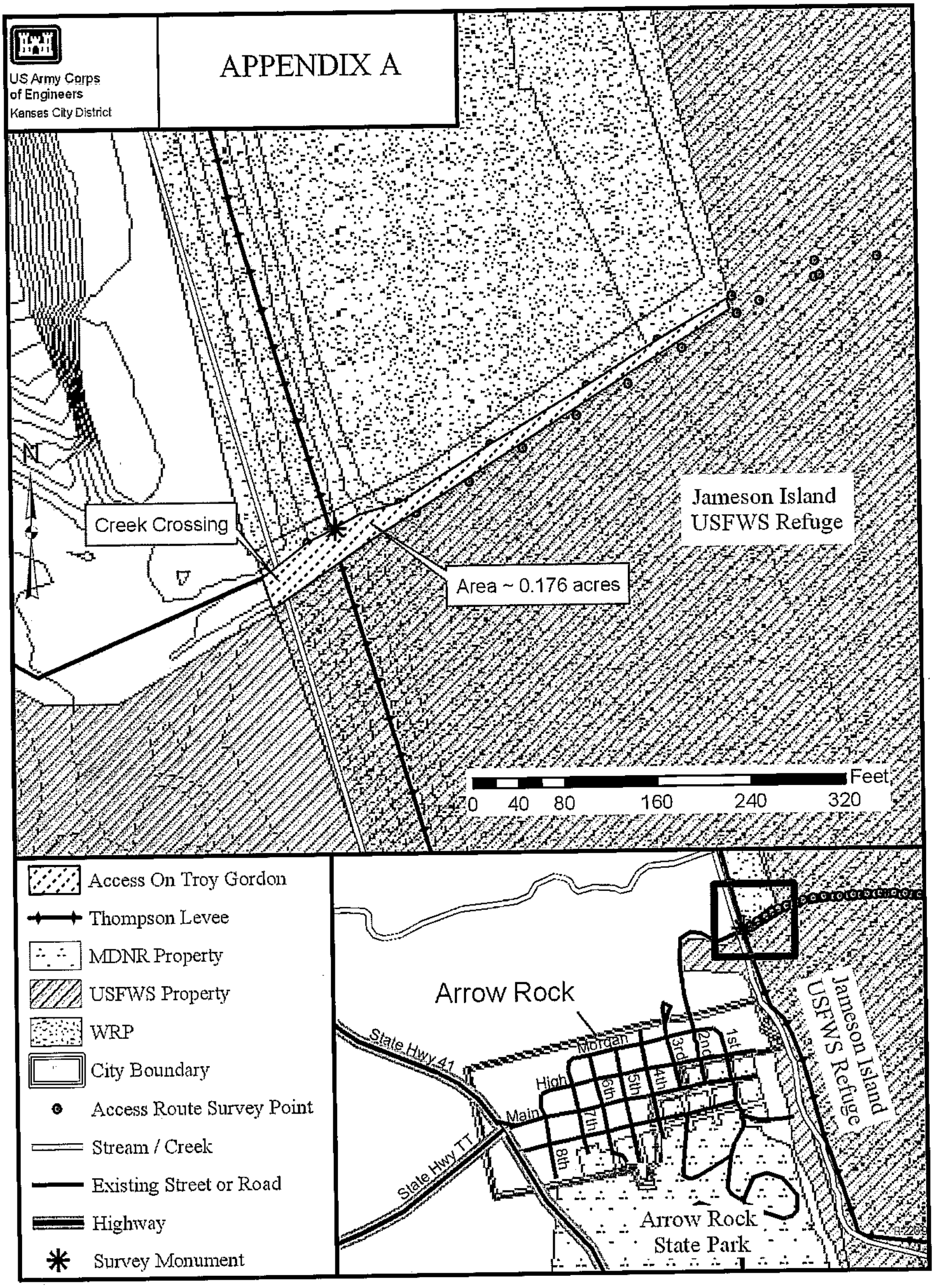
On this _____ day of _____________, ____, before me, the undersigned, a Notary Public in and for said County and State, personally appeared **M. Troy Gordon** and **Janine N. Gordon**, (husband and wife) to me known to be the persons described in and who executed the foregoing instrument, and acknowledged that they executed the same as their free act and deed.

Witness my hand and Notarial Seal subscribed and affixed in said County and State, the day and year first above written.

____
Notary Public

My Commission Expires:

APPENDIX A



US Army Corps of Engineers
Kansas City District
N
Creek Crossing
Area ~ 0.176 acres
Jameson Island USFWS Refuge
Feet
0 40 80 160 240 320
Access On Troy Gordon
Thompson Levee
MDNR Property
USFWS Property
WRP
City Boundary
Access Route Survey Point
Stream / Creek
Existing Street or Road
Highway
Survey Monument
Arrow Rock
State Hwy 41
State Hwy TT
Morgan
High
Main
1st
2nd
3rd
4th
5th
6th
7th
8th
Jameson Island USFWS Refuge
Arrow Rock State Park