PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 5
Section 2

Channel Capacity of the North Platte River Upstream of Highway 83

December 7, 2005

I. Purpose

The purpose of this section of the Water Plan is to describe the capital investment and maintenance measures addressed in Section III.E.2.d.iii of the Program Document.

II. Description

The descriptions of the capital investment and maintenance measures are provided in Exhibit A to this attachment. Exhibit A consists of the report entitled "North Platte Channel Capacity Study," prepared by J.F. Sato and Associates, Inc, absent the appendices. This report was prepared for the Water Management Committee during the term of the Cooperative Agreement. The Governance Committee, based on input from the Water Management Committee, concluded the Base Case, Alternative 1 and Alternative 2, outlined in the report should be implemented to increase the capacity of the channel of the North Platte River upstream of Highway 83 to 3,000 cubic feet per second (cfs). The report refers to the Base Case, Alternative 1 and Alternative 2 as short-term solutions as J.F. Sato and Associates, Inc. proposed additional studies to identify long-term solutions. The Governance Committee did not approve the proposal for additional studies.

III. Schedule

It is the intent of the Governance Committee to complete the Base Case, Alternative 1 and Alternative 2, described in Exhibit A, as one project in accordance with the following preliminary schedule:

Tasks		Completion Date
1.	Permitting (federal, state, local)	October 1, 2007
2.	Final design; acquisition of easements; preparation of bid packages, as needed.	July 1, 2008
3.	Solicit and review bids. Prepare contracts. Issue the construction notice to proceed.	October 1, 2008
4.	Completion of the project.	October 1, 2009

It is understood that the proposed project must undergo a review under the National Environmental Policy Act (NEPA) in order to secure the necessary federal permits. The NEPA review could alter the configuration of some of the components of the project and impact the above preliminary schedule. However, it is the intent of the Governance Committee to complete as much of the project as possible by October 1, 2009. It may be necessary to phase the work to ensure as much work as possible can be completed by this date.

PLATTE RIVER RECOVERY IMPLEMENTATION PROGRAM
Attachment 5
Section 2
Exhibit A

Final Report
North Platte Channel Capacity Study
For the
Water Management Committee
North Platte Cooperative Agreement

JFS&A
J. F. SATO AND ASSOCIATES
Engineering, Environmental,
and Program Management Services
5898 South Rapp Street • Littleton, CO 80120
Phone 303.797.1200 • Fax 303.797.1187
www.jfsato.com

Final Report
North Platte Channel Capacity Study
For the
Water Management Committee
North Platte Cooperative Agreement

December 1, 2005

Prepared by

J.F. Sato and Associates, Inc.
5898 South Rapp Street
Littleton, Colorado 80120
(303) 797-1200
Contact: Steve Lowry

JFS&A
J. F. SATO AND ASSOCIATES
Engineering, Environmental,
and Program Management Services
5898 South Rapp Street • Littleton, CO 80120
Phone 303.797.1200 • Fax 303.797.1187
www.jfsato.com

North Platte Channel Study
Final Report

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C. Technical Memorandum No. 2 dtd Aug 31 2005 -
D. List of resource materials and contacts
E. Meeting minutes, field memoranda, correspondence
F. Presentations: July 13 and September 12 (Powerpoint) -
G. Scope of Services from Contract -
H. JFSA Technical Proposal -
I. Survey data from JFSA (AutoCAD format)
J. Photographs -
K. Aerial Mapping (on ~20 CDs available from WEST, Inc)
L. HEC-RAS runs -
M. Data from Gary Lewis (3 CD's available from WEST, Inc)

JFS&A
J. F. SATO AND ASSOCIATES
Engineering, Environmental,
and Program Management Services
5898 South Rapp Street • Littleton, CO 80120
Phone 303.797.1200 • Fax 303.797.1187
www.jfsato.com

North Platte Channel Capacity Study –Final Report

Purpose: This Final Report is submitted in accordance with Section 3.6 of the Scope of Services in the contract between J.F. Sato and Associates (JFSA) and the Nebraska Community Foundation. Based on the Preliminary Review Technical Memo dated August 31 that was first presented to the Water Management Committee (WMC) on September 7, 2005, and then to the Governance Committee (GC) on September 12, 2005, JFSA was directed to consider the following three alternatives for conceptual design:

- Base Case: construction of channels to intercept and drain the area near Washboard Road
- Alternative 1: Includes the Base Case, plus two additional channels for additional drainage
- Alternative 2: Includes Alternative 1, plus removes a sand bar in one of the critical upper channels

Background: The objective of this study is to investigate methods to increase and maintain a channel capacity in the North Platte River at North Platte, Nebraska of 3,000 cubic feet per second (cfs). In July 2001 flows of this magnitude caused nuisance flooding of properties approximately 1,500 feet upstream of Highway 83 (Hwy 83). In July 2002 more serious flooding occurred in several homes, hay meadows, and parts of both Washboard Road and North River Road. The National Weather Service (NWS) visited the site in response to concerns from local residents. Based on daily stream gauge and water level measurements and the corresponding degree of flooding, the NWS issued a letter on September 9, 2002, that lowered the flood stage from El 6.0 to El 5.7. The stream gauge is located just downstream of Hwy 83. This stage equated to a flow of about 1,980 cfs, less than the desired amount. This water level impacts the Platte River Recovery Implementation Program's (Program) ability to pass Environmental Account (EA) water and the Central Nebraska Public Power and Irrigation District's (Central) ability to pass flows needed for irrigation demands without exceeding the flood stage.

The activities leading up to this final report are listed on the timeline in Table 1.

JFS&A
J. F. SATO AND ASSOCIATES
Engineering, Environmental,
and Program Management Services
5898 South Rapp Street • Littleton, CO 80120
Phone 303.797.1200 • Fax 303.797.1187
www.jfsato.com

Table 1. Timeline of Activities.

Date	Activity
May 23 2005	RFP Issued
June 15 2005	Proposals Received
July 5 2005	Contract Award
July 6-7 2005	Field Visit
July 13 2005	Scoping Session, Cheyenne
July 25-27	Additional data collection
August 1 2005	Initial Technical Memorandum
August 31 2005	Preliminary Results Technical Memorandum
September 7 2005	Teleconference with the Water Management Committee
September 12 2005	Presentation to the Governance Committee in Denver
November 1 2005	Draft Final Report
December 1 2005	Final Report

Further background information can be found in the Technical Memoranda included as appendices.

Problem Identification and Solutions: In our earlier reports we described the flooding problem as having two parts - the "local" and the "big-picture" parts. The local problem is the flooding upstream of Hwy 83 in the area south of North River Road. The big-picture problem is the change over time in the conveyance in the reach extending from Central's Main Supply Canal diversion to several miles upstream of Hwy 83. The alternatives selected for conceptual design provide a solution to the local problem. The solution will be effective as long as the main channel capacity in the reach near the Hwy 83 bridge continues to maintain the ability to convey 3000 cfs without causing direct flooding of the impacted area. Many factors impact the longevity of the solution. These include continued invasive vegetation growth in the main channels, continued deposition of sediments, and floods that may temporarily restore part of the channel capacity.

As part of our initial investigation, we had looked at a Base Case and seven alternatives as described below:

Base Case. The following elements are included:

1. Open State Channel
2. Extend State Channel north to existing ponds/North River Road
3. Construct road ditch along west side of Washboard Road
4. Open southern channel from road ditch to abandoned detour road
5. Remove abandoned detour road and construct ditch to main channel of the North Platte
6. Remove phragmites along opened drainages

Alternative 1. The following additional elements are **added** to the Base Case:

1. Improve and open the channel to connect existing culverts in Washboard Road to the existing concrete box culvert under Hwy 83.

2. Improve conveyance through the ponds to the main channel and provide overflow structure.

Alternative 2. The following additional element is **added** to Alternative 1:

1. Remove sand bar that is blocking the northern channel about 1,500 feet above Hwy 83 and improve the channel downstream of this point.

Alternative 3. Construct dikes to protect properties.

Alternative 4. Purchase or remove properties.

Alternative 5. Dredge channel through the reach and place berms.

Alternative 6. Revise diversion operation.

Alternative 7. Interconnect NPPD's Sutherland Canal and Central's Main Supply Canal (aka Tri-County Canal).

Section 3.3 of the contract scope requested JFSA to look at several factors in evaluating alternatives. These are:

- An opinion of capital cost
- An estimate of annual O&M costs
- A description of logistics, including permitting
- Comments on the potential for channel aggradation
- Channel capacity expected
- Probability of success

This information was summarized in a decision matrix to decide on the scenarios to be carried into conceptual design. The three highest ranking scenarios, in order, were Alternative 2, Alternative 1, and the Base Case.

Cost Estimates: The cost estimates have been reviewed and updated as part of this phase. The updated cost estimates are included in Appendix A. Quantities were developed from the drawings. Unit prices were estimated from construction cost guides, such as R.S. Means, as well as input from local contractors. Standard unit prices were increased to allow for small work areas and access. Land values were estimated from records of the County Assessor's office and increased about 20 percent. Phragmite's removal costs were estimated from literature sources. At this level of study a contingency of 25 percent is standard practice. Engineering costs at 15 percent include surveying, final design, plans and specifications, and limited construction administration. Legal and administrative costs are included to cover city, county, and project sponsor costs. Permitting costs and costs for an Environmental Assessment (EA) are our estimates after we discussed the scope with the United States Army Corps of Engineers (USACE) in Kearney, NE. Wetlands may be present in all locations. The costs for wetland delineation include field time, preparation of exhibits and coordination with regulators. The costs noted for the EA for each alternative are inclusive, for example the EA cost for Alternative 2 includes the costs of the EA for Alternative 1 and the Base Case.

JFS&A
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Easements: The proposed work is on both public and private property. Where work extends outside of the public right-of-way, additional easements would be needed. We have indicated on the drawings the proposed easements. Temporary easements would be needed during construction. Permanent easements would be needed where maintenance is required. Temporary easements were taken as 3 percent of the land value; permanent easements were taken as 10 percent of the land value. Because the work generally occurs in the undeveloped portion of private parcels, the land value was reduced 50 percent when calculating easement costs.

Permitting: An overview of permit requirements follows.

Federal**.** The US Army Corps of Engineers (USACE) will require Section 404 permitting for all work accomplished in wetlands and other waters of the United States, such as the North Platte River. The permitting process will begin with accurate delineation of jurisdictional wetlands within the project area. The USACE office in Kearney, Nebraska, will verify these delineations and provide guidance on permit application. Initial discussion with the USACE concerning this project has resulted in their opinion that an Individual Section 404 Permit will be required. This permit type would require a diversity of data collection, including threatened and endangered species (T&E) clearances, wetland delineation, and cultural resource clearances. Other federal agencies, such as the US Fish and Wildlife Services, would be involved. A public comment period is involved. The timeframe for preparing and processing this type of permit is no less than three months.

Mr. Dwight Tillotson of the Kearney office of the USACE has indicated that an Environmental Assessment will be needed as part of the decision making process for the 404 permit. The applicant normally assists in the preparation and analysis of alternatives for a project of this complexity.

Any alternative that would permanently impact the jurisdictional floodplain would also require the submittal of a Conditional Letter of Map Revision (CLOMR) to Federal Emergency Management Agency (FEMA) in accordance with the National Flood Insurance Program. Currently, there is an update (Flood Hazard Mitigation Study (FHMS)) to the floodplain boundaries being prepared by the City of North Platte. The scenario studies in the Conceptual Design are not expected to require a CLOMR because they have not significantly changed the cross section of the main channels.

State. At this point, no state permits have been identified. The North Platte Game Refuge is located in the project area. The Refuge area is off limits to hunting. The boundaries are based on the delineated riverbank, but none of the proposed work is expected to impact the riverbank delineation. The limits of the Refuge are shown on the drawings.

Local. Because Washboard Road is a county road, a county road permit is anticipated. Haul permits may be needed if large amounts of material are moved on public roads. The City regulates the floodplain in this area. Any construction in the floodplain would require a Floodplain Development Permit. Obtaining a permit requires performing studies similar to the studies needed for a CLOMR, as noted above.

Description of Alternatives. A description of each scenario follows. Drawings are provided in Appendix A.

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5898 South Rapp Street • Littleton, CO 80120
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Scenario: Base Case

Description: The Base Case is a short-term solution that represents the minimum work required to reduce the flooding of properties and allow passage of 3,000 cfs through the Hwy 83 Bridge. The following features are included and shown on the drawings in Appendix A:

Open the State Channel. The State Channel is approximately 2,360 feet long and was built in the late 1960s as part of the Hwy 83 bridge reconstruction project. The purpose of the channel was to drain water from the upper floodplain, or , to keep the bridge construction area dry. After the bridge construction, this channel was allowed to fill in with vegetation and sediment. Vegetation consists of trees, grasses, and phragmites. Opening this channel would intercept flows in the overbank and convey them to the main channel. The proposed work would clear and grub the channel and excavate about 1.5 feet from the channel bottom. The channel width would be restored to 20 feet. To ensure that flows reach this channel, the natural channel (North Channel) to which it connects would also be cleared of vegetation and regraded at a width of 80 feet for a distance of about 800 feet.

Extend the State Channel. To intercept water that flows near the North River Road, a new channel with a 20-foot base width would be extended to the North River Road. To minimize excavation and disruption, the existing ponds would be incorporated.

Construct Road Ditch along Washboard Road. Any flow that passes around or under the State Channel will continue to Washboard Road. A road ditch approximately 1,150 feet long with a bottom width of 8 feet would be constructed along the west side of Washboard Road to convey flows south to the South Channel, a natural channel. Culverts with headwalls would be installed under the existing drives. The ditch would be re-vegetated and the landscaping restored. The bottom of the ditch would be lined with 2-inch rock to reduce erosion and facilitate maintenance.

Open South Channel. At the end of the proposed road ditch along Washboard Road, the flows would enter an existing channel (South Channel) that used to convey significant flows before being blocked with vegetation and sediment. The Base Case would open about 800 feet of channel by removing vegetation and regrading the invert. The end of this channel would connect to the next ditch that is proposed.

Remove Abandoned Road, Construct Ditch. The 24-foot wide asphalt road constructed as part of the detour for the Hwy 83 bridge construction was never totally removed. A section about 800 feet long remains in place. The road embankment interferes with flow in the floodplain. The Base Case would remove the road and construct a ditch that connects the South Channel to the main channel of the river. Where the South Channel meets the proposed ditch, an existing temporary culvert would be removed and the earthwork reshaped to provide smooth flow. A private duck blind has been constructed next to the road and would have to be relocated.

Removal of *Phragmites australis* (common reed). Besides the clearing and grubbing work in the channels that would mechanically remove *Phragmites australis*, the Base Case proposes to use chemical methods to kill *Phragmites* for at least 50 feet on each side of the reopened channels. Part of this treatment is proposed to be done with aerial

methods using the glyphosate compound Rodeo®. In areas where adjacent vegetation may be damaged by drift, the use of backpack sprayers is proposed. One application of chemical at the correct time of year has been reported to be effective in killing the standing growth. Subsequent annual applications are needed to keep the plant from returning.

Capital Cost: Estimated quantities and unit prices were developed for the work as described above. The opinion of cost is attached. The estimated cost is $398,610. The estimated cost for the EA has been shown separately.

O&M Cost: Annual costs will be incurred to keep the channels free of vegetation and sediment. An allowance has also been provided for maintenance of the road ditch and culverts.

Logistics, including permitting: This scenario will impact the waters of the US and therefore require an Individual 404 Permit. The USACE has indicated that an EA will need to be prepared as part of the review process for the Permit.

Potential for additional channel aggradation: This alternative will not have any significant impact on the mechanisms causing aggradation in the main channel.

Probability of success: Based on our understanding of the causes for the flooding during 2002, this proposed action has a high probability of success to eliminate flooding at a flow of 3,000 cfs as long as the channels that are noted are kept open.

Channel capacity expected: For the short term, the main channel should be able to convey 3,000 cfs through the reach without resulting in flooding. If aggradation and encroachment of vegetation in the main river channel continues, the effectiveness of this scenario may diminish over time.

JFSA **EXHIBIT BC-1**

NORTH PLATTE CHANNEL CAPACITY STUDY
CONCEPTUAL DESIGN
ENGINEER'S OPINION OF PROBABLE COST

ALTERNATIVE: **BASE CASE**

CAPITAL COST:

No.	Item	Quantity	Unit	Unit Price	Total
1	Mobilization	1	LS	$12,500.00	$12,500.00
Open & Extend State Channel, North Channel					
2	Clear and grub	5.6	Ac	$1,250.00	$7,000.00
3	Excavate and haul	4,600	CY	$7.00	$32,200.00
				subtotal:	$39,200.00
Construct Road Ditch along Washboard Rd					
4	Clear and grub	0.6	Ac	$1,250.00	$750.00
5	Excavate and haul	1,550	CY	$7.00	$10,850.00
6	Culverts, 36-inch CMP, 50 ft long	6	EA	$5,000.00	$30,000.00
7	Headwalls	6	EA	$2,500.00	$15,000.00
8	Restore drives, landscaping	3	EA	$7,500.00	$22,500.00
9	Channel lining, 2-inch rock	260	CY	$25.00	$6,500.00
10	Geotextile fabric	2,550	SY	$3.00	$7,650.00
				subtotal:	$93,250.00
Remove Detour Road, Open South Channel, Build Ditch					
11	Clear and grub South Channel	1	Ac	$1,250.00	$1,250.00
12	Remove 3-inch asphalt road	2,150	SY	$5.00	$10,750.00
13	Remove embankment, haul	8,900	CY	$7.00	$62,300.00
14	Excavate ditch	2,075	CY	$5.00	$10,375.00
				subtotal:	$84,675.00
Phragmites					
15	Treat phragmites, aerial spray	5	Ac	$225.00	$1,125.00
16	Treat phragmites, backpack sprayer	2	Ac	$1,100.00	$2,200.00
				subtotal:	$3,325.00
Investigations, Permits					
17	Wetland Delineation/Verification	96	Hr	$85.00	$8,160.00
18	USACE Section 404 Individual Permit	120	Hr	$85.00	$10,200.00
19	Easements, Permanent	9	Ac	$200.00	$1,800.00
20	Geotechnical Report	1	LS	$2,000.00	$2,000.00
				subtotal:	$22,160.00
				Sub-total:	$255,110.00
			Contingency:	25%	$63,780.00
				Sub-total:	$318,890.00
			Engineering:	15%	$47,830.00
			Legal and Admin:	10%	$31,889.00
				Total:	$398,610.00
			Environmental Assessment (if required):		$80,000.00

JFSA **EXHIBIT BC-1**

NORTH PLATTE CHANNEL CAPACITY STUDY
CONCEPTUAL DESIGN
ENGINEER'S OPINION OF PROBABLE COST

ALTERNATIVE: BASE CASE

ANNUAL O&M COST:

No.	Item	Quantity	Unit	Unit Price	Total
1	Clear vegetation	5	Ac	$500.00	$2,500.00
2	Treat Phragmites	6.6	Ac	$750.00	$4,950.00
3	Clear culverts	1	LS	$500.00	$500.00
4	Road ditch maintenance	1	LS	$1,000.00	$1,000.00
5	Remove sediment from opened channels	1	LS	$3,500.00	$3,500.00
6	Mitigation monitoring for 404 Permit	24	HR	$85.00	$2,040.00
				Sub-total:	$14,490.00
				Contingency: 25%	$3,620.00
				Sub-total:	$18,110.00
				Legal and Admin: 10%	$1,811.00
				Total:	$19,921.00

Scenario: Alternative 1 – Base Case and Drainage Improvements

Description: Alternative 1 is a short-term solution that **includes** the elements of the Base Case and **adds** two elements to improve drainage. The first element is restoring the drainage way from the culverts that cross under the north end of Washboard Road to the concrete box culvert (CBC) under Hwy 83. The second element is improving the flow from the eastern lake to the southern lake and on to the main channel of the North Platte River (NPR). The features are shown on the drawings in Appendix A.

The improvements to the drainage way begin at two 24-inch-diameter corrugated metal pipe (CMP) culverts under Washboard Road. The upstream ends of these culverts have been damaged, restricting flow. The culverts will be repaired and headwalls provided to protect the upstream ends. The downstream channel will be cleared of vegetation and brush for a length of approximately 800 linear feet and a width of about 50 feet and reshaped to improve its ability to convey flows. This reach of the channel discharges into the northern lake (former sand pit).

Water that enters the northern lake now exits either through two 12-inch-diameter CMPs to the east or through one 18-inch diameter culverts and a swale to the south. The lake discharges over a low spot in the south berm where it overflows to the main channel of the NPR.

The improvements to the east would include replacing the two 12-inch-diameter culverts with two 36-inch-diameter culverts with upstream and downstream headwalls. These will discharge into a natural channel that needs to be cleared of vegetation and widened for a distance of about 400 feet to reach the CBC. The CBC consists of two cells, each 4 feet wide and 2.5 feet high. Downstream of the CBC, an additional 600 feet of channel needs to be cleared and regraded to allow flow to continue into the lake on the east side of Hwy 83. A controlled overflow section will be constructed to reduce damage should the lake level rise to the point of overtopping.

The improvements to the south include replacing the culvert between the lakes with two 30-inch-diameter CMPs with headwalls and constructing an overflow section in the berm of the south lake at an elevation to provide for adequate drainage. The overflow section would consist of a concrete cutoff wall with a 10-foot-long overflow section. A riprap blanket would be placed downstream to minimize erosion or the embankment.

There are few, if any, phragmites in this area. Treatment of vegetation would be limited to mechanical removal of trees and brush.

Capital Cost: Estimated quantities were developed for the work as described above. The Opinion of Probable Construction Cost for Alternative 1 has been estimated at $530,145. The estimate is attached.

The estimated cost for the EA, $90,000, includes the work for the Base Case, and has been shown separately.

O&M Cost: Annual costs will be incurred to keep the channels free of vegetation and sediment and to maintain the culverts.

Logistics, including permitting: There will be minimal impact to the channels. No additional permitting other than needed for the Base Case is expected to cover this work.

Potential for additional channel aggradation: The additional channels that would be improved as part of this alternative are not subject to significant aggradation. See the Base Case for comments on the river channels.

Probability of success: Because these drainage improvements are not impacted by either uncontrolled vegetation or aggradation, they are expected to function well and result in a high probability of success.

Channel capacity expected: The same as for the Base Case, that is, for the short term, the channel should be able to convey 3,000 cfs through the reach without resulting in flooding. If aggradation and encroachment of vegetation in the main river channel continues, the effectiveness of this scenario may diminish over time.

JFSA **EXHIBIT ALT1-1**

NORTH PLATTE CHANNEL CAPACITY STUDY
CONCEPTUAL DESIGN
ENGINEER'S OPINION OF PROBABLE COST

ALTERNATIVE: **ALTERNATIVE 1** (Base plus connection to the CBC)

CAPITAL COST:

Item

No.	ITEM	Quantity	Unit	Unit Price	Total
1	Base Case (includes mobilization)	1	LS	$255,110.00	$255,110.00
2	Clear and grub	2.5	Ac	$1,250.00	$3,125.00
3	CMP 30-inch repair upstream ends (2)	1	LS	$1,000.00	$1,000.00
4	Culverts, 30-inch CMP, 150 ft long	2	EA	$10,000.00	$20,000.00
5	Headwalls, 30-inch CMP	8	EA	$2,500.00	$20,000.00
6	Culverts, 36-inch CMP, 100 ft long	2	EA	$9,000.00	$18,000.00
7	Headwall, 36-inch CMP	4	EA	$2,500.00	$10,000.00
8	Concrete cutoff wall, including excavation	3.3	CY	$600.00	$1,980.00
9	Revegetate	2	Ac	$500.00	$1,000.00
10	Bank protection	42	CY	$40.00	$1,680.00
11	Additional geotechnical	1	LS	$1,500.00	$1,500.00
12	Additional permitting	24	Hr	$85.00	$2,040.00
13	Additional Easements, permanent	2.3	Ac	$200.00	$460.00
14	Additional Wetland Delineation	40	Hr	$85.00	$3,400.00

Sub-total:		$339,295.00
Contingency:	25%	$84,820.00
Sub-total:		$424,115.00
Engineering:	15%	$63,620.00
Legal and Admin:	10%	$42,410.00
Total:		$530,145.00

Environmental Assessment (if required): $90,000.00

ANNUAL O&M COST:

No.	Item	Quantity	Unit	Unit Price	Total
1	Base Case	1	LS	$14,490.00	$14,490.00
2	Clear vegetation, additional	2	Ac	$500.00	$1,000.00
3	Treat Phragmites, additional	0	Ac	$750.00	$0.00
4	Clear culverts, additonal	1	LS	$500.00	$500.00
5	Road ditch maintenance	0	LS	$1,000.00	$0.00
6	Remove sediment from opened channels	1	LS	$1,500.00	$1,500.00
7	Mitigation monitoring for 404 Permit	24	HR	$85.00	$2,040.00

Sub-total:		$19,530.00
Contingency:	25%	$4,880.00
Sub-total:		$24,410.00
Legal and Admin:	10%	$2,441.00
Total:		$26,851.00

Scenario: Alternative 2 – Base Case plus Alternative 1 plus Removal of Sand Bar

Description: Alternative 2 is a short-term solution that **includes** the elements of both the Base Case and Alternative 1 and **adds** the removal of the sand bar located about 1.5 miles above Hwy 83 where the main channel splits into two. See the drawings in Appendix A. Information from local residents and officials indicates that this channel used to convey significant flows. During the low flow period of the mid-1980s to late 1990s, a sand bar built up at the upper end of this channel. Aerial photographs reviewed during this period confirm this statement. This sand bar was observed in 2002 by the USACE representatives and also during our June 2005 field visit. By comparing the photographs from the 2002 visit with our observations, it is clear that this sand bar has continued to grow and that vegetation, primarily phragmites, has become established. The effect contributes to flow being restricted upstream of this point so that water flows out of the main channel, into the overbank and along the area just south of North River Road. By removing this sand bar more flow is expected to pass down the north channel of the river, thereby lowering water levels upstream and reducing the flow in the overbank.

From a review of recent aerial photographs, the sand bar is estimated to contain approximately 3,750 cubic yards (cy) of material, assuming maximum dimensions of 250 feet long by 120 feet wide and 4 feet deep. To encourage flow through this channel, approximately 500 feet of the natural channel would be cleared and regraded for a width of approximately 80 feet. An access road on private property will have to be cut through the buildup of phragmites to reach this area.

Capital Cost: Estimated quantities were developed for the work as described above. The Opinion of Probable Construction Cost for Alternative 2 (includes Base Case and Alternative 1) has been estimated at $629,010. The cost estimate is attached.

The estimated cost for the EA, $100,000, also covers the work needed for the Base Case and Alternative 1, and is shown separately.

O&M Cost: The nature of the stream in this area is likely to result in additional sand deposits in the reopened channel. Annual maintenance to remove the accumulated material will be required. Likewise, due to the prevalence of *Phragmites australis* adjacent to the channel, control methods (spraying) will be needed annually. These costs are included in the cost estimate.

Logistics, including permitting: Permit requirements would be similar to those described under the Base Case.

Potential for additional channel aggradation: As noted above, this area is subject to continued aggradation as long as the overall characteristics of the river channel are not changed in this reach.

Probability of success: As long as the channel is kept open, this alternative is expected to have a high probability of success.

Channel capacity expected: Similar to Alternative 1, this activity should reduce flooding in the affected area. The river channel will be able to pass 3,000 cfs through

J. F. SATO AND ASSOCIATES
Engineering, Environmental,
and Program Management Services
5898 South Rapp Street • Littleton, CO 80120
Phone 303.797.1200 • Fax 303.797.1187
www.jfsato.com

the Hwy 83 Bridge under current conditions. Continued aggradation or encroachment by vegetation will diminish the conveyance.

JFSA **EXHIBIT ALT2-1**

NORTH PLATTE CHANNEL CAPACITY STUDY
CONCEPTUAL DESIGN
ENGINEER'S OPINION OF PROBABLE COST

ALTERNATIVE: **ALTERNATIVE 2**: (Base + Alt 1 + remove sand bar)

CAPITAL COST:

Item

No.	Item	Quantity	Unit	Unit Price	Total
1	Base Case + Alternative 1	1	LS	$339,295.00	$339,295.00
2	Access road	1	LS	$2,500.00	$2,500.00
3	Clear and grub	2.0	Ac	$1,500.00	$3,000.00
4	Excavate and haul	7100	CY	$7.00	$49,700.00
5	Revegetate	1	Ac	$500.00	$500.00
6	Additional permitting	40	Hr	$85.00	$3,400.00
7	Excavate and haul	2.55	Ac	$200.00	$510.00
8	Additional Wetland Delineation	40	Hr	$85.00	$3,400.00
9	Easements, temporary	1.85	Ac	$60.00	$111.00
10	Easements, permanent	0.75	Ac	$200.00	$150.00
				Sub-total:	$402,566.00
				Contingency: 25%	$100,640.00
				Sub-total:	$503,206.00
				Engineering: 15%	$75,480.00
				Legal and Admin: 10%	$50,320.00
				Total:	$629,010.00
				Environmental Assessment (if required):	$100,000.00

ANNUAL O&M COST:

No.	Item	Quantity	Unit	Unit Price	Total
1	Alternative 1, includes Base Case	1	LS	$19,530.00	$19,530.00
2	Clear vegetation, additional	2	Ac	$500.00	$1,000.00
3	Treat Phragmites, additional	1	Ac	$750.00	$750.00
4	Clear culverts	0	LS	$500.00	$0.00
5	Road ditch maintenance	0	LS	$1,000.00	$0.00
6	Remove sediment from opened channels	1	LS	$2,000.00	$2,000.00
7	Add'l mitigation monitoring for 404 Permit	24	HR	$85.00	$2,040.00
				Sub-total:	$25,320.00
				Contingency: 25%	$6,330.00
				Sub-total:	$31,650.00
				Legal and Admin: 10%	$3,165.00
				Total:	$34,815.00