Implementation of the Whooping Crane Monitoring Protocol

Spring 2011

FINAL REPORT

Prepared by

Gary Lingle

ASSESSMENT **I**MPACT **M**ONITORING
ENVIRONMENTAL CONSULTANTS
45320 Kilgore Road
Gibbon NE 68840

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Final Report Prepared by
AIM Environmental Consultants

For
Committee's of the
Platte River Recovery and Implementation Program

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Assessment Impact Monitoring Environmental Consultants (AIM) was awarded a contract to assist the Governance Committee in implementing specific monitoring associated with the *Platte River Recovery and Implementation Program (PRRIP)*. The specific task was to implement the protocols developed by the Technical Advisory Committee entitled *Monitoring Whooping Crane Migrational Habitat Use in the Central Platte River Valley* (dated 16 September 2005) during the spring and fall migrations. The contract specified the implementation of the draft protocol along with guidelines presented in the *Request for Proposal*. The term of the contract was January 2008 through December 2010. This contract was extended one migration season. I present the results of spring 2011 Whooping Crane migration pursuant to the *Contract for Services* dated 2 February 2008.

Study Area and Methods

The study area was the Platte River reach between U.S. Highway 283 (near Lexington) and Chapman, Nebraska. This reach was about 90 miles long and included an area extending 3.5 miles either side of the outermost banks of the Platte River. I hired and trained twelve technicians and conducted field work from 21 March through 29 April 2011. A set of six data sheets was provided by Headwaters Corporation and all data were entered into a web-based Microsoft SharePoint database developed by Riverside Technology, Inc. using Microsoft InfoPath 2010.

Two air services were contracted and aerial surveys were conducted along specified routes near sunrise from 21 March through 29 April 2011 as weather permitted. Censuses were initiated no earlier than 30 minutes before sunrise and typically were completed within 2 hours. Start times were delayed when weather/visibility conditions dictated. Flights were cancelled due to unsafe weather or mechanical problems. Cessna 172's were equipped with GPS units and each had two observers to conduct the surveys. Waypoints for each survey route were programmed into the GPS units onboard the aircraft. Surveys were flown at an altitude of 750' and at a speed of about 100 mph.

The study area was divided into two legs. The east leg surveyed the Platte River reach between Chapman and the Minden (Highway 10) bridges and the west leg surveyed from the Minden to the Lexington (Highway 283) bridges. Each census began flying upstream (east to west) along the south side of the main river channel with both observers looking out the passenger side of the aircraft. This provided optimum light conditions such that observers looked away from the rising sun thereby minimizing glare off reflective surfaces. Start points were alternated for each leg to address the concern that one end of the river transect would always be flown earlier than the other end. On the east leg, day one began at Chapman, flew the river west to Minden then flew a predetermined route back to Chapman. Day two began at Wood River, flew the river to Minden, returned along a predetermined route back to Chapman, then flew the rest of the river transect from Chapman to Wood River. The start points for the west leg were Minden and Odessa bridges. Day one began at Minden, flew the river west to Lexington then flew a predetermined route back to Minden. Day two began at Odessa, flew the river to Lexington, returned along a predetermined route back to Minden, then flew the rest of the river transect from Minden to Odessa. When the initial portion of the river transect was completed, one of 7 possible return routes located along the centerline of the main channel and 1, 2, and 3 miles north and south of the river respectively was flown with observers looking out opposite sides of the aircraft.

Four ground observers were stationed along the survey routes. Communication between the ground observers and the aircraft was accomplished through the use of two-way radios. In the event of a possible Whooping Crane sighting by the air crew, the ground person nearest the sighting was contacted and immediately dispatched to the location in an effort to confirm the identity of the white object. Each technician had a set of color aerial photos of the river. The photos were inserted in polypropylene sheet protectors that enabled the observer to mark sighting locations on the photo for later reference. Efforts were made to photograph Whooping Cranes from the air using digital cameras. In addition, a GPS reading of the location was taken by air crew.

If a Whooping Crane was located by ground personnel, habitat use and activity monitoring commenced. These observations were continuous until the bird was either lost from view or went to roost for the night. Each Whooping Crane sighting was assigned a unique number and later compared with the U.S. Fish and Wildlife Service's (USFWS) sighting records in Grand Island. A Whooping Crane sighting was defined as:

"…the observation of a single whooping crane or a group of whooping cranes that are migrating together through the area. Confirmed sightings in the same general area (within a reasonable distance of daily crane activities) along the Platte and within one to several days of another sighting is assumed to be the same bird/bird group, unless: 1) the number of birds differs, 2) the bird(s) constitute a bird/bird group in addition to those already known to be in the general area, or 3) the original birds were observed to migrate from the valley or are known to have moved to a different area of the valley. This assumption is necessary because individual cranes cannot be distinguished; very few birds are marked and continuous surveillance of a crane or crane group using the study area is not possible." (Aransas – Wood Buffalo Population Whooping Crane Contingency Plan 2006, Whooping Crane Committee of the Central Flyway Council).

Whooping Crane movements, behavior, and diurnal habitat use were recorded when possible. All monitoring activities followed USFWS and Nebraska Game & Parks Commission guidelines. Jeanine Lackey, USFWS biologist, kept our team apprised of the latest sighting reports. Tom Stehn, refuge biologist at Aransas National Wildlife Refuge in Texas, conducted surveys on the wintering grounds and provided the results via email. Landowner permission was obtained prior to entering any property.

Whooping Crane decoys were placed in the river channel at 10 randomly selected locations provided by Headwaters Corporation (Table 1) for the purposes of determining survey detection rates. The air crew did not know when or where the decoys were placed. Decoys were placed either the morning of the flights or the day before. Observations of Whooping Crane decoys by the air crew were reported to the ground crew for confirmation.

Topographic profiles were measured at Whooping Crane roost sites using surveying equipment owned by the Program. Three parallel transects 25m apart were established perpendicular to the general flow of the river at each site such that the middle transect crossed the crane or decoy location. Elevation measurements were taken about every 3m along each transect using a stadia and transit. End points were determined when an obstruction greater than 1.5 m in height was encountered such that it formed a visual barrier to a crane. Stream flow data was collected from the U.S. Geological Survey (USGS) at gauging stations located at Overton, Kearney, and Grand Island. Leica laser rangefinders were used to measure the length of sandbars and distance to visual obstructions >1.5m above the water surface.

A toll-free telephone number for the public to report Whooping Crane sightings was sponsored by the Platte River Whooping Crane Habitat Maintenance Trust. This volunteer effort was known as *Whooper Watch*. AIM personnel distributed *Whooper Watch* flyers to prominent bird-watching centers alerting the public of this number. All Whooping Crane sightings reported to officials by the public were classified as opportunistic locates. Following a report, ground crew procedures were implemented as outlined above.

Changes to the monitoring protocol dated 16 September 2005 that began last fall continued this spring. They were:

1. No off-river decoys were placed.
2. No river channel profiles were surveyed at decoy locations.
3. The rebar protocol was discontinued.
4. An aerial search for Whooping Cranes observers lost during the day was conducted when feasible.

Results

Opportunistic Locates.—

We received 19 reports of possible Whooping Cranes from the public, Rowe Sanctuary, Whooper Watch, or USFWS. On March 21, 3 adult Whooping Cranes were observed by PRRIP

personnel near 748 and G Roads in Phelps County near Cottonwood Ranch. AIM and PRRIP personnel could not relocate the cranes; however, 3 adult Whooping Cranes were observed by the East Leg air crew ½ mi east of Rowe Sanctuary headquarters on March 24 about 32 miles east of the previous location. They were last seen flying SSE at 8:05 AM. On March 26, 3 adult Whooping Cranes were confirmed on a wetland near Norman, Nebraska about 12 miles southeast of the Rowe group. These may have been the same individuals.

On March 23, Jeanine Lackey reported 1 Whooping Crane NNW of Rainforth Road and Highway 281. We located the crane and monitored it.

On March 24, a single Whooping Crane was reported by Conservation Officer Terry Brentzel south of Prosser. We located the crane and monitored it.

On March 26, Bill Taddicken of Rowe Sanctuary reported 1 Whooping Crane flying passed the headquarters. We conducted a ground search and did not find the crane.

On March 31, Dave Baasch of the PRRIP received a report around 6 pm from USFWS personnel of 4 Whooping Cranes 2 miles east of the Alda I-80 Exit seen while driving westbound on I-80. They exited and conducted a search but could not find them. AIM did not conduct a ground search.

On the evening of April 2, Jeanine Lackey and Bill Taddicken reported 11 Whooping Cranes near Rowe's north blind about 2 miles east of the Minden bridge. We were already monitoring the cranes at that time.

On April 3, Bill Taddicken received a report of 2 Whooping Cranes on the south channel SW of Rowe Headquarters. A ground search located 2 Great Egrets at that location.

At 6:35 pm on April 3, Bill Taddicken reported 3 possible Whooping Cranes on river west of Rowe's north blind. AIM personnel confirmed them on the river.

At 9:00 AM on April 3, Jeanine Lackey received a report from a conservation officer of 5 Whooping Cranes ¾ mi southeast of Highway 44 and V roads in Kearney County. They flew south into the hills and were lost. AIM did not conduct a ground search but did conduct an aerial search from 2:30-3:30 PM. No Whooping Cranes were observed.

On the evening of April 3, Karine Gil of Whooper Watch, received a report of 2 Whooping Cranes seen from the Alda bridge viewing platform and another report of 1 Whooping Crane seen flying north about ½ mile west of the bridge. AIM did not conduct a ground search.

On April 4, AIM received a report of 9 Whooping Cranes from Nebraska Game & Parks personnel located on Ducks Unlimited's Andersen tract on 747 and J roads in Phelps County. We located the birds and monitored them.

On April 4, Kent Skaggs of Rowe Sanctuary reported 7 Whooping Cranes ½ mile east of the Gibbon bridge at 4:00 pm. He photographed them. We conducted a ground search and did not locate the cranes.

At 6:15 PM on April 4, Kent Skaggs reported 2 Whooping Cranes near Rowe's north blind. Another joined the pair and we observed them from the Minden bridge.

At 2:00 PM on April 10, Karine Gil received a report of 1 Whooping Crane 4 miles south and 2 miles west of the Gibbon bridge. AIM was monitoring that crane.

On April 11 at 11:40 AM, Jeanine Lackey received a report of 5-6 Whooping Cranes flying NW ¼ mile west of the Odessa bridge. AIM did not conduct a ground search because we believed they were migrating.

AIM received 3 reports on different days of a Whooping Crane in a cornfield ½ mile west of the Minden exit north of I-80. AIM conducted a ground search after the initial report and found a leucistic Sandhill Crane that was present in that location for at least 2 weeks. No additional ground searches were conducted.

Aerial Survey.--

CONFIRMED WHOOPING CRANE SIGHTINGS-

Of a possible 40 morning flights per leg, the West Leg completed 25 (62%) flights and the East Leg flew 25 (62%). Fog, low ceiling, precipitation, and high winds were factors in cancellations. We recorded 18 confirmed Whooping Crane sightings. Fifteen sightings were on transect 0S, 1 on 0R, and 2 on 1N (Figures 1-7).

INDEX OF USE-

We completed 100 (62%) aerial survey transects out of a possible 160. Eighteen Whooping Crane sightings were made on these transects. This resulted in an index of use (frequency of occurrence) of 0.18 sightings per transect.

OPPORTUNISTIC FLIGHTS-

We conducted fourteen opportunistic flights that totaled 3.3 hours. Twelve opportunistic Whooping Crane sightings occurred during the regular aerial surveys when the plane deviated from the systematic survey route at the request of the ground observer. Two additional flights were deployed in the afternoon and no Whooping Cranes were observed.

OTHER WHITE OBJECT SIGHTINGS-

Twenty ground searches were conducted on objects at the request of the air crew. These resulted in confirmation of Whooping Cranes, Sandhill Cranes, Snow Geese, Great Egret, American White Pelicans, or no finding.

Searcher Efficiency Trials.—

Whooping Crane decoys were placed at 10 locations between April 11-27 (Table 1). The air observers detected a decoy at 6 sites for a detectability rate of 60%. Factors that likely contributed to the low detectability rate included decoys in the "blind spot" below the underbelly of the aircraft, poor light conditions, and high flows.

Table 1. Random locations of decoys for detectability trials.

Strata	Random number	Date Placed	Detected?
0	68	4/12	Y
0	19	4/24	N
0	34	4/24	Y
0	17	4/11	N
0	69	4/24	N
0	48	4/23	Y
0	39	4/24	Y
0	32	4/26	Y
0	57	4/27	N
0	29	4/23	Y

Use-Site Characteristics, Diurnal Movements, and Activity.--

FLOW-

Streamflow measured at the USGS gauging stations located near Grand Island, Kearney, and Overton was generally twice the median streamflow for each site during the survey (Figures 8-10). Note all flow data are provisional and subject to revision. Table 2 depicts the minimum and maximum values for unit (instantaneous) flows at each station.

Table 2. Discharge values (cfs) at USGS gauging stations (provisional data).

	Overton	**Kearney**	**Grand Island**
Minimum	3340	3190	3690
Date	3-23, 26	4-14	4-14
Maximum	4470	4300	4916
Date	4-22	4-15	4-16

The streamflow when Whooping Cranes were observed on the river/wetland and when roost channel profiles were measured is shown in Table 3. Depth was not determined at Use Site 1 (palustrine wetland) because water surface elevation was not surveyed therefore only a relative elevation between data points was obtained.

Table 3. Flow conditions during Whooping Crane use and channel profile measurements. (Discharge is at the Platte River gauging station near Kearney). Use Site 1 was a palustrine wetland.

Use Site	Use Date	Use Time	Measured Date	Discharge (cfs)	
				Use	Measured
1	4/5	7:55	4/17	4190	NA
2	4/3	8:05	4/17	4220	3810
3	4/3	7:17	4/20	4240	3520
4	4/11	6:52	4/27	3940	3370
5	4/6	7:17	NA	4170	NA
6	4/5	7:11	4/28	4190	3230
7	4/4	16:00	NA	4240	NA
8	4/6	7:05	4/26	4170	4040
9	4/3	7:02	NA	4220	NA
10	3/21	8:00	4/26	3750	4090
11	3/23	7:40	4/23	3670	4260
12	4/1	7:53	NA	4130	NA
13	4/4	7:06	4/29	4240	3810
14	3/24	7:26	NA	3710	NA

RIVERINE/WETLAND USE SITES-

We surveyed profiles at 9 Whooping Crane roost sites (Figures 11-19). Twenty-five transects were surveyed. Six sites were not surveyed due to high flows or they were lumped within a representative reach although visual obstruction data were collected at 3 of these (Use Sites 5, 8A, & 12). Use Site 14 was denoted as Crane Group 2011SP05 on Figures 4 and 5. Figures 20-31 depict the habitat used at Whooping Crane Use Sites.

DISTANCE TO VISUAL OBSTRUCTION, SUBSTRATE, AND WATER DEPTH-

Visual obstructions at Whooping Crane use sites are given in Table 4. Substrate was characterized as fine sand to small gravel. The average water depth at the 8 Whooping Crane roost locations measured was 0.34 ± 0.10m.

Table 4. Location, visual obstruction distance (m), substrate, and roost depth (m) at Whooping Crane use sites. Use Site 1 was a palustrine wetland.

Use Site ID	VO Upstream Distance	VO Right Distance	VO Downstream Distance	VO Left Distance	Fine Sand %	Coarse Sand %	Small Gravel %	Roost Depth
1	30	70	90	70	100	-	-	NA
2	98	47	52	64	70	30	-	.41
3	120	140	178	175	20	80	-	.40
4	110	71	137	207	40	60	-	.20
5	212	52	96	198	70	30	-	NA
6	215	179	199	178	20	60	20	.22
7	NA	-	-	-	-	-	-	NA
8	80	183	95	59	20	80	-	.44
8A	17	18	21	260	90	10	-	NA
9	NA	-	-	-	-	-	-	-
10	266	200	170	187	40	60	-	.42
11	119	147	132	81	40	60	-	.38
12	91	150	73	57	60	40	-	NA
13	93	63	127	112	40	60	-	.25
14	NA	-	-	-	-	-	-	NA

UNOBSTRUCTED WIDTH-

Table 5 depicts unobstructed width as measured at use locations. The width was the average of the 3 river profiles measured at each Use Site except that only 1 profile was measured at Use Site 10. Five of the sites were not surveyed due to high water conditions or the precise roost location was not known.

Table 5. Unobstructed channel width at use sites (units in m). Use Site 1 was a palustrine wetland.

Use Site ID	Unobstructed Width
1	99
2	107
3	310
4	276
5	Not surveyed
6	276
7	Not surveyed
8	306
9	Not surveyed
10	352
11	168
12	Not surveyed
13	173
14	Not surveyed

DIURNAL USE SITES-

Diurnal and activity data was collected when possible. We documented 13 sections of off-river diurnal use locations and three sections of riverine locations during 16 days of observation (Figures 1-7). Whooping Cranes were observed 0 – 6.4 miles from their roost locations.

CRANE-USE DAYS-

Crane-Use days were calculated by multiplying the number of Whooping Cranes by the number of days present. For this calculation, we assumed that a Whooping Crane observed during the morning aerial survey was present the previous day. Whooping Cranes occurred in the study area 23 (58%) of the 40 days of the survey. An estimated 118 crane-use days was recorded (Table 6). There were 4 juvenile Whooping Cranes and between 32 and 34 adult Whooping Cranes present. The number of individual cranes and the number of crane-use days cannot be precisely determined because unmarked individuals may be counted more than once. For example, we know that the 2 radio-tagged family groups moved 26 miles west of Rowe Sanctuary to the Ducks Unlimited wetland where they spent 2 nights. Had they not been color-banded, we would have recorded them as additional individuals. How much of this type of movement occurred within the study area was not known without having a color-marked population where individuals could be identified.

Table 6. Whooping Crane numbers (adult:juvenile), dates of occurrence, and crane-use days.

Crane Group (Prefix 2011SP)	Program Name	Number of Cranes	Dates of Occurrence	# of days present	Crane-Use Days
01,02,03,04,06,07,08,10,11	MICM single	1:0	3/4-4/2	13	13
05	Rowe trio	3:0	3/21-24	4	12
22 AIM did not see	WR family	2:1	4/2-3	2	6
13,16,34,35	Rowe N blind	8:3	4/2-5	2	22
15,17,18,35	Unbanded fam	2:1	4/2-4	1	3
24	N blind trio	3:0	4/4-5	2	6
AIM did not see	J. Peka report	5:0	4/2-3	2	10
12	Westering	2:0	4/2-3	2	4
14	Wyoming	1:0	4/3	2	2
19,20	DU wetland	7:2	4/3-5	2	18
09	E Gibbon bdg	7:0	4/4	1	7
21	W Gibbon bdg	5:0	4/5	1	5
23,27	Mangelsen	1:0	4/4-6	3	3
25,26,28-33	Rowe single	1:0	4/4-12	9	9
TOTAL		32:4*	3/21-4/12	23	120

*Represents minimum numbers.

LAND-COVER CLASS-

Ag-Corn, Ag-Alfalfa, Palustrine Wetland, and Wetted Channel were the cover-types Whooping Cranes used during the day. Twenty-three locations were AG-Corn, 4 were Wetted Channel, 1 was AG-Alfalfa, and 1 was Palustrine Wetland. Some locations were used on more than one occasion. One nocturnal roost location was in Palustrine Wetland, the rest were in Wetted Channel.

ACTIVITY-

A total of 107.2 hours of Whooping Crane continuous and instantaneous use (time budget) data was collected by ground personnel during 16 days of observation. The breakdown of observation time in various habitats is depicted in Table 7. Most of the diurnal activity recorded occurred in corn (79%) followed by wetted channel (12%), palustrine wetland (9%), and alfalfa (<1%). We recorded 429 data points of activity (time budget). Feeding was the most frequently observed activity in all of the habitats combined(Table 8).

Table 7. Count of instant points by habitat.

Habitat	Hours	n	Percent
Ag-Corn	84.2	337	79
Ag-Alfalfa	0.1	1	<1
Palustrine Wetland	9.8	39	9
Wetted Channel	13.0	52	12

Table 8. Whooping Crane activity by habitat.

Habitat	Activity	n	Total	Percent
Ag-Corn	Alert	50	337	14
Ag-Corn	Courtship	1	337	<1
Ag-Corn	Feeding	257	337	77
Ag-Corn	Preening	9	337	3
Ag-Corn	Resting	20	337	6
Ag-Alfalfa	Alert	1	1	100
Palustrine Wetland	Alert	7	39	18
Palustrine Wetland	Feeding	16	39	41
Palustrine Wetland	Courtship	1	39	2
Palustrine Wetland	Resting	11	39	28
Palustrine Wetland	Preening	4	39	10
Wetted Channel	Alert	19	52	37
Wetted Channel	Defensive	1	52	2
Wetted Channel	Feeding	5	52	10
Wetted Channel	Courtship	1	52	2
Wetted Channel	Preening	1	52	2
Wetted Channel	Resting	25	52	48

Search Effort.--

Ground searches were initiated on 34 occasions. A total of 47.2 hours was expended on this effort and 1542 miles were driven. Search duration extended from 0.1 to 3.8 hours. Whooping Cranes were found on 13 (38%). Other white objects observed were 1 leucistic Sandhill Crane, 2 Snow Geese, and 1 Great Egret. Searches were terminated when the object was found or after a 2-hour search effort was made.

Program ID and U.S. Fish & Wildlife Service ID Comparisons.--

Table 9 compares the Program numbering system with the USFWS database (Jeanine Lackey, personal communication). We had 14 groups of Whooping Cranes present in the study area during the survey. Two of the four juvenile Whooping Cranes observed were radio-tagged.

Table 9. Comparison of Program Crane ID and USFWS Crane ID.

Program Crane ID (Prefix 2011SP)	Program Name	USFWS Crane ID	Dates of Occurrence	# of cranes (Ad:Juv)
01,02,03,04,06,07,08,10,11	MICM subadult	11A-01	3/4-4/2	1:0
05	Cottonwood trio	11A-05	3/21-24	3:0
22 AIM did not see	Wild Rose family	11A-22	4/2	2:1
13,16,34,35	Rowe N blind	11A-13	4/2-5	8:3
15,17,18,35	Unbanded family	11A-13	4/2-4	2:1
24	N blind	11A-23	4/5	2+1=3:0
AIM did not see	Peka	11A-11	4/3	5:0
12	Westering	11A-19	4/2-3	2:0
14	Wyoming	11A-46	4/3	1:0
19,20	DU wetland	11A-14	4/3-5	7:2
09	E Gibbon bdg	11A-16	4/4-5	7:0
21	W Gibbon bdg	11A-16	4/5	5:0
23,27	Mangelsen	11A-20	4/5-6	1:0
25,26,28-33	Rowe single	11A-23	4/5-12	1:0

Summary of Confirmed Sightings in the U.S.--

There were 20 confirmed Whooping Crane sightings comprised of 91 cranes in Nebraska including those contained herein (Jeanine Lackey, personal communication). As of 5 May 2011, there were 46 confirmed sightings in the United States as follows: North Dakota- 11, South Dakota- 8, Nebraska-20, Kansas- 4, Oklahoma- 2, and Montana- 1. A total of 269 Whooping Cranes (26 juveniles) were expected to migrate from their wintering grounds this spring.

Discussion and Recommendations

The Whooping Crane migration this spring was as surprising as it was unique. We documented east-west migration within the study area for the first time (see "Crane-Use Days" on page 9. It was made even more surprising since they left the riverine channel at Rowe Sanctuary to roost in a newly created palustrine wetland 26 miles to the west. Extremely high winds along with high flows persisted during that time and it may be they sought the wind protection offered by stand of wheatgrass surrounding the wetland over that of the river channel. They roosted within 2 miles of NPPD's Cottonwood Ranch riverine complex and were about 300 m from the county road. We also documented mixing of various crane groups. This was facilitated by having color-marked individuals in the population even though this was not the first time Whooping Cranes were color-marked. A record number of individuals occurred this spring when an estimated 36-38 Whooping Cranes stopped along the Platte River. The previous high was 20 individuals recorded during the fall 2008 migration. The group of 11 (8:3) beat the previous largest group of 9. One hundred twenty crane-use days was a record for spring topping the previous mark of 54 crane-use days in spring 2006. The all-time record of 121 crane-use days in fall 2002 still stands.

Microsoft SharePoint Database

The transition from the Microsoft Access database to Microsoft SharePoint was completed during this monitoring effort. The process should be more efficient next fall since most of the "bugs" were worked out with this spring's data.

Methods

- 1 river transect surveyed through the roost site is sufficient. Eliminate the upstream and downstream transects.

Spring 2011 Expenses

The cost of field implementation of this project was about $77,000. The total cost of the spring monitoring effort was about $92,300.

Supplements

Original Data Sheets

CD containing a Microsoft Word final report file, selected photographs, and InfoPath files.

Figure 1. Whooping Crane Use Sites 10, 11, and 12 (left to right) and diurnal use areas near Doniphan. Crane Group Identification Numbers accompany diurnal use areas.

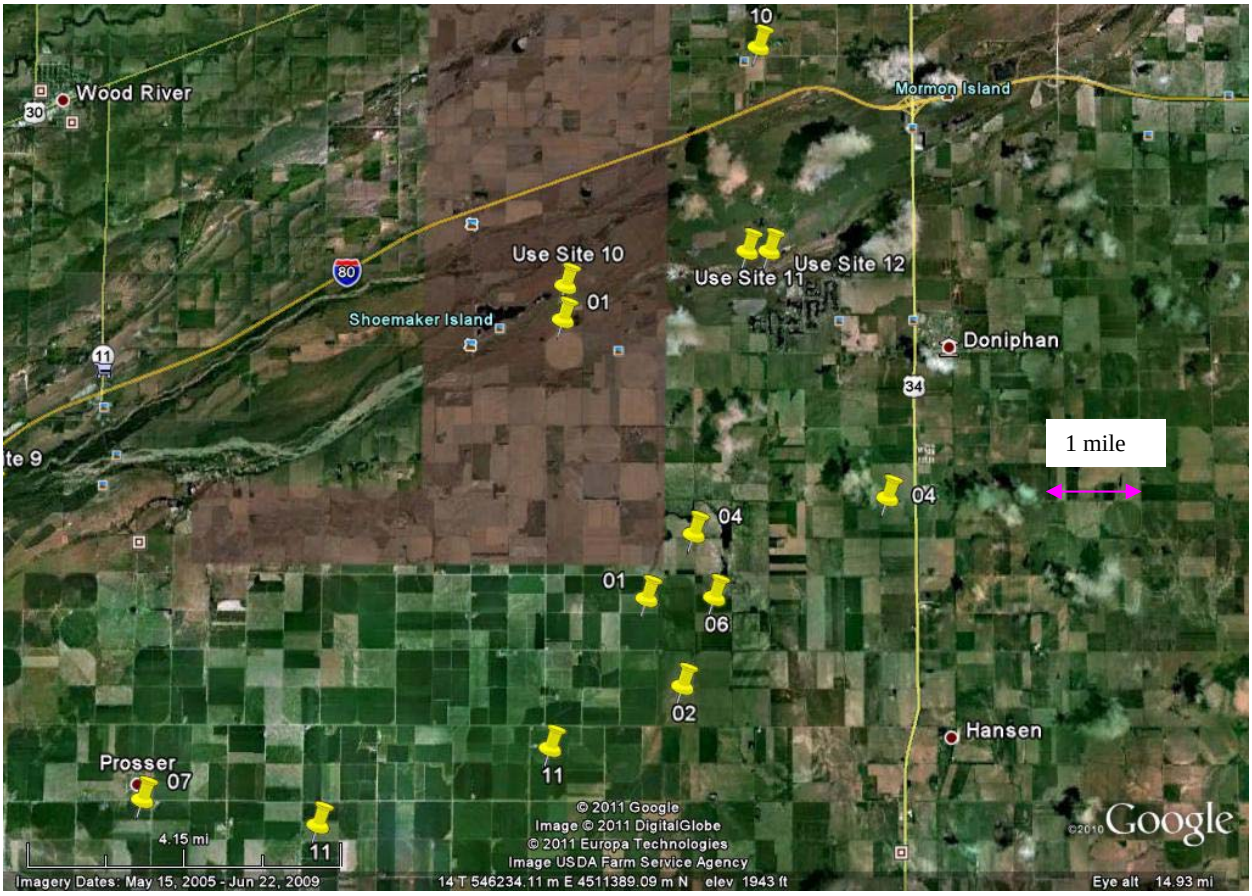


Figure 2. Whooping Crane Group 2011SP19 & 20 use site near Cottonwood Ranch and upland feeding site (green circle).

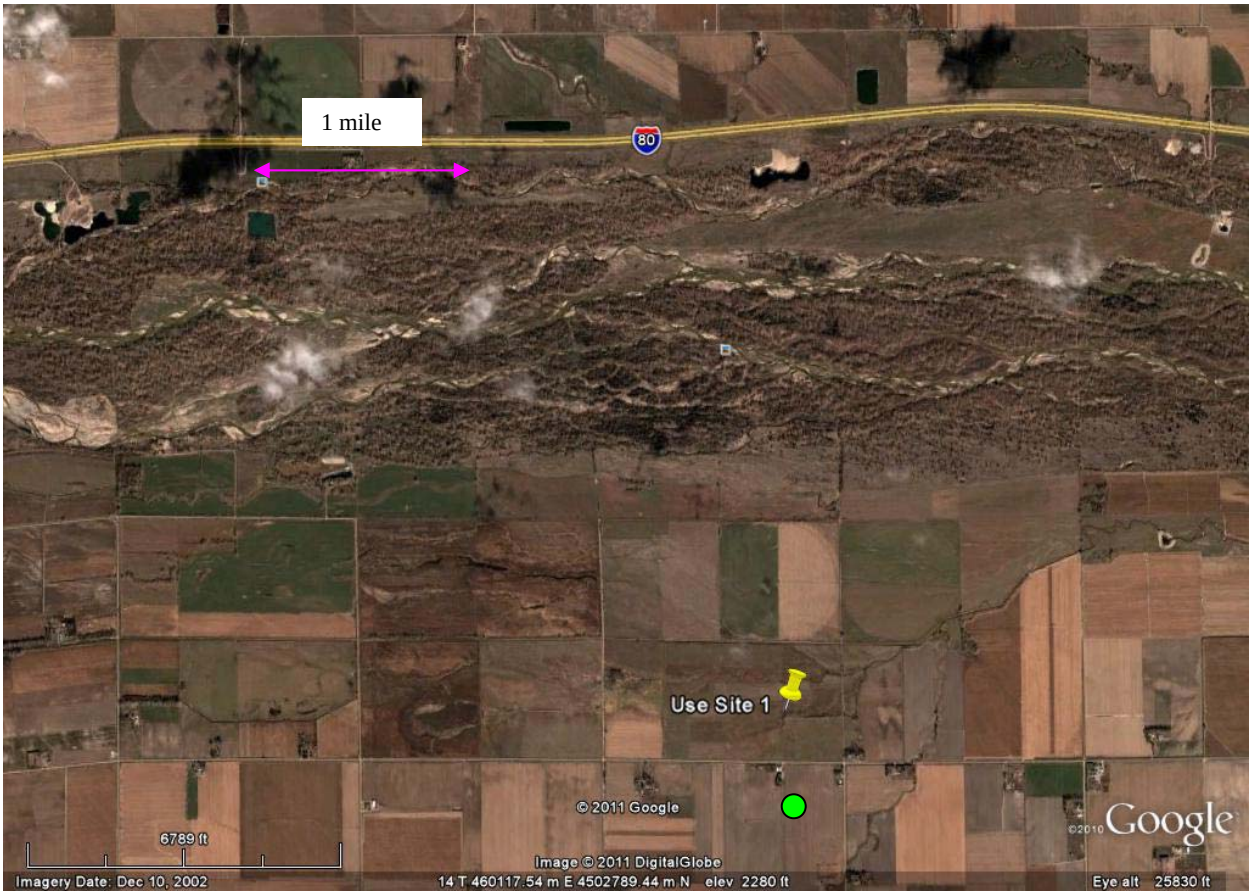


Figure 3. Whooping Crane Use Site 2 and diurnal use area on Wyoming ground southeast of Kearney.

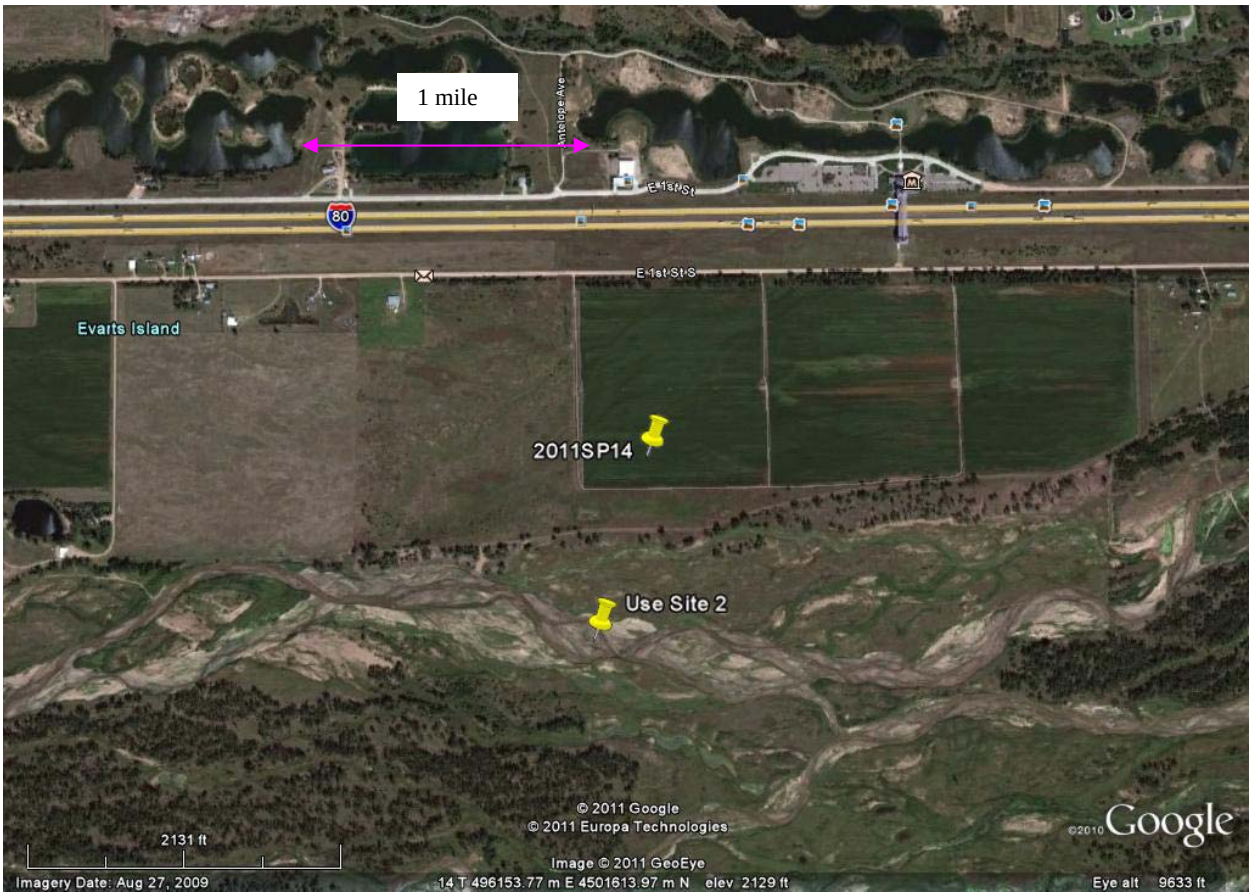


Figure 4. Whooping Crane Use Sites in the vicinity of Audubon's Rowe Sanctuary south of I-80. Crane Group Identification Numbers accompany diurnal use areas.

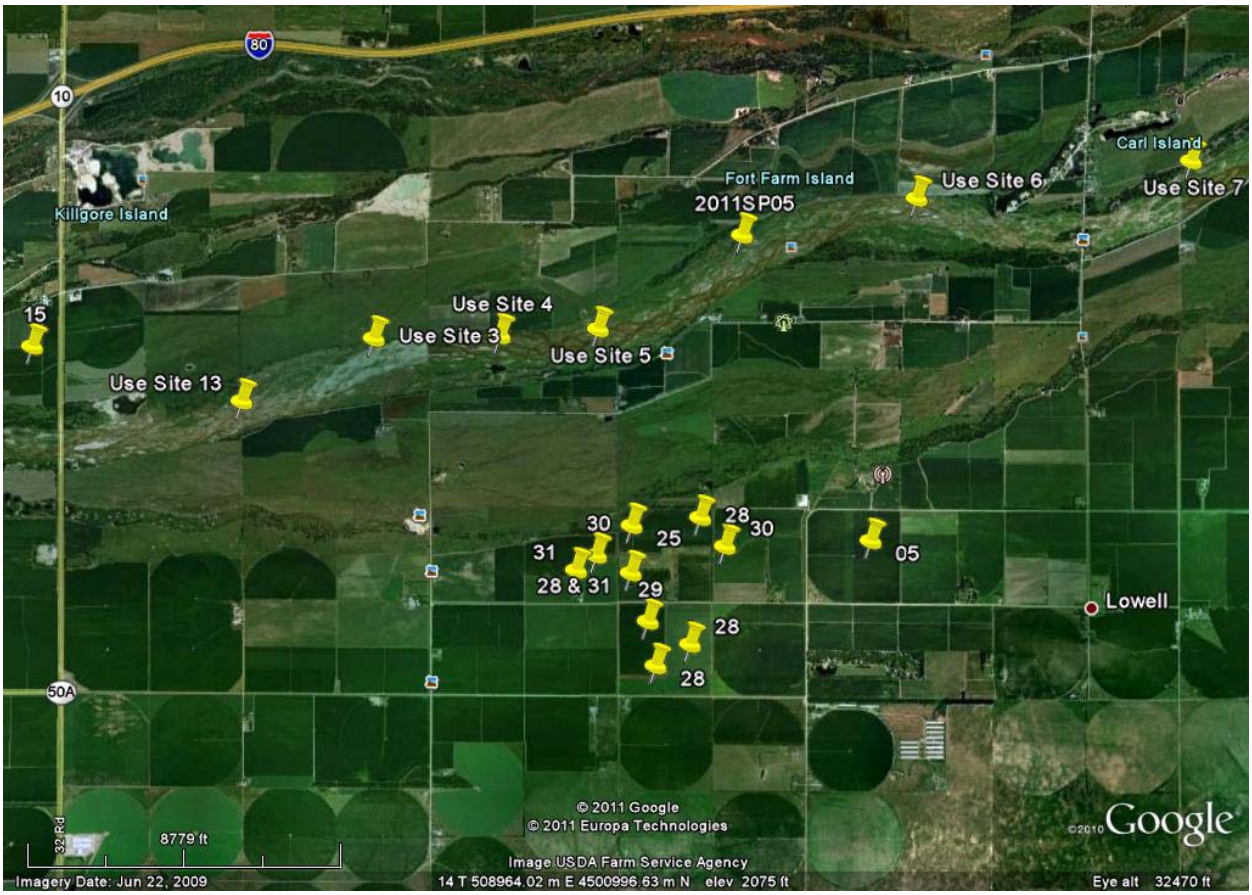


Figure 5. Whooping Crane Use Sites in the vicinity of Audubon's Rowe Sanctuary north of I-80. Crane Group Identification Numbers accompany diurnal use areas.

Figure 6. Whooping Crane Use Sites west of the Wood River bridge.

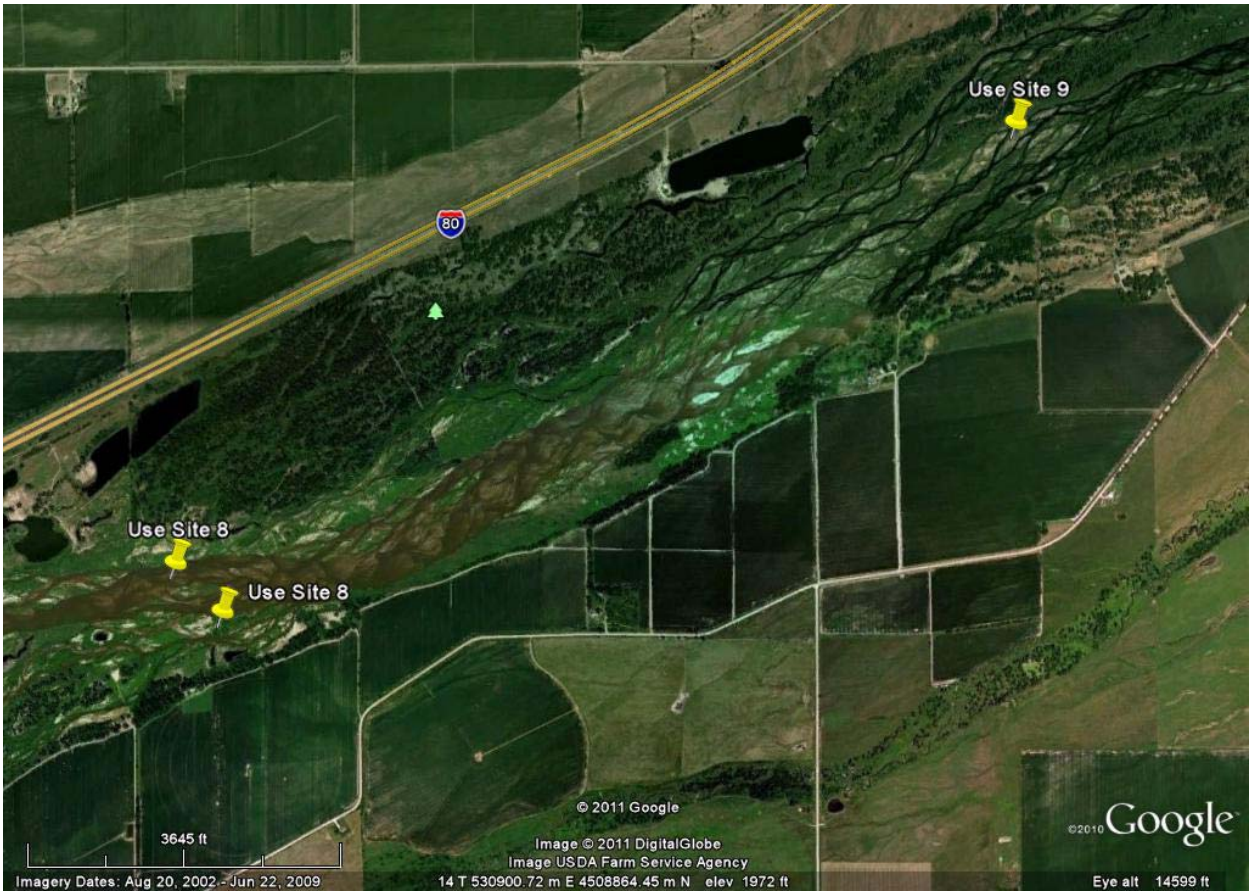
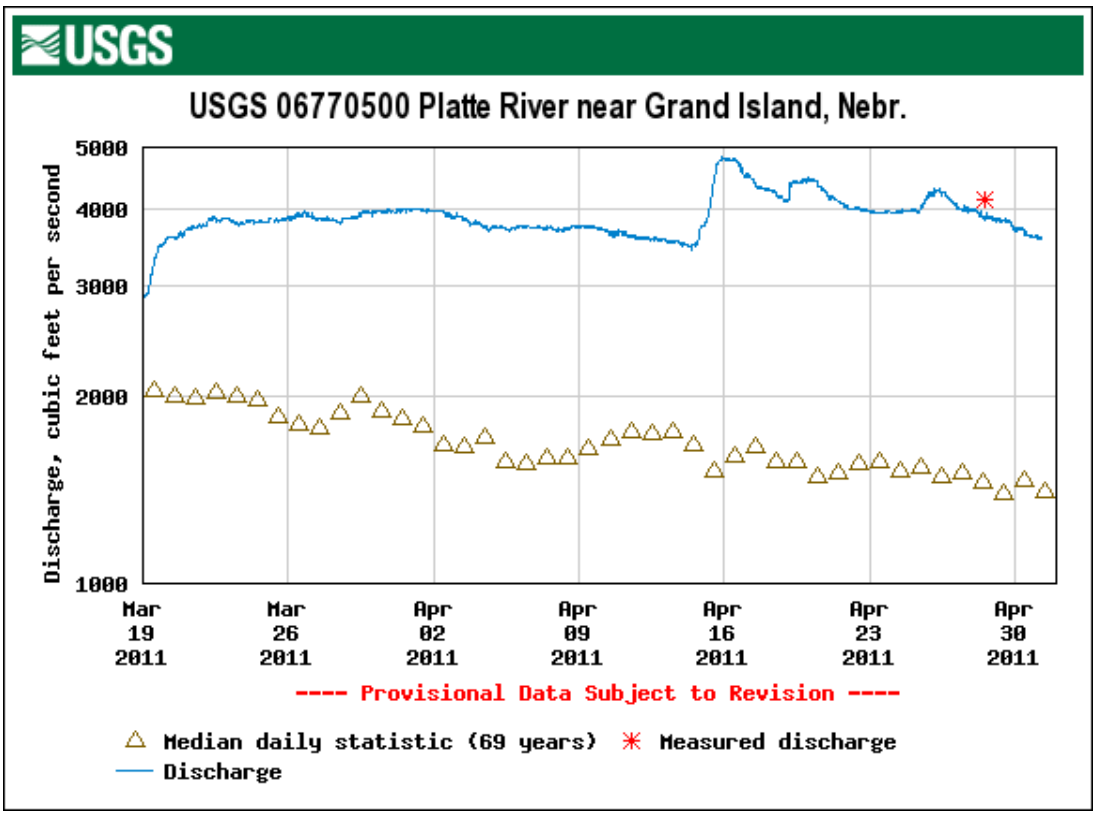


Figure 7. Whooping Crane Use Sites near the Minden bridge on Highway 10.

Figure 8. Platte River discharge (cfs) and gage height (ft) at Grand Island.



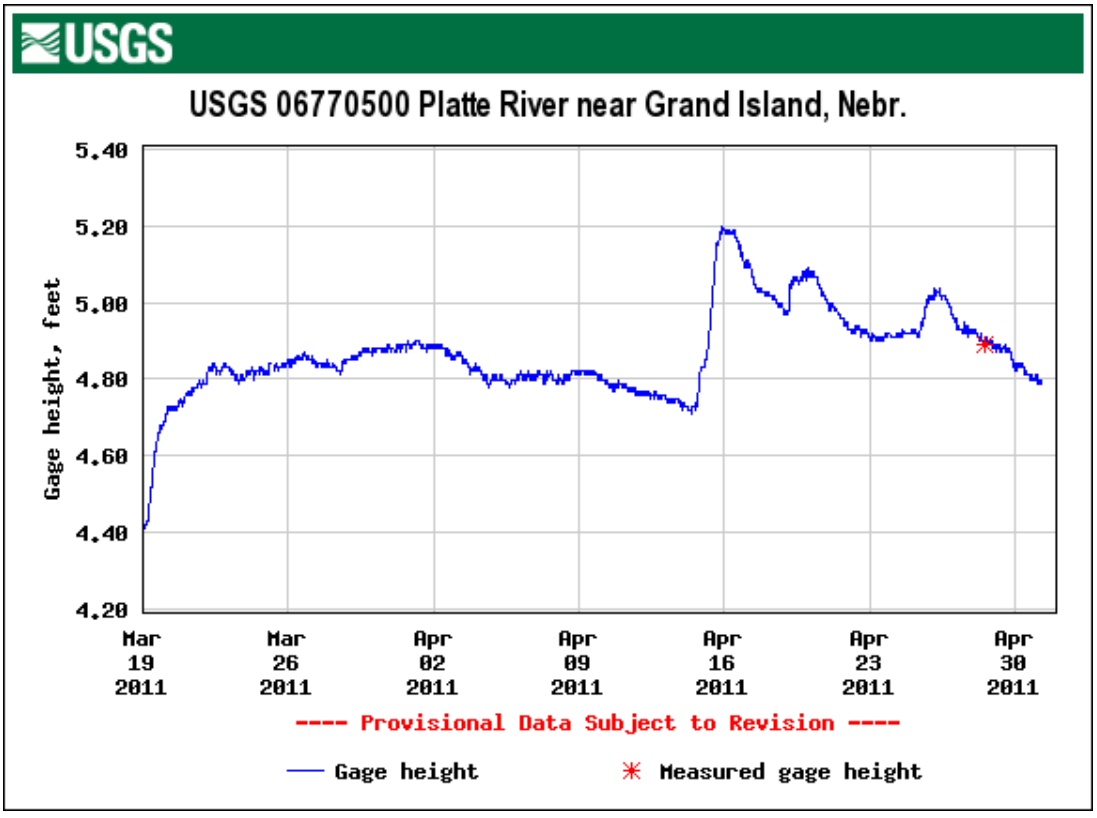
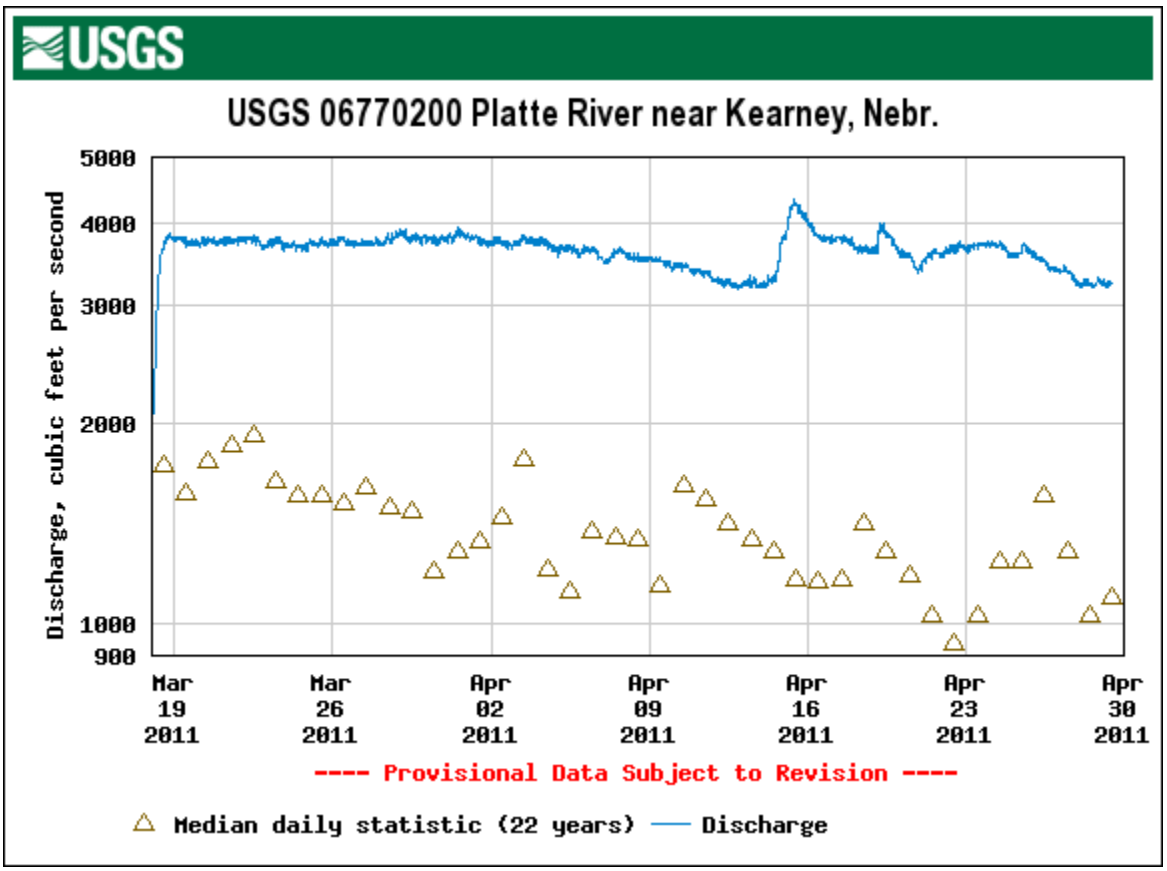


Figure 9. Platte River discharge (cfs) and gage height (ft) at Kearney.



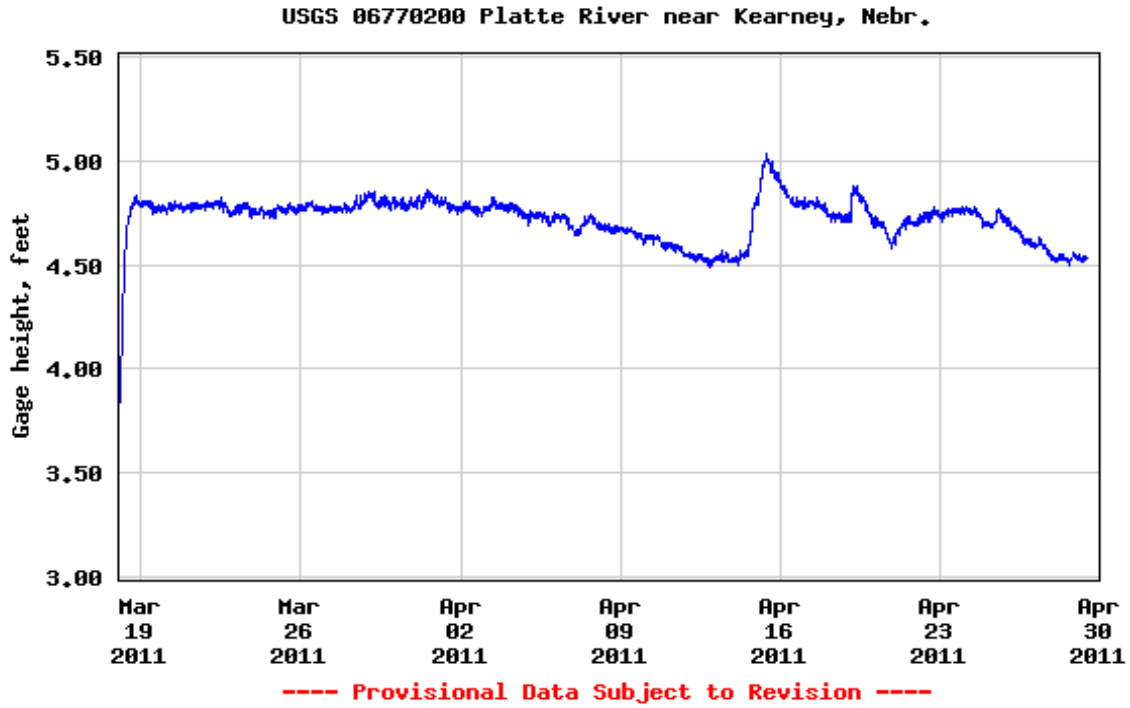
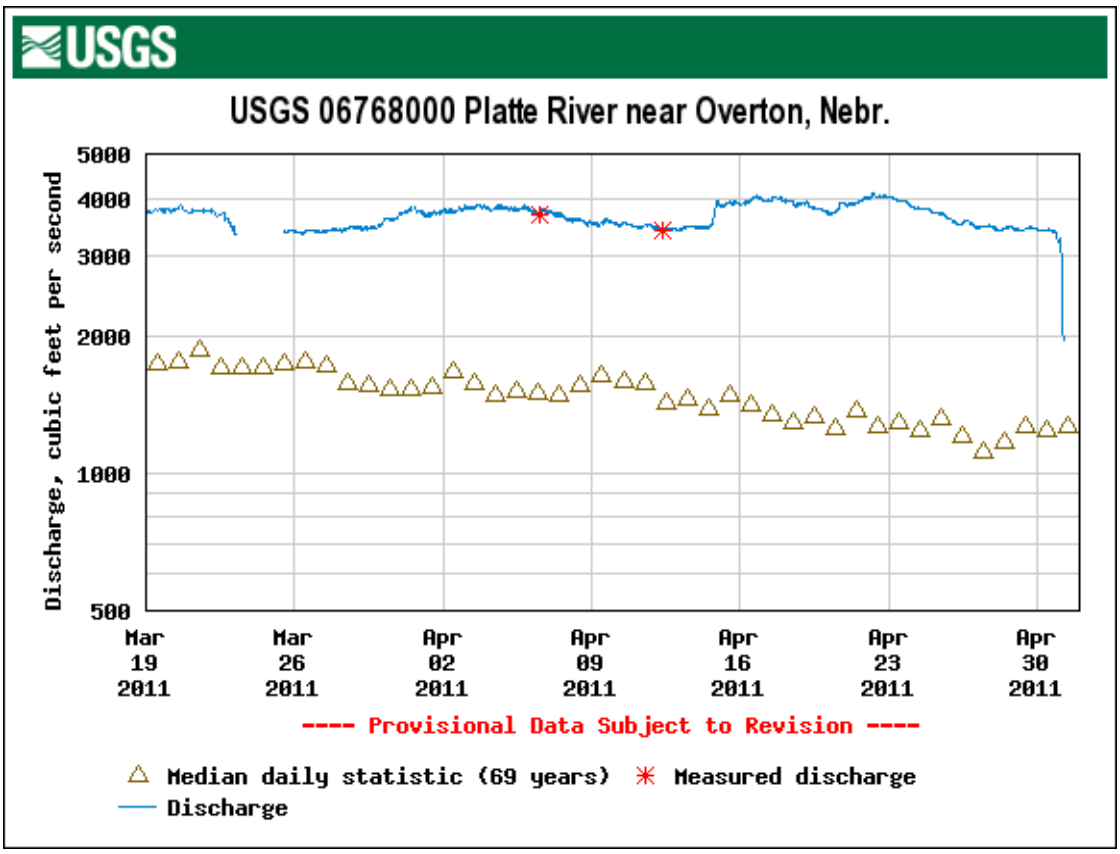


Figure 10. Platte River discharge (cfs) and gage height (ft) at Overton.



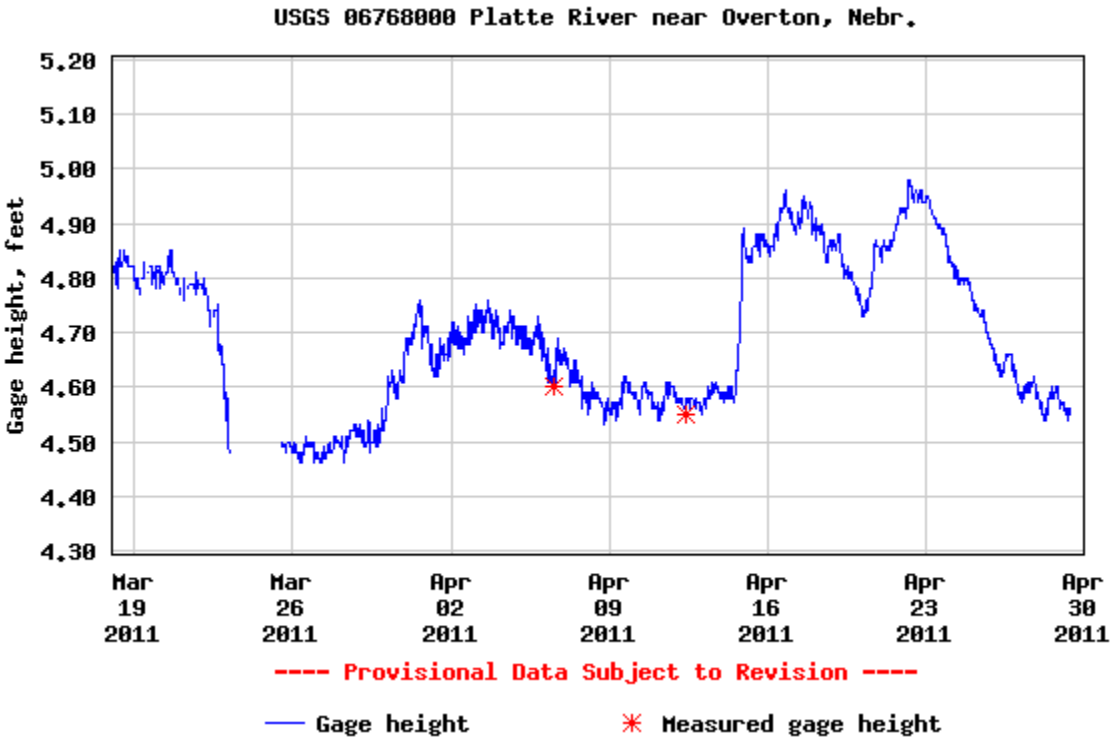


Figure 11. Roost profile for Use Site 1 (palustrine wetland) (south to north).

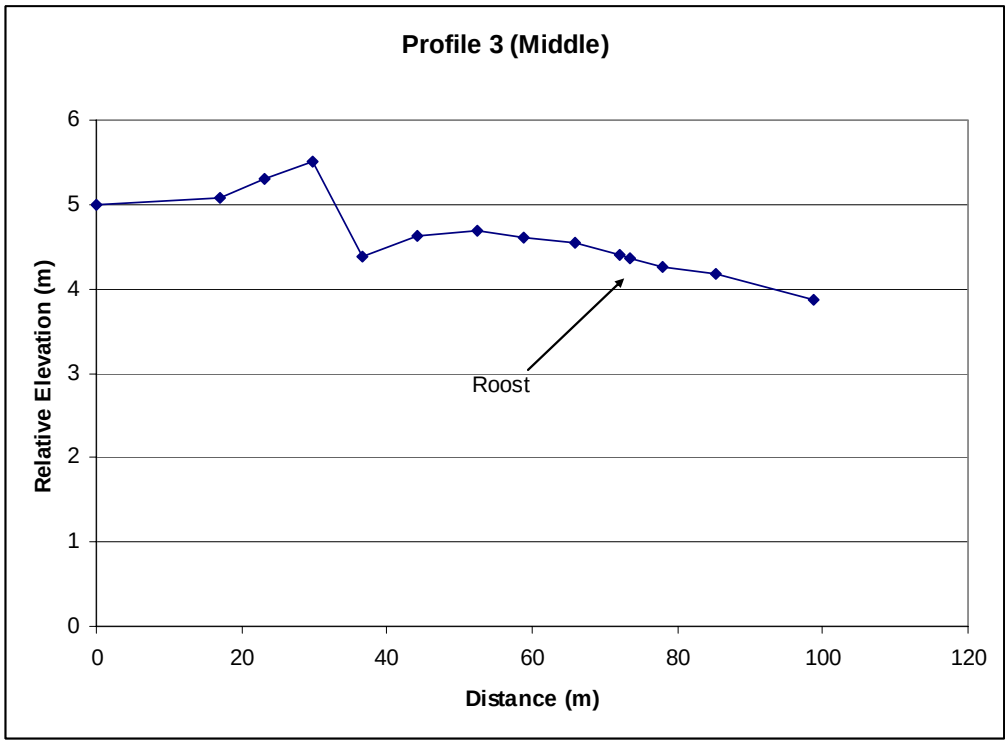


Figure 12. Roost channel profile for Use Site 2 (left to right bank).

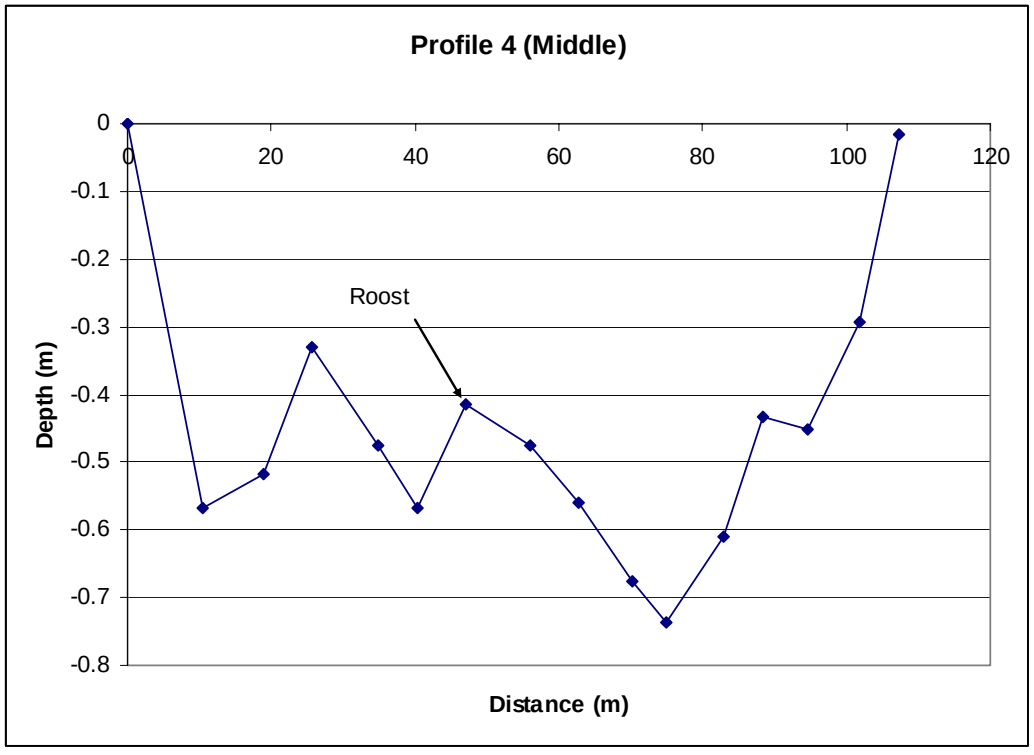


Figure 13. Roost channel profile for Use Site 3 (left to right bank).

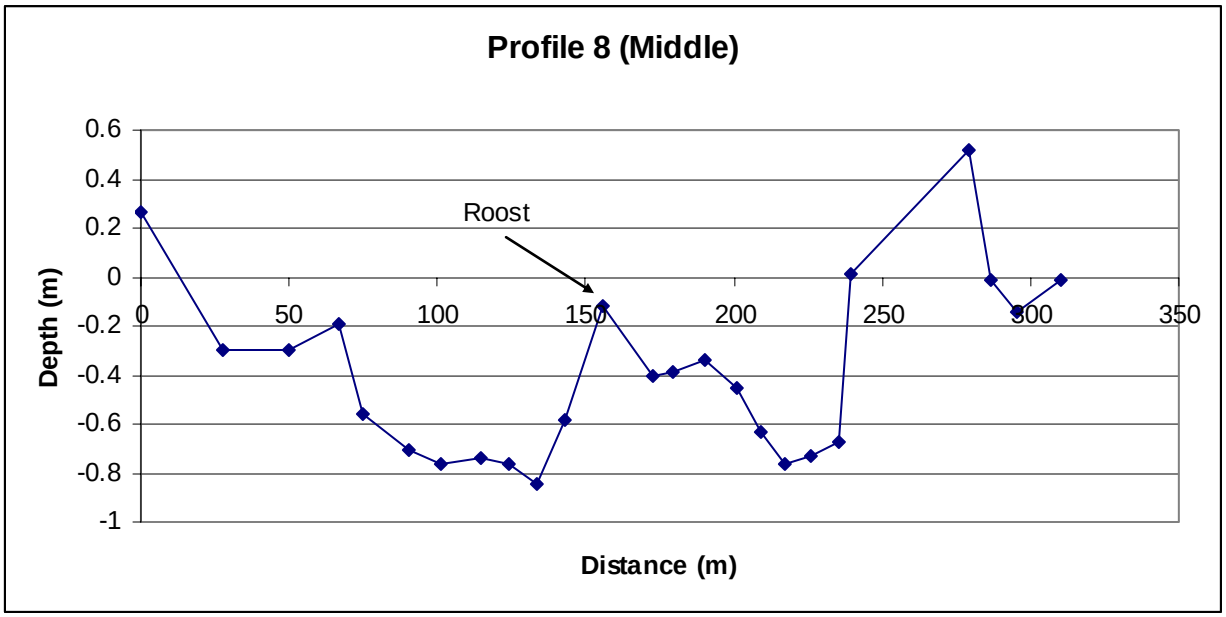


Figure 14. Roost channel profile for Use Site 4 (left to right bank).

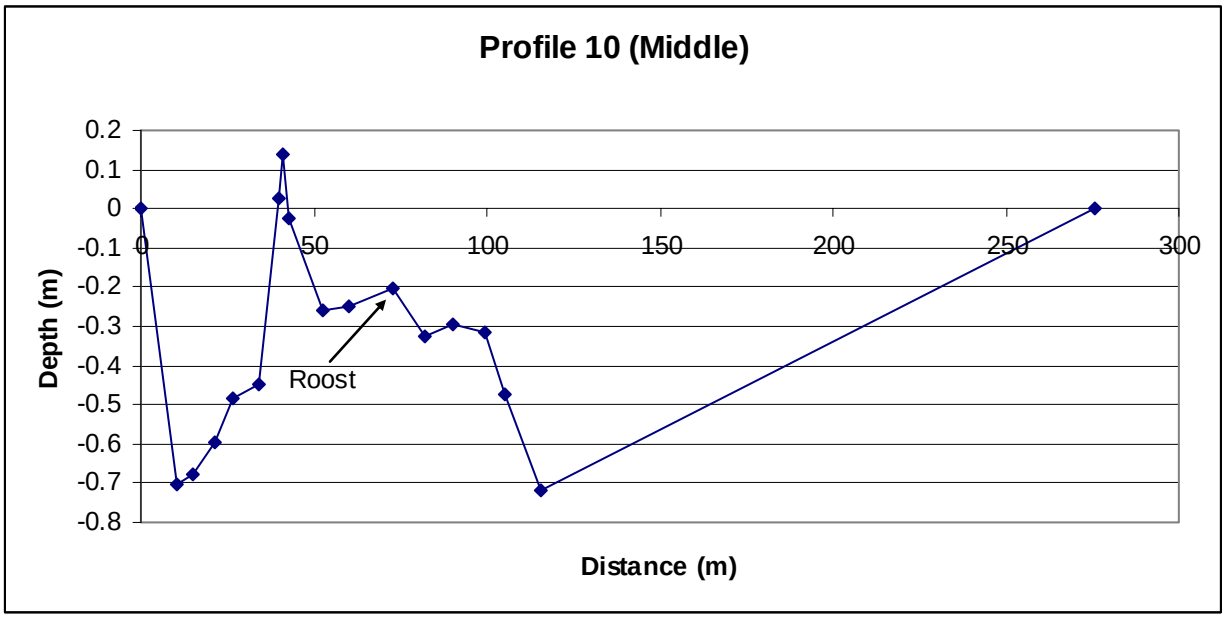


Figure 15. Roost channel profile for Use Site 6 (left to right bank).

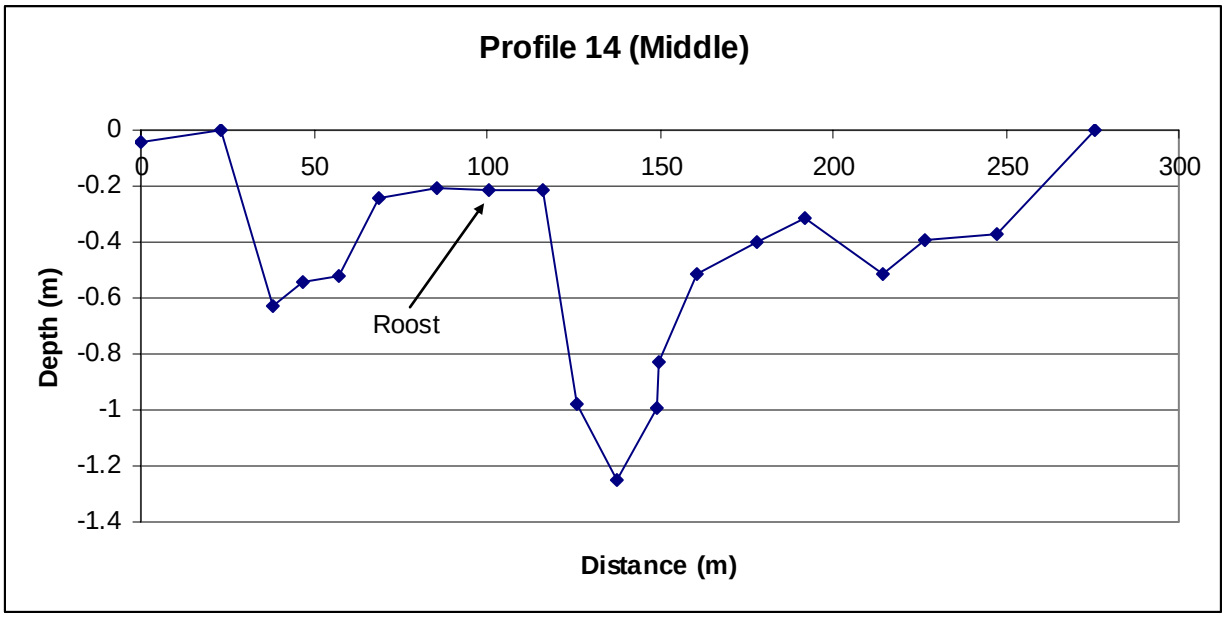


Figure 16. Roost channel profile for Use Site 8 (left to right bank).

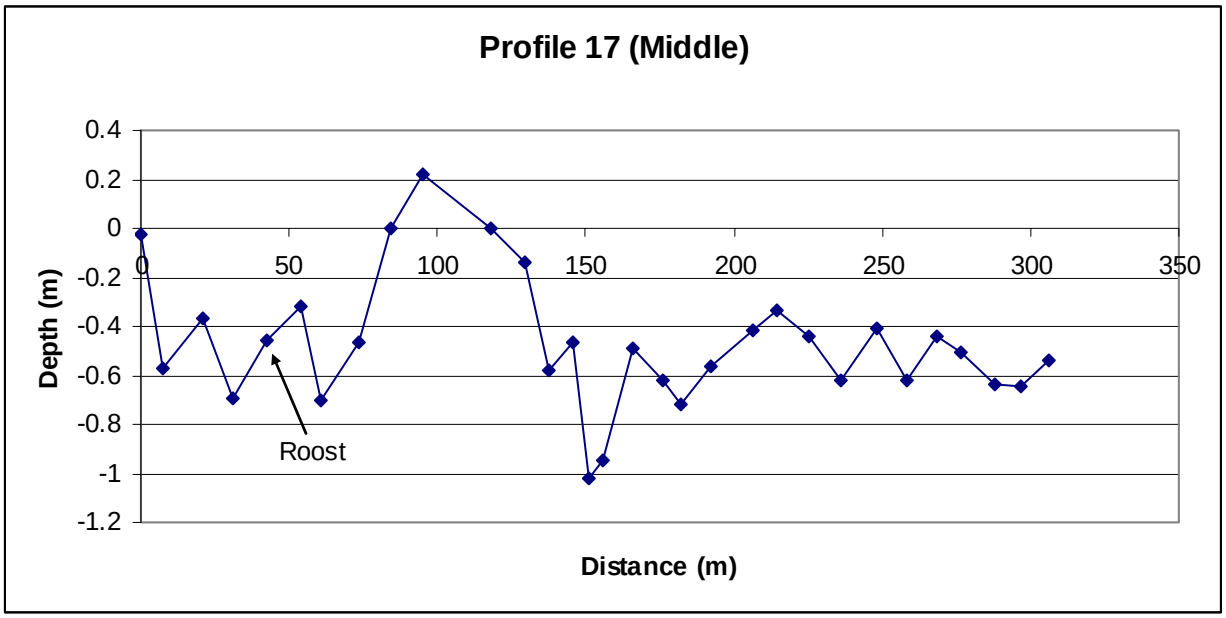


Figure 17. Roost channel profile for Use Site 10 (left to right bank).

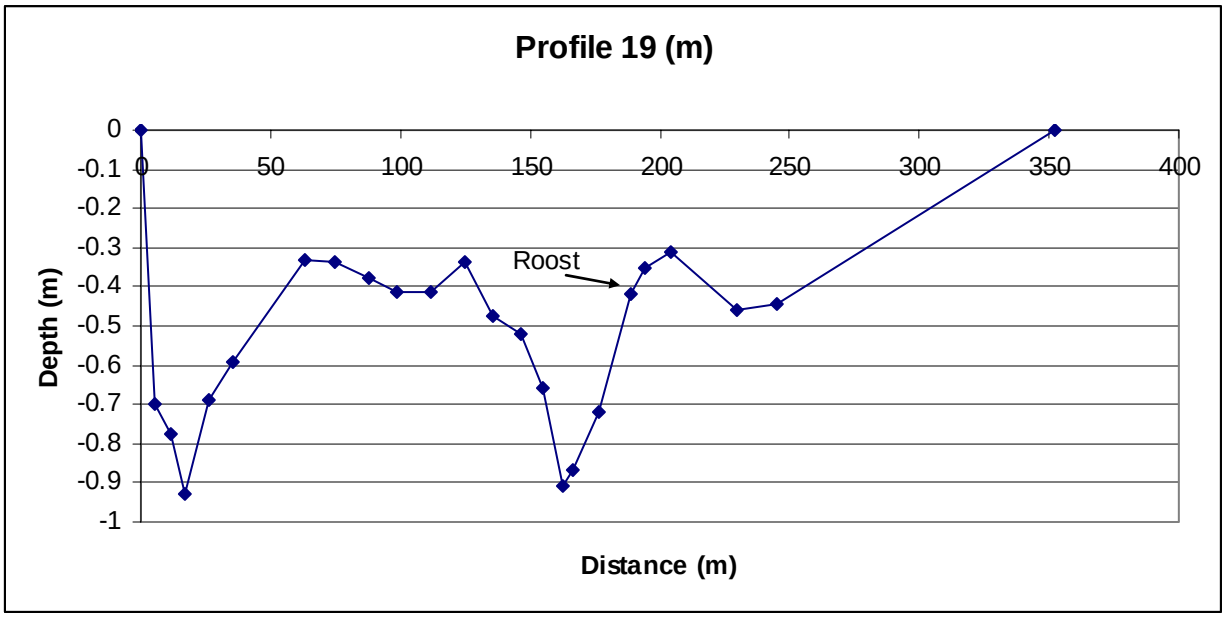


Figure 18. Roost channel profile for Use Site 11 (left to right bank).

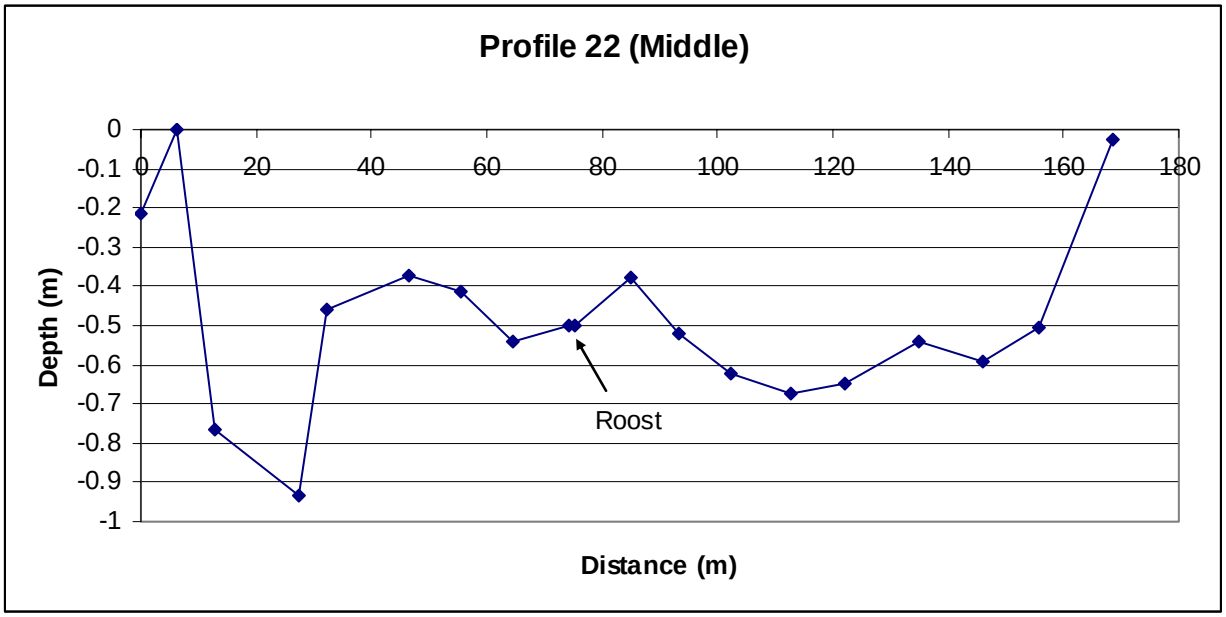


Figure 19. Roost channel profile for Use Site 13 (left to right bank).

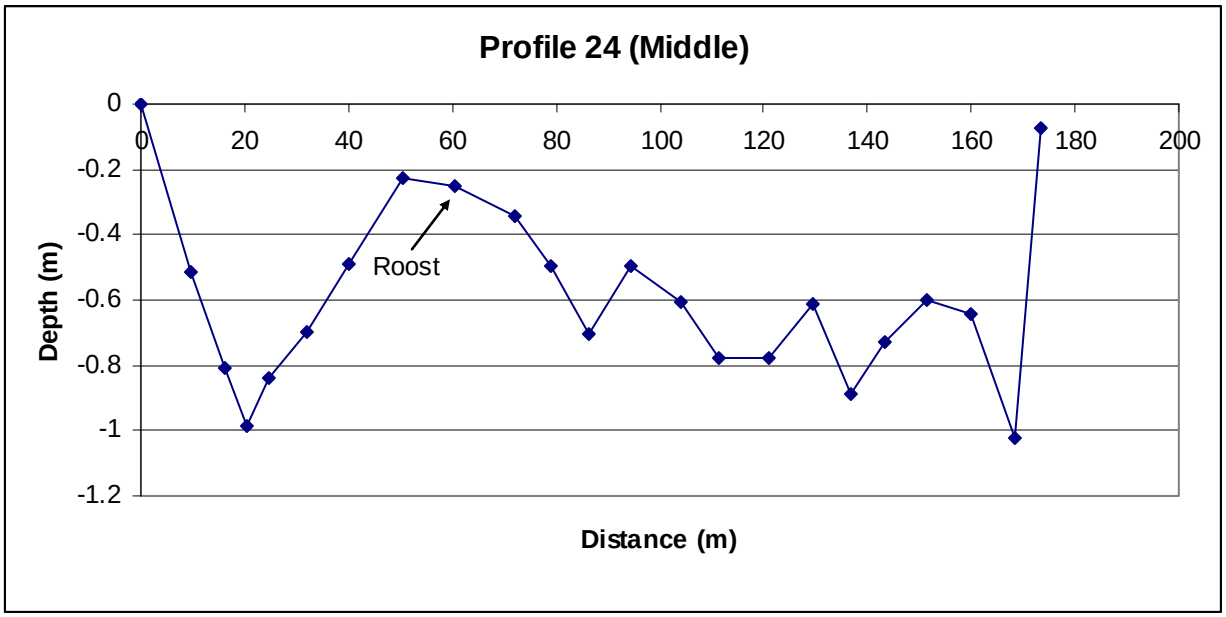


Figure 20. Whooping Crane Use Site 1 on newly created palustrine wetland near Cottonwood Ranch (Sec 15 T8 R19 Phelps County).

North

East

South

West

Figure 21. Whooping Crane Use Site 2 on the Wyoming ground (Sec 17 T8 R15 Buffalo County).

Upstream

Left Bank

Downstream

Right Bank

Figure 22. Whooping Crane Use Site 3 1.75 miles east of the Minden bridge on Rowe Sanctuary (Sec 17 T8 R14 Buffalo County).

Upstream

Left Bank

Downstream

Right Bank

Figure 23. Whooping Crane Use Site 4 on Rowe Sanctuary (Sec 16 T8 R14 Buffalo County).

Upstream

Left Bank

Downstream

Right Bank

Figure 24. Whooping Crane Use Site 5 on Rowe Sanctuary (Sec 9 T8 R14 Buffalo County).

Upstream

Left Bank

Downstream

Right Bank

Figure 25. Whooping Crane Use Site 6 on Rowe Sanctuary near the Triplett Trail (Sec 2 T8 R14 Buffalo County).

Upstream

Left Bank

Downstream

Right Bank

Figure 26. Whooping Crane Use Site 8 west of the Wood River bridge (Sec 27 T9 R12 Hall County).

Upstream

Left Bank

Downstream

Right Bank

Figure 27. Whooping Crane Use Site 8A west of the Wood River bridge (Sec 27 T9 R12 Hall County).

Upstream

Left Bank

Downstream

Right Bank

Figure 28. Whooping Crane Use Site 10 1.5 miles east of the Alda bridge (Sec 5 T9 R10 Hall County).

Upstream

Left Bank

Downstream

Right Bank

Figure 29. Whooping Crane Use Site 11 2.5 miles west of the U.S. 281 bridge (Sec 34 T10 R10 Hall County).

Upstream

Left Bank

Downstream

Right Bank

Figure 30. Whooping Crane Use Site 12 2.5 miles west of the U.S. 281 bridge (Sec 34 T10 R10 Hall County).

Upstream

Left Bank

Downstream

Right Bank

Figure 31. Whooping Crane Use Site 13 1 mile east of the Minden bridge on Rowe Sanctuary (Sec 18 T8 R14 Buffalo County).

Upstream

Left Bank

Downstream

Right Bank