SCI ENGINEERING, INC.
CONSULTANTS IN DEVELOPMENT, DESIGN AND CONSTRUCTION
GEOTECHNICAL
ENVIRONMENTAL
NATURAL RESOURCES
CULTURAL RESOURCES
CONSTRUCTION SERVICES

October 27, 2009

Mr. Phil Morris
Dynegy Midwest Generation, Inc.
604 Pierce Boulevard
O'Fallon, Illinois 62269

RE: Streambank Stabilization Report
Vermilion Power Station
Oakwood, Illinois
SCI No. 2009-3006.31

Dear Mr. Morris:

Enclosed find the completed report on the Streambank Stabilization project located at the Vermilion Power Station on the Middle Fork of the Vermilion River. We trust it is what you need to gain the necessary permits to be prepared for construction. Although several types of stabilization were evaluated, soil bioengineering stabilization is our final recommendation. We believe this is the best option to meet the objectives of all commenting agencies.

If you have any questions, or if we can be of further assistance, please do not hesitate to call.

Respectfully,

SCI ENGINEERING, INC.

Scott D. Harding, CPSS/SC
Vice President

MIDWEST STREAMS, INC.

Wayne Kinney
President

SDH/WK/jlj

Enclosure

M:\PROJECT FILES\!2009 PROJECTS\2009-3006 VERMILION POWER STATION ORCHID SURVEY\NR\31\2009-3006 31 STREAMBANK STAB COVER LTR (3).DOC

650 Pierce Boulevard, O'Fallon, Illinois 62269•618-624-6969 phone •618-624-7099 fax •www.sciengineering.com

Proposed Solution for Bank Armoring

Dynegy Midwest Generation Power Station

Vermilion County, Illinois

The Dynegy Midwest Generation Power Station is located on the right bank of the Middle Fork of the Vermilion River in the SW1/4 Sec. 21 of T20N and Range 12W in Vermilion Co., IL. The Middle Fork is a nationally designated "Wild and Scenic River" under Public Law 90-542. Under PL 90-542 no water resource project can be implemented within the designated area that will have any adverse impact on the scenic, geologic, fish and wildlife, ecological, recreational or historic resources of the Middle Fork of the Vermilion River. As a designated Wild and Scenic River the Middle Fork must remain a "free-flowing" river which is defined as a river "flowing in natural conditions without impoundment, diversion, straightening, riprapping, or other modification of the waterway" Sec. 16(b) Wild and Scenic Rivers Act(16 U.S.C. 1271-1287).

The Middle Fork is however experiencing lateral migration that is threatening to damage an existing "ash pond" on the right descending bank within the power station complex. Bank stabilization is required to protect the ash pond, but stabilization must be allowable under the criteria of PL90-542. The use of gabion baskets has been determined to be outside of the parameters established by PL90-542 as well as the use of Stream Barbs or other techniques normally used to re-direct the existing flow pattern to reduce the near bank shear stress and control erosion.

The solution that appears to meet the established criteria for this site is therefore limited to bank armoring with native vegetative material. After field examination it appears that success with vegetation alone would be very difficult at this site and minimal use of inert material to protect the slope below water where woody vegetation cannot be established and above normal water to reinforce a vegetative solution during the establishment period is recommended. The technique proposed is referred to as Streambank Soil Bioengineering and is defined as the use of living and nonliving plant material in combination with natural and synthetic support materials for slope stabilization, erosion reduction, and vegetative establishment.

Proper design of bioengineering techniques requires careful analysis of the stream characteristics, selection of vegetation, planting and care of vegetative materials and monitoring. There are several "planting zones" within the riparian corridor which dictate the selection of plant materials. These zones are typically a "toe zone", "bank zone", "overbank zone", "transitional zone" and "upland zone".

Field investigations were made on Aug. 19, 2009 to determine the geomorphological aspects of this site in preparation for entering the design stage. This site drains approx. 426 miles of rural landscape with a "geomorphic" bankfull dimension of 181 ft. wide by 7.4 ft. deep at an average velocity of 3.8 ft./sec. (see appendix pg. 16,17) The radius of curvature is 350 ft. with 115 degrees of curvature.

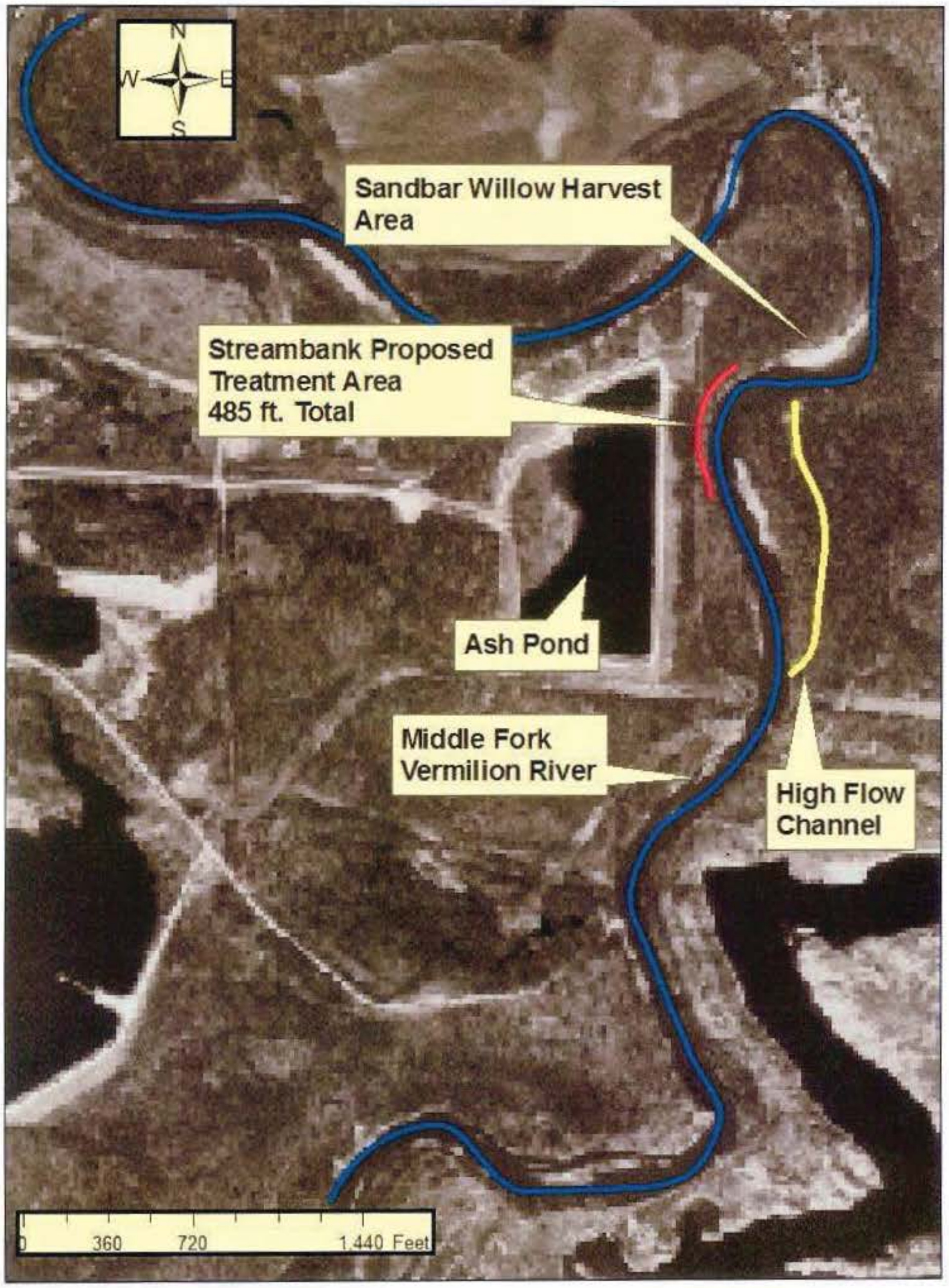
The treatment area will be 485 ft. long to protect the "ash pond"; however, the unstable bank continues downstream for approximately another 115 ft. By limiting the treatment to 485 ft. there will be a need to monitor the unstable area downstream to insure that the continued erosion downstream does not begin to cause damage to the lower end of the treated area. If that should begin to occur then a second treatment reach would be needed to extend downstream from the proposed area to stabilize the additional length of eroding bank.

There is an existing "high flow" channel at the upper end of the curve that is active and could well develop into the main channel in the foreseeable future. The Radius of Curvature to Bankfull Width (Rc/W) of this site is 1.93 (350 ft/181ft) which is very near the range of 1.6 to 1.8 where a "cutoff" might be predicted, yet still above the level where a cutoff would be imminent. It should be noted that the area near the upper end of the "high flow" channel is a very severely eroding bank on the left with no plans for stabilization. The result will therefore be that over time as this unprotected bank erodes the radius will decrease and the Rc/W will narrow to the critical range and the "high flow" channel will become the main river channel leaving the site we investigated as an abandoned channel.

It is very difficult to nearly impossible to predict when this channel change will occur, so the wiser option at this time is to continue to pursue a stream stabilization project to protect the "ash pond" on the Dynegy complex with the realization that the river could change courses at any time.

The eroding bank on the right side of the channel near the "ash pond" has incised into shale approx. 2.5 ft. with the shale extending across the entire streambed and acting as a "grade control" severely limiting or halting any channel degradation. Our investigation did not discover any shale in the "high flow" channel, however our hand probe may not have been able to reach a sufficient depth to discover the existence of shale. If there is NOT shale in the "high flow" channel it will be another factor that will encourage the development of a future channel change.

Dynegy Midwest Generation
Power Station, T20N, R12W SW1/4 Sec. 21
Vermilion Co., Illinois



Planview of Streambank Proposal for Dynegy Midwest Generation Power Station

With these factors in mind the USGS Gage #03336645 located just downstream approximately 2.5 miles provides historical flow data which can easily and reliably be used to calculate flow at this site. Using the Annual Maximum Peak discharges measured at this gage a Probability curve has been constructed that shows the maximum discharge for the 1.5 yr. return interval event to be approx. 4200 cfs or 9.7 cfs per sq. mile of drainage area. Likewise the 2 yr. event has a maximum discharge of 5500 cfs or 12.7 cfs/sq.mi. (see appendix pg. 22)

Our field investigation found indicators of "geomorphic bankfull" flow to be at a flow depth of 7.4 ft. which would require a discharge of 3940 cfs or approx. a 1.33 yr. return interval storm. While "geomorphic bankfull" is not a precise measurement, it is widely accepted to be between the 1 and 2 yr, event with most Illinois rural streams falling between the 1 and 1.5 yr. event. These measurements therefore are precisely where they would be expected to fall and 4000cfs will be used as a design discharge.

While the 4000 cfs will be the design discharge, the "toe zone" discussed earlier is the area near the base of the banks where vegetation will not establish or persist due to excessive inundation. This area must be protected by hard structure such as stone or other inert material.

The proposed elevation of the stone material (toe zone) is the average water elevation as established by analyzing the 30 years of data collected at USGS Gage 03336645 located on the Middle Fork of the Vermilion River downstream of the project site. This figure is arrived at by the "mean monthly gage height" which ranges from a low of 1.13 ft. in Sept. to a high of 2.93 ft. in May. (see appendix pg. 23-24) By adding a safety factor of 1 ft. to the gage height we can conservatively estimate the height of the "toe zone" requirement to be approx. 4 ft. (In this case the gage height is nearly equal to the flow depth, i.e. "0" flow is less than 1 ft. on gage height)

Above the "toe zone" is the "bank zone" which can support vegetative establishment up to the "overbank zone". In the Middle Fork this "bank zone" will extend from the top of the toe zone to the top of bank or approx. 8 ft. (12 ft above the channel bed)

With all these factors in mind let's consider the options available:

1. Do Nothing---this option will depend on the river bed near the ash pond becoming an abandoned channel before the ash pond is damaged. No reliable prediction of timing can be made, however the situation could be monitored regularly with implementation taking place only after the risk is determined to outweigh continued monitoring. At this time, the ash pond is approx. 50 ft. from the eroding bank. A margin of 25 ft. would seem to provide ample safety to implement stabilization before damage occurs.

2. PL90-542, Section 16, paragraph (b) defines "free flowing" required by law to mean "flowing in natural condition without impoundment, diversion, straightening, rip-rapping, or other modification of the waterway". Therefore it appears from PL90-542 and from direction received from the National Park Service that the following options normally considered would only be allowed as a component of a Soil BioEngineering solution that would meet the requirements of PL90-542:
   a) Gabion baskets
   b) Gabion mattresses
   c) Rip-Rap
   d) Stream Barbs
   e) Bendway Weirs
   f) Other similar techniques
3. Soil BioEngineering Techniques seem to be the only viable solution available, however they are especially dependent on a stabilized "toe zone" to prevent undercutting of the bank. Next their success depends on the initial establishment and long-term development of riparian plant species. There are a whole host of bioengineering techniques to consider, but many can be ruled out as the average velocity on the Middle Fork is 3.8 ft./sec. at "bankfull" and 4.5 ft/sec. at flood stage. Typically some areas within the channel will have velocities nearly twice the average velocity, therefore the treatment should be able to resist velocities up to nearly 9 ft./sec.
   The Soil BioEngineering Technique recommended for this site, capable of safely handling initial permissible velocities of up to 9 ft/sec., is Live Poles or Joint Planting with Riprap or Gabion Mattresses.

Recommendations

In consideration of the unique characteristics of this site, the geomorphic assessment made from field investigations, and the historical flow data available from USGS records, there are three recommendations provided for consideration at this site.

Recommendation 1 --- Do Nothing

Since there is no immediate danger to the ash pond, the first recommendation is to monitor the river until the safety margin determined by Dynegy becomes unacceptable. The river may well capture the "high flow" channel before this threshold is reached eliminating the need for bank stabilization.

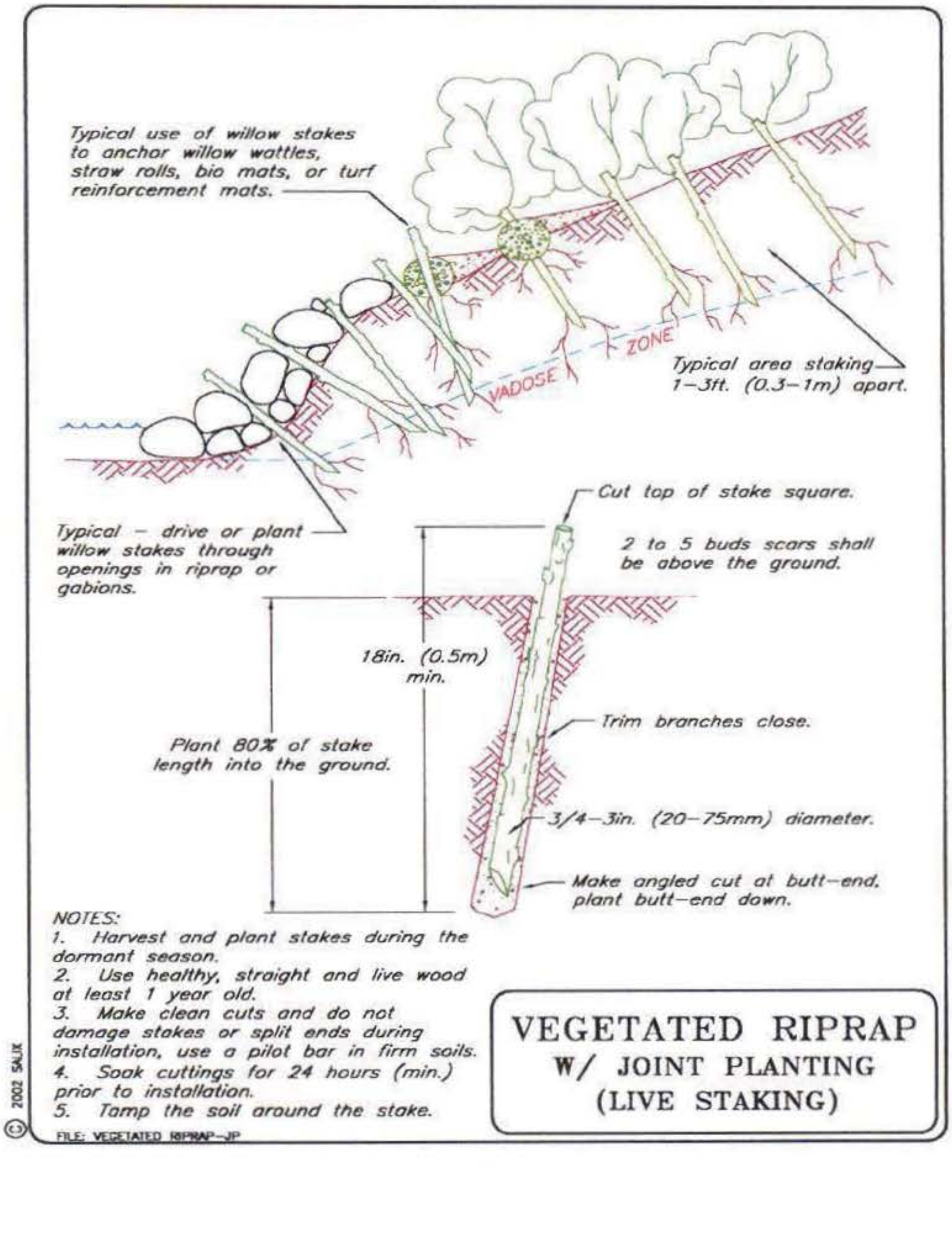
Recommendation 2 ---Live Poles or Joint Planting with Riprap or Gabion Mattresses

In the event the safety threshold is reached and implementation of a bank stabilization technique is deemed necessary it is recommended that the necessary permits and plans be in place to quickly implement a pre-approved plan of action. This technique will protect the bank by using inert material (stone) to protect the eroding bank and the new vegetation during the establishment period. The point bar located upstream on the right bank has been identified as an excellent source of "sandbar willow" for harvesting and use as live pole or joint planting stock. Thus reducing the cost of harvesting and transport to the site. Sandbar Willow is a preferred species of willow for this application as it does not develop into a large tree (like Black Willow) maintaining lower growth and flexibility to absorb and dissipate energy in the near bank region.

I have included a discussion about pole planting and live staking from the USDA-NRCS discussing the installation and material handling requirements as well as a drawing showing pole planting with gabion mattresses from John McCullah, Salix Applied Earthcare.

The recommended treatment would be to use Riprap in place of gabion mattresses due to several factors:

a) Less expensive to install (no gabions to purchase)
b) Reduced labor cost
c) Larger stone used which does not rely on gabion mattress to resist movement
d) Self-adjusting and easy to repair and/or maintain
e) No sacrifice of bank stability


Typical use of willow stakes to anchor willow wattles, straw rolls, bio mats, or turf reinforcement mats.
ZONE
VADOSE
Typical area staking 1–3ft. (0.3–1m) apart.
Cut top of stake square.
Typical – drive or plant willow stakes through openings in riprap or gabions.
2 to 5 buds scars shall be above the ground.
18in. (0.5m) min.
Trim branches close.
Plant 80% of stake length into the ground.
3/4–3in. (20–75mm) diameter.
Make angled cut at butt-end, plant butt-end down.
NOTES:
1. Harvest and plant stakes during the dormant season.
2. Use healthy, straight and live wood at least 1 year old.
3. Make clean cuts and do not damage stakes or split ends during installation, use a pilot bar in firm soils.
4. Soak cuttings for 24 hours (min.) prior to installation.
5. Tamp the soil around the stake.
VEGETATED RIPRAP
W/ JOINT PLANTING
(LIVE STAKING)
© 2002 SALIX
FILE: VEGETATED RIPRAP–JP

Pole Planting

Pole Plantings use large diameter cuttings (poles vs. stakes) which are relatively long, 5 to 10 feet in length. The cuttings are taken from willow (*Salix spp.*) or cottonwood (*Populus spp.*). The cuttings are intended to sprout and take root, stabilizing the streambank with a dense matrix of roots. Pole plantings are planted deep so they usually require heavy equipment assisted construction techniques. As defined by Schiechtl and Stern, in *Water Bioengineering Techniques, 1997*, poles are straight, poorly branched stems 1-2.5 m long.

Conditions Where Practice Applies

This mitigation project involved the use of pole plantings in order to reestablish a riparian corridor in an urban watershed. (Pedestrian Bridge Mitigation Project, Redding, CA)

Pole planting is suitable for floodplains, streambanks, and other riparian zones. Pole plantings are very useful for highly erodible areas and sites with fluctuating water tables. Pole planting is a useful "stand alone" revegetation technique for replacing and/or reestablishing riparian vegetation and cover. Pole planting is also particularly suitable for conjunctive uses with other streambank stabilization techniques such as vegetated riprap, vegetated gabions, rootwad revetments with vegetated riprap, vegetated deflectors, and longitudinal peaked stone toe protection.

Pole planting areas may need to be accessable to heavy equipment as the poles should be planted into deep holes. The location of the water table (saturated zone) and vadose zone (moist soil zone including the capillary fringe, located above the saturated zone) should be approximately identified so the pole plantings can access sufficient moisture. Pole plantings are usually planted with a power auger or punch bar ("Stinger").

Materials

Cottonwood or willow pole cuttings. A pond or storage area for soaking the cuttings will be necessary. Pole planting techniques may require the use of a power auger, "Stinger", or other method to excavate deep holes. The "Stinger" is a large metal punch bar mounted on a backhoe or hydraulic excavator. Instructions for building a "Stinger" can be obtained from:

USDA-NRCS Plant Materials Center
Box 296
Aberdeen, ID 83210
208 397-4133

Advantages

Larger diameter cuttings have greater supply of stored energy ("stored" photosynthesis). Works well with non-irrigated projects as the deep planting can ensure contact of the basal ends of the poles with the vadose zone during hot, dry summer months.

The poles have tremendous tensile strength which can enhance the strength and shear resistance of the soil, and when incorporated into structural practices, the poles can benefit the strength and longevity of the structures. When established, pole plantings can protect gabions (and the wire) from scour and the deep roots provide tremendous pull-out resistance which can greatly reduce future collapse of the structures. Pole plantings are an extremely useful way to provide habitat enhancement to standard structural engineering practices.

Disadvantages

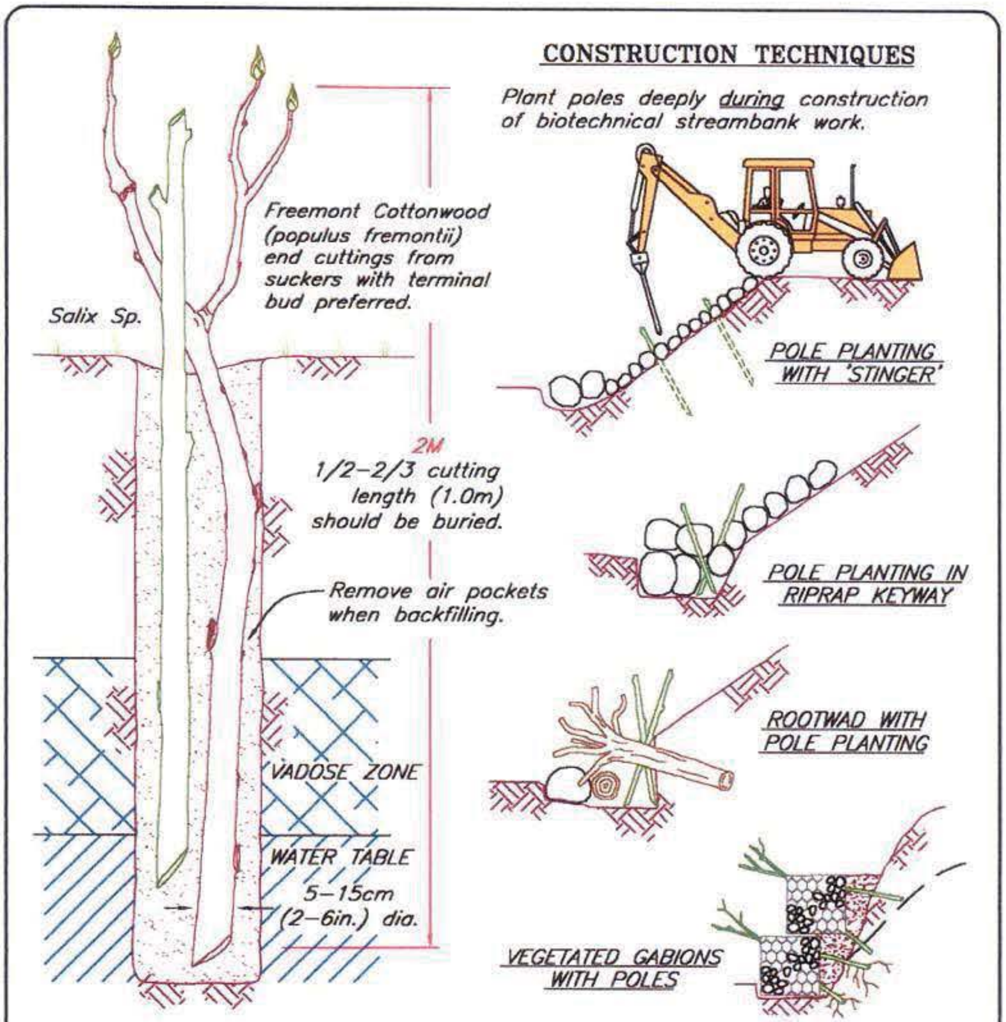
Pole plantings often require conjunctive use of appropriate erosion control as large diameter poles can cause local turbulence and small-scale scour. Pole plantings usually require the excavation or construction of deep holes. Pole planting techniques implemented after construction is complete, for instance, after riprap placement, is very difficult. Pole plantings should be designed and scheduled to coincide with construction if possible.

Implementation

Collect and harvest cuttings (ideally during the dormant season) and then soak the poles for 5 to 7 days. See harvesting and handling. Plant poles into an augered, "punched", or excavated hole. The holes should extend to approximately 1 foot above the water table and through the vadose zone. This depth can be difficult to determine in areas with reservoirs and streams with widely fluctuating seasonal water levels. In this case, ensure that the ends of the poles reach the low waterline at the time of planting if possible.

Pole plantings should ideally be installed during the construction of any structural appurtenances. For instance, plant the poles with the placement of riprap, especially into any trenches excavated for keyways or scour trenches. Another example is to plant the poles during riprap placement such that the poles extend through the riprap and backfill and into contact with the "native" bank. The backfill can be placed over and around the poles rather than having to "punch" holes through the riprap. Another method is to plant the poles during gabion construction. See vegetated gabions.

The pole plantings, especially the basal ends, must have good contact with the soil. "Mudding" (filling the hole with water and then adding soil to make a mud slurry) can remove air pockets.



NOTES:

1. Pole cuttings of willow or cottonwood are longer and have a larger diameter than branch cuttings or live stakes.

2. Larger diameter cuttings have a greater supply of stored energy (stored photosynthesis) than smaller diameter cuttings.

3. Pole cuttings are better suited for highly erodible areas and sites with fluctuating water levels.

4. The pole cuttings should extend through the vadose zone and into the permanent water table. At least 1/2 to 2/3 of the pole should be below the ground, at least 1.0m (3 ft.), and long enough to emerge above adjacent vegetation.

5. "Muddying" – filling the hole with water and then soil to make a mud slurry can remove air pockets.

POLE PLANTING

POLEPLNT

Typical drawing: Pole Planting

.dwg

Costs

Depends upon site conditions and plant (pole) availability. Machinery is costliest expense.

Source: The Practical Streambank Bioengineering Guide. USDA-NRCS, 1998, Chris Hoag and Gary Bentrup. David Polster, Polster Environmental Services.

Recommendation 3 –Continued Monitoring

Monitoring of the stream under the Do Nothing option or one of the Pole Planting or Joint Planting options selected must be done to insure that satisfactory vegetative establishment is achieved and/or safety margins are not exceeded. Needed repairs and/or maintenance will be evaluated annually and implemented as needed until stability is achieved. Annual inspections will continue indefinitely.

All costs and quantities are preliminary estimates based on 485 ft. of bank protection. Labor costs is based on other project data available. Local cost and time with less experienced crews may vary significantly. These costs are estimated as a guide for decision making, actual cost may be considerably different. Solicitation of bids from several sources is highly recommended.

Compliance with PL90-542

The three recommended treatment alternatives outlined above will have little to no effect on the "scenic, geologic, fish and wildlife, ecological, recreational or historic resources" of the Middle Fork of the Vermilion River. All options leave the stream geometry intact, remove only vegetation needed to install the soil bioengineering treatment, do not divert any flow and will have only temporary impact on the scenic value. As the treatment option becomes established the willow planted with pole planting, joint planting, or a combination will in fact restore the eroding bank to natural vegetation harvested just a few hundred yards from the site and maintain the "free flowing" state of the Middle Fork of the Vermilion River.

APPENDIX

Geomorphic Information

Stream Stabilization I & E Form

ILLINOIS NRCS - Version 2.05- modified 9/12/04 R.Book

County	Vermilion	T.	20N	R.	12W	Sec.	21
Date	9/9/2009	By	Wayne Kinney				

Stream Name	Middle Fork Vermilion River	UTM Coord.	160437454E 4448036N
Landowner Name	Dynegy Midwest Generation		
Drainage Area	426 sq. mi.		Clear Cells

Regional Curve Predictions:

Bankfull dimensions	Width	158 ft.	Cross Sectional Area	1364 sq. ft.
	Depth	8.7 ft.		

Reference Stream Gage:

Vermilion river near Catlin	Station No.	03338500	Gage Q_2	8470 cfs
	Drainage Area	959 sq.mi	Regression	9860 cfs
Vermilion County, IL	REFERENCE STREAM DATA ONLY			

USGS Flood-Peak Discharge Predictions:

Valley Slope:	2.8	ft./mi. (user-entered)				Regression Q_2	4635 cfs
		ft/mi (from worksheet)	Rainfall	2.95 in	(2 yr, 24 hr)	Adjusted Q_2	3981 cfs
	0.0005	ft./ft.	Regional Factor	1.057		Typical Range for Bankfull Discharge:	1590 to 3190 cfs

Local Stream Morphology:

Channel Description: (c) Clean, winding, some pools and shoals

Manning's "n" 0.04

			Stream Length		ft.		
Basic Field Data:			Valley Length		ft.		
Bankfull Width	181	ft.	Contour Interval		feet		
Mean Bankfull Depth	5.8	ft.	Estimated Sinuosity				
Width/Depth Ratio	31.21						
			Channel Slope:			Bankfull Q from:	
Max. Bankfull Depth	7.4	ft.	Surveyed:	0.001	ft./ft.	Cross-Section	3889 cfs
Width at twice max. depth		ft.	Estimated:		ft./ft.	Basic field data	3994 cfs
(14.8 ft.)						Selected Q	3941 cfs
Entrenchment Ratio	0.00		Radius of Curvature (Rc)	350	ft.		
			Rc/Bankfull width:	1.93			

Bankfull Velocity Check: (typical Illinois streams will have average bankfull velocity between 3 and 5 ft/sec.)

Bedload:	D_{90}	6 in.	Velocity required to move D_{90}:	5.1	ft./sec.
	D_{50}	in.	Velocity from Cross-Section data:	3.70	ft./sec.
GOAL: Develop confidence by matching			Velocity from basic field data:	3.80	ft./sec.
velocities from different sources.			Velocity from selected Q:	3.8	ft./sec.

Channel Evolution Stage: V

Stream Type (Rosgen):

Notes

Natural Open Channel Flow

back to I&E form

Clear Cells

Project:	ynegy Midwest Generati
Assisted by:	Wayne Kinney
Date:	9/9/2009
Channel Slope (S):	0.001000 ft/ft
Manning's n:	0.040
Flow Depth:	7.4 ft

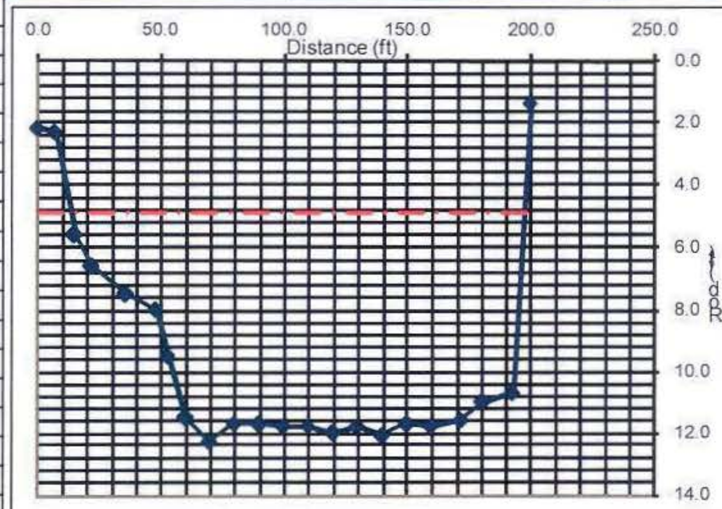
$$Q = \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

assuming uniform, steady flow

		Trial Depth 2	Trial Depth 3
Selected Flow Depth:	7.4 ft	10.1	
Channel Flow (Q):	3,888.9 cfs	7,085.7	
Channel Velocity:	3.7 ft/sec	4.5	
Cross-Sectional Area (A):	1,050.5 sq.ft.	1,559.4	
Hydraulic Radius (R):	5.6 ft	7.6	

Survey Data:

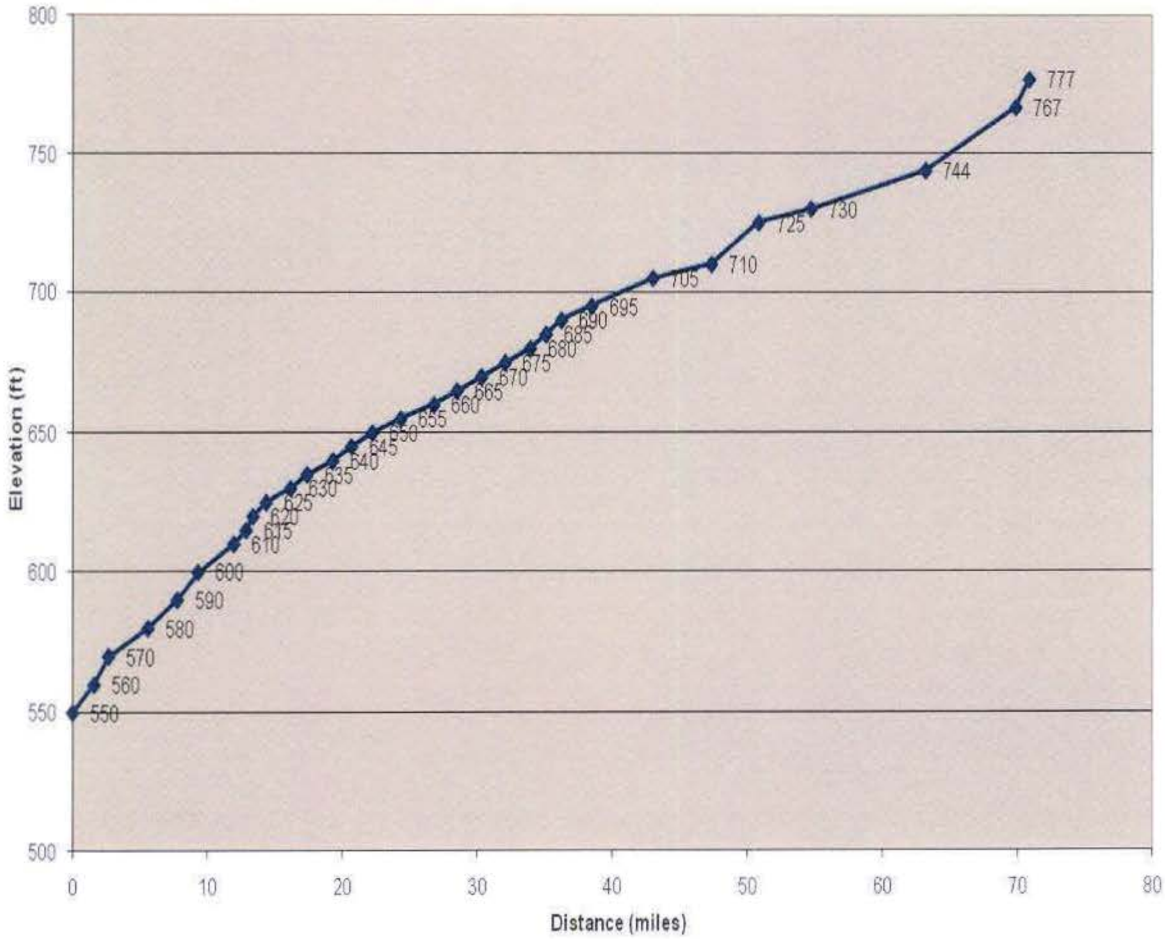
Rod *(ft)*	Distance *(ft)*
2.2	0.0
2.3	7.0
5.6	15.0
6.6	22.0
7.5	36.0
8.0	48.0
9.5	53.0
11.5	60.0
12.3	70.0
11.70	80
11.70	90
11.80	100
11.80	110
12.00	120
11.80	130
12.1	140
11.7	150
11.8	160
11.6	172
11.0	181
10.7	193
1.4	200



COMMENTS:

Field determined "bankfull flow" 6.4 ft. above waterline or 7.4 ft. above flowline at cross section location. Places "bankfull" just below the 1.5 yr. Return Interval of 4140 cfs based on USGS gage #03336645 located just downstream of this site.

Profile Middle Fork Vermilion River above Oakwood



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Geographic Area: Illinois

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News New Mapper and Experimental Real-Time Web Service - updated August 2009

Peak Streamflow for Illinois

USGS 03336645 MIDDLE FORK VERMILION RIVER ABOVE OAKWOOD, IL

Available data for this site SUMMARY OF ALL AVAILABLE DATA GO

Vermilion County, Illinois

Hydrologic Unit Code 05120109

Latitude 40°08'13", Longitude 87°44'45" NAD27

Drainage area 432 square miles

Gage datum 544.42 feet above sea level NGVD29

Output formats
Table
Graph
Tab-separated file
peakfq (watstore) format

Reselect output format

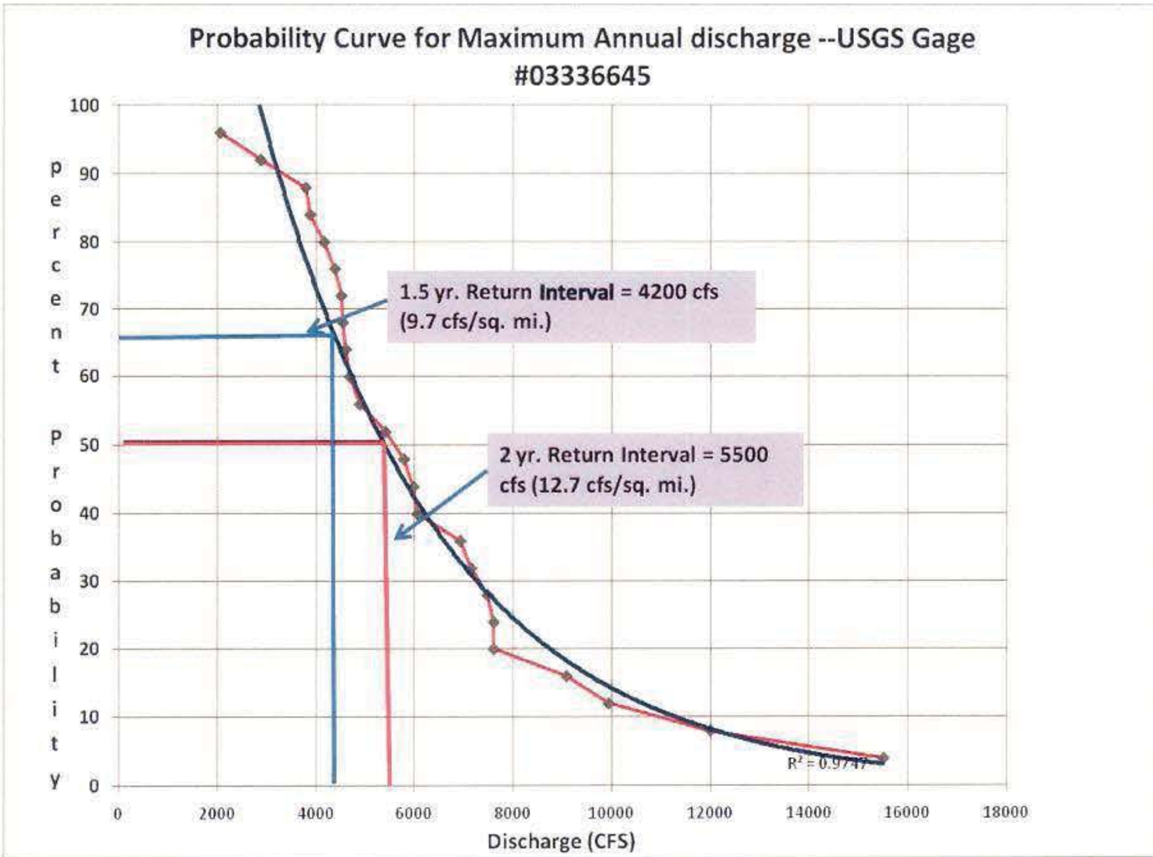
Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1939	Mar. 1939		29,000[2,7,B]	1992	Jul. 31, 1992	8.06	4,180[E]
1956	May 1956		21,000[2,7,B]	1993	Jul. 02, 1993	13.58	9,090
1979	Mar. 05, 1979	14.41	9,400	1994	Apr. 13, 1994	20.46	15,500
1980	Jun. 04, 1980	10.56	6,160	1995	May 19, 1995	8.39	4,530
1981	Aug. 07, 1981		4,620[2]	1996	May 11, 1996	11.69	7,160
1982	Feb. 21, 1982	15.79	10,600	1997	Feb. 27, 1997	8.62	4,700[E]
1983	May 02, 1983	13.51	8,610	1998	Jun. 16, 1998	10.03	5,800
1984	Mar. 20, 1984	10.35	5,990	1999	Jan. 24, 1999	8.43[2]	4,560
1985	Feb. 24, 1985	11.52	6,940	2000	May 28, 2000	6.11	2,900[E]
1986	Nov. 20, 1985	12.35	7,620	2001	Feb. 25, 2001	8.28	4,900
1987	Apr. 15, 1987	5.41	2,080[E]	2002	Aug. 23, 2002	9.55	5,420
1988	Dec. 28, 1987	7.57	3,810[E]	2003	Sep. 01, 2003	12.07	7,490
1989	May 26, 1989	8.30	4,400[E]	2004	Jun. 12, 2004	10.36	6,070
1990	May 16, 1990	15.96	12,000	2005	Jan. 14, 2005	12.22	7,620
1991	Dec. 30, 1990	14.29	9,940	2006	Mar. 12, 2006	6.88	3,900[E]
				2007	Jan. 15, 2007	7.73[2]	4,620

Peak Gage-Height Qualification Codes.

- 2 -- Gage height not the maximum for the year

Peak Streamflow Qualification Codes.

- 2 -- Discharge is an Estimate
- 7 -- Discharge is an Historic Peak
- B -- Month or Day of occurrence is unknown or not exact
- E -- Only Annual Maximum Peak available for this year



Probability Curve for Maximum Annual discharge --USGS Gage #03336645
percent Probability
100
90
80
70
60
50
40
30
20
10
0
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
Discharge (CFS)
1.5 yr. Return Interval = 4200 cfs (9.7 cfs/sq. mi.)
2 yr. Return Interval = 5500 cfs (12.7 cfs/sq. mi.)

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News New Mapper and Experimental Real-Time Web Service - updated August 2009

USGS Surface-Water Monthly Statistics for the Nation

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USGS 03336645 MIDDLE FORK VERMILION RIVER ABOVE OAKWOOD, IL

Available data for this site | Time-series: Monthly statistics | GO

Vermilion County, Illinois
Hydrologic Unit Code 05120109
Latitude 40°08'13", Longitude 87°44'45" NAD27
Drainage area 432 square miles
Gage datum 544.42 feet above sea level NGVD29

Output formats
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Tab-separated data
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00065, Gage height, feet,												
YEAR	Monthly mean in ft (Calculation Period: 1993-10-01 -> 2008-09-30)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1993										3.805	3.350	3.255

1994	2.837	2.429	2.638			1.720	1.271	1.010	0.952	1.055	1.650	2.199
1995	2.791	1.719	2.629	2.898	4.526	2.498	1.593	1.800	1.083	1.162	1.943	
1996	2.111	1.883	1.858	2.213	3.964	3.162	1.746	1.439	1.056	1.041	1.322	
1997	2.446	3.639	3.366	2.089	2.702			1.507		1.040	1.027	
1998	2.332	2.205	4.264		4.356					1.137	1.322	1.155
1999	2.787	2.992	2.535	3.121		2.631	1.353	0.925	0.751	0.880	0.878	0.906
2000	0.965		1.404	1.477	1.939	2.031	1.364				1.162	1.355
2001	1.827	3.906	2.320			2.145					1.896	2.555
2002		3.463		3.053	3.651	2.563	1.491	2.435	1.211			1.150
2003			1.871	2.016	2.575	2.181	3.253	1.949		1.789	2.770	2.692
2004		1.937	3.216	2.453	2.428	3.743	2.674		1.240	1.537	3.206	
2005		3.186	1.935	2.244	1.813	1.568	1.773	1.153	0.969	1.096	1.773	1.928
2006	2.323	1.899	2.489	2.887		1.574	1.406	0.974	1.044	1.491	1.772	3.166
2007	3.125		3.384	2.470	1.816	1.399	1.286	0.943	0.732	0.839	1.457	2.744
2008		3.647	2.846	2.377	2.486	3.495	1.929	1.000	2.297			
Mean of monthly Gage height	2.35	2.74	2.63	2.44	2.93	2.36	1.76	1.38	1.13	1.41	1.82	2.10

** No Incomplete data have been used for statistical calculation

USGS 03336645 MIDDLE FORK VERMILION RIVER ABOVE OAKWOOD, IL

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Vermilion County, Illinois

Hydrologic Unit Code 05120109

Latitude 40°08'13", Longitude 87°44'45" NAD27

Drainage area 432 square miles

Gage datum 544.42 feet above sea level NGVD29

Output formats

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Tab-separated data

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00060, Discharge, cubic feet per second,												
Day of month	**Maximum of daily mean values for each day for 30 - 30 years of record in, cfs (Calculation Period 1978-10-01 -> 2008-09-30)**											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1	4,800	4,250	3,850	2,870	3,330	3,550	4,420	1,850	6,290	657	1,060	3,340
2	3,970	3,660	2,500	2,300	7,980	3,310	7,900	2,690	5,910	526	4,550	2,640
3	2,290	2,090	2,490	2,750	6,070	5,120	6,000	1,580	2,890	437	3,260	2,140
4	5,53	1,360	6,90	2,630	4,29	7,53	4,04	1,20	2,56	386	2,61	2,00

	0		0		0	0	0	0	0		0	0
5	7,200	5,890	8,800	1,720	4,300	5,060	1,590	974	2,530	353	1,640	2,800
6	4,930	11,400	5,820	2,570	2,630	3,170	1,010	2,040	1,280	1,180	1,070	2,000
7	4,150	9,600	4,400	1,950	2,070	4,190	1,920	4,150	1,550	2,120	932	1,980
8	2,900	5,600	3,550	1,920	3,540	4,780	2,150	2,390	2,010	1,210	634	2,420
9	6,400	2,870	3,270	1,110	3,950	3,820	1,990	1,070	1,960	1,290	525	3,180
10	6,900	3,130	2,640	1,210	4,250	1,810	4,280	950	758	3,450	659	2,650
11	5,620	2,960	7,480	4,000	5,900	3,640	3,350	1,060	481	2,630	1,930	3,450
12	4,660	2,500	7,770	12,200	3,830	5,540	3,260	584	355	2,000	3,470	4,200
13	5,810	4,000	5,180	14,400	3,970	5,680	1,810	509	293	993	3,470	4,010
14	7,220	3,800	4,070	11,000	3,910	2,860	1,370	354	1,130	4,320	2,860	4,060
15	5,650	2,890	3,830	7,580	3,840	4,260	1,330	988	4,690	2,410	1,790	3,410
16	4,080	2,370	3,440	4,500	7,590	4,970	826	2,600	4,820	2,130	2,250	2,370
17	2,690	5,870	3,100	3,940	6,380	4,610	505	2,400	4,620	3,620	2,540	1,590

18	1,150	7,480	4,040	4,570	3,930	3,430	2,350	1,760	2,590	3,790	3,140	1,900
19	1,910	6,910	3,750	4,020	4,280	2,870	2,920	2,730	746	3,800	5,490	1,050
20	2,300	7,850	4,840	1,510	3,410	2,140	2,680	2,070	509	3,450	7,270	2,620
21	2,050	8,720	4,420	1,230	2,870	2,100	2,240	3,310	438	2,970	6,560	2,490
22	2,900	5,610	3,480	2,210	3,210	2,070	1,860	2,960	437	2,250	4,930	2,970
23	3,500	5,400	2,790	2,650	3,150	1,640	1,900	4,490	316	1,320	3,220	3,330
24	3,970	6,760	2,750	1,470	2,300	1,110	1,710	3,230	288	1,500	2,560	2,860
25	3,100	6,120	3,750	4,210	3,370	801	930	3,150	295	3,000	2,300	2,400
26	1,870	4,390	3,560	3,180	4,310	1,240	2,170	2,610	757	2,550	2,890	1,900
27	909	4,530	4,780	2,780	4,910	927	2,350	740	2,870	2,190	3,700	1,500
28	3,580	4,260	4,200	3,570	4,130	748	2,860	2,390	1,560	903	3,890	2,670
29	2,260	298	3,560	3,030	4,120	1,390	2,550	1,240	1,090	630	2,780	3,540
30	998		3,370	2,480	3,370	2,450	1,320	2,970	1,440	531	2,790	9,110
31	2,920		3,330		2,060		2,900	1,510		558		6,000

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USGS 03336645 MIDDLE FORK VERMILION RIVER ABOVE OAKWOOD, IL

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Vermilion County, Illinois Hydrologic Unit Code 05120109 Latitude 40°08'13", Longitude 87°44'45" NAD27 Drainage area 432 square miles Gage datum 544.42 feet above sea level NGVD29	**Output formats** HTML table of all data Tab-separated data Reselect output format

Day of month	00065, Gage height, feet,											
	Mean of daily mean values for each day for 12 - 15 years of record in, ft (Calculation Period 1993-10-01 -> 2008-09-30)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2.08	2.61	2.86	2.49	2.41	2.64	2.00	1.37	1.81	1.23	1.48	2.48
2	1.99	2.55	2.57	2.41	2.36	2.82	1.99	1.28	1.74	1.18	1.65	2.33
3	1.99	2.42	2.78	2.29	2.57	2.73	1.82	1.29	1.41	1.17	1.67	2.30
4	2.09	2.35	2.62	2.27	2.78	2.96	1.83	1.42	1.22	1.16	1.65	2.08
5	2.31	2.73	2.60	2.21	2.77	2.70	1.93	1.38	1.18	1.20	1.55	1.99
6	2.67	3.07	2.58	2.22	2.64	2.56	1.99	1.36	1.18	1.26	1.51	1.89
7	2.49	3.09	2.72	2.37	2.55	2.71	2.13	1.43	1.14	1.24	1.58	1.81
8	2.22	2.94	2.77	2.50	2.62	2.69	2.01	1.43	1.18	1.21	1.56	1.87
9	2.20	2.78	2.89	2.47	2.96	2.62	2.08	1.31	1.10	1.24	1.49	1.83
10	2.18	2.59	3.04	2.35	3.35	2.54	2.58	1.38	1.06	1.30	1.51	2.09
11	2.51	2.44	2.74	2.60	3.44	2.96	2.34	1.18	1.08	1.28	1.54	2.00
12	2.60	2.21	2.69	2.64	3.39	3.40	2.22	1.17	1.07	1.25	1.60	2.14
13	2.81	2.14	2.58	2.47	3.15	3.43	2.03	1.15	1.06	1.28	1.62	2.16
14	3.16	2.26	2.66	2.42	3.08	3.18	1.88	1.13	1.17	1.62	1.62	2.16
15	3.22	2.39	2.60	2.48	3.09	2.92	1.78	1.10	1.50	1.50	1.69	2.16
16	3.09	2.34	2.42	2.62	2.88	2.82	1.64	1.10	1.50	1.51	1.70	2.01
17	2.56	2.29	2.48	2.76	2.94	2.82	1.54	1.08	1.45	1.82	1.89	2.06
18	2.46	2.36	2.70	2.76	2.82	2.61	1.76	1.27	1.29	1.67	2.00	2.06
19	2.48	2.49	2.70	2.74	2.87	2.50	1.78	1.64	1.14	1.81	2.09	1.95
20	2.39	2.77	2.73	2.47	3.02	2.24	1.81	1.60	1.13	1.74	1.95	1.90
21	2.34	2.80	2.65	2.43	2.65	2.14	1.66	1.42	1.10	1.66	1.84	1.96
22	2.58	2.63	2.49	2.69	2.39	2.11	1.95	1.28	1.07	1.57	1.86	2.14
23	2.62	2.52	2.50	2.65	2.28	2.05	2.05	1.65	1.05	1.43	1.79	2.31
24	2.55	2.34	2.46	2.46	2.48	2.02	1.76	1.48	1.07	1.42	1.92	2.31
25	2.40	2.62	2.47	2.39	2.55	2.08	1.57	1.47	1.10	1.35	2.02	2.12
26	2.32	3.01	2.54	2.53	2.75	2.04	1.46	1.47	1.13	1.31	2.03	2.05
27	2.19	3.33	2.66	2.51	3.00	2.13	1.43	1.34	1.38	1.58	2.10	1.97

28	2.36	3.11	2.87	2.65	3.12	2.07	1.51	1.27	1.21	1.51	2.11	1.94
29	2.23	1.87	2.88	2.57	2.95	1.96	1.56	1.42	1.17	1.49	2.11	2.11
30	2.30		2.70	2.54	2.65	1.95	1.47	1.61	1.15	1.49	2.21	2.04
31	2.51		2.50		2.53		1.42	1.35		1.46		2.02