A New Approach to Streambank Stabilization

Compiled by:

The Oklahoma Conservation Commission
Water Quality Division

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Final Report

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Task 1: Workshop Development

- Detailed workplan
- Promotional Materials
- Potential attendee list

Agency: Oklahoma Conservation Commission
in cooperation with
U.S. Army Corps of Engineers
Oklahoma's 88 Conservation Districts
Oklahoma's Wetlands Working Group

Title: A New Approach to Streambank Stabilization

Introduction:

Section 404 of the Clean Water Act recognizes that although individual impacts to streams may cause minimal degradation of aquatic habitat, the cumulative impacts of numerous activities can result in major changes in the water quality and the health of aquatic ecosystems. Hydrologic modifications to and around streams can impact the chemical, physical and biological integrity of those streams. These alterations could potentially result in altered flow regimes, increased bank erosion and sediment loading, and degraded habitat. While these processes may occur naturally, anthropogenic impacts such as urban sprawl and poor agricultural practices often accelerate bank erosion and decrease water quality. In an effort to minimize flood damage to engineered structures, crops and other important features, humans have historically straightened, channelized, concrete lined and created impervious engineered structures for water control. In some cases these activities may run contrary to the more stable tendencies of the river in its natural state, and may result in the long term failure of the project.

Fluvial geomorphology is the study of the form and shape of stream channels, which are created naturally as a result of water and sediment transport. Rosgen (1996) defines a stable stream as a stream that has a stable dimension, pattern and profile such that, over time, channel features are maintained and the stream system neither aggrades nor degrades. Streambank stabilization is best accomplished when all of the following components are included; 1) restoration of a proper dimension, pattern and profile within the stream segment, 2) mitigation of underlying pressure causing instability within the system and 3) restoration of riparian corridors. Riparian corridors are therefore a key ingredient in stabilizing the river. The importance of corridor management cannot be over-emphasized. Riparian restoration not only decreases bank erosion, but also minimizes flood impacts, provides fish and wildlife habitat, improves water quality and provides recreational opportunities.

Instability at an upstream location may also induce instability within downstream stretches even though the same impact is not occurring at the secondary site. To alleviate this problem and keep it from continuing, recent restoration efforts have focused on the source of instability. Utilizing natural channel design to stabilize stream flow is often an overlooked alternative to traditional hard structures. By providing practical training in the techniques of applied fluvial geomorphology (FGM), stream degradation and destabilization can be minimized. However, without the transfer of technology of this information to consultants, contractors and engineers, traditional hard methods of stabilizing streams will continue.

Project Goals:

The goal of this project is to provide training in FGM. This transfer of technology will serve to greatly impact both current and future decision makers, as well as consultants, contractors and government employees.

Project Objectives:

1. Establish a means of technology transfer by conducting one 24-hour workshop on FGM, emphasizing attendance by city engineers and planners, construction companies, consultants, natural resource agency personnel and university professors.

Measures of Success:

1. Participation in the 24-hour training courses by approximately 50 professionals in the ecological and engineering sciences, construction and academia. The Commission will solicit attendance from city engineers and planners, construction companies, natural resource personnel and university professors from each state within EPA Region VI.

Workplan:

Task 1: A small contact group will be established with members from each state, OCC and the U.S. Army Corps of Engineers to determine an appropriate location for the course and to develop the information to be utilized during the course.

Milestone Date: *July 2001*
Deliverables: *Listing of the schedule, promotional materials and mailing list*
Cost: *$3,580 ($2,685 federal)*

Task 2: One 24-hour training courses in FGM and the principles of sustainable engineering design will be conducted. This course will be conducted in conjunction with the U.S. Army Corps of Engineers. There will be a small registration fee to help offset some costs of the course, and will help pay for experiential learning activities and snacks during the conference.

Milestone Date: *October 2001*
Deliverable: *Listing of participants, curriculum development and materials used during the workshop, and pre-and post tests documenting technology transfer to the public.*
Cost: *$13,000 ($9,750 Federal)*

Justification: State, federal and tribal entities cannot accomplish the goal of restoring all 150 priority 1 watersheds within a reasonable timeframe. This is especially true when considering the stream quality trends in Oklahoma. In order to impact significant numbers of watersheds, the

Commission believes that training must be integrated into implementation projects, providing decision making entities with alternative methods to traditional engineered water control structures.

Task 3: Final Report

Milestone Date: *October 2004*
Deliverable: *Final Report*
Cost: *$3,000 ($2,250 Federal)*

Public Participation:
The Wetland Working Group is open to the public, but is primarily comprised of people from state, federal, tribal and local governments. This group will be heavily utilized to accomplish the tasks of this project. By providing educational opportunities to professionals involved in stream management, the Conservation Commission can successfully transfer this technology to a large number of individuals within Region 6.

Resource Allocation:

State: $3,333
Federal $10,000
Total $13,333

Budget Categories:

	Federal	*State*	*Total*
Personnel	$10,000	$3,333	$13,333
Fringe Benefits	$1,950	$650	$2,600
Equipment	$0	$0	$0
Travel	$0	$0	$0
Supplies	$0	$0	$0
Contracting	$735	$245	$980
Total Direct Charges	$12,685	$4,228	$16,913
Indirect Charges @ 20%	$2,000	$667	$2,667
Total	*$14,685*	*$4,895*	*$19,580*

Personnel:

Personnel	*Years*	*Cost*
District Operations Director	0.007	$403
Assistant District Operation Dir.	0.01	$480
Executive Director	0.01	$600
Assistant Director	0.01	$580
Administrative Officer	0.02	$1270
Wetlands Program Coordinator	0.33	$10,000
Total		*$13,333*

Coordination With Oklahoma's Comprehensive Wetlands Conservation Plan Objectives:

Objective 1: To promote the coordination of wetlands management in Oklahoma through discussion, information exchange, cooperation and sharing of resources.

Objective 3: To integrate wetlands management with other related resource issues on a watershed or hydrologic unit basis.

Objective 7: To develop information/education programs on Oklahoma's wetlands resources.
to accomplish this work.

Objective 10: To integrate wetlands conservation with Oklahoma's floodplain management program and create more wetland urban riparian areas.

Objective 12: Research and develop techniques for protecting, enhancing and constructing wetlands for pollutant control and/or mitigation. Developed techniques will be implemented to maximize beneficial uses of wetlands pollutant removal and mitigation capabilities.

December 3, 2001

To: Individuals interested in natural stream channel design and restoration

From: Matt Mercer, Oklahoma Conservation Commission

RE: Short Course in Fluvial Geomorphology

The Oklahoma Conservation Commission is offering a 32-Hour short course in the principles and applications of fluvial geomorphology. Fluvial geomorphology is the study of stream channel shape and design, with restoration efforts focusing on developing a sustainable dimension, pattern and profile as opposed to traditional "hard" stabilization measures. The course will introduce attendees to the concepts of stream degradation problems, channel stability/evolution and classification, and will have a strong field component providing hands-on experience.

"The form a stream takes provides many clues to its behavior. Understanding stream form is a necessary first step in evaluating and predicting fluvial (riverine) mechanics, geomorphology, stream stability, habitat characteristics and functional potential. These, in turn, are necessary to develop alternatives for the restoration and management of our stream systems and to make an informed choice among alternatives." – Stream Management – Concepts and Methods in Stream Protection and Restoration, USACE 1999

Time/Date: 8am-4pm, February 5-8, 2002
Location: Super 8 Motel, Norman, Oklahoma. A block of rooms have been set aside at $50 per night. Reservations need to be made 3 weeks in advance to get this conference rate. Call (405) 329-1624
Cost: Free with a $100 deposit. Deposit will be returned upon course completion. (Must be received with registration). Please email Matt Mercer your name and contact information

- Course is limited to 75 participants on a first come, first serve basis
- Individuals are responsible for their own travel and lodging costs.
- Most of the cost associated with this course are being provided by the Oklahoma Conservation Commission through a grant from the U.S. Environmental Protection Agency

What to Bring: If you have a laptop computer, please bring it. Also, one day will be spent on a field trip, so plan to be outside. Bring warm clothes, a field notebook, waders and a calculator.
Contact: Matt Mercer, Wetlands Program Coordinator
5225 N. Shartel, Suite 102
Oklahoma City, OK 73118-6035
mattm@okcc.state.ok.us or (405) 810-1026

Instructor:
J. Craig Fischenich is a research civil engineer at the U.S. Army Engineer Waterways Experiment Station (WES). He holds a bachelor of Science in Civil Engineering and a Master of Science Degree in Environmental Engineering from South Dakota School of Mines and Technology, and a PhD in Hydraulics from Colorado State University. His research has focused on stream and riparian restoration, erosion control and flood drainage reduction.

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Task 2: Short Course in Fluvial Geomorphology

- Attendee list
- Curriculum

Natural Stream Restoration

Short Course in Fluvial Geomorphology
February 5--8, 2002
Norman, Oklahoma

	LAST NAME	FIRST NAME	ORGANIZATION	PHONE
1	Fjeseth	Wayne	Natural Resources Conservation Service	405-321-7766
2	Drennan	Trent	Grady County Conservation District	405-224-0523
3	Owen	Keith	Rogers County Conservation District	918-341-4147
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5	Coluin	Charlie	Natural Resources Conservation Service	580-323-2580
6	Beem	Marley	OSU-Department of Forestry	405-744-9636
7	Heathermon	Bill	City of Overland Park, KS	913-895-6050
8	Doll	Cathy	City of Overland Park, KS	913-895-6172
9	Miller	Debbie	City of Oklahoma City-Engineering	405-297-3126
10	Johnson	Derek	City of Oklahoma City-Stormwater	405-297-1517
11	Jones	Bryan	City of Oklahoma City-Stormwater	405-297-1516
12	Wiley	Yvette	Sac and Fox Nation	918-968-2583
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14	Sneegas	Peggy	City of Overland Park, KS	913-895-6290
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18	Smith	Daniel	Natural Resources Conservation Service	580-336-5515
19	Coppock	Larry	Natural Resources Conservation Service	918-341-3222
20	Jarrell	Larry	Natural Resources Conservation Service	405-323-2580
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22	Stover	Holly	Oklahoma Conservation Commission	405-810-1043
23	Ramming	Jason	Oklahoma Conservation Commission	405-542-3204
24	Ormston	Cheryl	Oklahoma Conservation Commission	405-810-1024
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30	Woodfin	Linda	West Environmental	405-360-7115
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Curriculum

Please refer to Appendix A and the attached CD for the curriculum used to conduct the fluvial geomorphology workshop.

Task 3: Final Report

- Workshop Review
- Workshop Summary

Natural Stream Restoration Review

Oklahoma Conservation Commission
U.S. Environmental Protection Agency
U.S. Army Corps of Engineers

February 5-8, 2002
Super 8 Motel

1. Was the educational material presented at the class applicable to stream issues where you work? Do you feel more prepared to address stream issues in your area?

2. Was the material presented in a manner conducive to your learning?

3. Were the facilities/accommodation appropriate?

4. Was the field trip useful in visualizing the concepts of stream channel design and stabilization?

5. Are there any changes you would make?

6. Please make any additional comments regarding this class that you feel would make the class better next time.

Natural Stream Restoration Review

Short Course in Fluvial Geomorphology
February 5--8, 2002
Norman, Oklahoma

1. a) Were the educational material presented at the class applicable to stream issues where you work?

   b) Do you feel more prepared to address stream issues in your area?

2. Was the material presented in a manner conducive to your learning?

3. Were the facilities/accommodation appropriate?

4. Was the field trip useful in visualizing the concepts of stream channel design and stabilization?

5. Are there any changes you would make?

6. Please make any additional comments regarding this class that you feel would make the class better next time.

	#1 a)	#1 b)	#2	#3	#4	#5 Changes	#6 Other Comments
1	Y	Y	N	Y	Y	less generalization, make slower more focused w/ examples to work through	slow down
2	Y	Y	Y	Y	Y	better class preparation	need more planning
3	Y	Y	N	Y	Y		#2 too much talking, need more interaction
4	Y	Y	Y	Y	Y	slow down or have handouts	#2 handouts at the time
5	Y	Y	Y	Y	Y	more field trips would aid understanding of stream channel	#4 field trip gives better understanding of discussion; more field trips; drivers need to know site locations
6	Y	Y	Y	Y	Y	more printed materials	#4 appreciated review of a constructed channel, plant material applications, and use of natives
7		N		Y	Y		#1 little design info. presented; #2 a lot of material presented
8	Y		Y	Y	Y	break up class and field trip time 1/2days 1) sat too long, 2) would allow direct tie of info. to examples	#1 more emphasis as related to urban environment/issues; hold later in spring or summer to better include vegetation
9	Y	Y	Y	Y	Y	would like more specifics geared toward engineers	

10	Y	Y		Y	N	pictures of projects during construction would be beneficial	#2 more specific with less general overview; step by step examples of jobs that have been completed
	#1 a)	**#1 b)**	**#2**	**#3**	**#4**	**#5 Changes**	**#6 Other Comments**
11	Y	Y		Y	Y	give drivers maps for field trips to avoid getting lost	#2 presentation material needs to be better organized w/ handouts that followed the discussion topics; never needed the laptop coputer requested before class
12	Y	Y	Y	Y	Y	more classes	#1 streams are not in my usual field of study, has opened my eyes to areas of secondary concern; #2 opened my eyes to areas I need to know something about; #4 helped organize pictorial views
13	Y	Y	Y	Y	Y	need more hands-on at stream or viewing of this type of construction	#2 need handouts and class agenda; more time for class and field (5 day); prior preparation by main instructor needed
14	Y	Y	Y	Y	Y	more information needed on stream restoration and less technical data	
15	Y	Y	Y	Y	Y	too much sitting--mix up field trips and class time	#4 field trips very important, helped better understand the information more in-depth
16	Y	Y	Y	Y	Y		
17	Y	N	Y	Y	N	a class project such as taking measurements on a stream	#2 a list of subject material needed; #4 S. Canadian River was interesting, but no one will work on a project that size
18	Y	Y	Y	Y	Y	add a quantitative component to the class with homework and workgroups	#4 some characterization would have been nice
19	Y	Y	Y	Y	Y	add a section just on vegetation and techniques to establish vegetation	
20	Y	N	Y	Y	Y	need some data collection demonstrations during field trip	#4 field trip was a good break and informative
21	Y	Y	Y	N	Y	use different facilities for the next conference	#4 field trip of projects sites extremely good
22	Y	Y	Y	Y	Y		
23	Y	N	N		Y		#2 jumped around a lot, sometimes hard to follow, need more in depth look at design criteria; #3 need a bigger screen and microphone
24	Y	Y		Y	Y	more presentation on specific methods, regime equations and analytic equations	#2 some sessions were lengthy; handouts to accompany presentation

25	Y	Y	Y	Y	Y	more bioengineering techniques	more case studies
	#1 a)	**#1 b)**	**#2**	**#3**	**#4**	**#5 Changes**	**#6 Other Comments**
26	Y	Y	Y	Y	Y	handouts for slides that were presented	#2 more geomorphology hours would be better
27	Y	Y	Y	Y	Y	a group exercise would be useful	
28	N	Y	Y	Y		more discussion on the actual structures used to stabilize the streams and why they should be used	#1 I work on remote streams with cobble substrate, the course focused urban streams dominated by sand substrate
29	N		Y	Y	Y		#1 not all applicable to issues we were looking for, too much wildlife, fish, etc. info.; #4 hard to hear instructor at field sites
30	Y	Y	Y	Y	Y	as an ecologist, the intro. talks on riparian ecological/wildlife values were not helpful; more examples of stream modification projects	#2 difficult to follow spreadsheets, too small, and information presented quickly; #3 screen was small, difficult to see slides
31	Y	Y	Y	Y	Y	add an urban focused presentation; future short course heavily geared toward urban issues	great job organizing
32	Y	Y	Y	Y	Y	hand out an agenda listing speakers at the beginning of seminar	excellent speakers
33	Y	Y	Y	Y	Y	more handout materials of items covered in class; an agenda	#2 amount of material made it difficult to cover any one subject in great detail
34	Y	Y	Y	Y	Y	possibly make the class 2 weeks so more information can be given	show how to make some of the calculations, such as the resistence coefficient
35	Y	Y	Y	Y	Y	need more field time; utilize this time to gather data and let us work it out	week long course 2 days in field, gather data, work it up, discuss results; would like an intermediate much more focused course
36	Y	Y	Y	Y	Y	allow opportunity for young people to actually operate equipment to gain appreciation for the limitations and needs of the contractor	better visual aids for field visit locations
37	Y	Y	Y	Y	Y		#1 some material applicable, made me more aware of factors considered in stream restoration other than physical stream parameters; #2 such a broad spectrum covered it was difficult to absorb it all
38	Y		Y	Y	Y		#1 I don't currently work in this field

39	Y	Y	Y	Y	Y		#2 hard to digest at a rapid pace; #4 disappointed we did not see some typical farmland with stream problems; presenters did not seem to have been briefed on who the audience was
	#1 a)	**#1 b)**	**#2**	**#3**	**#4**	**#5 Changes**	**#6 Other Comments**
40	Y	Y	Y	Y	Y		
41	Y	N	Y	N	Y	2 week course with 2-3 days in the field	#3 more planning and preparation needed, agenda, name tags, handouts, etc.
42	Y	Y	Y	Y	Y	need agenda and sign-in table	
43	Y	Y	Y	Y	Y	first day-too much lead up to the material, just start talking about material	#2 at times it was information overload; #3 a larger screen
N	**2**	**5**	**3**	**2**	**2**		
Y	**41**	**38**	**40**	**41**	**41**		

Natural Stream Restoration

Short Course in Fluvial Geomorphology

FEBRUARY 5 – 8, 2002
NORMAN, OKLAHOMA

WORKSHOP SUMMARY

The Short Course in Fluvial Geomorphology, hosted by the U.S. Army Corps of Engineers, U.S. Environmental Protection Agency Region 6, and Okalahoma Conservation Commission, provided an opportunity for technology transfer among city engineers and planners, construction companies, consultants, and natural resource agency personnel. The workshop included presentations and information regarding the basic principles of fluvial geomorphology, stream problems, and possible restoration approaches with site visits to visualize these concepts.

The workshop, February 5 – 8, 2002, was held at the Super 8 Motel in Norman, Oklahoma. A research civil engineer, Dr. Craig Fischenich, from the U.S. Army Corps of Engineers Waterways Experiment Station led the workshop. Dr. Fischenich is an expert in applying fluvial geomorphology principles and engineering solutions to streambank and stream channel problems inherent in urban areas.

Streams in urban areas are under continual pressure to respond to changes in their watershed, either due to increased runoff volumes, increased velocities from upstream channelization, changes in the peak and duration of storm flows, concomitant changes in stream bank slope or stability, and changes in the sediment load or carrying capacity of the stream. These perturbations have lasting negative impacts on water quality, aquatic habitat, adjacent properties and improvements, and on existing or planned infrastructure. The workshop focused on the incentives and benefits of non-traditional and environmentally compatible stream engineering solutions, and application of this knowledge in specific situations. Guidance and training were provided on fluvial morphology (the study of river channel formation), streambank failure, streambank restoration and stabilization, hydraulics, water quality, aquatic habitat, and design and implementation of projects that incorporate fluvial morphological principles.

The conference was well attended with over 50 professionals representing natural resource agencies, consultants, construction companies, cities and tribes. The workshop review showed that 95% of the participants felt that the material presented was applicable to stream issues in their area of work. In addition, nearly 90% of participants felt that they were more prepared to deal with these stream issues in their areas after completing the workshop. Also, nearly all participants felt that the field trip portion of the workshop

was useful for visualizing the concepts of stream channel design and stabilization. The most promising aspect of the review showed that this workshop left the participants wanting more information. As more people become trained and familiar with these "new" stream design and stabilization techniques, the better the work that will be put on the ground for the enhancement and protection of streams, riparian areas and wetlands.

Appendix A: Regulation and Policy

U.S. Army Corps of Engineers

Department of the Army
Regulatory Permits

Regulation and Policy

U.S. Army Corps of Engineers

Tulsa District Geographic Area

- Oklahoma (All 77 counties),
- Texas (47 counties) - Panhandle and Red River watershed in northern Texas,
- Kansas (58 counties) - Civil Works (Corps) projects in southern ⅓ of state

U.S. Army Corps of Engineers, Tulsa District 2

Tulsa District Geographic Area

- In Oklahoma alone:
  - More than 12,000 miles of major streams and rivers ("major" > 20 miles), and countless miles of small streams and creeks
  - More than 4000 miles of shoreline on major lakes, and countless small impoundments on streams

U.S. Army Corps of Engineers, Tulsa District 3

Relevant Statutes

- RIVERS AND HARBORS ACT OF 1899
- CLEAN WATER ACT
  (Federal Water Pollution Control Act of 1972)
  AND AMENDMENTS

U.S. Army Corps of Engineers, Tulsa District 4

Section 10 of RHA of 1899

- Requires prior authorization from the Corps of Engineers for any work or structures which could affect the *location, course, condition, or capacity* of Navigable waters
- Navigable waters is a subset of "waters of the United States

U.S. Army Corps of Engineers, Tulsa District 5

Section 10 Navigable Waters

- Tulsa District navigable waters include:
  - McClellan-Kerr Arkansas River Navigation System and backwaters
  - Portions of South Canadian River and Lake Eufaula
  - Lake Texoma and portions of the Red River
  - Portion of Illinois River

U.S. Army Corps of Engineers, Tulsa District 6

Section 404 of CWA

- Requires prior authorization from the Corps of Engineers for the discharge (placement) of dredged or fill material into "waters of the United States"
- Waters of the United States includes coastal and navigable waters, rivers, lakes, streams, intermittent and ephemeral streams, natural ponds, and "adjacent" wetlands
- Streams are blue line or dashed blue line on 7.5' Quad

U.S. Army Corps of Engineers, Tulsa District 7

Regulatory Permits

- Levels of authorization based on magnitude of impact -
  - Nationwide permits for projects with *minimal environmental impact*
  - General permits for categories of *minor impact activities*
  - Individual permits - require a more intensive public interest review and impact evaluation

U.S. Army Corps of Engineers, Tulsa District 8

Activities Requiring 404 Authorization

- Road and Bridge construction
- Erosion protection - bank stabilization
- Stream modification for development
- Fill placement in wetland for development
- Buried utility line placement
- Mechanized landclearing in wetlands
- Temporary activities such as access roads, stream crossings, etc.

U.S. Army Corps of Engineers, Tulsa District 9

Individual Permits

- Require:
  - Public Notice for comment and opportunity for Public Hearing
  - Public Interest Review
  - Federal and State agency coordination
  - Section 404(B)(1) Guidelines Evaluation
  - Case-specific water quality certification from state regarding compliance with Water Quality Standards
  - Substantial mitigation likely necessary

U.S. Army Corps of Engineers, Tulsa District 10

Factors Considered in Evaluation

Water Quality	General Environmental Values
Conservation	Cultural Resources
Economics	Flood Plain Values
Fish and Wildlife	Erosion and Accretion
Navigation	Water Supply
Mineral Needs	Property Ownership
Recreation	Food and Fiber Production
Aesthetics	Energy Needs
Land Use	Cumulative Impacts

General Needs and Welfare of the People

U.S. Army Corps of Engineers, Tulsa District 11

Nationwide Permits

- Categories of activities which generally have minimal environmental impact (43 types of NWPs)
- Examples include activities such as:

utility line placement	survey activities
road / stream crossing construction	navigation aids
small bank stabilization	farm buildings
maintenance of existing facilities	moist soil mgmt
stream and wetland restoration	small hydropower
temporary construction access	outfall structures

- Some require Pre-Construction Notification (PCN)

U.S. Army Corps of Engineers, Tulsa District 12

Nationwide Permits

- 85% of all Nationwide Permit confirmations are either (listed in order from most frequent):
  - NWP 12 - Utility Line Activities
  - NWP 14 - Linear Transportation Crossings
    - ~95% are ODOT or County projects
  - NWP 3 - Maintenance
  - NWP 13 – Small Bank Stabilization

U.S. Army Corps of Engineers, Tulsa District 13

Advantages NWP vs. Individual Permit

- Notification to the Corps often not required
- Corps review involves less scrutiny
- Quicker administrative conclusion from Corps – less than 30 days
- No Public Notice to "interested parties"
- Rarely requires coordination with Federal or State agencies
- Reduced impacts to the Aquatic Environment
- Less likely to require complex mitigation

U.S. Army Corps of Engineers, Tulsa District 14

Mitigation of Impacts

- Mitigation is the avoidance, minimization, or compensation of impacts to the aquatic ecosystem
- Sequential priority:
  - Avoid First
  - Minimize Second
  - Compensate for remaining impacts

U.S. Army Corps of Engineers, Tulsa District 15

Avoidance and Minimization of Impacts

- Avoidance - Selection of alternative sites or methods to eliminate impacts to the aquatic environment
- Minimization – Reduction of project size and scope or reconfiguring project "footprint" to reduce magnitude of expected impacts

U.S. Army Corps of Engineers, Tulsa District 16

Compensatory Mitigation

- Compensation in the form of restoration, enhancement, creation, or preservation of aquatic habitats, wetlands, and associated upland buffers
- On-Site vs. Off-site (proximity to impact)
- In-Kind vs. Out-of-Kind
- Temporal losses – time for compensatory site to mature
- Risk of Failure or Underachievement

U.S. Army Corps of Engineers, Tulsa District 17

NWP 27 Stream and Wetland Restoration

- Restoration or enhancement of:
  - Degraded lakes and ponds
  - Degraded waterways
  - Degraded Wetlands
  - Riparian areas
- Creation of wetland or riparian areas where none previously existed

U.S. Army Corps of Engineers, Tulsa District 18

Wetlands and Riparian Areas

- Wetlands are lands that are transitional between terrestrial and aquatic environments, not always inundated or saturated, but frequently and long enough to exclude vegetation intolerant of saturation in the root zone
- Riparian areas are the habitat bands in the flood plain on each side of a stream

U.S. Army Corps of Engineers, Tulsa District 19

Importance of Wetland and Riparian Areas

- Enhancement of water quality by:
  - Trapping of sediments and contaminants
  - Utilization of nutrients
  - Removal of contaminants by absorption in plant tissue
- Reduction of peak flood heights
- Sustains base flow – reduces flashiness of flows
- Fish and wildlife habitat

U.S. Army Corps of Engineers, Tulsa District 20

Possible NWP 27 Activities

- Removal of accumulated sediment
- Small water control structures
- Current deflectors
- Riffle and Pool stream structure
- Modification of bed/banks to restore stream meanders
- Back-filling of channels and ditches
- In-stream habitat structures
- Construction of nesting islands or open water

U.S. Army Corps of Engineers, Tulsa District 21

NWP 39 Residential, Commercial, and Institutional Developments

- Building foundations / attendant features
- Avoidance and minimization required
- No stream channelization or relocation
- Impacts less than 1/2 acre and less than 300 feet of intermittent or perennial streambed impacts
- PCN if impacts greater than 1/10 acre or for loss to open water, perennial or intermittent streams
- Vegetated buffers for open water and streams

U.S. Army Corps of Engineers, Tulsa District 22

Section 404 Permit - Enforcement and Compliance

- Activities commenced without authorization are violations
  - EPA has primacy for enforcement
  - Potential fine up to $25,000 per day
- Activities not in accordance with permit conditions are non-compliance
  - USACE has primacy for enforcement
  - Potential fine up to $10,000 per day

U.S. Army Corps of Engineers, Tulsa District 23

Additional Information:

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U.S. Army Corps of Engineers, Tulsa District 24