Stream Restoration Inventory, Phase 1 Final Report

Prepared for Chicago Wilderness by the Northeastern Illinois Planning Commission

October 2002

This project was a joint effort of the Northeastern Illinois Planning Commission, The United States Fish and Wildlife Service's Chicago Illinois Field Office, Openlands Project, the Illinois Department of Natural Resources, the Chicago Wilderness Streams Implementation Task Force, and the Chicago Wilderness Science and Land Management Teams Coordinator.

It was funded through a grant program supported by the USDA Forest Service Northeastern Area, State and Private Forestry, and The US Fish & Wildlife Service, in Support of Chicago Wilderness. USFS and USFWS grants of federal monies are administered by the Illinois Conservation Foundation. Additional funding for this project was provided by voluntary financial support from local governments and the private sector.

Exhibit E: Abstract Outline

GENERAL INFORMATION

Grant Number: FWS 0103 **Date Report Submitted:** October 22, 2002

Project Title: Stream Restoration Inventory

Project Goal: The goal of this project was create an inventory of stream restoration projects that have been undertaken throughout Chicago Wilderness, including stream bank stabilization, channel remeandering, riparian buffer restoration, in-stream habitat restoration and dam modification/removal.

Funding Amount: $10,000

Institutional Match: $10,030

Principal Investigator:

Name: Laura Barghusen
Email: lbarg@nipc.org
Fax: 312-454-0411
Organization: Northeastern Illinois Planning Commission
Address: 222 S. Riverside Plaza Suite 1800, Chicago, IL 60606

Collaborators:

Name: Jeffrey Mengler
Email: jeffrey_mengler@fws.gov
Fax: 847-381-2285
Organization: U.S. Fish and Wildlife Service
Address: 1250 South Grove, Suite 103 Barrington, IL 60010

Collaborators, Continued:

Name: Cathy Pollack
Email: cathy_pollack@fws.gov
Fax: 847-381-2285
Organization: U.S. Fish and Wildlife Service
Address: 1250 South Grove, Suite 103 Barrington, IL 60010

Collaborators, Continued:

Name: Diane Trgovcich-Zacok
Email: zacok@calumet.purdue.edu
Fax: 219-989-2130
Organization: Chicago Wilderness
Address: 2200 169th Street Hammond, IN 46323

PRODUCT AVAILABILITY

Chicago Wilderness Members can access the products of this project (this final report, including the summary of project results, and the spreadsheet holding survey results) through the Chicago Wilderness Member Website.

Is there a publication available? There is this final report, including the summary of project results, available.

If so, how can they obtain it?: It is available for downloading through the Chicago Wilderness Member Website.

Is there a web site with project information/results? If so, note the web site address: www.chicagowilderness.org/members/teams

Other Products and Availability: The spreadsheet holding survey results, and the project final report has also been distributed on CD to the U.S. Fish and Wildlife Service, Chicago Wilderness Science and Land Management Teams Coordinator, and selected Streams Implementation Task Force members, including Steve Pescitelli of the Illinois Department of Natural Resources, Don Roseboom of the U.S. Geological Survey, and Kent Taylor of Openlands Project.

Introduction and Purpose

With support from Chicago Wilderness Priority Project Funding 2001, the Northeastern Illinois Planning Commission (NIPC), the US Fish and Wildlife Service (USFWS), and the Chicago Wilderness Streams Implementation Task Force have completed phase 1 of a streams restoration inventory project which included doing a mail survey of agencies, consultants and groups that have undertaken streams work to learn what practices have been used, where they have been used, and to collect information on the cost and success of the projects. We received information on over 100 restoration projects through this survey. Project types included bank stabilization, riparian buffer restoration, instream and streambed habitat restoration, channel remeandering, and dam modification/removal. The products of phase 1 include a summary of survey results and a spreadsheet containing project information such as type of project and comments/lessons learned about factors that contributed to the success or failure of the project. These products are available on-line through the Chicago Wilderness Members Website. Information about what agency or consultant did each project will not be available on-line in order to protect the identity of survey participants. However, key groups, including the Chicago Wilderness Science and Land Management Team, the Northeastern Illinois Planning Commission, the U.S. Fish and Wildlife Service, and selected members of the Streams Implementation Task Force have been sent a CD holding a spreadsheet of all information collected through the survey.

Methods

Development of the Survey Form

The survey form used to collect information for this project was developed by the Chicago Wilderness Streams Implementation Task Force during the winter of 2002, with input from consultants who do stream restoration work. Members of the Task Force suggested questions to be included on the survey form, and reviewed drafts as the form was developed. Once the Streams Implementation Task Force Members were satisfied with the survey, it was sent to several consultants for comment. As a result of the consultant review, the form was shortened somewhat and reviewed again by the Task Force. The final survey form appears in Figure 1 below:

FIGURE 1

Chicago Wilderness Streams Implementation Task Force
Stream Restoration Inventory Data Reporting Form
Please complete all sections that apply

GENERAL PROJECT INFORMATION		
Project Title:		
Stream/River Name:		
Your Name and Contact Information For Your Firm or Agency	Your Name: Phone: Email: Name and address of your firm or agency:	
Types of Restoration Activities (check all that apply)	❑ bank stabilization **(see section A)** ❑ riparian buffer restoration/management **(see section B)** ❑ instream/streambed habitat restoration **(see section C)** ❑ channel remeandering **(see section D)** ❑ dam modification/removal **(see section E)** ❑ other, please describe_____	
Lead Agency and Landowner:		
Collaborating Agencies:		
Project Location:	If possible, please mark location on a USGS quad sheet (or xerox of one) and attach	And/or provide the following information: State: Township: Range: Section: Quarter Section (s): River Mile:
Total Cost / Funding Sources:		
Project Duration:	Date Started:	Date Completed:
Linear Distance of Project (feet or miles)		
Design /Engineering:	❑ In-house ❑ Contractual: Name of company_____	
Installation:	❑ In-house ❑ Contractual: Name of company_____	
US Army Corps of Engineers Permit #		

Section A: Bank Stabilization Methods Used ***Check all that apply***	
❑ Rip rap – toe protection only ❑ Rip rap – full bank ❑ A-Jacks ❑ Lunker structures ❑ Fiber rolls ❑ Bank regrading (e.g., terracing)	❑ Vegetated geo-grid ❑ Brush layering ❑ Willow posting ❑ Other vegetative stabilization (describe) _____ ❑ Other: _____ ❑ Erosion blanket/filter fabric used in conjunction with other practices

Section B: Riparian Buffer Restoration	
Pre-restoration Vegetative Condition--Community Type: ❑ Wetland ❑ Woodland/Savanna ❑ Prairie ❑ Unassociated grassy ❑ Unassociated woody ❑ Other_____	**Pre-restoration Vegetative Condition—Invasive Species:** ❑ Buckthorn ❑ Box Elder ❑ Reed Canary Grass ❑ Purple Loosestrife ❑ Other_____
Pre-restoration plant diversity: # of pre-restoration native species present_____(ball park figure and attach plant lists if available)	
Vegetation Removal: ❑ Herbiciding (specify):_____ ❑ Brush removal ❑ Soil removal/scraping ❑ Other:_____	
Community Type(s) Being Restored: ❑ Wetland ❑ Woodland/savanna ❑ Prairie ❑ Other:_____	
Post-restoration plant diversity: # of species installed_____(attach list of installed species if possible)	
Average buffer width (feet):_____	

Section C: Instream Restoration

Method Used:

- ❑ Artificial riffles/Riffle enhancement
- ❑ Bendway weirs
- ❑ Wing deflectors
- ❑ Stream barbs
- ❑ Emergent vegetation planting
- ❑ Boulder clusters
- ❑ Pool excavation
- ❑ Other(s):_____

Section D: Channel Remeandering

Description:

Channelized length (before restoration): _____

Meandered length (after restoration completed): _____

Design Basis:

What was the basis of the design?

- ❑ Reproduced original meander pattern (e.g., using historic aerial photography)
- ❑ Regional equations (e.g., to determine channel dimensions, meander frequency)
- ❑ Nearby reference reaches
- ❑ Other _____

Section E: Dam Removal/Modification
Dam height (before modification/removal) _____ Dam width (before modification/removal) _____
Modification/removal technique ❑ Breaching ❑ Partial removal (e.g., lowering of dam height) ❑ Bypass channel ❑ Full removal ❑ Other or innovative practice used? Please describe:_____ _____
Sediment Management Technique ❑ Left sediment in place ❑ Hydraulic dredging ❑ Excavation ❑ Revegetation ❑ Other:_____

MONITORING		
Does monitoring occur at this site? ❑ Yes ❑ No (attach available results)	Before start of project? ❑ Vegetation ❑ Fish ❑ Macroinvertebrates ❑ Water quality ❑ Geomorphic ❑ Other:_____	After project completion? ❑ Vegetation ❑ Fish ❑ Macroinvertebrates ❑ Water quality ❑ Geomorphic ❑ Other:_____

ONGOING MANAGEMENT ACTIVITIES		
Ongoing management and maintenance activities at site: (after initial restoration/installation)	**Activity**:	**Frequency:**
	❑ Re-seeding/replanting	
	❑ Remedial erosion control	
	❑ Controlled burning	
	❑ Invasive species removal	
	❑ Mowing	
	❑ Other:_____	

QUALITATIVE INFORMATION	
Did project meet intended goals? ❑ Yes ❑ No ❑ Partially	Comments:
Did project budget: ❑ Stay within projected costs (+/- 10%) ❑ Exceed costs by 10-25% ❑ Exceed costs by more than 25% ❑ Under costs by 10-25% ❑ Under costs by more that 25%	
Did project failures occur necessitating substantial replanting or re-construction? ❑ Yes ❑ No	Comments:
Comments or lessons learned from this project that you would like to share with others?	

PLEASE REMEMBER TO SUBMIT THE FOLLOWING INFORMATION WITH THIS FORM IF AVAILABLE

- ❑ USGS quad sheet (or photocopy of one) with project extent marked
- ❑ Pre-restoration plant list
- ❑ List of installed plant species
- ❑ Monitoring results
- ❑ Report documenting the project

THANK YOU!

Please mail this form and any supporting information to: Laura Barghusen, Northeastern Illinois Planning Commission, 222 S. Riverside Plaza, Suite 1800, Chicago, IL 60606

Development of the Mailing List
A mailing list of consultants, agencies, and groups that have done stream restoration work in the region was developed using the following sources:

- An Illinois Environmental Protection Agency report of 319 projects funded between 1990 and 2000 (including both completed and ongoing projects) was used to identify groups and firms having done streams work. Citation: Illinois Environmental Protection Agency, Bureau of Water. *State of Illinois Section 319—Biannual Report*, March 2001.

- The USFWS Chicago Field Office provided contact information for individuals, agencies and firms who applied to them for a letter stating that their stream or river restoration work would not be harmful to endangered and threatened species. This is letter is necessary in order to obtain an Army Corps of Engineers permit for stream work.

- County Natural Resources and Conservation Service (NRCS) offices provided contact information for agencies, firms and individuals who had done stream restoration projects. The following Illinois NRCS offices provided information: North Cook County, South Cook/Will County, Kane/DuPage County, Lake County, and McHenry County.

- Save the Dunes Council and the Northwest Indiana Regional Planning Commission (NIRPC) provided contact information for firms and groups who had done stream restoration work in Lake, Porter and LaPorte counties, Indiana.

- The Lake County Stormwater Management Commission contributed contact information for individuals, agencies and firms who had done stream restoration within Lake County, Illinois.

The Survey Form Mailing and On-line Access to the Survey Form
The survey form and cover letter were sent to the individuals, firms, and agencies identified as having done stream or river restoration work. If information about the name of the project was available at the time the surveys were sent, the project name was written onto the survey form in advance to encourage response. If information about a specific person who worked on the project was available at the time of the mailing, the survey was sent to the attention of that person. The initial survey mailing took place in April, 2002. The text of the cover letter that accompanied this mailing appears as Figure 2 below:

FIGURE 2

April, 2002

Dear Stream Restoration Practitioner,

The Chicago Wilderness Streams Implementation Task Force seeks your cooperation in producing an "Inventory of Stream Restoration Projects" in the Chicago Wilderness region (including Cook, DuPage, Kane, Lake, McHenry, and Will Counties in Illinois, Lake, Porter and LaPorte Counties in Indiana, and Kenosha County in Wisconsin).

The purpose of the project is to catalog and assess the following restoration practices: streambank stabilization, riparian buffer restoration, instream restoration, channel remeandering, and dam modification and removal. This joint effort, among the US Fish and Wildlife Service, The Illinois Department of Natural Resources, The Northeastern Illinois Planning Commission, Openlands Project, and county governments is seeking input from your firm or agency because of your known involvement or expertise in these types of projects.

Your help is needed in providing us with information about stream restoration projects you have undertaken. Please find a survey form enclosed. We are requesting that you fill a form out as completely as possible for each project in which your firm or agency has participated. If your project involved more than one restoration activity on a given site, please document each restoration activity on the same form. Please note that although the survey form covers all project types, you need only fill out the general sections and sections that relate to your particular project. If we are aware of a specific project you have undertaken, we have filled in the name of the project on one of the enclosed survey forms.

The database that results from this project will be useful to anyone considering stream restoration projects. It will provide real-world examples of the different types of practices, lessons that agencies and firms have learned in implementing these practices, their applicability under different conditions, and their costs. The database, which will be made available on-line, will contain an appendix with the name and contact information of those consultants, groups and agencies that submit the enclosed survey form, and work with us on this inventory/assessment project. However, no specific information about what firm or agency completed any particular project will be reported in order to protect the anonymity of survey respondents.

This effort has been initiated based on area-wide consensus that there is a need to begin evaluation of the different practices being applied in the Chicago area. This inventory and subsequent project evaluations will enhance our understanding of the scope and benefits of stream restoration techniques and help improve the effectiveness of future projects. We are currently seeking funding to conduct field evaluations of selected sites

FIGURE 2, Continued

and publish recommendations for practices used in stream restoration in the Chicago Wilderness region.

Your support in this effort is greatly appreciated. If you would need any assistance in supplying information, if you would like to receive additional survey forms, or if you have any questions, please contact me. I will be out of the office between April 29, 2002 and May 20, 2002 so if you have questions during that time please contact Jeff Mengler at US Fish and Wildlife Service 847-381-2253, extension 226 or Cathy Pollack at US Fish and Wildlife Service, extension 239. If you would like to receive additional survey forms during the time I am away please contact Tina Garrett at Northeastern Illinois Planning Commission 312-454-0401, ext. 306.

If you would like to fill out and submit this form on-line, see a sample form that has been filled out, and/or read more about this project, please refer to:

http://www.calumet.purdue.edu/public/biology/wilderness/survey.htm

Thank you again for your input.

Sincerely,

Laura Barghusen
Associate Environmental Planner
312-454-0401, ext. 305
lbarg@nipc.org

An initial electronic mailing including the survey form as an attachment was also done in April, 2002. The Northeastern Illinois Planning Commission's Natural Resources e-mail list was used for this e-mailing.

The Chicago Wilderness Science and Land Management Teams Coordinator posted a version of the survey on-line at the following web address:
http://www.calumet.purdue.edu/public/biology/wilderness/survey.htm
This allowed respondents to fill out and submit information about their stream restoration projects via the internet.

In July, 2002 reminder letters and e-mails were sent to everyone on the initial mailing list who had not responded by that time. At the same time, reminder e-mails were sent to everyone on the e-mail list, thanking them if they had already submitted a survey and reminding them if they had not. In this mailing the deadline for survey form submission was established as August 15, 2002.

Creation of the Database
The Northeastern Illinois Planning Commission and the U.S. Fish and Wildlife Service entered information from the survey forms into a Microsoft Excel spreadsheet as the survey forms were returned. One hundred and twelve survey forms were submitted in time for inclusion in this database.

The Summary Report
Once the information from the survey forms was entered into the spreadsheet, Microsoft Excel was used to make charts summarizing and expressing the information from the surveys, such as how many restoration projects involved bank stabilization techniques, which specific techniques were used, how many projects involved monitoring, and what types of monitoring were most prevalent, etc. The summary report also includes comments that the survey respondents wrote regarding the lessons they learned from their projects. This report appears below under "Summary of Survey Results."

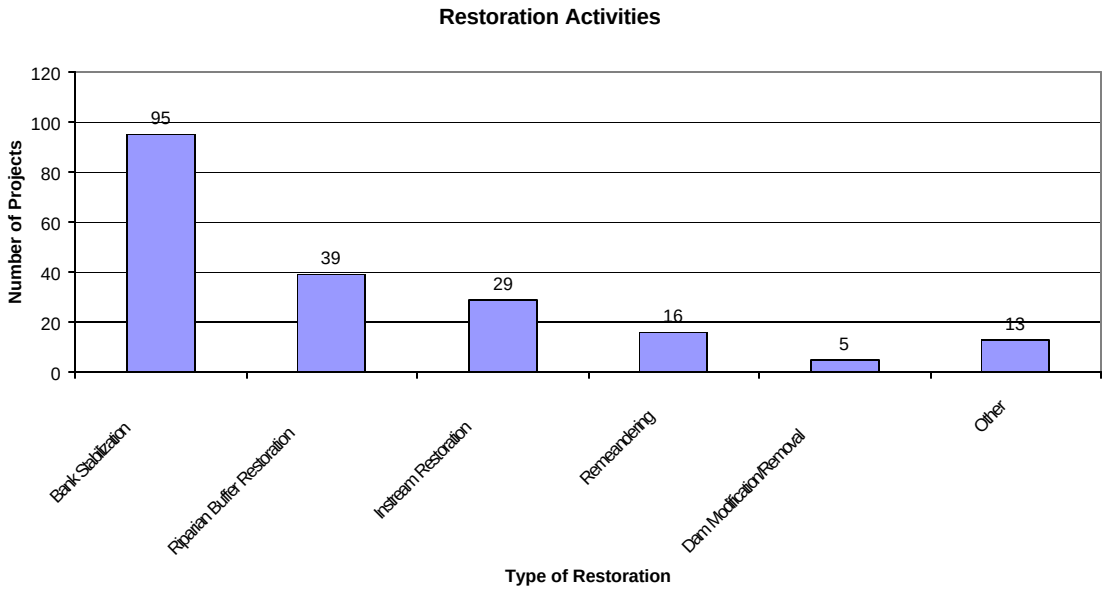
Summary of Survey Results

Restoration Activities

Bank stabilization was the most common restoration activity reported in the survey forms returned, with 95 of the 112 projects involving some form of bank stabilization. Riparian buffer restoration and management was the next most frequent, followed by instream/streambed restoration and then channel remeandering. Dam modification and removal was the least common, with only five projects involving this activity. Four of these dam modification projects are still in progress and one involving repairs to an existing dam and the addition of a new wingwall, was completed in 1998. Thirteen projects reported "other" restoration activities and these fall into the following categories:

wetland habitat restoration
infrastructure/stormwater BMPs

remove culverts and repair deer washout, swale banks to allow flooding of marsh
riverwalk amenities
streamside wetland restoration
wetland restoration and overflow channels
wetland/floodplain creation
water control structures
wetland restoration/enhancement
vegetation restoration



Project costs:

Bank stabilization

Costs of projects ranged from approximately $5,000 to over a million dollars. Projects at the very low end of the cost scale tended to involve bank stabilization with rip rap (toe protection only). However, at the other end of the scale, a bank stabilization project involving the use of lunkers, a-jacks, fiber rolls, native plantings, and erosion control blankets over the entire length of a stream reach was reported at over a million dollars.

Riparian buffer restoration and management

There was only one project that was reported as involving only riparian buffer restoration. Costs for this project were not reported. Projects using riparian buffer restoration and management in conjunction with other restoration activities ranged in cost from $5,000 to well over a million. At the low end was a project that involved bank stabilization including rip-rap --toe projection only, bank regrading, and an erosion control blanket, as well as restoring an unassociated wooded community to a community with 150+ prairie and savanna species.

Instream/streambed habitat restoration

There was only one project that involved only instream /streambed habitat restoration, and the costs for this project were reported as unknown. Costs for projects using instream/streambed habitat restoration in conjunction with other restoration activities ranged from a low of $9,000 to a high of over a million. The $9,000 project was described as "seat of pants" in terms of design and as covering a very small area. It involved a combination of stabilization, exotic species removal in the riparian buffer, instream restoration in the form of emergent vegetation planting and riffle enhancement, and remeandering. At the other end of the cost scale, a project covering half a mile of stream bank and involving installation of stormwater best management practices, bank stabilization, riparian buffer restoration, and instream /streambed restoration, and including geomorphic and fish monitoring, cost over a million dollars.

Remeandering

There were no projects that involved only remeandering. Costs for projects using remeandering in conjunction with other restoration activities ranged from a low of $9,000 (this project is described under instream/streambed habitat restoration above) and a high of a million dollars. This million dollar project included bank stabilization, riparian buffer restoration, instream/streambed habitat restoration and remeandering. The stabilization involved bank regrading, revegetation and erosion control blankets. The riparian buffer restoration involved restoring an unassociated grassy and woody community to savanna, prairie, sedge meadow and possibly fen, with a 100 foot buffer. Artificial riffles/riffle enhancement was used for the instream restoration and the remeandering design was based on reproducing original meander patterns, regional equations and nearby reference reaches. This project involved maintenance activities including reseeding/replanting, remedial erosion control, controlled burning and invasive species removal.

Dam modification/removal

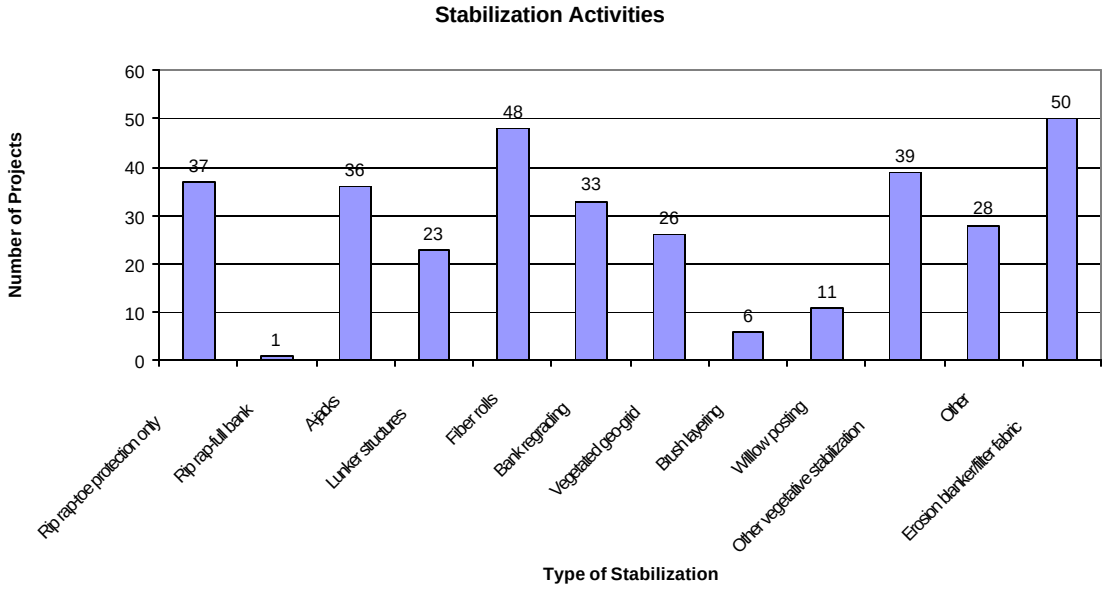
Costs were reported for only two projects involving dam modification and removal. Of these, one included repairing an existing dam and adding a new wing wall. Costs for this project were reported as $77,000. The other involved gradually lowering the height of a dam until the dam was removed and the costs for this were projected to be about $890,000.

Bank stabilization:

The three most commonly reported stabilization techniques were use of erosion blankets/filter fabric in conjunction with other stabilization practices, use of fiber rolls, and use of "other vegetative stabilization." These "other vegetative stabilization" projects were described as follows:

native trees and shrubs
native plants and plugs

emergent plugs on toe
interplanted boulder toe
live stakes, plugs
native plantings, hydric grasses
native plants
plant plugs
planting *spartina pectinata* and *elymus virginicus* (long rooted native grasses)
Red Osier Dogwood planted on slopes
sedge meadow/wet prairie installed
seeding
seeding and planting
small willows with rootballs, red osier dogwood
vegetated conlock blocks, vegetated gabion baskets, log and rootball revetment, joint plantings
vegetative stabilization
prairie cord grass, bulrush, red osier dogwood along upper and lower banks
planting
native plantings
deep rooted grasses
some just said yes and did not elaborate



The 28 “other” stabilization (i.e. not necessarily vegetative) were described:

dogwood stakes
shade trees removed from corridor
articulated concrete blocks
cement blocks with stakes
channel overflow into and out of forebay wetland
fiberdam

Lannon stone stabilization with integrated plantings
native slope vegetation
prayer/singing
revegetation
rootwads with boulder footings
seeding
soil lifts
turf reinforcement mat
vegetated gabion
gabions, stone contained
low block retaining wall
coco beds
open weave geo-textile
wingwall, soil lifts
gabion, slope mattress
coco logs
excavation of channel
retrofit existing detention basin into wetland
gabions and remove channel blockages
revegetation

Many of these could be combined into other vegetative stabilization.

Comments made about stabilization:

Since stabilization and buffer restoration often made up components of the same project it was not always easy to tell what comments went with what restoration type, so these may also apply to buffer restoration.

Five forms held comments relating to sunlight (or lack thereof) and/or soil moisture being important to whether or not plantings were successful. One stabilization project involving a brush layer and willow posting was declared a failure: "The project failed due to a desire to keep all the trees. Without clearing of trees there was no way to control the erosion on the bank, because of shade." Another project focused on removing shade trees and installing sedge meadow and wet prairie in order to stabilize the bank. Another reported that "sunny south aspect of this north slope provided excellent growing conditions." Yet another stated that "the timing of vegetative installation may have caused partial failure of plantings."

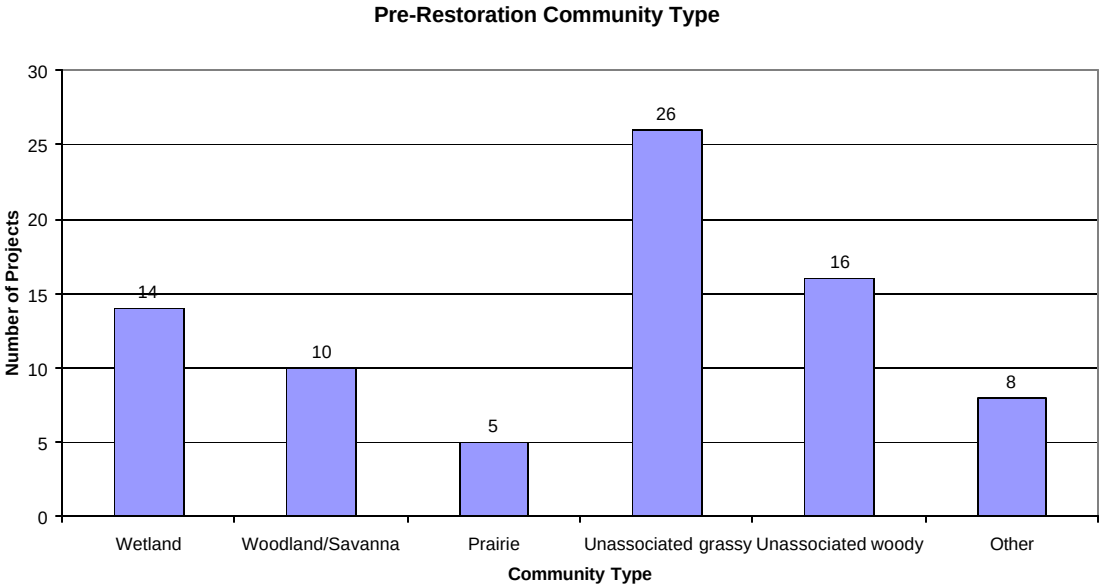
Four projects noted that active maintenance is necessary for successful bank stabilization. One involving A-jacks, lunkers, fiber rolls, regrading and erosion control blanket reported "very active post-construction management and monitoring are required." Two of those reporting a need for maintenance referred to vandalism as a barrier to success and cited the need for on going maintenance to counteract the actions of vandals: "When using lunkers covered with rip rap and/or stone toe protection, be aware in areas that are accessible to children, much of the rock will be thrown into the creek." and "in high use

areas rock was removed by vandals, exposing toe soils to scouring. The following suggestion was made on one form
"Maybe have a schedule of future management with persons responsible agreed upon before project is initiated."

Riparian Buffer Restoration:

Of those projects that involved riparian buffer restoration (39 of the 112 projects), the most common pre-restoration community type was unassociated grassy, with unassociated woody being the second most commonly cited. The eight "other" pre restoration community types were described as:

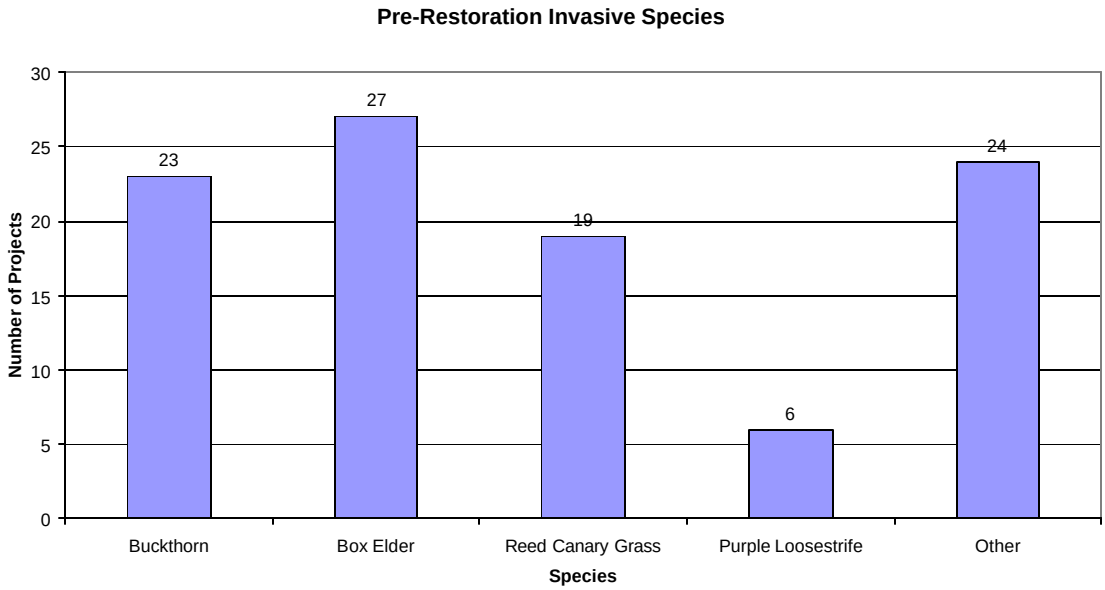
agricultural
degraded farmed wetland
fen
river floodplain and slope
row crop
mowed turf
concrete
wet meadow



In terms of pre-restoration invasive species, box elder was the most common (27 projects), with "other" a close second (24 projects), and purple loosestrife the least often reported (6 projects). The "others" were comprised of:

elm
garlic mustard

garlic mustard, green ash, yellow iris, thistle, dame's rocket, forget-me-nots, *florabunda* honeysuckle
osage orange
Kentucky blue grass
willow
agricultural
Bush Honeysuckles, multiflora rose
coral berry, garlic mustard
elm, hybrid and Siberian
garlic mustard
lawn grasses
narrow leaved cattail, horsetail, garlic mustard
narrow-leafed cattail, multi-flora rose, honeysuckle, garlic mustard
pasture (cited in four projects)
Phragmites australis
Agropyren repens, Dipsacus sylvestvis, Iris pseudacorus



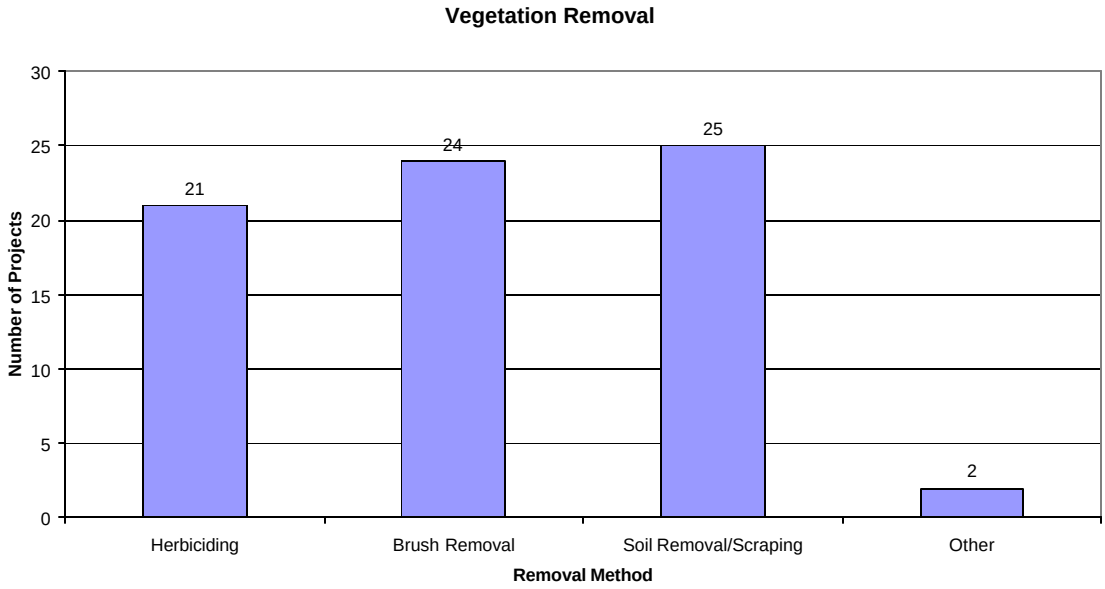
The methods of vegetation removal that were most commonly reported were soil removal/scraping (25 projects) followed by brush removal (24 projects) and herbiciding (21 projects). Only two projects included other methods. These were:

hand pulling
pulling herbaceous plants

types of herbicides used were:

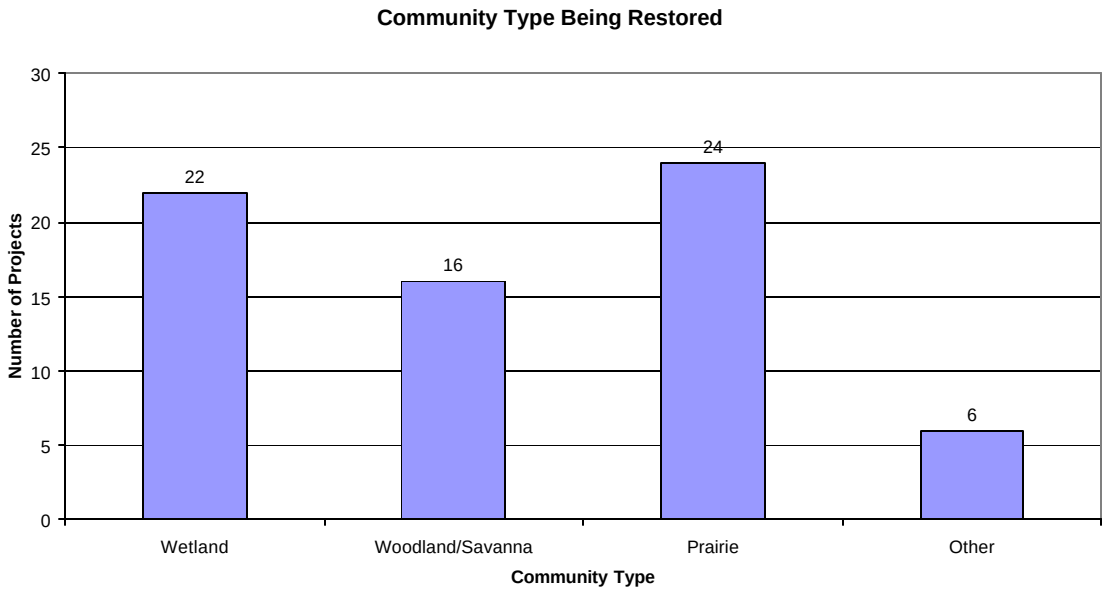
RoundUp 1% 1x (glyphosate); not performed on bank growing *Phalaris arundinaceae*
yes; Garlon 4, Rodeo, Round-up
Rodeo

yes; Rodeo, ltd.garlon
yes; Round-up used on *Phalaris arundinacea*
garlon 4
Many projects reporting use of herbicide did not specify the kind used.



Of the community types being restored, the most common was prairie, with wetland being next, followed by woodland/savanna and "other." The "others" included:

gardens at top of bank with woodland/savanna species
floodplain forest/scrub-shrub
sedge meadow
sedge meadow, possibly fen
upland and riparian accent plantings
riparian/urban



Width of riparian buffers:

Widths reported for restored buffers ranged from a low of 12 feet to a high of 2000 feet. 36 survey forms reported a riparian buffer width.

Comments made about riparian buffer restoration: see also stabilization comments, some of which refer to buffer restoration.

Two projects in addition to those discussed under stabilization cited difficulties with planting success. It was noted on one form that cord grass planting alone was not sufficient to impede subsequent weed takeover:

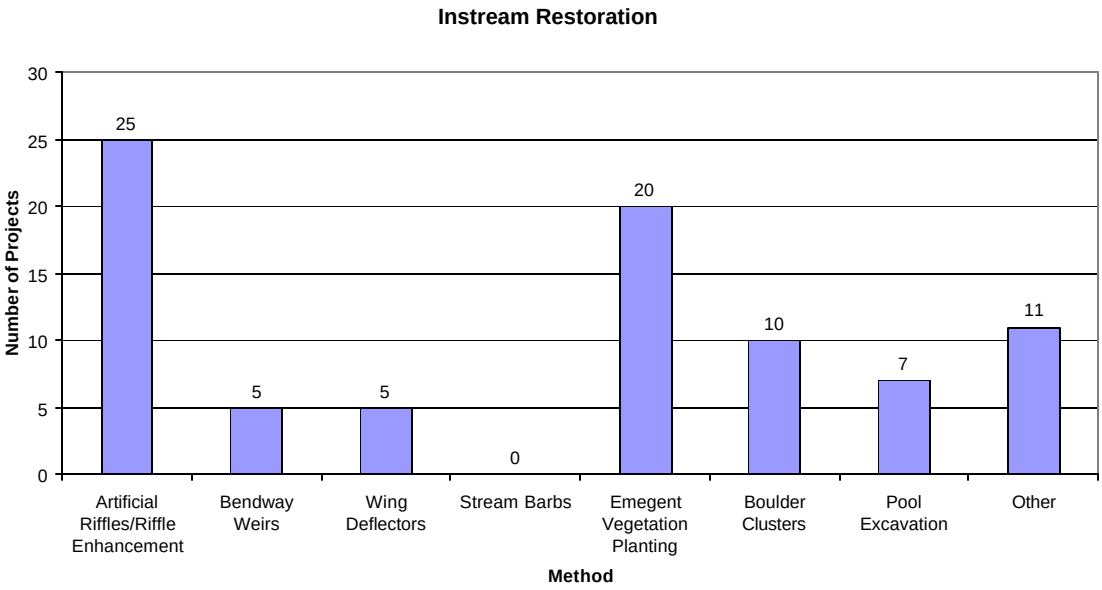
"Bioengineering did work in holding certain banks. The cord grass planting alone has not worked as well as is needed. The seed sown in the riparian buffer did not germinate sufficiently to impede subsequent weed take over. Riparian buffer (floodplain and upland) is being reseeded and replanted."

On another, difficulties with wetland plantings was cited "wetland plantings have been much less successful [than nature trail plantings]; experiments ongoing."

Instream/streambed restoration:

The most commonly reported activity was the creation of artificial riffles/riffle enhancement (25 projects). This was followed by emergent vegetation planting (20 projects). The other techniques were reported less often, with "other" being the third most commonly reported. The "others" were made up of:

Boulders will be used in a V formation for grade control and will also provide a slight riffle
cleared of excess debris
rock vanes
5 rock deflectors
carp mesh, wave attenuation
channel overflows into forebay and wetland and back into river
fill existing channel to previous level with rock
gravel bars, rootball deflectors
islands
islands
removal of trash, removal of beaver dams, installation of bank cover structures



Comments about instream/streambed habitat restoration:

One project reported difficulty due to shade as did several of the bank stabilization projects:
"Artificial riffles used. Some reconstruction necessary because willow cuttings had high mortality probably due to shade."

Another project reported that, although the project is still in early stages some plantings appear to have become established and fish have been observed in pools. This form contained the suggestion that one contractor be responsible for project success and keeping the project on budget.

Vandalism was also reported as a problem in instream/streambed restoration. One form read "child mischief caused some reconstruction [of bendway weirs] to be necessary."

Channel remeandering:

Sixteen projects involved channel remeandering and the majority (11) of these reported that the meander design basis was reproduction of the original meander pattern (e.g. using historical aerial photography), with five reporting use of regional equations, seven reporting use of nearby reference reaches and six including "other" methods. These "others" consisted of:

instream cover, increase hydraulic diversity in this channelized stream

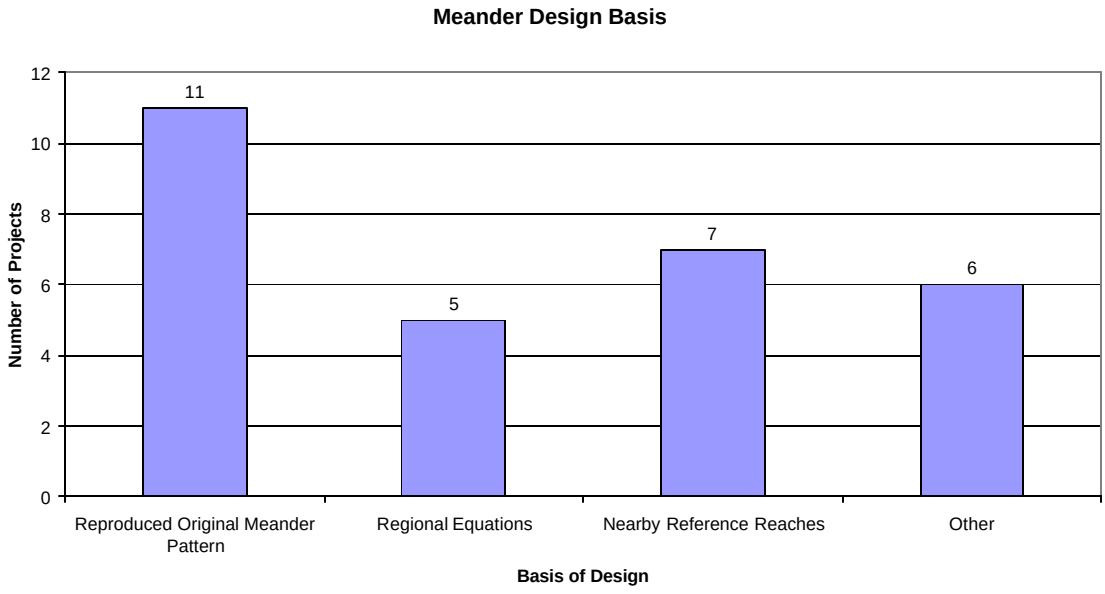
This is such a small project, it was designed as "seat of pants"

This stream has been severely downcut by upstream runoff. We are attempting to stabilize the current stream and its banks by adding rocks to the base and modifying the pulses of water flowing from the new subdivision with a water control structure at the head of the stream.

topo soils, historic aerials for stream geometry

create a low-flow, narrowed meandering channel in section of highly straightened reach, considered experimental

historic meanders visible



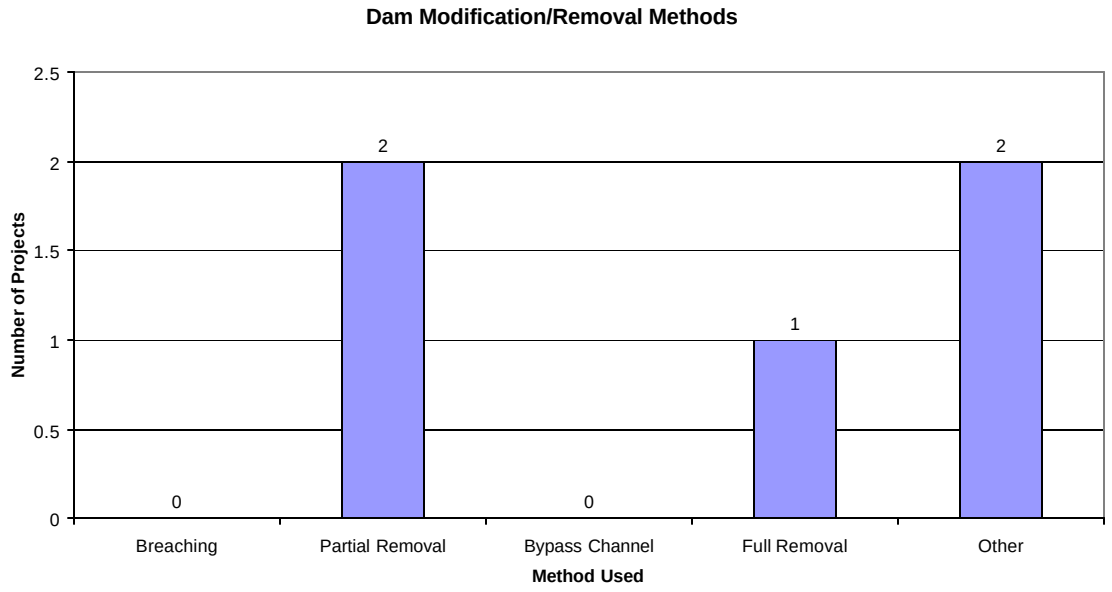
Comments about remeandering:

Two projects reported that failures occurred because "channel was not meandered enough" and that because "more meanders were needed, toe protection needed to stabilize cutting." Other comments/lessons learned included that "the steeper the fall, the more one must design the stream to accommodate it." One project reported use of soils, 1 foot topos and old aerials to identify pre-settlement channel vicinity. Another project form indicated that the project would not have been necessary if it weren't for the fact that a subdivision near the headwaters of the creek did not have proper stormwater management in place and so run off from the subdivision caused problems.

Dam Modification/Removal

Five projects reported dam modification/removal. Of these, four are still in progress. Two reported partial removal of the dam as a method used, one reported full removal and 2 reported using other techniques, listed as:

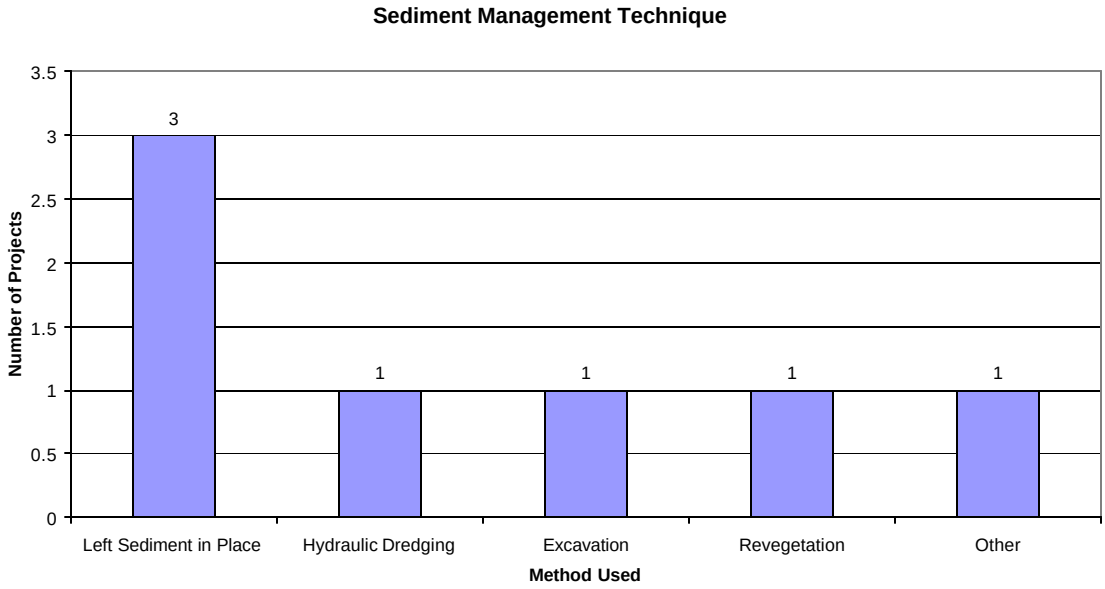
gradual lowering of dam height, incrementally, until completely removed
hinged crest gate installation



Sediment management technique:

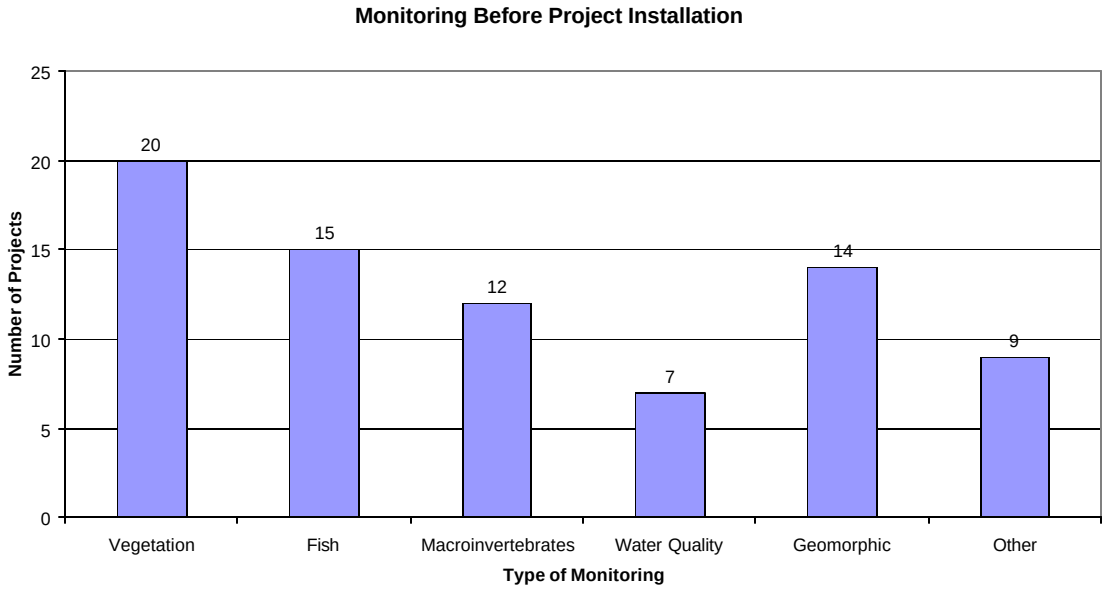
Three dam modification/removal projects involved leaving sediment in place, one reported using hydraulic dredging as well as leaving sediment in place and revegetation. This same project also reported "other" sediment management techniques, specified as "used existing dam as control structure while the new dam was constructed downstream." Although the sediment management section of the survey form was intended to be used only for projects that included dam modification/removal, several survey forms included

information about sediment management techniques for other project types as well. For example, six projects that did not involve dam modification or removal reported using revegetation as a sediment management technique, another reported leaving sediment in place, and another reported leaving sediment in place and revegetation. Only information for those projects that *did* include dam removal or modification appear on the graph below.



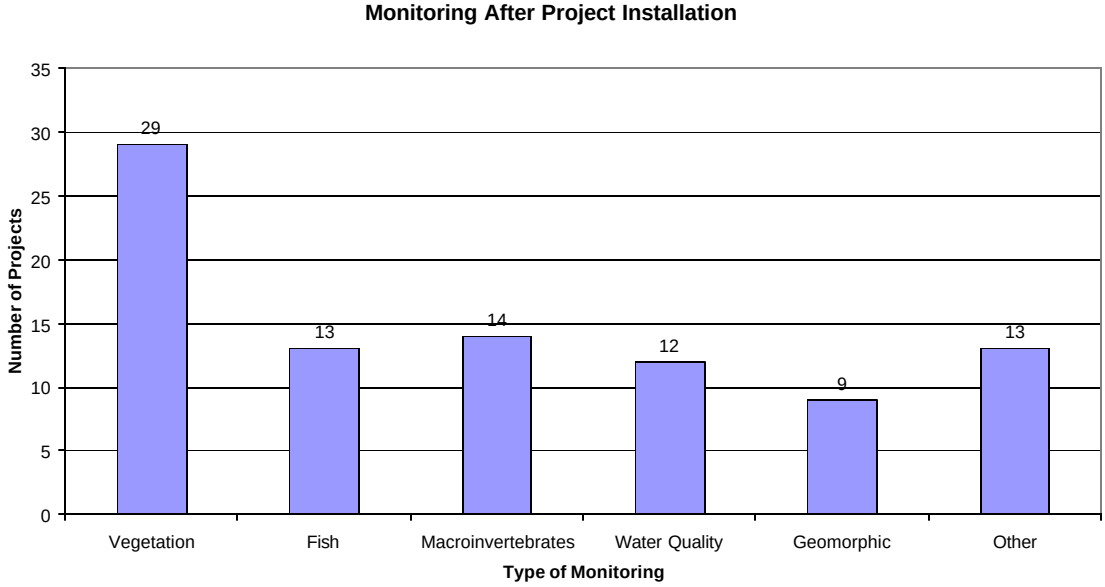
Project Monitoring

Thirty-three projects reported monitoring. Vegetation monitoring was most prevalent, both before (20 project sites) and after (29 project sites) the restoration activities took place. Fish monitoring was second most prevalent before restoration activities (15 project sites), while monitoring of macroinvertebrates (14 project sites) was second most common after restoration activities, closely followed by fish (13 project sites).



Nine project sites had "other" monitoring activities reported before the restoration took place. These "others" fell into the following categories:

Wildlife, casual obs.
Sediment quality
Bank erosion, siltation, hydrologic and hydraulic analysis
Amphibians
Stream bank
Stream profile
Stream inventory
Reference reach

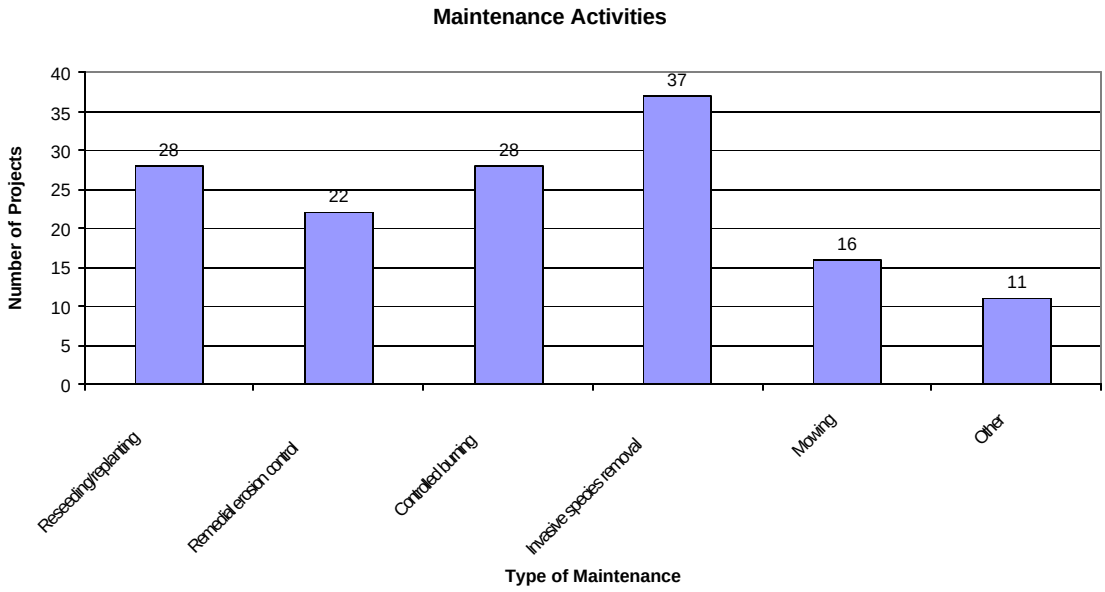


Thirteen projects had "other" monitoring activities reported after the restoration took place. These "others" fell into the following categories:

Inspections
Stream bank
Fish
Photo
Sediment quality
Wildlife
General-wildlife

Maintenance Activities

The most common maintenance activity reported was removal of invasive species (37 projects), the next two most common were reseeding/replanting (28 projects) and controlled burning (28 projects).

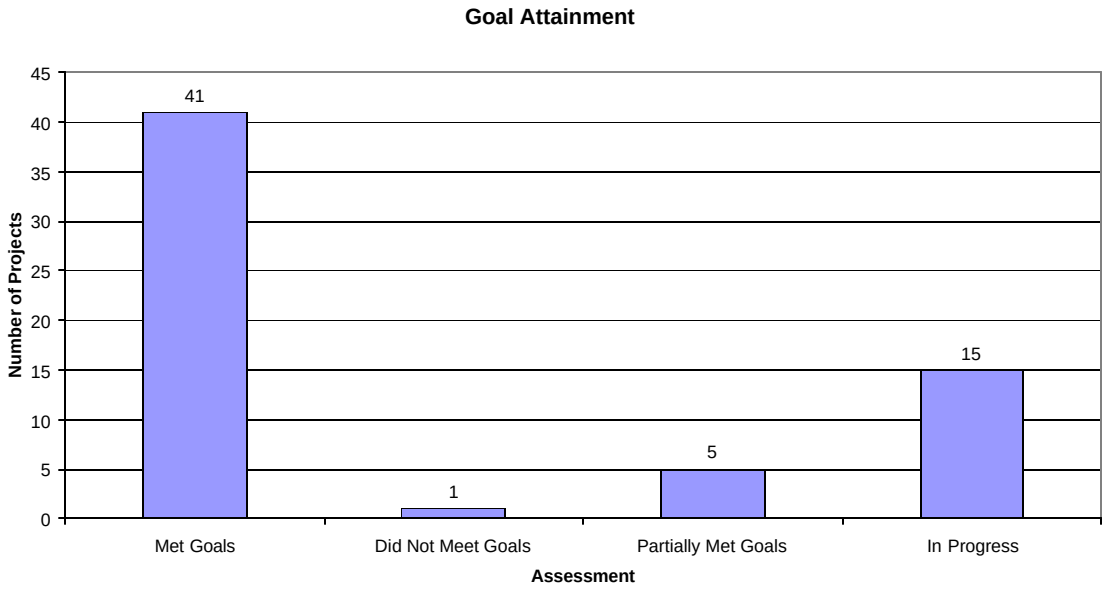


Eleven projects reported "other" maintenance activities and these were as follows:

Inspection of veg
Beetle release for purple loosestrife
Herbiciding as needed
Herbiciding and replacement of some of the lunkers that have started to deteriorate
Hydrology, bi-weekly; dam, monthly; and bridge, annually
Replacement of poorly constructed bioengineering
Junk clean up as needed
Path and fencing
Photo documentation

Attainment of Goals

Forty-one projects were described as having met their goals, one was reported not to have met its goals, five were reported to have partially met their goals and fifteen were reported as "in progress." For the balance of the projects no information about goal attainment was given.



The project reported as not having met its goals was described as follows:

"The project failed due to a desire to deep all of the trees. Without clearing trees there was no way to control the erosion of the bank, because of shade. So, the project was left as is."

Of those that partially met their goals the following comments were included:

"Partially; banks are stabilized but management required to control aggressive weed species"

"Partially; wetland plantings have been much less successful; experiments ongoing; nature trail plantings have succeeded in robust growth for three years"

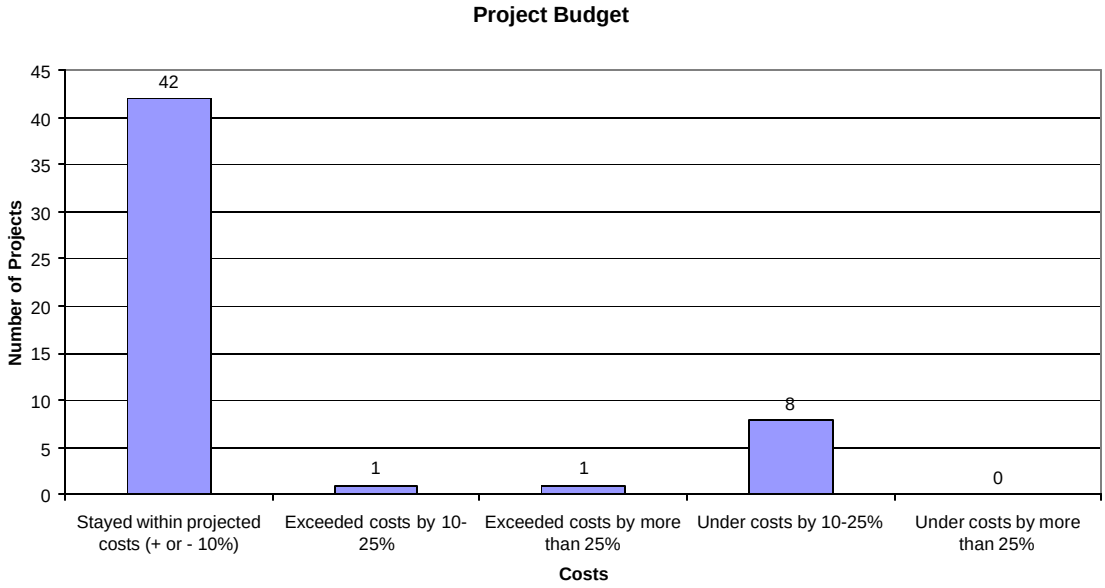
"Partially; still first growing season after planting so overall success not quantifiable at present"

"Partially; project still under construction, some vegetation established, fish observed in pools."

"Partially; project has served as a demonstration site. Bioengineering did work in holding certain banks. The cord grass planting alone has not worked as well as is needed. The seed sown in the riparian buffer did not germinate sufficiently to impede subsequent weed take over."

Project Budget

Forty-two projects were reported to have stayed within their budgets (+ or – 10%). One project was reported to have exceeded costs by 10-25%, and another to have exceeded costs by more than 25%. Eight projects were reported as having been under costs by 10-25%, and none were reported to have been under costs by more than 25%.



Project Failures

14 projects were reported to have experienced failures that resulted in the need for substantial replanting and reconstruction. Comments on these were as follows:

"yes; wetland [plantings were not as successful as hoped] - it is not correct to refer to them as failures. This is an ongoing experimental process to determine how to re-introduce wetland habitat to the Chicago River"

"yes; timing of vegetation installation may have caused partial failure of plantings"

"Rock replacement installed incorrectly - Lower toe need grating. In high use areas rock was removed by vandals, exposing toe soils to scouring. Rock added in 2001 far in excess of amount requested."

“yes; a few fine tuning adjustments but nothing major”

“yes; channel was not meandered enough”

“yes; needed more meanders, wound up using toe protection to stabilize cutting”

“yes - plants”

“Some erosion is occurring along toe which will necessitate repair work”

“yes; willow cutting had high mortality probably due to shade”

Project Participants

Special thanks to the following agencies, groups and consultants that participated in this study by submitting survey forms for their restoration projects:

Baetis Environmental Services, Inc.
2852 West Leland Avenue
Chicago, Illinois 60625
312-316-5858

Baxter & Woodman, Inc
256 S. Pine,
Burlington, WI
(262)763-7834

Chicago Botanic Garden
Lake Cook Rd.,
Glencoe, IL 60022
(847)835-831-2100

Christopher B. Burke Engineering, Ltd
9575 W. Higgins Rd.
Rosemont, IL 60018
(847)823-0500

City of Lockport
Central Square, 222 East 9th Street
Lockport, IL 60441-3497
(815)838-0456

Deerfield High School
1959 N. Waukegan Rd.
Deerfield, IL 60015
847-405-8458

Dundee Township Open Space Program
557 Barrington Ave.,
E. Dundee, IL 60118
(847) 428-8092

DuPage County Department of Development and Environmental Concerns
421 N. County Farm Rd.,
Wheaton, Il 60187
(630) 682-7230

Forest Preserve District of Cook County
536 North Harlem Avenue
River Forest, IL 60305

Friends of the Chicago River,
407 S. Dearborn, Suite 1580,
Chicago, IL 60605
312-939-0490

Hitchcock Design Group
221 W. Jefferson Ave.,
Naperville, IL 60540
(630)961-1787

Illinois Department of Natural Resources /Office of Water Resources
3215 Executive Park Drive
Springfield, IL 62703

Kane County Environmental Management
719 Batavia Ave.,
Geneva, IL 60134
(630)208-8665

Kane/DuPage Soil and Water Conservation District
545 S Randall Road,
St. Charles, IL 60174
(630) 584-7961

Lake County Forest Preserve District, Natural Resources Division,
32492 N. Almond Rd.
Grayslake, IL 60030
(847) 968-3286

Lake County Soil & Water Conservation District
100 N. Atkinson, 102-A,
Grayslake, IL 60030
(847)223-1056

Landscape Resources, Inc.
1135 South Lake Street
Montgomery, IL 60538
(630) 801-1122

Long Grove Park District
3849 RFD,
Long Grove, IL 60047
(847)438-4743

McHenry County Conservation District
6720 Keystone Rd
Richmond, IL 60071
(847)653-2297

Oswegoland Park District
313 E. Washington,
Oswego, IL 60543
(630)554-1010

Park District of Highland Park
636 Ridge Rd.,
Highland Park, IL 60035
Park (847)681-2189

Riverside Neighbors
2546 Hutchinson,
Chicago, IL 60618
(773)463-8968

Rogina & Associates, Ltd
93 Caterpillar Dr.,
Joliet, IL 60436
(815)729-0777

St. Charles Park District
8 North Avenue,
St. Charles, IL 60174
(630) 584-1885

Ted Gray & Associates, Inc.
822 Hillgrove Ave., Ste 205
Western Springs, IL 60558
(708)784-9930

U.S. Army Corps of Engineers-Chicago District
111 North Canal Street,
Chicago, IL 60606
(312) 353-6400 ext. 4025

V3 Consultants
7325 Janes Ave., Suite 100
Woodridge, IL 60517
(630)724-9200

Village of Lake Zurich
70 E. Main Street,
Lake Zurich, IL
(847) 540-1694

Waukegan Park District
2000 Belvidere Road,
Waukegan, IL 60085
(847)360-4729

Will/South Cook Soil & Water Conservation District
1201 South Gougar Rd.
New Lenox, IL 60451
(815)462-3106

Stream Restoration Inventory, Phase 2
Final Report
March 2004

Prepared for Chicago Wilderness
by the Northeastern Illinois Planning Commission

This project was a joint effort of the Northeastern Illinois Planning Commission, The United States Fish and Wildlife Service's Chicago Illinois Field Office, The United States Geological Survey, Openlands Project, and the Chicago Wilderness Streams Implementation Task Force.

It was funded through a grant program supported by the USDA Forest Service Northeastern Area, State and Private Forestry, and the US Fish and Wildlife Service, in Support of Chicago Wilderness. USFS and USFWS grants of federal monies are administered by the Illinois Conservation Foundation. Additional funding for this project was provided by voluntary financial support from local governments and the private sector, and by the Lieutenant Governor's Office.

Abstract Outline

GENERAL INFORMATION

Grant Number: FWS 0207 **Date Report Submitted:** April 26, 2002

Project Title: Stream Restoration Inventory, Phase 2

Project Goal: The overall goal of this project is to create a set of recommended practices for stream restoration in the Chicago Wilderness region. The goal of phase 2 of this project was to analyze survey information collected during phase 1, and field check restoration projects that were more than 4 years old. The analysis of survey information included identifying projects that were more than 4 years old, mapping projects based on location information submitted by survey respondents, and figuring out the % impervious surface and % population growth between 1980 and 2000 in the watersheds in which the projects are located. Site visits to projects more than 4 years old included checking the condition of the project and collecting data that would allow further analysis of stream condition and stream dynamics in the project area.

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Funding Amount: $20,361.05

Institutional Match: $15,269.83

Principal Investigator:

Name: Laura Barghusen
Email: lbarg@nipc.org
Fax: 312-454-0411
Organization: Northeastern Illinois Planning Commission
Address: 222 S. Riverside Plaza Suite 1800, Chicago, IL 60606

Collaborators:

Name: Jeffrey Mengler
Email: jeffrey_mengler@fws.gov
Fax: 847-381-2285
Organization: U.S. Fish and Wildlife Service
Address: 1250 South Grove, Suite 103 Barrington, IL 60010

Collaborators, Continued:

Name: Cathy Pollack
Email: cathy_pollack@fws.gov
Fax: 847-381-2285
Organization: U.S. Fish and Wildlife Service
Address: 1250 South Grove, Suite 103 Barrington, IL 60010

Collaborators, Continued:

Name: Kent Taylor
Email: ktaylor@openlands.org
Fax: 312-427-6251
Organization: Openlands Project
Address: 25 E. Washington St., Suite 1650 Chicago, IL 60602

Collaborators, Continued:

Name: Sue Cubberly
Email: scubberly@openlands.org
Fax: 312-427-6251
Organization: Openlands Project
Address: 25 E. Washington St., Suite 1650, Chicago, IL 60602

Name: Don Roseboom
Email: Roseboom@mtco.com
Fax: 217-344-0082
Organization: U.S. Geological Survey
Address: 221 North Broadway Ave. Urbana, IL 61801

Collaborators, Continued:

Name: Timothy Straub
Email: tdstraub@usgs.gov
Fax: 217-344-0082
Organization: U.S. Geological Survey
Address: 221 North Broadway Ave. Urbana, IL 61801

PRODUCT AVAILABILITY

Chicago Wilderness Members can access the products of this project by request through Laura Barghusen at Northeastern Illinois Planning Commission.

Is there a publication available? The Stream Restoration Inventory Phase 2 final report is available.

If so, how can they obtain it?: It can be requested from Laura Barghusen at Northeastern Illinois Planning Commission.

Is there a web site with project information/results? If so, note the web site address: Not at this point.

Other Products and Availability: The products from this study include a final report, two GIS databases with accompanying metadata, an access database holding data collected in the field, short reports summarizing the conditions and installations seen at each site that was field checked, and digital photographs from project sites. These can be requested by contacting Laura Barghusen at Northeastern Illinois Planning Commission.

Introduction and Project Background

Streams are dynamic and naturally undergo processes of erosion and deposition. However, streams in urban and urbanizing watersheds, such as those found throughout the Chicago Wilderness region, often suffer from man-made changes that result in excessive erosion and deposition and impair their ability to support aquatic life. For example, land clearing associated with construction activities can result in large amounts of sediment entering streams, filling pools, smothering aquatic plants, and destroying macroinvertebrate habitat (Brown, 2000). As a watershed undergoes development impervious surfaces that prevent water from seeping into the ground, such as pavements, are laid down. This results in large volumes of water running rapidly and directly into streams. Pollutants carried with this run off reduce the quality of a stream's water. Research shows that as human population in a watershed grows, the ecological integrity of streams decreases (Dreher, 1996) with watersheds with more than 15% impervious surface showing a decrease in stream health (Moore *et al*., 1998). Streams receiving large volumes of quickly flowing water are also susceptible to flooding and to bank and streambed erosion (Brown, 2000). As streambeds erode, channels may become entrenched with high vertical banks that are vulnerable to erosion and collapse (Riley, 1998). Conventional measures taken to protect property from bank erosion and flooding often result in loss of ecological structure and function as channels are straightened and armored with rock, concrete and/or sheet metal (Riley, 1998).

Project Goals

Many techniques have been implemented over the last decade to restore ecological value while stabilizing banks and restoring streams to a more balanced condition where erosion and deposition are not excessive. Examples include bioengineering techniques that use plants and plant material as part of the bank stabilization process and in-stream restoration practices that strive to enhance aquatic habitat. The purpose of this study is to evaluate methods that have potential to enhance biodiversity, and suggest what techniques have been most successful in terms of stabilizing banks and enhancing habitat, as well and what lessons have been or can be learned from their implementation.

Phase 1

Phase 1 of this project was a survey of agencies, consultants and groups that have undertaken streams work to learn what practices have been used, where they have been used, and to collect information on their success. We mailed surveys to groups and agencies we knew had done streams work, e-mailed surveys to natural resource agencies that we expected might have contacts that had done streams work, and posted the survey on the internet through the Chicago Wilderness member site. We attempted to survey everyone who had done stream restoration or bank stabilization in Northeastern Illinois, Southeastern Wisconsin, and Northwestern Indiana. Completed in October of 2002, this phase resulted in information about more than 100 restoration projects.

Phase 2
Phase 2, finished in November 2003, consisted of analyzing the survey information collected during phase 1, and field checking projects that were more than 4 years old. The analysis of survey information included identifying projects that were more than 4 years old, mapping projects based on location information submitted by survey respondents, and figuring out the % impervious surface and % population growth between 1980 and 2000 in the watersheds in which the projects are located. Information on additional projects and photographs of project areas before and during project installation were also collected during phase 2. The site visits to projects more than 4 years old included checking the condition of the project and collecting data that would allow further analysis of stream condition and stream dynamics in the project area.

Phase 3
Twenty of these sites representing a variety of techniques and settings were then chosen for an in-depth evaluation of the conditions leading to the success or failure of the projects. Phase 3, in-depth evaluations of selected projects, is currently underway, with most of the field work completed.

Methodology: Analyzing Information from the Phase 1 Survey
Although we sent surveys out to groups and agencies throughout the Chicago Wilderness region during phase 1 of this project, we only received surveys back on projects in Cook, DuPage, Kane, Lake, McHenry, and Will Counties in Illinois. The map shows the locations of all restoration sites surveyed. In addition, the map shows the location of sites that received a field visit during phase 2 of this project. A GIS point layer of project locations was created using maps submitted by survey respondents. In a few cases, no map was submitted but we field checked the project because someone on the field team had personal knowledge of its location. In these cases, the general location was created for the GIS point layer using GPS waypoints from the field visit. Since we expected the percent of impervious surface in the watershed to impact stream dynamics and the success of restoration practices, we calculated the percentage of impervious surface (urbanized land) in the watershed for each project using the Chicago Wilderness/NASA 1997 land cover dataset and watershed boundaries provided by the U.S. Geological Survey. In addition, we determined the percent population growth in the watershed between 1980 and 2000 as a measure of how quickly the watershed is urbanizing using Census data by quarter section. The majority of projects reported and field checked had between 30% and 45% impervious surface in the watershed and less than 25% population growth between 1980 and 2000, although we had representative projects from all of the categories as is shown in Table.

TABLE 1: Projects by Percent of Watershed that is Urbanized and Percent Population Change

% Urbanized	Reported	Field Checked	% Pop Change	Reported	Field Checked
< 15%	30	17	< 25%	54	20
15 to 30%	17	7	25 to 50%	18	12
30 to 45%	54	24	50 to 75%	25	10
> 45%	20	6	75 to 100%	13	3
			> 100%	11	9
Total	121	54		121	54

FIGURE 1: Stream Restoration Inventory Sites

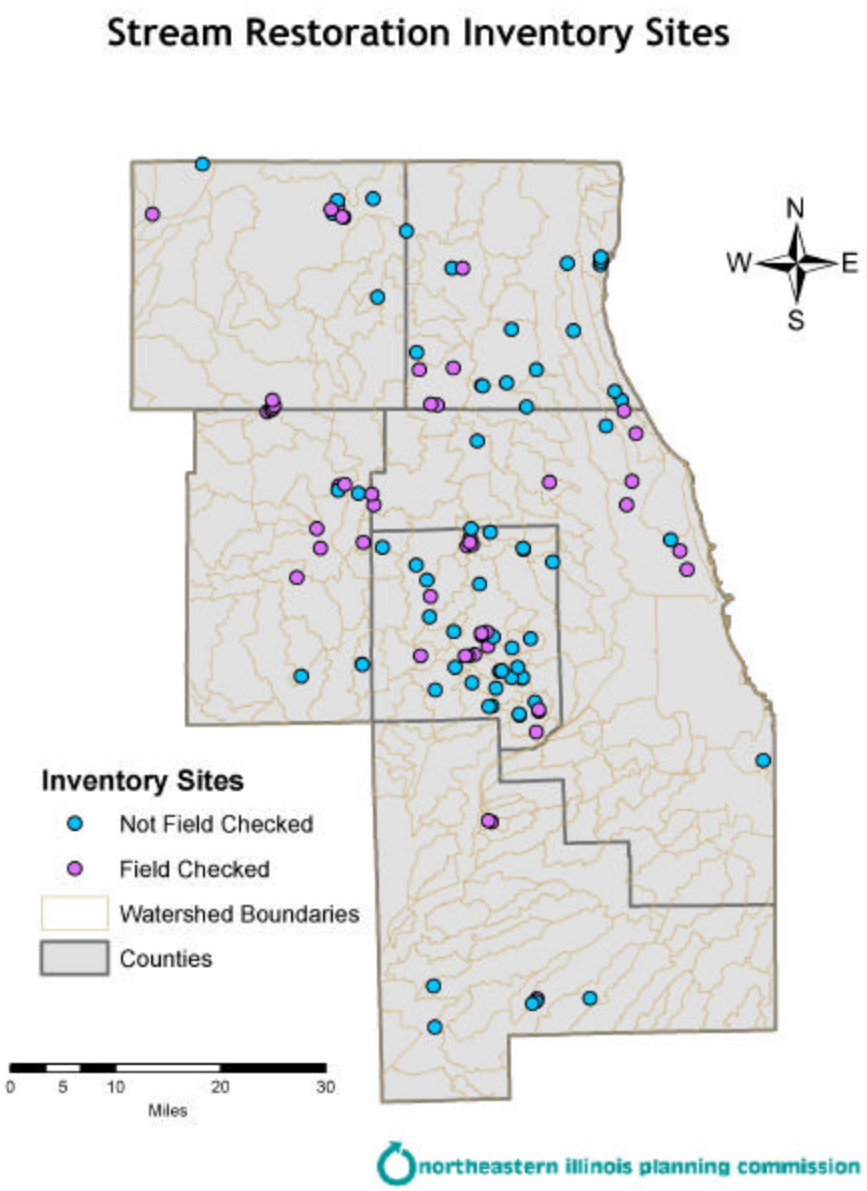


FIGURE 2: Stream Restoration Inventory Sites by Percent Impervious Surface in the Watershed

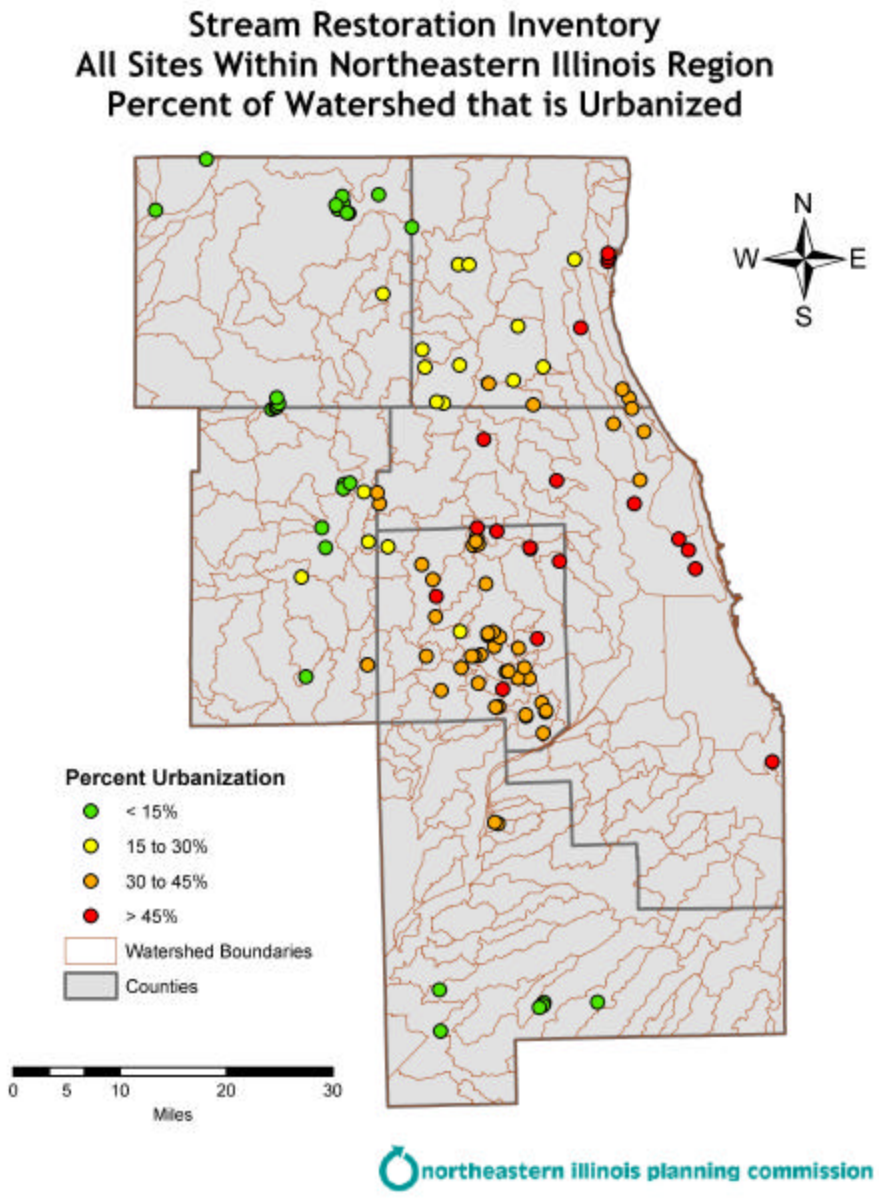
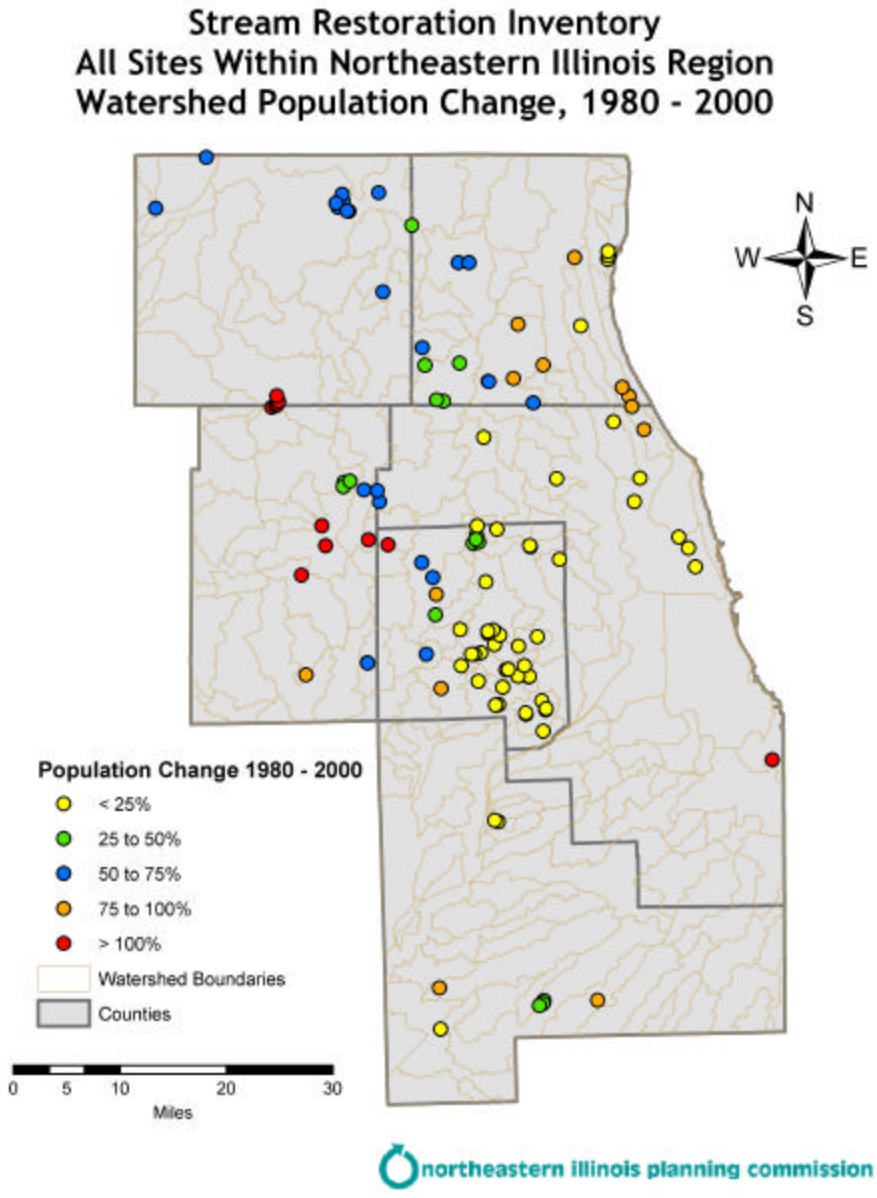


FIGURE 3: Stream Restoration Inventory Sites by Percent Population Growth Between 1980 and 2000



Methodology: Field Data Collection

Fifty-Four projects received a site visit during phase 2 of the project. Site visits were conducted from April 2003 through November 2003. In most cases projects visited were four or more years old. We chose the older projects in order to see how the techniques had held up over time under a variety of flow conditions. Projects less than four years old were checked when they were found in the field near a project receiving a site visit, when they included the only example we knew of in the region of a given technique, or when they were close to 4 years old and occurred on the same creek as other, older projects being evaluated. Of the 54 projects that received a site visit, 41 were more than 4 years old. Site visits were conducted by field teams made up of personnel from the U.S. Geological Survey, Openlands Project, Northeastern Illinois Planning Commission, and the U.S. Fish and Wildlife Service. In several cases, people who were involved in the installation or maintenance of a project joined the field team at the site to discuss the project and show it to the team. We arranged these meetings by calling the contact person for a given project before visiting that project site. Data were collected in the field using video, digital photographs, a hand held Global Positioning Systems unit, and field notes. The field notes were collected using a form (FIGURE 4) designed by Northeastern Illinois Planning Commission and USGS to capture information on the installations present at a given site, their condition, and the bank stability and habitat at the site. They were also designed to capture the relationships between a given GPS location (also called a waypoint), the installations and conditions found at that point, and the photographs taken there. The projects that received a field visit are arranged by county in Table 2 below:

TABLE 2: Projects by County

	Reported	Field Checked
Cook	13	9
DuPage	49	18
Kane	13	8
Lake	22	6
McHenry	14	9
Will	10	4
Total	121	54

FIGURE 4: Sheet Used for Field Data Collection

STREAM RESTORATION INVENTORY
PHASE 2 FIELD SHEET

Project Name: _____

Project Number: _____

Circle Project Type(s): Stabilization Riparian Buffer Restoration
Instream Restoration Remeandering
Dam Modification/Removal

Date: _____ Time Started: _____

Team Members: _____

Location at start (road intersection or other feature that could be found on a map):

_____

General instructions:

Take video of stream at start point. Rotate the camera to get a 180-degree view. Proceed along creek to beginning of installation. Take video (360-degree view to see both upstream and downstream), take photo, take GPS point, measure length of the practice with survey tape. When taking the video and the photo, have someone standing by the practice holding a staff with the distance marked for every foot (to see how deep the water is). Be sure to zoom in with the video camera and then zoom out to get a close view and then a broader view. Repeat this procedure at the beginning (and end point) of every installation along the creek and at the beginning and end point of significant conditions such as erosion. When taking video and photos of an installation, leave something at the other end of the extent of the practice so that the spot is marked. In the notes section below note whether there is a stable starting and ending point to stabilization installations (an example would be a tree). If there is extensive erosion control fabric, describe it in notes. Is there a space between the fabric and the soil?

NOTE: Limit each project to approximately 15 minutes of video tape.

Field Equipment:

Survey Tape
Video Camera
Tripod
Hand Held GPS
Digital Camera
Extra AA batteries and video tapes
Hip or Chest waders
Large Fanny Pack to Hold Video Extensions
Staff with Distance marked Every Foot

Sketch the site, indicating upstream/downstream, direction of north (if possible), location of installation, major features, length, width, pool depth, and any other information.

Continue on back of sheet if necessary.

INSTALLATION #	TYPE (Ajacks, lunkers, etc.)	
LENGTH	WIDTH	BANK R / L (circle one)
POOL DEPTH	SUBSTRATE	GRADIENT Steep / Medium / Low (circle one)
PLANTING SURVIVAL	STABILITY	
NOTES		

INSTALLATION #	TYPE (Ajacks, lunkers, etc.)	
LENGTH	WIDTH	BANK R / L (circle one)
POOL DEPTH	SUBSTRATE	GRADIENT Steep / Medium / Low (circle one)
PLANTING SURVIVAL	STABILITY	
NOTES		

INSTALLATION #	TYPE (Ajacks, lunkers, etc.)	
LENGTH	WIDTH	BANK R / L (circle one)
POOL DEPTH	SUBSTRATE	GRADIENT Steep / Medium / Low (circle one)
PLANTING SURVIVAL	STABILITY	
NOTES		

Photo #	WPT #	WPT Coords	Inst. # (from above)	Notes

Organization and Storage of Data Collected in the Field

Access Database

A Microsoft Access database was designed to store the field information collected. For each of the 54 projects field checked, the database combines general information about the site visit, specific details and notes about the installations found at the site, a list of GPS waypoints associated with the site, and notes and descriptions of the digital still photographs taken during the site visit. A detailed description of this database can be found in Appendix B.

Project Short Reports

Short reports detailing the site visits to many of the projects were created. The reports summarize the information contained in the Access database and are generally not more than 3 or 4 pages in length. These reports are very helpful for getting a quick overview of the projects. The short reports include information that was reported during the phase 1 survey as well as data and observations from the day of the site visits. The Short Reports for the projects that were chosen for in-depth analysis can be found in Appendix A.

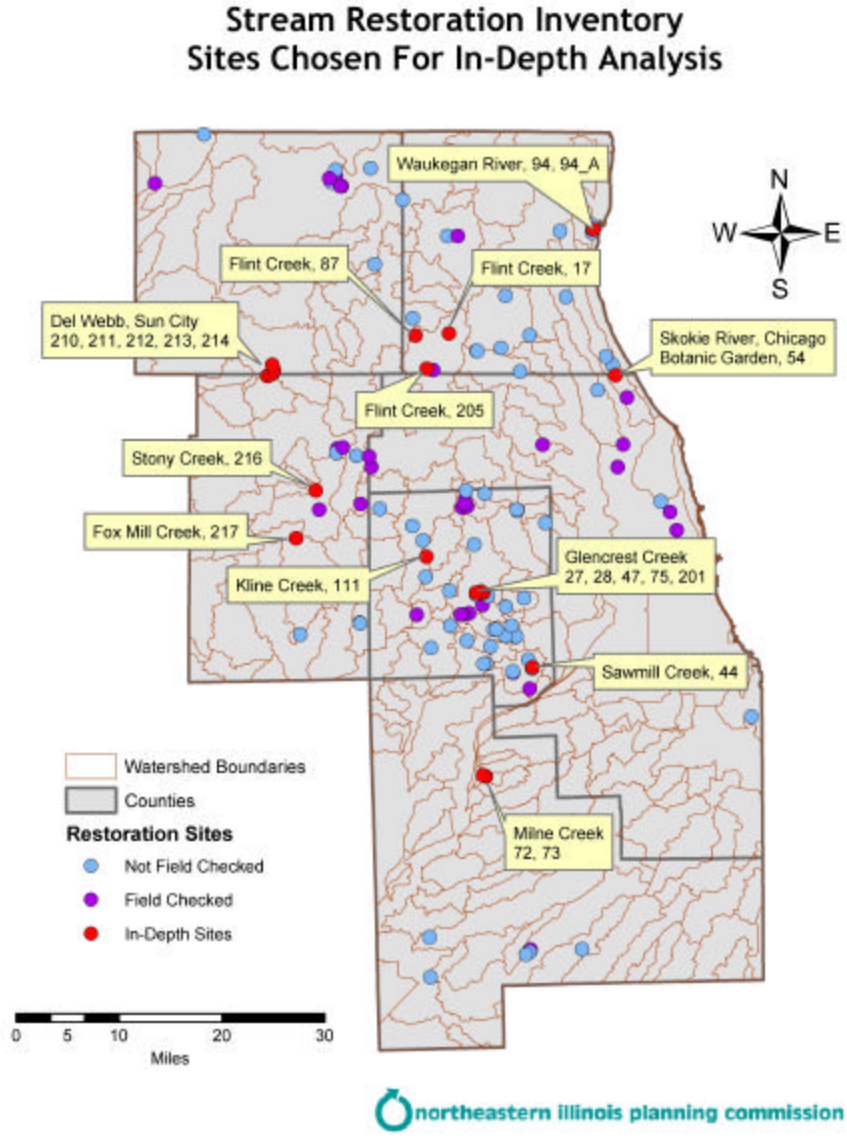
Geographic Information Systems Global Positioning Systems (GPS) file

A GIS shapefile (and associated metadata) containing the GPS waypoints taken during the site visits was created. Field information associated with each of these waypoints is stored in the access database (described above).

Projects Chosen for Phase 3 In-Depth Analysis

Twenty of the sites that received Phase 2 field checks have been chosen for an in-depth evaluation of the conditions leading to the successes and failures seen at the project sites. These twenty projects are located on ten different creeks and rivers and were chosen to represent a variety of practices and watershed conditions in terms of degree of urbanization. They were also selected as being representative of the geographic area from which we received survey responses, with at least two projects from each county. The Phase 3 analysis is expected to be complete in summer 2004, when a report and a DVD including recommended uses of the practices evaluated will be produced and presented at a workshop aimed at regulators, consultants and municipalities.

FIGURE 5: Sites, Labeled with Creek Name and Project Number, Chosen for Phase 3 In-Depth Analysis



Phase 2 Results

Selected Findings and Recommendations from Phase 2

Although the goal of Phase 2 was to collect information on restoration projects that would then be analyzed in Phase 3, below are listed selected problems that were observed in the field with preliminary suggestions about how these problems might be avoided.

A-Jacks

A-jacks are concrete jacks which are nested together in an interlocking pattern to reinforce the toe of eroding banks, generally on the outer bank of a meander. The jacks are buried in the bank and bed, and vegetation is planted through them. Normally only the more severe channel erosion sections are treated with a-jacks. In projects where a-jacks had become unstable over time, either the a-jacks were not interlocked below the streambed or streambed erosion had undermined the jacks so they fell apart. This instability can result from the installation of the a-jacks on both sides of the channel so that a constricted stream flow may increase stream velocity and streambed erosion, which undermines the a-jacks. This problem may be avoided by installing a-jacks on one side of the channel only and using softer practices, which allow for some scour in the stream channel, on the other side. Installing a-jacks or other hardened bank practices on both banks is a technique that requires careful engineering analysis.

A-jacks installed on both sides of a stream

Lunkers

Lunkers were originally developed for trout streams to provide in-stream habitat and reinforce the toe of eroding banks, especially on the outside of meander bends. Lunkers are similar to wooden pallets in design except the top and back are covered while both ends and the front are open to water flow. Lunkers are interlocked along the streambed at the toe of the bank with rebar. Rip rap is placed above and behind the lunkers. Situations were observed in the field where the rip rap or bed material placed above and behind the lunkers was too small and therefore easily eroded away. Situations were also observed where wooden lunkers were not placed on the streambed, but were higher on the stream bank. In small urban streams with intermittent flow, this lead to intermittent exposure of the wood to air causing deterioration of the wooden planks. It also lead to the tilting of lunkers when the bank beneath them was undermined by erosion. In addition, lunkers that are not placed at the level of the streambed have limited habitat value for desirable

aquatic species. Lunkers should be installed on the streambed at the deepest level of the pools. In streams where flow is intermittent recycled plastic planks should be used instead of wooden planks.

Lunkers installed high on the bank

Fiber Rolls

Fiber rolls are composed of coir (fiber from coconut husk), which is molded into 12" and 24" diameter rolls of 10-20 foot length. Either coir or nylon cord mesh covers the exterior surface. The rolls are held in place with wooden stakes or metal rods along the toe of the eroding bank. Several projects were observed in the field where both sides of the channel were treated with fiber rolls for long distances and where fiber roll was the sole technique used. In steeper streams with the higher velocity floodwaters common in urban streams, the wooden stakes were often not sufficient to hold the rolls in place resulting in sections of rolls missing in high velocity areas. In addition, in places where pools were deep, the 12" and 24" diameter rolls either were not large enough or were not installed at a deep enough level to protect the toe area and erosion of bank soils occurred below the fiber rolls. Ultimately, the success of fiber rolls in stabilizing the bank depends on the root systems of installed plants becoming established to reinforce the degrading coir fabric and bank soil.

The fiber rolls originally held in place by these wooden stakes are missing

In cases where the vegetation did not survive, nearly empty nylon mesh was found along eroding banks with very few planted riparian species remaining. In areas of high velocity flow fiber rolls may not be the most appropriate stabilization technique. Where fiber rolls are installed a schedule for maintenance of plantings should be considered.

Riparian Vegetation

Where riparian vegetation was successful, maintenance was key, according to comments from site managers. At many sites lack of long-term maintenance resulted in loss of planted herbaceous species. Reasons for this loss included reintroduction of invasive species, and excessive shade created by the regrowth of stumps after initial herbicide treatment, and growth of new woody species from either planting or natural recruitment.

Regrowth of stumps after herbicide treatment

Preliminary results from the sites selected for in-depth study indicate that in most cases almost none of the installed species could be found during the site visit, while invasive and weedy species were common. Exceptions to this occur at sites where an aggressive program of plant maintenance has been followed. At sites where maintenance to control tree species is not ongoing, herbaceous species that are shade tolerant should be considered.

Summary

Understanding the hydrodynamic and geomorphologic characteristics of a stream is important in choosing appropriate stream restoration and bioengineering techniques and implementing them correctly. The recommendations that result from this study will help guide land and water resource managers in choosing the best techniques given stream conditions.

Acknowledgements

This study has been a collaboration of the following groups and agencies: The U.S. Geological Survey-Water Resources Discipline (USGS-WRD), The U.S. Fish and Wildlife Service, Northeastern Illinois Planning Commission, Openlands Project, the Illinois Department of Natural Resources, and the Chicago Wilderness Streams Implementation Task Force.

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Appendix A:
Short Reports for the Twenty Projects Selected for In-depth Analysis

Stream Restoration Inventory / Phase 2
Report of Restoration Field Verification

Project #: 17 **Name:** Flint Creek/Lake Zurich

SITE VISIT DETAILS

Team: Sue Cubberly, Kent Taylor, Laura Barghusen, Cathy Pollack, Ellen and Kristy (Fish and Wildlife Interns)
Date: 05/12/2003

SUBMITTED INFORMATION

Original installation date: June 1997
Type of Project: Bank Stabilization, Riparian Buffer Restoration
Total length of project: 1100 feet upstream from U.S. Highway 12

GENERAL NOTES AND INFORMATION

On the day of the site visit water levels were one to 1.5 feet higher than usual due to heavy rains in the preceding days. Buffer species noted include switch grass, Indian grass, milkweed, goldenrod, reed canary grass, and multi-flora rosa.

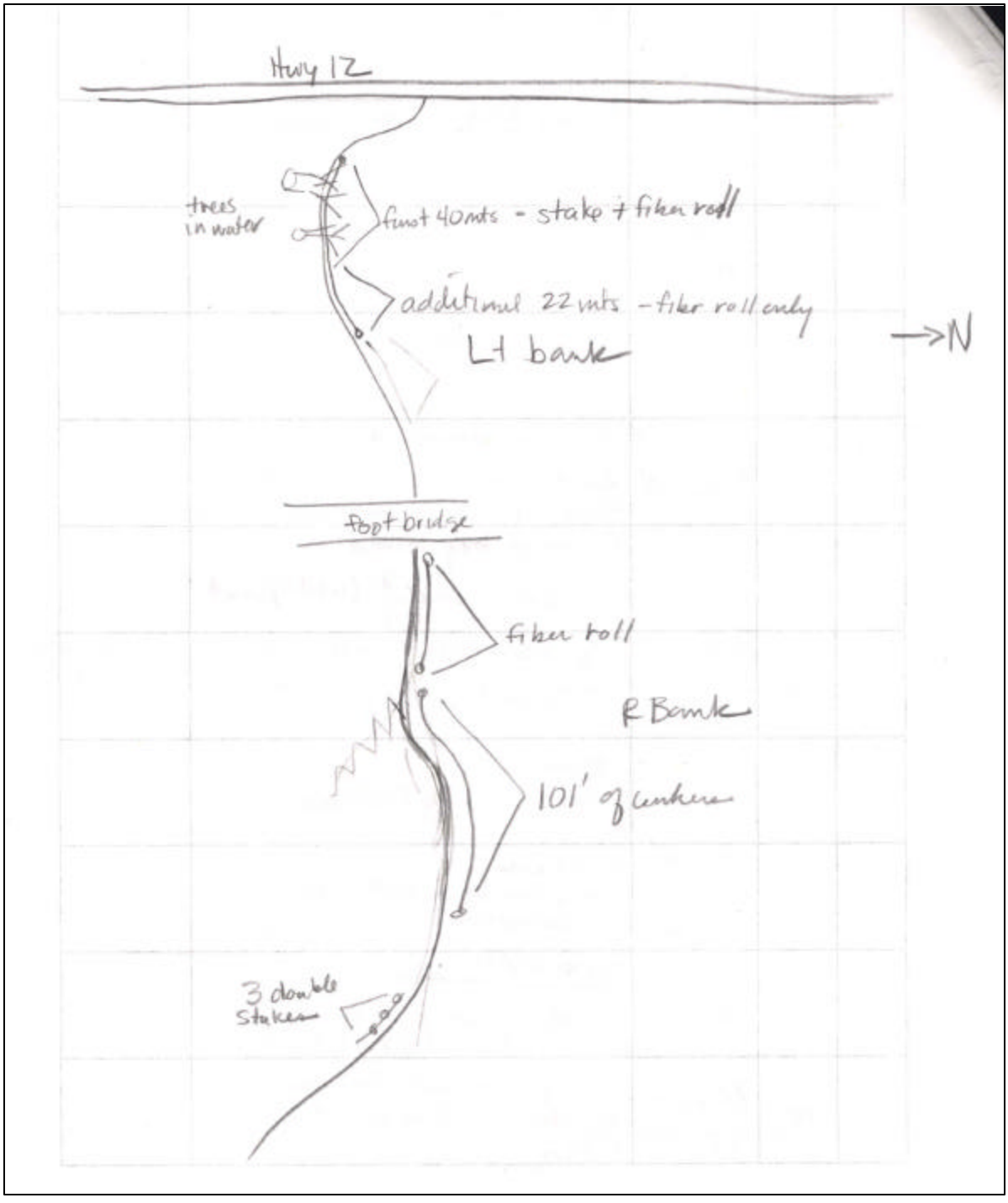
INSTALLATIONS FOUND AT SITE

1. Fiber rolls, multiple installations on both banks, some with and some without visible stakes
2. Lunkers, about 100 ft. on right bank (see site sketch below)
3. Ajacks, four different installations
4. Brush mattress with willow stakes (about 29 feet)

DOCUMENTATION

The photograph above was taken from the Highway 12 bridge, looking upstream from the downstream end of the project.

Sketch Plan of site on day of visit:



Fiber rolls:

In this case, fiber roll is holding soil well.

In contrast, this photograph shows a case where the fiber roll is not holding soil.

Pool depth in this location is ~1.8 feet on this very high water day.

Lunkers:

The lunkers extend for about 100 feet along the right bank.

They seem to be pretty open, were about 2 in below surface of water, and had some exposed fabric; not much soil or rock could be found directly on top of the lunkers.

Ajacks:

Ajacks were found in four different locations in the project; some areas were aging better than others.

Brush mattress:

The brush mattress is held in place by willow stakes, and appears to be holding quite well.

Installation Lengths:

1. Fiber rolls, three installations, some with and some without visible stakes
    a. 131 ft.
    b. 72 ft.
    c. ? – not measured

2. Lunkers, about 100 ft. on right bank (see site sketch above)

3. Ajacks, four different installations
    a. 108 ft.
    b. 82 ft.
    c. 43 ft.
    d. 43 ft.

4. Brush mattress with willow stakes (about 29 feet)

Stream Restoration Inventory / Phase 2
Report of Restoration Field Verification

Project #: 87 **Name:** Flint Creek / Grassy Lake **319 FUNDED**

SITE VISIT DETAILS

Team: Don Roseboom, Tim Straub, Sue Cubberly, Laura Barghusen, Kathleen Odell
Date: 04/28/2003
Start Location: Kelsey Rd. @ Flint Creek

SUBMITTED INFORMATION

Original installation date: 1997
Type of Project: Bank Stabilization, Buffer Restoration, In-stream Restoration

INSTALLATIONS FOUND AT SITE

1. Brush layering, willow posting, stone toe (57 ft.)
2. Artificial Riffle (Water depth about 5 in. in front and behind riffle)
3. Lunkers w/ bank re-vegetation (80 ft.)

GENERAL NOTES AND INFORMATION

Practices are located quite far apart along the stream. Follow bike path, then cut through trees to get to Installation 1 at farthest downstream point.

DOCUMENTATION

Installation 2: Artificial Riffle

This artificial riffle appeared to be in a "reverse chevron" configuration, with the point pointing downstream.

Pool depth: 1 foot (not much change in front vs. behind riffle).

Bank full width: 50 ft.
Bank full depth: 3.2 ft.

Installation 1: Brush layering, willow posting, stone toe

BEFORE / DURING

Willow posting installation.

AFTER

This photograph was taken on the day of the site visit from a similar angle to the one above. The willow posts are barely visible, though the brush layers can still be seen.

Although the initial project notes do not mention stone toe protection, we saw this practice as well.

Installation 3: Lunkers and bank revegetation

BEFORE

Lunker structure with established vegetation. The bank shows no signs of erosion, the lunkers look fairly uniform.

AFTER

On the day of the site visit, the water level was well below the top of the lunkers. Bank shows erosion and few plant species were visible on the bank.

There is a good deal of erosion BEHIND the lunker structures. In this photograph, Tim shows how the measuring stick drops quite deeply into the eroded area behind the stick.

Stream Restoration Inventory / Phase 2
Report of Restoration Field Verification

Project #: 205 **Name:** Flint Creek Barrington Stream Stabilization **319 FUNDED**

SITE VISIT DETAILS

This site visit extended over two days.
Day 1 Team: Laura Barghusen, Sue Cubberly, Cathy Pollack, Don Roseboom, Kent Taylor, Tim Straub, Ellen (Fish & Wildlife)
Day 2 Team: Laura Barghusen, Sue Cubberly, Kathleen Odell, Don Roseboom, Tim Straub
Date: 04/17/03 and 04/28/03
Start Location: Barrington Public Works

SUBMITTED INFORMATION

Original installation date: Summer 1997
Cost: $98,900 + 1,000 hours of village staff time
Type of Project: Bank Stabilization, Riparian Buffer Restoration

INSTALLATIONS FOUND AT SITE

Twenty-two installations were found at the site, as follows. On the first day, the team worked downstream of Raymond Avenue and on the second day the team worked upstream of Raymond Avenue.

Day 1 (downstream of Raymond): working from Raymond downstream

- Ajacks, triple row; left bank; 40 ft.
- Biologs; right bank; 150 ft.
- Biologs & stakes; left bank; 170 ft.
- Biologs; left bank; 20 ft.
- Lunkers; left bank; 50 ft.
- Ajacks; left bank; 35 ft.
- Ajacks; left bank; 100 ft.
- Lunkers & erosion control blanket; right bank; 20 ft.
- Ajacks; right bank; 70 ft.
- Ajacks; left bank; 60 ft.
- Ajacks; right bank; 30 ft.
- Ajacks; left bank; 50 ft.
- Ajacks; right bank; 35 ft.
- Ajacks; left bank; 55 ft.
- Ajacks; right bank; 40 ft.

Day 1, continued

- Ajacks; right bank; 90 ft.
- Fiber rolls; left bank; 60 ft.
- Fiber rolls; left bank; 165 ft.
- Fiber rolls; right bank; 180 ft.

Day 2 (upstream of Raymond):

- Fiber rolls & willow stakes, not really observable on site visit; right bank; 175 ft.
- Willow stakes; right bank; 30 ft.
- Brush clearance; left bank

GENERAL NOTES AND INFORMATION

Downstream of Raymond Avenue, the bed material was primarily one-inch gravel and fine silt, but the D-90 was large cobble, one foot to 18 inches in length. Most of the practices are in decent condition in the downstream section.

Upstream of Raymond, the bed material is muck and concrete. In the upstream section, the project overall is badly degraded. According to the report, prairie plugs were planted every five feet in this area, but these were not visible. The herbicide used to kill tree stumps during the brush removal was ineffective, and many of the stumps have sprouted.

DOCUMENTATION

Triple row of ajacks on left bank, downstream of Raymond Ave.

Note the depth of the stream here; the water level is higher than Cathy's knees. Pipes similar to the blue one in this photograph can be found all along the reaches both upstream and downstream of Raymond.

DOCUMENTATION (continued):

Above, on the right bank, biologs at the toe have survived will and appear to be holding the bank.

Left, a line of stakes is visible which once held biologs, but where the biologs are no longer in place.

DOCUMENTATION (continued):

Lunkers and erosion control blanket on right bank

The lunkers are beneath the surface of the water; the erosion control blanket extends up the bank. (Note additional drainage pipes in left of photo.)

Ajacks with erosion control fabric above

The ajacks on the right bank appear very stable. Behind the ajacks, the erosion control fabric is loose and not holding soil at the edge of the stream.

DOCUMENTATION (continued):

Installations upstream of Raymond Ave

This photograph, taken looking downstream, shows the mostly failed right bank installation as well as the heavy stone cover that has been installed on the left bank.

The report indicates that prairie plants were installed on the right bank, but on the day of the site visit mostly bare soil was visible.

Detail of the right bank; a line of stakes is visible at the toe, though the fiber rolls that we expected to find were not apparent.

DOCUMENTATION (continued):

Installations upstream of Raymond Ave

Long view looking upstream from the Raymond Avenue bridge.

The above photograph gives a general sense of the nature of this stream; brush removal was completed on the left, but without ongoing maintenance, much of the brushy growth is returning.

To the left, a stump of a tree that was removed during the brush clearance. The herbicide used did not fully kill the stump, and now the stump is vigorously sprouting.

Stream Restoration Inventory / Phase 2
Report of Restoration Field Verification

Project #: 27_28 **Name:** Atkins Residence Streambank Stabilization (GC 4)

SITE VISIT DETAILS

Team: Don Roseboom, Tim Straub, Jennifer Welch, Laura Barghusen, Kathleen Odell
Date: 04/16/2003
Start Location: Raintree & Park Boulevard

SUBMITTED INFORMATION

Original installation date: 10/97 (south bank); 3/98 (north bank)
Type of Project: Bank stabilization, Riparian buffer restoration

INSTALLATIONS FOUND AT SITE

4. Ajacks and lunkers around pool area just behind dam
5. Lunkers with vegetated geo-grid & native plantings on right and left banks, upstream from pool area

GENERAL NOTES AND INFORMATION

Installation lengths not available. Surveys were submitted for each bank of Installation 2; we do not have any survey information for Installation 1, the stabilization around the pool.

DOCUMENTATION

Installation 1: Stabilization around pool area (looking upstream from dam)

Installation 1: Pool area (continued)

Lunkers on left bank; the right bank stabilization is primarily ajacks.

Lunker either was not sealed or has a hole in it; area behind lunker has sunk significantly.

Installation 2: Bank stabilization and buffer revegetation

This image, taken looking upstream from the bridge at the top of the pool area, shows eroded banks in the foreground, with the left and right bank stabilization projects in the background, just below the culvert. Presumably without those projects the banks would look much like those in the foreground of this photo.

Installation 2: Left bank

On the day of the site visit, new grasses were just sprouting in this native prairie buffer planting area.

The lunkers are all open.

The D-50 is course sand.

BEFORE

The left bank was badly eroded before the stabilization project was undertaken.

JUST AFTER

Native prairie plants and shrubs were planted in the left bank buffer area.

Installation 2: Right bank

Lunkers on the right bank are about ½ open.

Dogwoods are growing well.

BEFORE

JUST AFTER

Stream Restoration Inventory / Phase 2
Report of Restoration Field Verification

Project #: 47 **Name:** Glencrest Creek Streambank Stabilization (3)

SITE VISIT DETAILS

Team: Laura Barghusen, Kathleen Odell, Don Roseboom, Tim Straub, Jennifer Welch
Date: 04/16/03

SUBMITTED INFORMATION

Original installation date: 1993
Type of Project: Bank stabilization

INSTALLATIONS FOUND AT SITE

1. Gabion dam
2. Ajacks on left and right banks (30 ft. on left bank, 35 ft. on right bank)
3. Stone toe on left bank (32 ft.)
4. Lunkers on left bank (no measurement available)

DOCUMENTATION

Installation 1: Gabion Dam

Pool depth here is just under 1 foot.

Installation 2: Ajacks on left and right banks

Ajacks on right bank, downstream of bridge (just above dam).

35 ft. of ajacks

Perspective: looking upstream

Ajacks on left bank, just upstream from same bridge shown in above photo.

Perspective: looking downstream

30 ft. of ajacks

Upstream end of ajacks installation (left bank)

Installation 3: Stone toe on left bank

Looking upstream at stone toe on left bank, just above gabion dam.

(On the right bank is the ajacks installation described above.)

Length: 32 ft.

Installation 4: Lunkers

Broad view of left bank lunker installation.

Downstream end of lunkers – note heavy erosion below roots of tree.

Stream Restoration Inventory / Phase 2
Report of Restoration Field Verification

Project #: 75 **Name:** Glencrest Streambank Stabilization Phase 2 (Glencrest 1)

SITE VISIT DETAILS

Team: Laura Barghusen, Don Roseboom, Tim Straub, Jennifer Welch
Date: 04/15/2003
Start Location: Bemis & Ridge (in Glen Ellyn)

SUBMITTED INFORMATION

Original installation date: 1997
Type of Project: Bank stabilization

INSTALLATIONS FOUND AT SITE

Ajacks and vegetated geogrid on both banks; we counted nine different ajacks installations.*

GENERAL NOTES AND INFORMATION

This project cost an estimated $80,000 to $106,000, and was subsidized by DuPage County ($68,300). The balance was paid by the homeowners who live along this reach.

DOCUMENTATION

This is a fairly typical example of the installations in this project.

Note the proximity of homes to the stream bank.

D-50 varies along reach from 3-4 inch cobble to sand.

* See list at end of report for a detailed list of installations.

Various forms that ajacks installations take along this reach:

Pool depth is about 1 foot here.

Ajacks have sunk into bank until barely visible.

Details of installations:

These trees were removed during the stabilization, but were not killed by herbicide.

Notice vigorous sprouting from stumps.

Here the vegetated geogrid has been unsuccessful; the grid is not holding soil and few plants have taken root.

Installation details:

1. Ajacks, mostly buried, 11 ft.
2. Ajacks, 7 ft.
3. Ajacks, left bank, 32 ft.
4. Ajacks, right bank, 100 ft.
5. Ajacks, right bank, 120 ft.
6. Ajacks, left bank, 40 ft.
7. Ajacks, right bank, 80 ft.
8. Ajacks, right bank, 100 ft.
9. 3 rows of ajacks, left bank, 135 ft.

Stream Restoration Inventory / Phase 2
Report of Restoration Field Verification

Project #: 201 **Name:** Glencrest 2
(no survey sheet for this project – found in field)

SITE VISIT DETAILS

Team: Laura Barghusen, Kathleen Odell, Don Roseboom, Tim Straub, Jennifer Welch
Date: 04/16/03
Start Location: Ridge & Bemis

SUBMITTED INFORMATION

Because we did not receive a survey form for this project, no information is available about the practices or installation date for this project.

INSTALLATIONS FOUND AT SITE

Thirteen separate installations were documented as part of this project. Working upstream from Bemis & Ridge, details are as follows:

1. Fiber roll and stakes, left bank, 100 feet
2. Ajacks, fiber roll, geotech lift, 25 feet
3. Ajacks with geolift above, 40 feet
4. Ajacks, fiber roll, and geolift above, 60 feet
5. Fiber roll only, 60 feet
6. Single row of ajacks, 110 feet
7. Ajacks, left bank, 85 feet
8. Ajacks, right bank, 115 feet
9. Stone toe protection, left bank, 60 feet
10. Lunkers with ajacks buried behind them, left bank, 135 feet
11. Remnants of vortex weir
12. Ajacks, right bank, 55 feet
13. Ajacks, left bank, 60 feet

GENERAL NOTES AND INFORMATION

This project extends from the start point at Bemis and Ridge upstream to the culvert at the main road. Over the course of the project are various types of installations as detailed above. Throughout the project, the pool depth (of deep areas) is approximately 1.5 feet, the D-50 is 3 to 4 inch cobble, and the D-90 is 6 to 8 inch cobble.

According to our notes on this project, some of the lunkers and ajacks were installed in 1992 – chances are that this information came from Don R.

DOCUMENTATION

Fiber rolls at downstream end of project:

Looking upstream – staked fiber roll on left bank.

Ajacks installations, various locations:

The ajacks, some installed as long ago as 1992, have settled into the bank in some areas, but in other places are still very visible.

Note visible fabric above ajacks.

The installation in the photograph at the right has two very different looking ajacks installations; on the left bank the ajacks are at the toe, but on the right bank the ajacks are well above the water level.

Detail of ajacks which are now surrounded by grassy vegetation.

Stone toe protection (left bank):

Lunker installation (with ajacks buried behind):

Circled below are the tips of several ajacks which are buried well behind the lunkers.

Remnants of vortex weir:

Upstream end of project:

Stream Restoration Inventory / Phase 2
Report of Restoration Field Verification

Project #: 44 **Name:** Sawmill Creek, Clarendon Hills Rd. to Joliet Rd.

SITE VISIT DETAILS

Team: Sue Cubberly, Kent Taylor, Cathy Pollack, Laura Barghusen, Kathleen Odell
Date: 05/22/2003
Start Location: Corner of Clarendon Hills Rd. & Frontage Rd.

SUBMITTED INFORMATION

Original installation date: 1997
Type of Project: Bank stabilization

INSTALLATIONS FOUND AT SITE*

6. Multiple biolog installations (upstream of Clarendon Hills Rd.)
7. Multiple installations of ajacks, biolog, willow posts, and vegetated geo-grid (downstream of Clarendon Hills Rd.)

GENERAL NOTES AND INFORMATION

In total we counted 19 different installations of varying lengths along the reach. It is possible that the three installations above Clarendon Hills Rd. were not part of the project reported on the survey sheet. The installations below Clarendon Hills Rd. consisted of varying combinations of ajacks, biologs, willow posts, and vegetated geo-grid. This project was reported twice in the original survey; it was also project #89 in the original data.

DOCUMENTATION

1: Biologs above Clarendon Hills Road

Pool depth is about 8 inches here.

Substrate is mucky silt.

Photo is taken looking upstream; biolog and vegetated geo-grid can be seen on the right bank.

* See end of document for individual description of 19 installations found at this site.

1: Biologs above Clarendon Hills Road (continued)

Biolog on the left bank. Note muddy condition of the water.

Midway along this installation a section of the biolog is missing. It looks like it might have washed away.

2: Installations south of Clarendon Hills Road

The installations south of Clarendon Hills Road are very similar in nature, consisting of various combinations of biolog, ajacks, willow stakes, and vegetated geo-grid. The stream depth was 6 to 8 inches all along the reach.

2: Installations south of Clarendon Hills Road (continued)

Closer view of ajacks embedded in the toe. Substrate is very soft, with material ranging from silt to small gravel.

In some places, vigorously growing willows almost completely shade the stream.

2: Installations south of Clarendon Hills Road (continued)

Another very typical example of the installations found on this reach. Note steep bank and shady conditions.

Installation details:

Working upstream to downstream:

1. Biolog w/ stakes, left bank, 60 ft.
2. Biolog w/ stakes, right bank, 180 ft.
3. Biolog w/ stakes, left bank, 70 ft.
4. 3 rows of ajacks with coconut roll, biolog at base of jacks, left bank, 38 ft.
5. 2 rows of ajacks, geo-lift above, right bank, 163 ft.
6. Biolog, ajacks, willow stakes, 5 geo-lifts, left bank, 120 ft.
7. Ajacks and biolog, right bank, 58 ft.
8. Biolog, ajacks, geo-lift, right bank, 55 ft.
9. Biolog, geo-lift, right bank, 20 ft.
10. Biolog, ajacks, willow stakes, geo-lift, left bank, 108 ft.
11. Biolog, ajacks, willow stakes, geo-lift, left bank, 92 ft
12. Biolog, ajacks, willow stakes, geo-lift, right bank, 38 ft.
13. Biolog, ajacks, willow stakes, geo-lift, left bank, 237 ft.
14. Biolog, ajacks, willow stakes, geo-lift, right bank, 115 ft.
15. Biolog, ajacks, willow stakes, geo-lift, right bank, 45 ft.
16. Biolog, ajacks, willow stakes, geo-lift, right bank, 115 ft.
17. Biolog, ajacks, willow stakes, geo-lift, left bank, 44 ft.
18. Biolog, geo-lift, willow stakes, right bank, 89 ft.
19. Biolog, ajacks, willow stakes, geo-lift, left bank, 88 ft.

Stream Restoration Inventory / Phase 2
Report of Restoration Field Verification

319 Funded

Project #: 54
Name: Chicago Botanic Garden

SITE VISIT DETAILS

Team: Don Roseboom, Tim Straub, Joan O'Shaughnessy, Kathleen Odell, Sue Cubberly
Date: 06/26/03
Start Location: Upstream end – (4900 LF)

SUBMITTED INFORMATION

Original installation date: early 1995
Type of Project: Bank Stabilization, Instream Restoration, Riparian Buffer Restoration, Meander Enhancement

INSTALLATIONS FOUND AT SITE

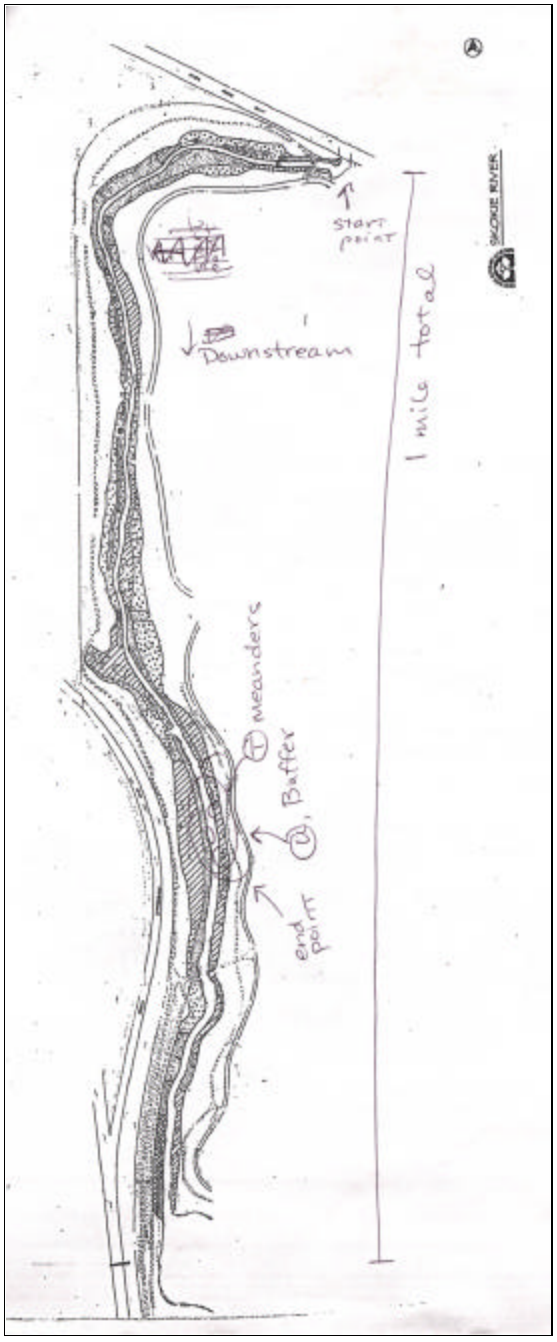
1. Willow stakes right/left banks; 150 ft. length, 30 ft. width; medium gradient; planting survival 15 ft. high; at least 2 to 6 ft. deep at inlet; hard pan clay and large 1 ½ inch angular cobble/gravel
2. Brush layer with willow stakes left bank; 25 ft. width; pool depth 2 ft.; medium gradient; planting survival generally good – willows; scour right bank, also bald cypress, 60 ft. of brush and willow; inverse vortex weir
3. Coir fascine left bank; 40 ft. length, 20 ft. width at start of stream, 12 ft. at mid-bank; pool depth .5 ft.; substrate sandy loam; medium gradient; planting survival good (grass)
4. Inverse weir; 20 ft. width; pool depth .5 ft. above, 1.5 ft. at deepest; medium gradient; weir is inverse; scouring of left and right banks
5. Brush fascine left bank; 42 ft. length; medium gradient; planting survival cord grass; holding up better than upstream section of same; right bank scour; wetland above-ground water seepage
6. Willow stakes right bank; 180 ft. width; pool depth 1 ft.; medium gradient; planting survival 15 ft. tall; outer bank holding, inner bank fill/channel narrowed and point bar exposed (deposition); all bed load washed off, undercut a little, "most successful" of willow practice. Got stakes down approximately 1.5 ft. when planted; maintenance – considering cutting back
7. Coir fascine coconut fiber roll right bank; 60 ft. length, 25 ft. width; pool depth 1 ft. medium gradient; planting survival cord grass, sweet flag; stability very good; was outside bank that was wiped out before practice was inserted; point bars 2 ft. cobble/gravel; "best wetland/coir log combo seen" (Don)

8. Willow stakes around 116 ft. start coir fascine and willow right bank; 116 ft. length/230 ft. total; pool depth .75 ft. – 1 ft.; substrate clear, no beds; medium gradient; planting survival bald cypress left bank; stability = lot of dead growth; willows were originally there; coir installed, willows planted self; note photo 25 – coir empty "most eroded section" outside bank; very clean channel
9. Brush layering right bank; includes inverted vortex weir; rock moved; no stack, willow migrated self; 170 ft. length; 16 ft. width; pool depth 1-15 ft.; substrate clay pan/clean, no bed; medium/steep gradient; planting survival volunteer willows; stability = good growth on bank; fast moving outside bank, bed load on inside bank
10. Demonstration of coir fascine/brush layering left bank; 45 ft. length brush layering/40 ft. length coir fascine, width 20-25 ft.; medium gradient; planting survival good – willow/cordgrass/stinging nettle; 65 ft. of willows along practice
11. Inverted vortex weir (two approximately 30 ft. apart) 25 ft. width; medium gradient; pool depth .9 to 1.0 ft.; planting survival willow; stream is flowing around weirs, 2nd set, 2nd weir – water flows to right of weir
12. None – reach without installations; pool depth 1.6 ft. at deepest; in the center a sandbar has formed, stream flowing around on both sides. Channel is eroding/undercutting on both banks.
13. Brush fascine left bank; 72 ft. length; pool depth 1.2 ft.; clay substrate; planting survival good, lots of plant species; base flow depth 1.4 ft., base flow width 28 ft., bank full depth 5.3 ft., bank full width 35 ft.; pretty much in tact with sediment loading
14. Brush fascine left bank; 39 ft. length; pool depth 1 ft.; clay substrate
15. Willow stakes left bank; 91 ft. length; pool depth 1.6 ft.; clay substrate; willow stakes did not take very well.
16. Willow stakes left bank; 25 feet; not doing very well.
17. Fascine with willows/fascine (2 installations) right bank; 21 ft. length; pool depth 1 ft.; sand/gravel substrate; planting survival willows doing great; fascine mostly washed out – willows have held up well
18. Same as 17 (the two installations are both described under 17)
19. Coir fascine right bank; 58 ft. length; pool depth .9 ft.; stability very good; "best" – doing very well, was a blown bank. Plant species competing well with reed canary grass.
20. Coir fascine left bank; length 58 ft.; pool depth 1-2 ft.; soft substrate; was a blown bank
21. Meanders/biologs right/left bank; planting survival good – blue flag iris, swamp dock, sweet flag; remainders of 3 instream marshes C-shaped biolog installation not based on study of shape of river – one on right bank has done well – 20 on left bank not so well.
22. Riparian buffer (prairie) left bank; 20-50 ft. width; planting survival compass plant, spider wort, prairie dock, cup plant, false white indigo, common milkweed, purple coneflower; about 12 acres total – runs all along.

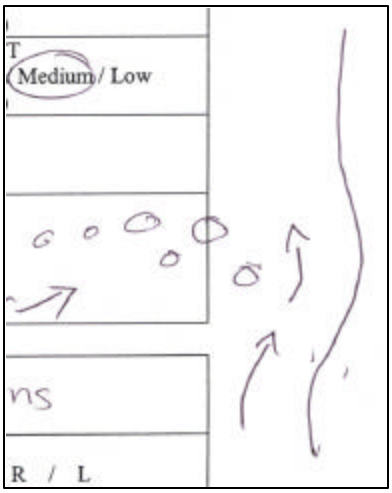
GENERAL NOTES AND INFORMATION

The nearly 1 mile stretch of the Chicago Botanic Garden project was intended to stabilize banks and enhance habitat in both the river channel and riparian corridor. 20+ installations were installed along the stretch; plantings of shrubs, prairie grasses, and willows, along with brush layering and fiber rolls placed in areas of severe erosion. A vegetation buffer zone was created from a 12 acre area from a seed mix of eight prairie plants native to the area. Five wetland zones were also created along the river in an effort to enhance and preserve wetland plants planted in the area. Riffles were installed, meanders were enhanced in a short section of the straightened channel, and wetland vegetation was planted in an effort to improve water quality and fish habitat.

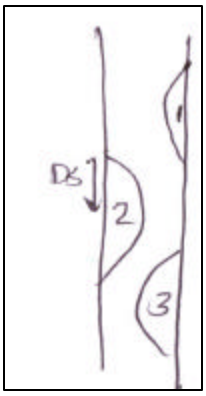
DOCUMENTATION: Site sketch from day of visit



DOCUMENTATION (continued): Site sketches from day of visit



Left:
Illustration of the stream flowing around the inverted vortex weir (installation 11). Circles indicate The rocks of the weir, arrows indicate water flow.



Right: Illustration of the C shaped biologs (installation 21) used to meander the stream. The one on the right bank (labeled #2 in the picture) has held up well.

DOCUMENTATION (continued):

The upstream end of the project at a very deep inlet where the Skokie River enters the Botanic Garden.

Scour on the right bank between installations 1 (willow stakes) and 2 (brush layer with willow stakes).

Broad view of the brush layer and willow stakes on the left bank (installation 2). Willow survival was good.

Looking upstream at inverse vortex weir that makes up part of installation 2.

View looking upstream at the bank, just downstream of the weir, where willows and cypress are stabilizing the bank.

Looking downstream at the coir fascine and stakes (installation 3), where the planting survival was good.

This photo was taken of an undercut, collapsed left bank about 15 feet downstream of installation 3 (the coir fascine and stakes).

Close up of collapsed bank showing that the cordgrass was not able to root in the soil; the roots are exposed and dried out.

Arrowhead (saggtaria latifolia) growing on the bank near installation 5 (brush fascine) – this was not planted and signifies a good bank.

This photo was taken of the willow stakes on the right bank (installation 6). This is the most successful example of willow installation.

A coir fascine roll on the right bank (installation 7), looking downstream. This coir was in good condition, cord grass and sweet flag were doing well, and stability was very good. Don referred to this as the best wetland/coir log combination seen.

A long shot looking downstream, downstream of installation #7.

Slab failure; the slab toe was eaten away.

A biolog planted offshore (right bank) with water behind it – the coir fascine is empty (installation 8). This was the most eroded section.

The riparian buffer at the downstream end of installation 8.

An inverted vortex weir (part of installation 9). Notice the rocks which have moved out of position.

The left bank and coir fascine with cord grass at installation 10. Planting survival is good here.

Looking downstream at the first set of weirs of installation 11.

Looking downstream at the second set of weirs of installation 11.

A long view looking downstream at the reach where no restoration has been done. A sandbar has formed in the center and the channel is eroding with undercutting of both banks. Two spawning beds were seen side by side, possibility made by blue gill.

A close-up photo of the brush fascine (installation 13).

Looking upstream at the left bank, at the willows and fascine of installation 14. .

This photo was taken of installation # 17, where the willows have held but the fascine is washed out.

View of a very successful coir fascine installation (installation 19).

Looking downstream at meander #1 of installation 21, on the left bank.

This photo was taken of meander #2 of installation 21 on the right bank. This installation is doing very well. You can also see installation #3 on the left bank which is not doing so well.

A hole behind the fascine of meander #2.

Looking downstream at meander #3 where nothing is growing.

Stream Restoration Inventory / Phase 2
Report of Restoration Field Verification

Project #: 210
Name: Old Sawmill Creek Del Webb Sun City, Huntley

SITE VISIT DETAILS

Team: Erin Poliakon, Laura Barghusen, Sue Cubberly, Jeff Mengler, Tim Straub, Don Roseboom, Karen Kabbes
Date: 07/01/03
Start Location: 13181 = address at end of culdesac (Summer Ridge Ct. and Juneberry Lane)

SUBMITTED INFORMATION

Original installation date: 2000
Type of Project: Instream Restoration, Riparian buffer restoration

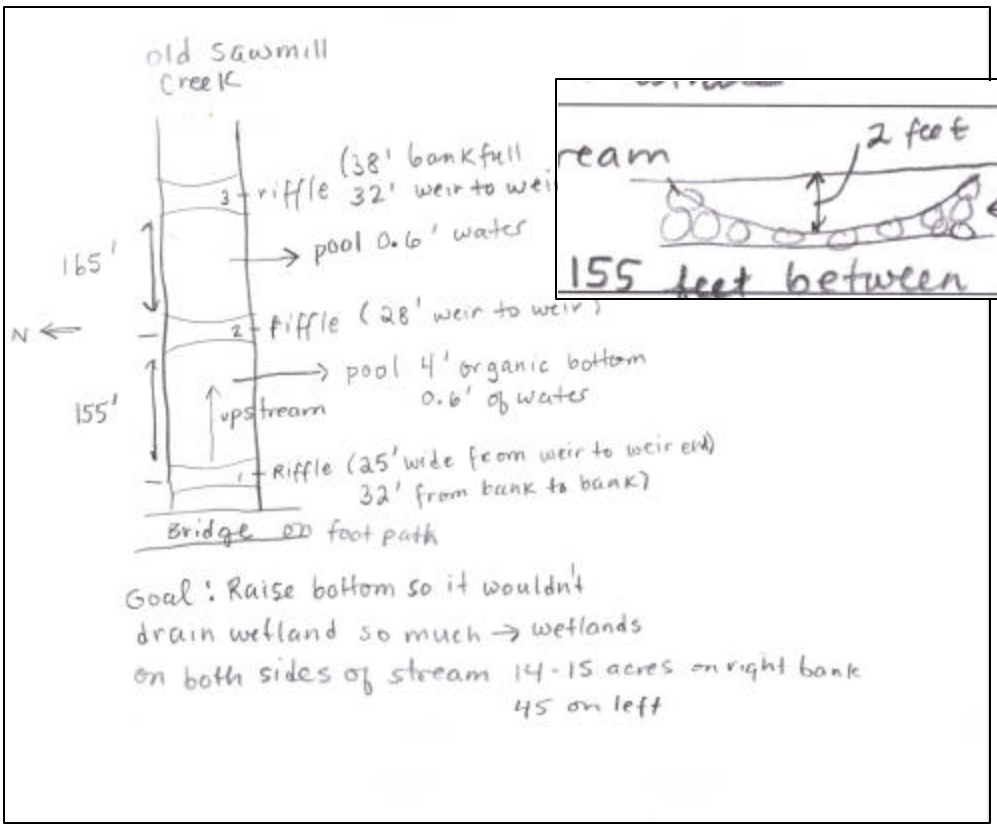
INSTALLATIONS FOUND AT SITE

23. Riffle – 25' from end to end; 32' bank to bank; pool depth 0.6 ft. of water and 4' of unconsolidated, organic bottom
24. Riffle – 28' from end to end; pool depth 0.9 ft. max; fine silt/clay/anaerobic substrate
25. Riffle - 38' top of bank to top of riffle; 32' of rock from end to end; pool depth 0.6 ft. of water

GENERAL NOTES AND INFORMATION

The goal of this project was to raise the bottom of the stream to minimize drainage of the surrounding wetlands. There are wetlands on both sides of the stream with a 14-15 acre wetland on the right bank, and a 45 acre wetland on the left bank. The riffle installations were built up so high that they had the appearance of dams. For example, at the western most riffle there was a 2 foot drop from the top of the rock to the stream. Riparian buffer restoration was also done in the surrounding wetlands.

DOCUMENTATION (continued): Site sketch from day of site visit



Riffle detail

Looking upstream from the footbridge at the riffle installations. There is 155' between the first and second riffle and 165' between the second and third.

Looking downstream from the footbridge

Looking upstream at Don on riffle 2 and Tim on riffle 3.

Riffle 2 seen from the left bank.

Don measuring pool depth at riffle 3. There was 0.6’ of water

Stream Restoration Inventory / Phase 2
Report of Restoration Field Verification

Project #: 211
Name: Eakin Creek Biologs, Del Webb, Sun City, Huntley

SITE VISIT DETAILS

Team: Laura Barghusen, Erin Poliakon, Don Roseboom, Tim Straub, Sue Cubberly, Karen Kabbes
Date: 07/01/03
Start Location: Upstream of bridge on Del Webb Road over Eakin Creek

SUBMITTED INFORMATION

Original installation date: 1997
Type of Project: Bank stabilization, Remeandering

INSTALLATIONS FOUND AT SITE

26. Biologs (gone); right bank, 21 ft.; firmish peat substrate
27. Biologs (gone); left bank, 50 ft.; stable firmish peat substrate; bank in good shape
28. Biologs; left bank, 240 ft.; pool depth 2.5 ft. in middle of meander bend and at upstream end of practice.
29. Biologs and stakes; left bank, 202 ft., firmish peat substrate; pool depth 2 ft. at apex; bank erosion behind netting at apex
30. Biologs; right bank, 216 ft.; scour at apex of meander; 2 ft. holes eroded into streambed near upstream end of practice
31. Biologs with stakes; left bank, 158 ft., firmish peat substrate
32. Biologs with stakes; right bank, 236 ft.; pool depth 2 ft.; firmish peat substrate

GENERAL NOTES AND INFORMATION

This project has primarily biologs with plantings and some stakes placed along the streambed. The combination of biologs and stakes has created a stable bank in many areas even though some of the biologs are no longer present. Some erosion and scour was observed at the meander apexes. The creek water was not moving very much; there was no break in the water surface profile after 6 meander bends.

DOCUMENTATION

Don measuring pool depth. The substrate throughout the streambed is firmish peat, with pool depth reaching not more than 2 ft.

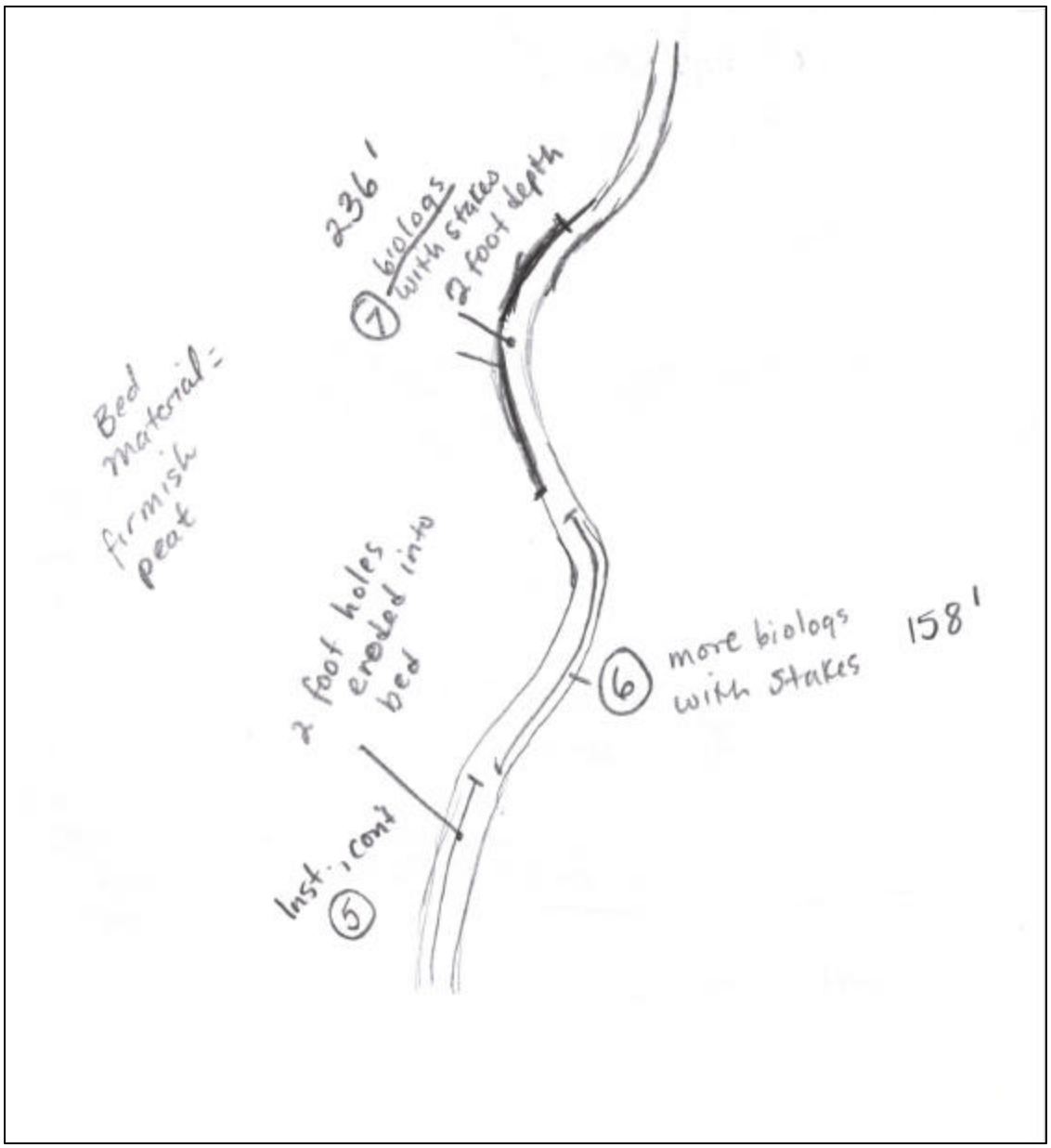
Looking upstream at the stakes and biolog rolls. Vegetation is growing from the biolog rolls here.

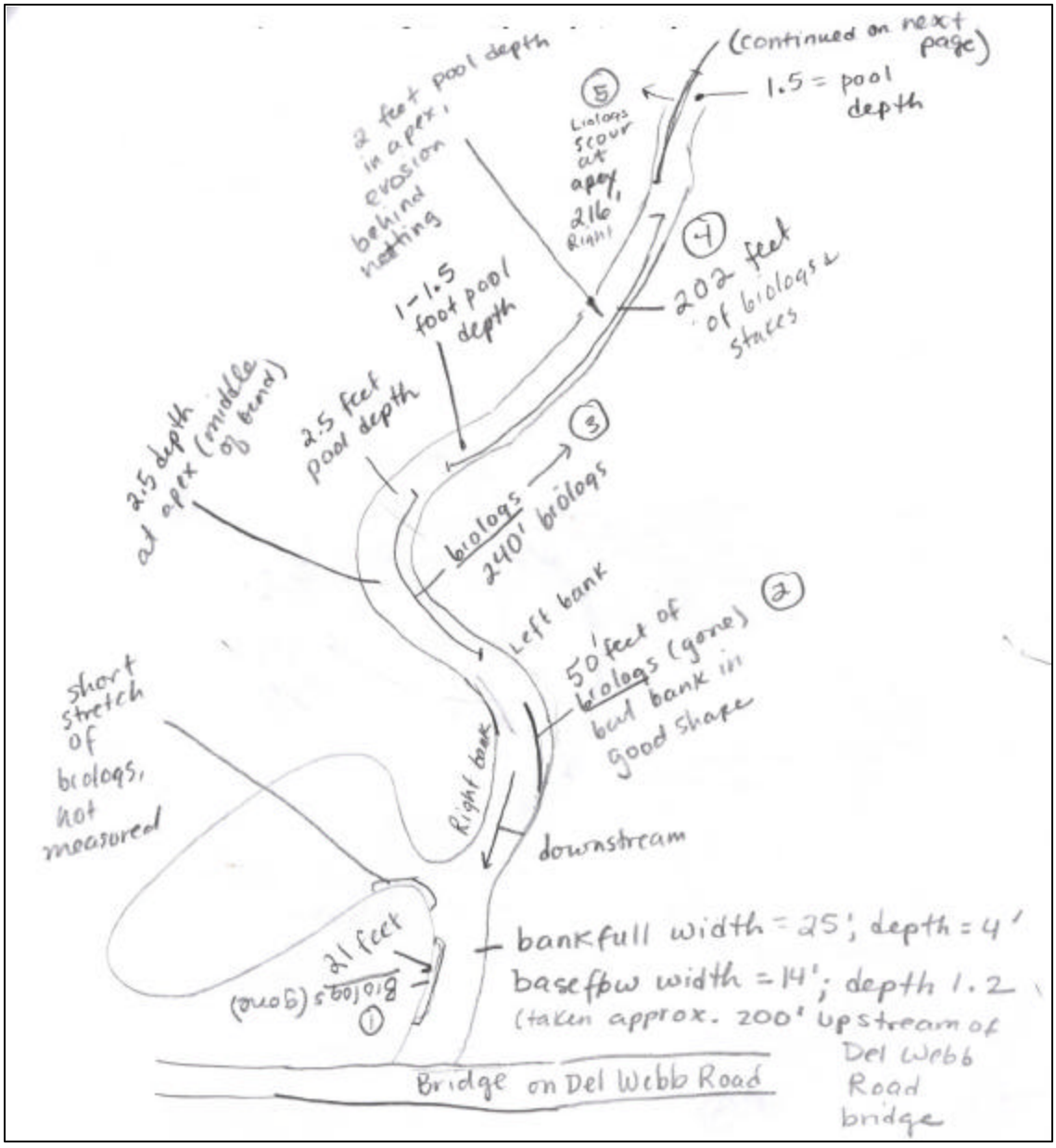
Don pointing to erosion occurring behind and beneath the netting at meander apex; there was scouring of the biologs and the streambed had shifted. The pool depth at this location was approximately 2 ft.

This photograph was taken looking downstream toward the Del Webb Road bridge at the right bank; there were previously 21 feet of biologs here that are now gone.

View from the Del Webb Road bridge, looking upstream, out over the meanders.

DOCUMENTATION (continued): site sketch from day of visit




(continued on next page)
2 feet pool depth in apex, evasion behind matting
5
Liologs scour at apex, 216 Right
1.5 = pool depth
1-1.5 foot pool depth
4
202 feet of biologs & stakes
2.5 depth at apex (middle of bend)
2.5 feet pool depth
3
biologs 240' biologs
Left bank
2
50' feet of biologs (gone) bed bank in good shape
short stretch of biologs, not measured
Right bank
downstream
bankfull width = 25'; depth = 4'
baseflow width = 14'; depth 1.2
(taken approx. 200' upstream of Del Webb Road bridge
21 feet
Biologs (gone)
1
Bridge on Del Webb Road

Stream Restoration Inventory / Phase 2
Report of Restoration Field Verification

Project #: 212
Name: Eakin Creek Lunkers, Sun City, Huntley

SITE VISIT DETAILS

Team: Laura Barghusen, Erin Poliakon, Don Roseboom, Tim Straub, Sue Cubberly, Karen Kabbes
Date: 07/01/03
Start Location: Downstream of bridge on Del Webb Road over Eakin Creek

SUBMITTED INFORMATION

Original installation date: 1997
Type of Project: Bank stabilization, Remeandering

INSTALLATIONS FOUND AT SITE

33. Lunkers; left bank, 24 feet in length; D90=3 inch cobble, the remaining substrate is 1" gravel.

GENERAL NOTES AND INFORMATION

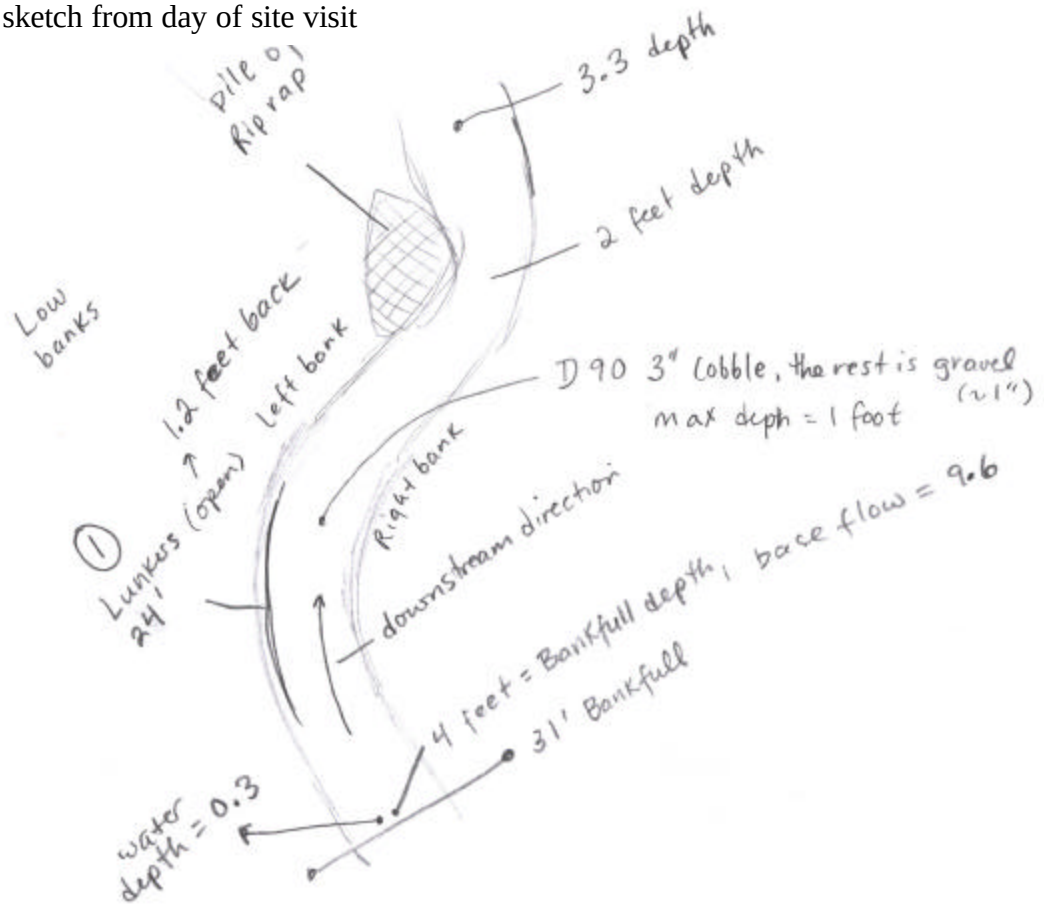
This project consists of lunkers placed along the left bank. Pool depth was 0.3 upstream of lunkers and 2 feet downstream of lunkers. Maximum pool depth at the lunkers was approximately 1 foot. The lunkers were open to approximately 1.2 feet back into the streambank. The gradient of the streambank was low in this area.

DOCUMENTATION

This photograph was taken from the start point, where the bank full measurement was taken.

DOCUMENTATION (continued):

Site sketch from day of site visit



DOCUMENTATION (continued):

Looking downstream from the lunker installation. There was a pile of rip rap along the left bank that can be seen in this picture.

View of the lunkers and mattress (the fabric above the lunkers).

The lunkers were open to a depth of about 1.2 feet

Looking downstream at reed canary grass and rip rap.

Stream Restoration Inventory / Phase 2
Report of Restoration Field Verification

Project #: 213
Name: Sun City Huntley, Del Webb, E. Fork S. Branch Kishwaukee River Site 1

SITE VISIT DETAILS

Team: Laura Barghusen, Erin Poliakon, Don Roseboom, Tim Straub, Jeff Mengler, Sue Cubberly, Karen Kabbes
Date: 07/01/03
Start Location: East Fork of the South Branch of the Kishwaukee River

SUBMITTED INFORMATION

Original installation date: 1997
Type of Project: Bank stabilization; Instream Restoration, Remeandering

INSTALLATIONS FOUND AT SITE

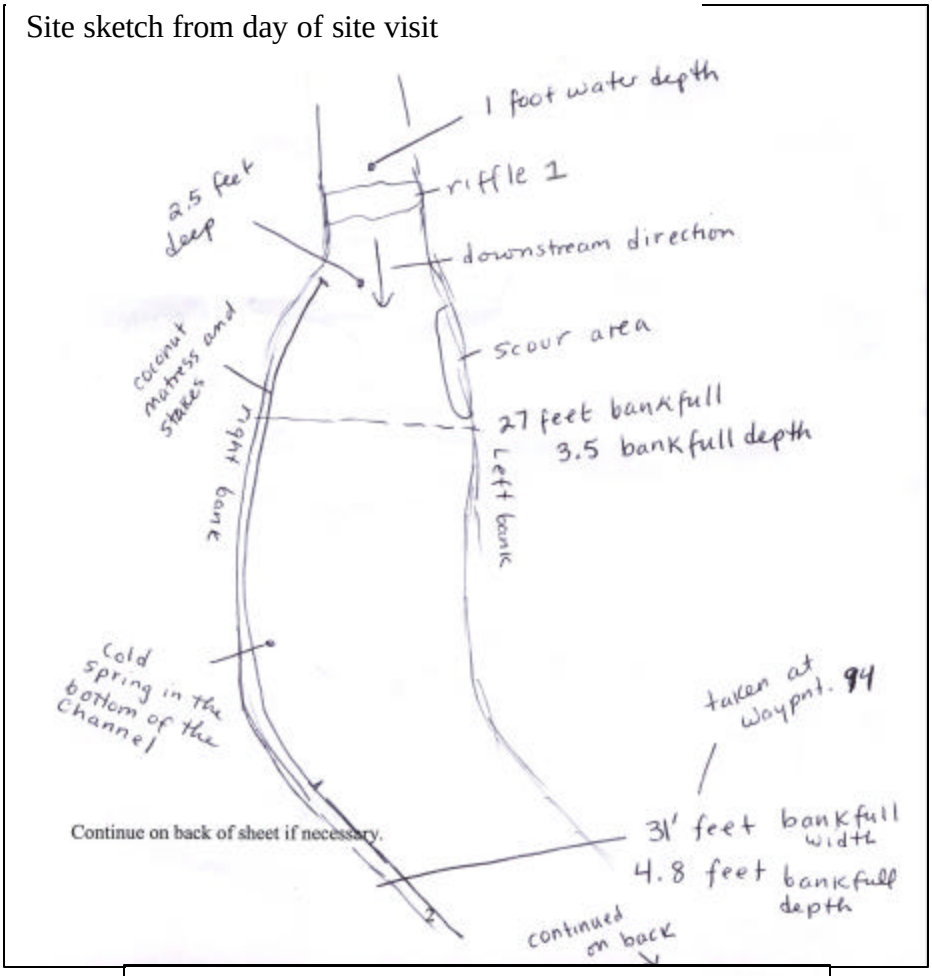
34. Riffle; medium gradient; pool depth 1 ft. above riffle; 2.5 ft. below riffle; scour area on left bank below riffle; 27 feet bank full width and 3.5 ft. bank full depth below riffle
35. Coconut mattress and stakes right bank along entire reach; steep gradient. Cold spring at bottom of channel at one point; 31 ft. bank full width, 4.8 ft. bank full depth at waypoint 94.
36. Riffle; steep gradient
37. Riffle; steep gradient; no erosion in streambed below riffle
38. Riffle; steep gradient

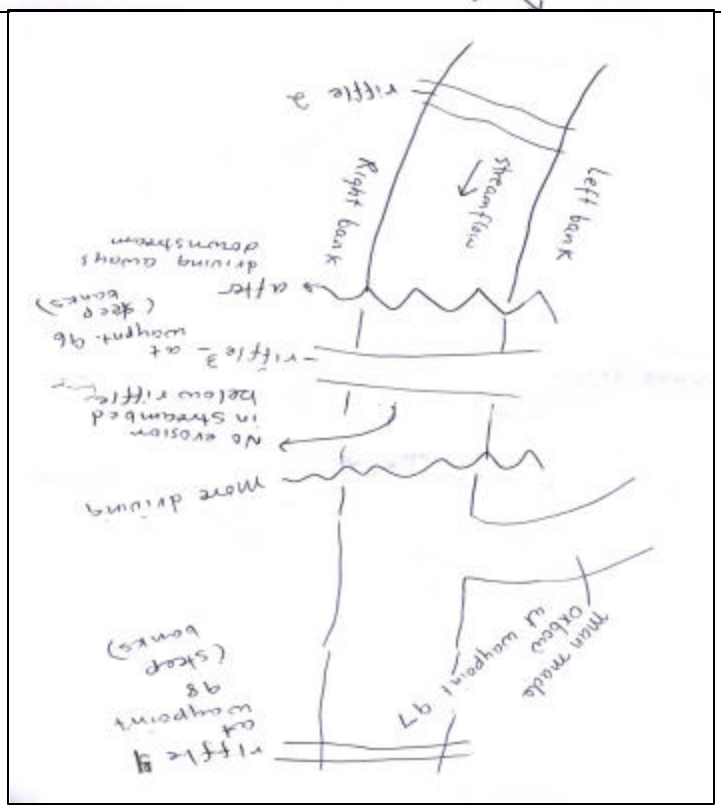
GENERAL NOTES AND INFORMATION

This project has four riffle installations as well as coconut mattress and stakes placed along the streambank. Pool depth ranged from 1 ft. to 2.5 ft. The gradient of the streambank was medium to steep. There were only 3 meander bends along the length of the channel, usually a channel of this length would have about 12 meander bends.

DOCUMENTATION:

Site sketch from day of site visit





DOCUMENTATION

Scour on the left bank just below the first riffle. This scour is caused by the riffle.

This photograph was taken of the second riffle installation.

View from left bank looking at an oxbow within the stream. Plants such as arrowhead and other flowers thrive here.

These two photographs were taken of a mussel found in the creek.

View of the right bank showing bank steepness.

Stream Restoration Inventory / Phase 2
Report of Restoration Field Verification

Project #: 214
Name: East Fork of the South Branch of the Kishwaukee River, Sun City Huntley Del Webb Site 2

SITE VISIT DETAILS

Team: Erin Poliakon, Laura Barghusen, Sue Cubberly, Jeff Mengler, Tim Straub, Don Roseboom, Karen Kabbes
Date: 07/01/03
Start Location: Sun City Huntley Del Webb Site 2

SUBMITTED INFORMATION

Original installation date: 2000
Type of Project: Bank Stabilization, Instream Restoration, Stream Remeandering

INSTALLATIONS FOUND AT SITE

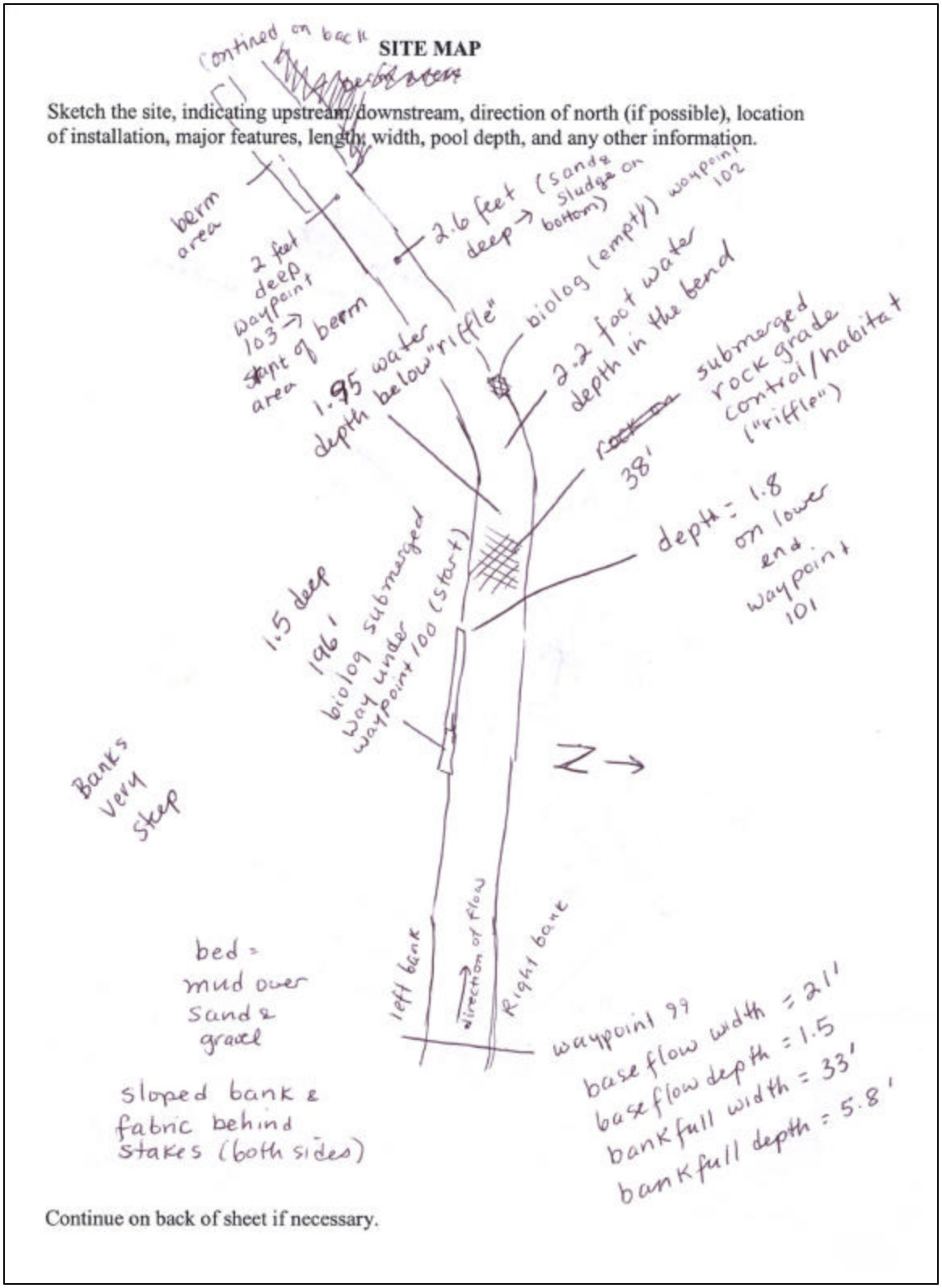
39. Sloped bank and fabric behind stakes; right/left banks; entire reach; pool depth varies 1.5 to 2.5 ft; substrate mud over sand and gravel; practice not measured because it was so long; (a mile?); baseflow width 21 ft., baseflow depth 1.5 ft. bank full depth 5.8 ft.
40. Biologs left bank; 196 ft. in length; pool depth 1.8 ft. lower end, 1.5 ft. upper end; substrate mud over sand and gravel; biologs submerged way underwater.
41. Submerged rock grade control (riffle 1) along entire streambed (bank to bank); 38 ft. in length; boulder substrate; pool depth 1.95 ft. below riffle
42. Biolog right bank; pool depth 2.2 ft. just above in the meander bend; substrate mud over sand and gravel; empty biolog
43. Riffle left bank; 2 ft. at upper end, substrate sand and sludge
44. Riffle along streambed; 35 ft. in length; 16 ft. width; pool depth 2 ft. below riffle; 128 ft. to the next riffle (riffle 3)
45. Riffle along streambed; 26 ft. length, 18 ft. width; steep gradient; boulder substrate
46. Lunkers left bank; 32 ft. length; steep gradient; mud substrate; lunkers clear all the way to the back
47. Rock deflector to direct flow toward lunkers, right bank

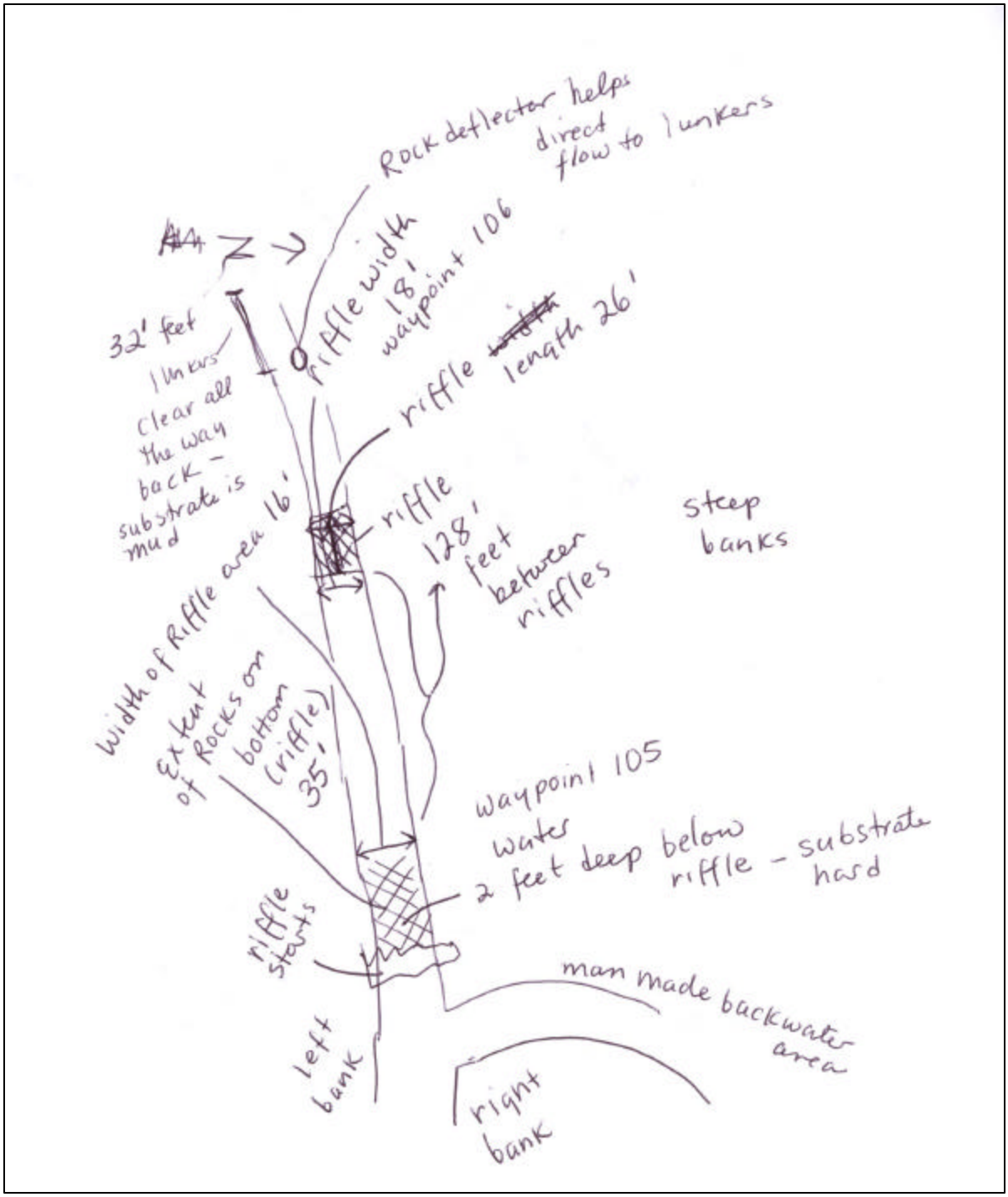
GENERAL NOTES AND INFORMATION

This project has four riffle installations, two biolog installations on the right and left stream banks, lunkers on the left bank, and stakes with fabric along the entire reach on

the right and left stream banks. Pool depth ranged from approximately 1 to 2 ft. The gradient of the stream bank was steep throughout.

DOCUMENTATION (continued): Site sketch from day of site visit




Rock deflector helps direct flow to lunkers
N
32' feet
lunkers clear all the way back - substrate is mud
riffle width 18' waypoint 106
riffle length 26'
riffle 128' feet between riffles
steep banks
width of Riffle area 16'
extent of Rocks on bottom (riffle) 35'
waypoint 105
water 2 feet deep below riffle - substrate hard
riffle starts
man made backwater area
left bank
right bank

DOCUMENTATION (continued):

Laura holding up a part of the biolog on the left bank which was submerged under water at the upper end of the biolog installation.

Erin standing at the first riffle; in this area of the stream pool depth was approximately 2 feet.

The berm on the left bank. Laura and Erin are standing on the berm to show its height; Karen is standing further away and off of the berm.

DOCUMENTATION (continued):

Looking upstream at the lunker structure. Don is measuring the internal length of the lunkers. The lunkers were clear of sediment all the way to the back. Pool depth in this area is approximately 2 feet.

Looking upstream at the second and third riffles; Erin is standing to the left of/on the riffle.

319 Funded

Stream Restoration Inventory / Phase 2
Report of Restoration Field Verification

Project #: 94
Name: Waukegan River National Monitoring Program—North and East Branches

SITE VISIT DETAILS

Team: Don Roseboom, Tim Straub, Laura Barghusen, Michael Norbeck
Date: 06/25/03
Start Location: Water Street, between Juniper Street and Utica Street

SUBMITTED INFORMATION

Original installation date: 1991-1994
Type of Project: Bank stabilization, Instream restoration, Wetland creation

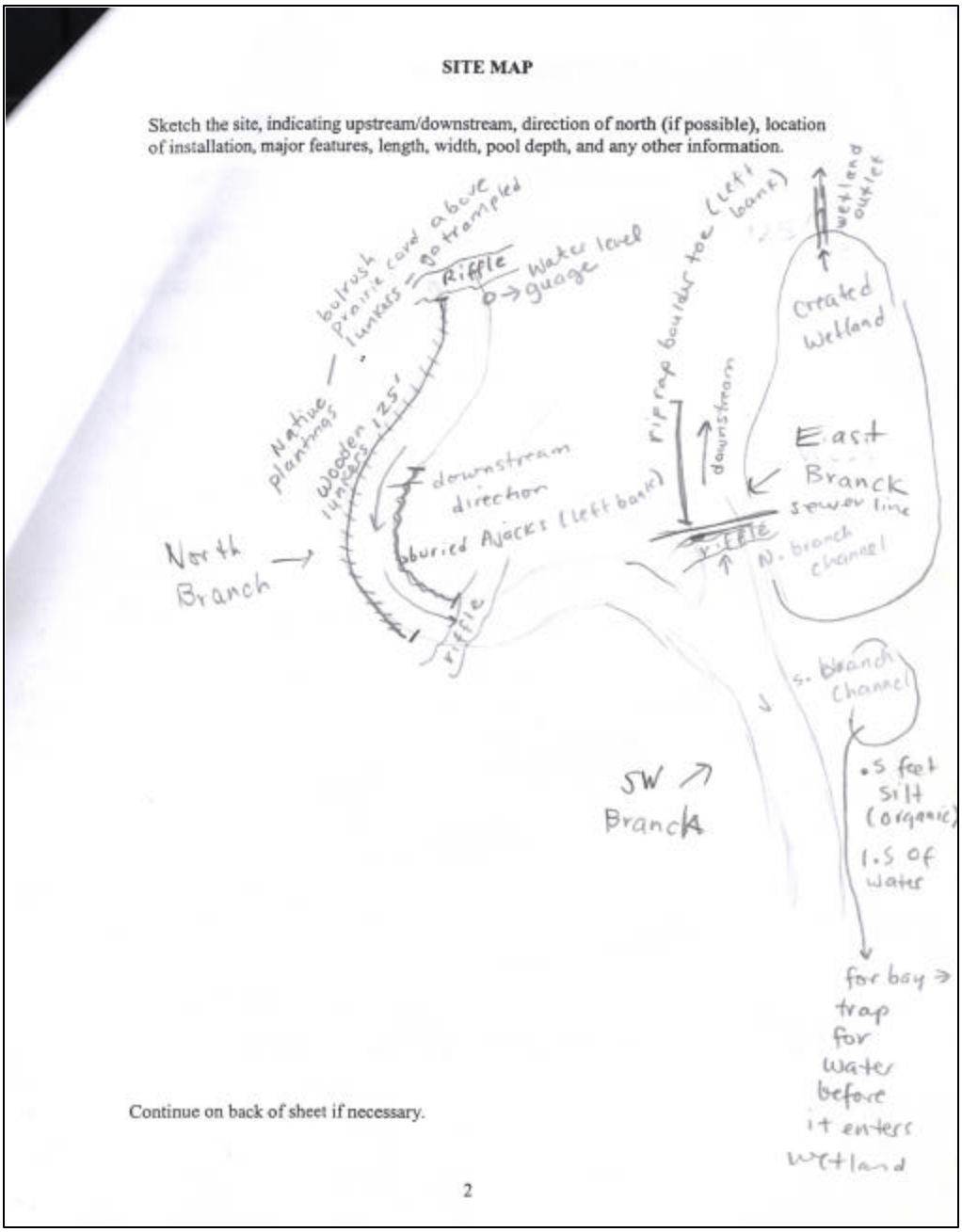
INSTALLATIONS FOUND AT SITE

48. Riffle; 117 ft. length; pool depth 2 ft. below riffle; coarse sand substrate; depth gage showed 0.5 feet just below riffle
49. Wooden lunkers; right bank; 125 ft. length; pool depth 1.8 to 1.2 ft. at lunker; 2 ft. at downstream end of lunker pool is 2.8 feet deep as you approach the downstream end. 1 inch gravel substrate (rip-rap); lunker half full of fine sediment, further downstream the lunkers are more open – 1.5 feet. 2 feet open as you get further downstream; back completely open; lunker partially full – 1.5 feet near downstream end.
50. Buried ajacks; left bank; 51.6 ft. length; gravel substrate; ajacks completely buried, not visible.
51. Riffle; 12.8 ft. width; medium gradient; pool depth 1.3 ft. upstream of riffle, 0.8 downstream of riffle; riffle at downstream end of wooden lunkers.
52. Riffle/weir at start of E. branch; 24.3 ft. width; pool depth 2.5 ft. between riffles 4 and 5, 2.7 ft. east of riffles 4 and 5; sewer line crosses stream near riffle
53. Riprap boulder tow; 150 ft. length; medium gradient; pool depth 1.8 ft.; put in to protect main sewer line; 22 ft. width at base flow; 28 ft. depth at bank full
54. Created wetland; 2 ft. of water; .45 ft. of fine deposited; skunk cabbage under trees in shade; outlet flowing over with wetland plants growing well. Submerged and emergent aquatics growing in wetland; pool depth near outlet = 3 ft., maximum depth = 4 ft. Toads calling, fish and spawning beds in wetland (not previously stocked); wetland forebay created to try H20 before it enters wetland; ..5 ft. organic silt on bottom; 1.5 ft. water

GENERAL NOTES AND INFORMATION

There were seven installations at this site; including wooden lunkers along the right bank of the North branch and buried ajacks on the left bank inside the meander. There is a riffle installation upstream of the lunkers and ajacks and another downstream of them. On the East branch, there is a riffle installation upstream of a rip-rap boulder toe. A wetland was created along the eastern side of the East branch channel.

DOCUMENTATION



DOCUMENTATION (continued)

Wooden lunkers on the right bank covered with rock on North Branch channel. At the upstream end the lunkers were halfway filled with sediment; farther downstream the lunkers were more open. The native plantings above the lunkers appear to have been trampled.

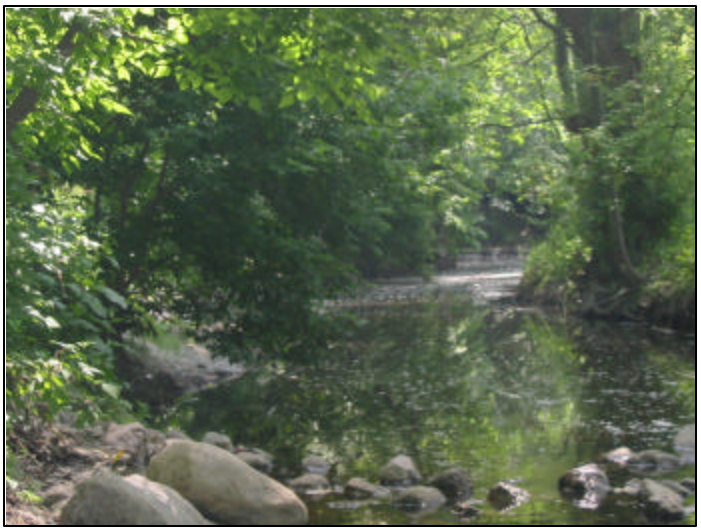
The riffle at the upstream end of the wooden lunkers on the North Branch Channel. The depth gauge just below this riffle showed 0.5" depth.

Ajacks on the left bank of the North Branch channel, downstream of the lunkers. The ajacks were completely buried and not visible.

DOCUMENTATION (continued):

The riffle at the downstream end of the lunkers. Pool depth was 1.3' just upstream of the riffle and 0.8' just downstream.

This photo was taken looking down the East Branch channel. The riffle can be seen in the foreground



Looking upstream at Tim measuring the pool depth at the riffle/weir on the East Branch channel.

Broad view of the created wetland area. Plants were growing well at the outlet at the north end of the wetland. Near the outlet the pool depth was 3'.

Tim taking the maximum depth of the wetland. The maximum depth was 4'. Toads were calling and there were fish and spawning beds in the wetland even though it was not stocked.

Don in the wetland forebay with the measuring rod. There was 0.5 feet of organic silt on the bottom and 1.5 feet of water in the forebay.

This final photo was taken of trash in the wetland forebay that floated in when flows were high. Water enters the forebay before flowing into the wetland.

Stream Restoration Inventory / Phase 2
Report of Restoration Field Verification

Project #: 94_A
Name: National Monitoring Site South Branch

SITE VISIT DETAILS

Team: Don Roseboom, Tim Straub, Laura Barghusen, Michael Norbeck
Date: 06/25/03
Start Location: Water Street between Juniper and Utica Streets

SUBMITTED INFORMATION

Original installation date: 1994
Type of Project: Bank Stabilization, Instream Restoration

INSTALLATIONS FOUND AT SITE

1.) Newbury weir; biologs originally put along banks instead of keying weir into bank; 16.9 ft. width; pool depth 1.5 ft. downstream, 2.2 ft. upstream of weir; 12 inch granite boulder substrate; medium gradient; weir stabilized the instream area.
2.) Sliding seep area right bank; rebar put in to see if it was slipping – rebar missing. Pool depth 2.5 ft. below slide area; gravel/cobble/sand substrate
3.) Newbury weir; 10.6 ft. width; pool depth 1 to 1.5 ft. upstream of weir, 2 feet downstream of weir; gravel/cobble/sand substrate; steep gradient.
4.) Newbury weir; 14 ft. width; boulder substrate; medium gradient
5.) Dogwoods growing in bank at area stabilized by buried ajacks; 20 ft. length; pool depth 2.6 ft.; gravel/sand substrate; planting survival and stability both good.
6.) Newbury weir; 11.2 ft. width; pool depth 2.6 ft.; cobble/gravel substrate
7.) Lunkers open about 1 ft., pool depth 2.5 ft. near lunkers; 85 ft. length
8.) Partial weir with ajacks stretching upstream (ajacks exposed by erosion); 10.3 ft. length (boulder to boulder); boulder substrate; upstream pool depth .2 to .45 ft.

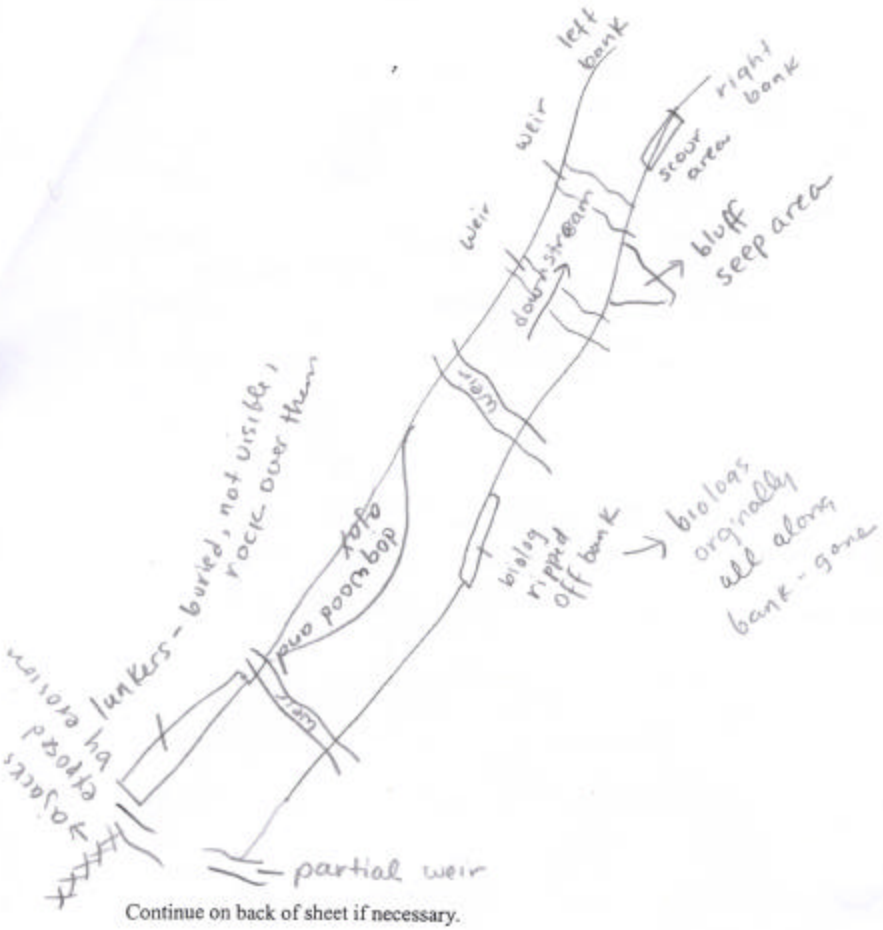
GENERAL NOTES AND INFORMATION

This project had 8 installations, 5 of which were Newbury weirs. At the northern most weir, the rocks were raised up to direct water into the wetland forebay. By putting weirs in series and making drops uniform, this project aimed to reduce the energy of the stream and therefore reduce sliding of the banks. At the sixth installation, a Newbury weir installed on a bend in the river, the downstream end of the weir was not armored and a scour hole formed below the weir and eroded the bank. This is why the fiber roll came

out at this site; what perhaps should have been used is rock to armor the bank (toe protection). At the last installation, a partial weir was installed because there is a house nearby and it was the goal to keep the weir low so that the house would not flood.

DOCUMENTATION (cont.): Site sketch from day of visit.

North



Continue on back of sheet if necessary.

2

DOCUMENTATION (cont.):

Newberry weir near the north end of the southern channel. This weir is raised up to direct water into the forebay of the created wetland; the weir is not keyed into the bank and it appears to have stabilized the instream area.

The remains of a biolog put in to stabilize the bank since the weir was not keyed into the bank.

This photo was taken of a sliding seep area between the first and second weirs. The series of weirs installed along the southern channel were designed to reduce energy and sliding. A rebar was originally installed here to measure sliding, but was missing on the day of the site visit.

This photo was taken of the weir upstream of the seep area.

A broad view of Don measuring the water depth near the third Newbury weir. Depth upstream was 1-1.5' and downstream was 2'. Bed material was gravel

Remnants of a biolog on the third Newbury weir.

Dogwoods growing on the left bank between the third and fourth Newbury weirs. There are buried ajacks stabilizing the bank here and vegetation growth is good.

Buried lunkers covered with rock upstream of the fourth Newbury weir. Lunkers were open to a depth of about 1 foot. There was some erosion resulting from the lunkers being put in too deep.

Eroded area just upstream of the lunkers.

This photo and the photo below were taken of the partial weir at the sourthern end of series of weirs. A partial weir was installed in order to keep the water level low so that flooding would not occur at a nearby house.

Ajacks exposed by erosion just upstream of the partial weir.

Stream Restoration Inventory / Phase 2
Report of Restoration Field Verification

Project #: 111
Name: Kline Creek

SITE VISIT DETAILS

Team: Kent Taylor, Don Roseboom, Tim Straub, Sue Cubberly, Laura Barghusen
Date: 07/09/03
Start Location: Kline Creek Farm Forest Preserve Parking Lot

SUBMITTED INFORMATION

Original installation date: 1997
Type of Project: Bank stabilization

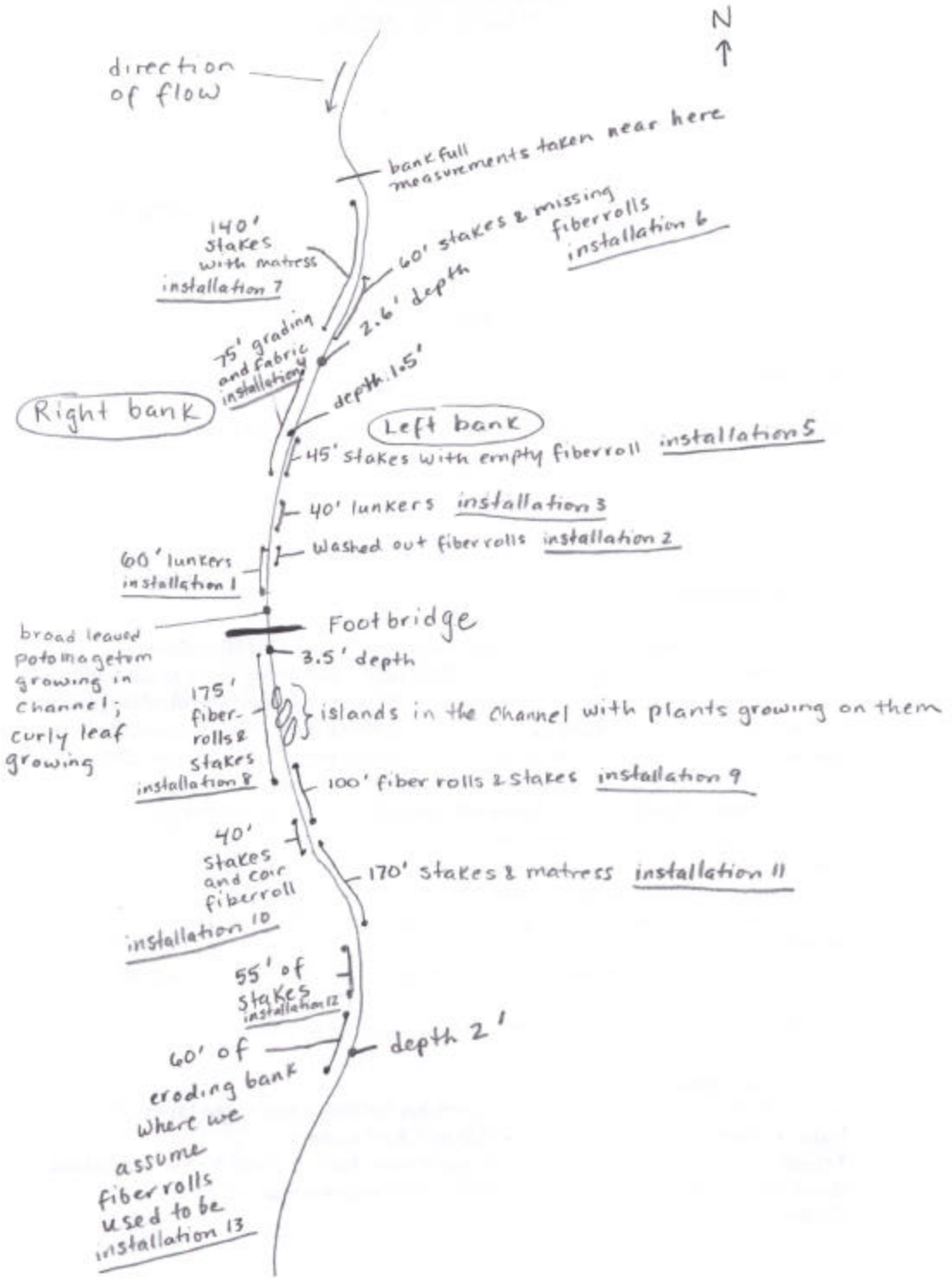
INSTALLATIONS FOUND AT SITE

1. Lunkers 60', right bank, gravel substrate, gradient low.
2. Washed out fiber rolls approximately 4-5', left bank, gravel substrate, gradient low
3. Lunkers 40', left bank, pool depth 1.8', gravel substrate, gradient low
4. Bank grading and fabric 75', right bank, pool depth 1.5' at upstream end, 2' near center of installation, gravel substrate.
5. Stakes with empty fiber roll 45', left bank, pool depth 2' near downstream end, substrate gravel, gradient low.
6. Stakes with missing fiber roll 60', left bank, pool 2.6 at downstream end, substrate silt and gravel, gradient low.
7. Stakes with mattress 140', right bank, pool depth 2.6', silt and gravel substrate, gradient low.
8. Fiber rolls and stakes 175', right bank, pool depth 3.5' at upstream end, silt substrate, gradient low.
9. Fiber rolls and stakes 100', left bank, substrate silt/gravel, gradient low.
10. Stakes and coir fiber roll 40', right bank, silt/gravel substrate, gradient low.
11. Stakes and mattress 170', substrate silt/gravel, gradient low.
12. Stakes 55', right bank, substrate gravel/silt, gradient low.
13. Eroding bank 60' (assume that fiber rolls used to be there), right bank, pool depth 2', substrate gravel/silt, gradient low.

GENERAL NOTES AND INFORMATION

This project is located in a very urbanized watershed, with more than 45% of its land cover made up of impervious surface. The project relied heavily on fiber rolls, many of which were washed out or missing on the day of the site visit. Two lunker installations were present, and the lunkers were mostly open.

DOCUMENTATION (Site sketch from day of visit)



DOCUMENTATION (continued):

Looking upstream at the lunkers on the right bank (installation 1). Approximately 2/3 of these were open, with the other 1/3 being partially filled. Broad leafed potomagetum and curley leaf were growing in the channel at the downstream end of these lunkers.

Area where fiber rolls washed out (installation 2). The stakes can be seen in the water with no fiber rolls behind them.

Don holding the remains of an empty fiber roll.

At installation 4, where bank grading and fabric were installed, 2 rolls of fabric were found, one overlaying the other. In some areas the bank was eroded and undercut behind the fabric.

Looking upstream toward the footbridge. The islands that have formed in the channel near installation 8 can be seen in this photograph.

Stakes at installation 8, which is made up of 175’ of fiber rolls and stakes. The pool depth varies a lot along this practice and the “islands” pictured above have formed in the channel. Pool depth was 3.5’ at the upstream end of this practice.

View looking downstream at stakes and fiber roll on the right bank (installation 10). There is about 20’ of good fiber roll and then it disintegrates.

Stream Restoration Inventory / Phase 2
Report of Restoration Field Verification

319 funded

Project #: 73
Name: Milne Creek

SITE VISIT DETAILS

Team: Don Roseboom, Tim Straub, Sue Cubberly, Kathleen Odell
Date: 07/10/03
Start Location: Route 7 and Madison Street (parked at Rusty's Auto)

SUBMITTED INFORMATION

Original installation date: 1998
Type of Project: Bank stabilization

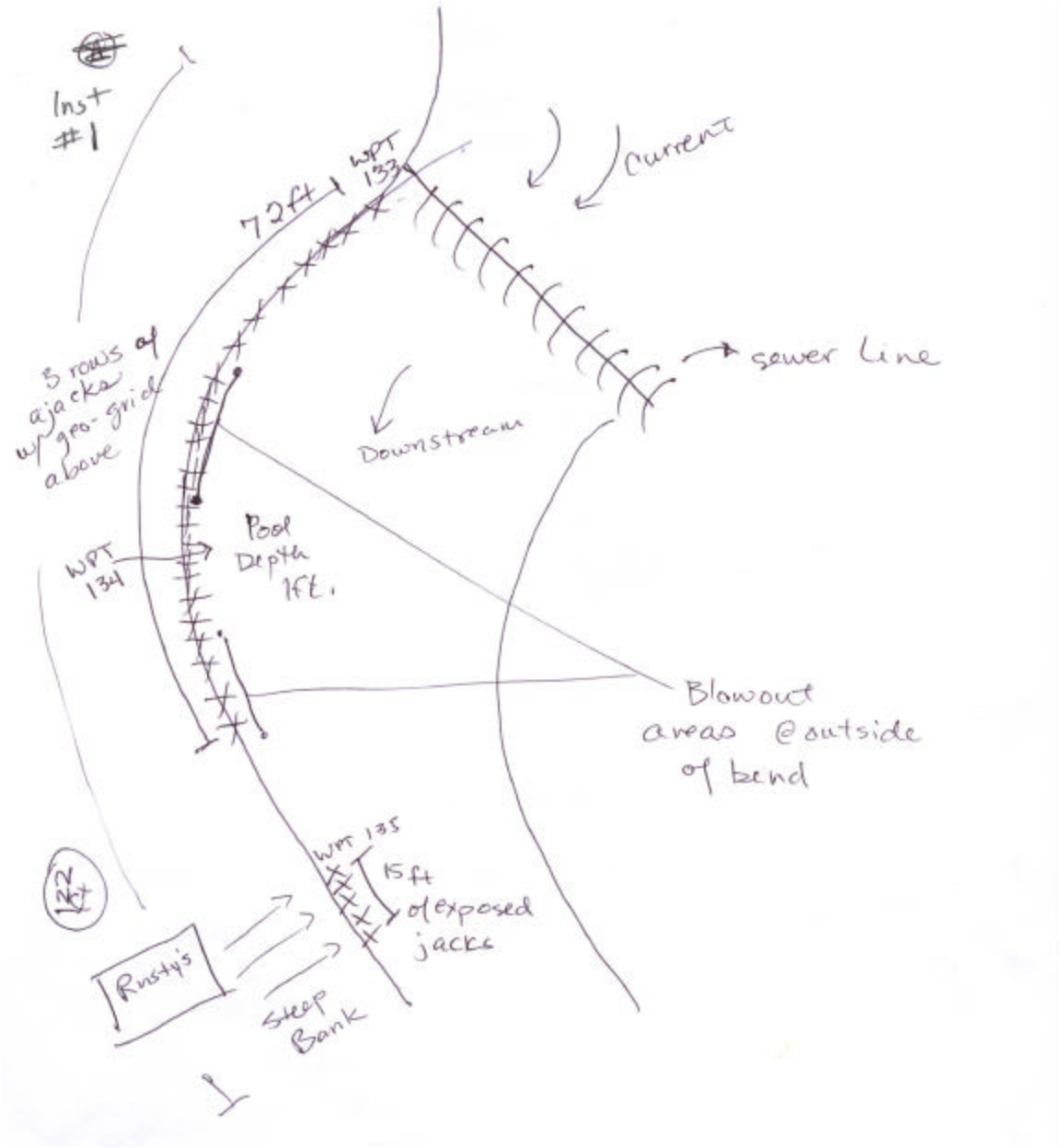
INSTALLATIONS FOUND AT SITE

1. Ajacks and geogrid 122' with 72' of ajacks, right bank, pool depth 1' at meander bend, substrate concrete chunks, steep gradient, willows were the only plantings that could be seen, stability not so good, stream breaks (drops) in the middle of meander bend
2. Ajacks (three rows) with geogrid 88', left bank, pool depth maximum 2.5 feet, substrate large rock, concrete and some cobble, D90 4 inches, D50 cobble, gradient steep, stability pretty good, blow out at meander bend
3. Ajacks with fabric above 60', left bank, pool depth 0.6 feet, D90 4 inch rock, D50 cobble, gradient steep, stability pretty good, the ajacks here are basically intact

GENERAL NOTES AND INFORMATION

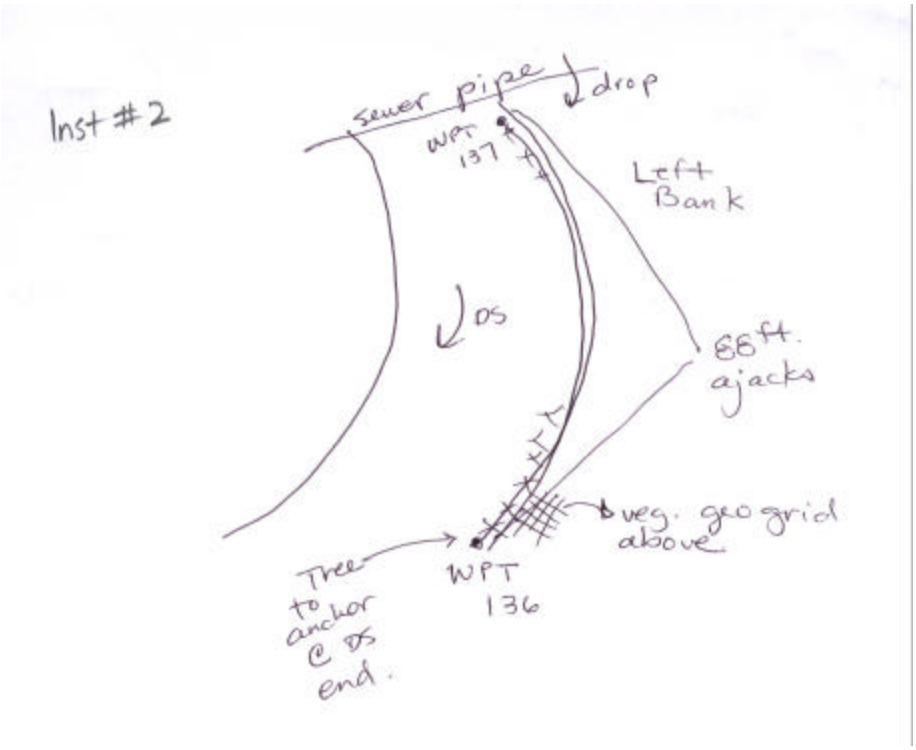
This project consists of ajacks, geogrid and fabric used to stabilize steep banks on the outside bends of three meanders. According to the *MILNE CREEK PHASE II STREAMBANK STABILIZATION PROJECT* 319 Report submitted to IEPA by Lockport's City Engineer, Milne Creek has served as the main tributary for conveying the City of Lockport's stormwater runoff. Over the years, Milne Creek's 3.8 miles of banks have been slowly eroded due to increased flows from various developments in the City of Lockport. The intent of this project is to stabilize the eroding stream banks, reduce the sediment loadings to the I&M Canal and increase public awareness of urban stream management techniques. The project was constructed in 1998 by BioTechnical Erosion Control, Ltd., Harvard Illinois.

DOCUMENTATION (Site sketch of installation 1 from day of visit)

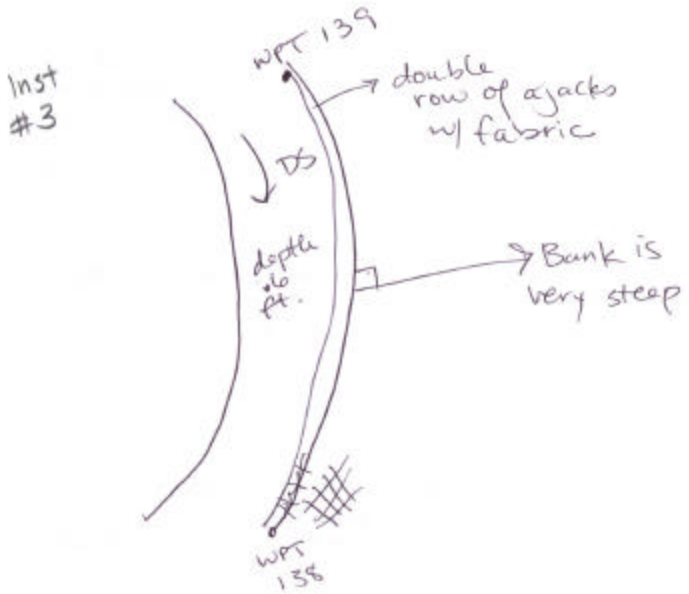


DOCUMENTATION, continued

(Site sketch of installation 2 from day of visit)



(Site sketch of installation 3 from day of visit)



DOCUMENTATION (continued):

Looking downstream at the ajacks and geogrid that make up installation 1 on the right bank.

The outside meander bend where installation 1 is blown out and the bank is undercut. The pool depth in this area was 1 foot and bank stability was not very good.

Close up of the bank undercutting on the outside of the meander bend.

Ajacks from installation 1 with their outer legs cracked or broken off. A second row of ajacks was still holding the bank here.

Looking downstream at the outside bend with the ajacks and geogrid of installation 2. At this installation the stability was pretty good, although there was some undercutting of the bank. The maximum pool depth was 2.5 feet, and the substrate was concrete with some larger 4 inch rock and cobble.

A view looking upstream along the left bank at installation 3. The ajacks here were basically intact and stability was pretty good. Pool depth was 0.6 feet, the substrate was cobble and 4 inch rock and the gradient was steep.

Stream Restoration Inventory / Phase 2
Report of Restoration Field Verification

319 funded

Project #: 72
Name: Milne Creek

SITE VISIT DETAILS

Team: Don Roseboom, Tim Straub, Sue Cubberly, Kathleen Odell
Date: 07/10/03
Start Location: Between Division and Adams, at Adams and Milne Creek in Lockport

SUBMITTED INFORMATION

Original installation date: 1998
Type of Project: Bank stabilization

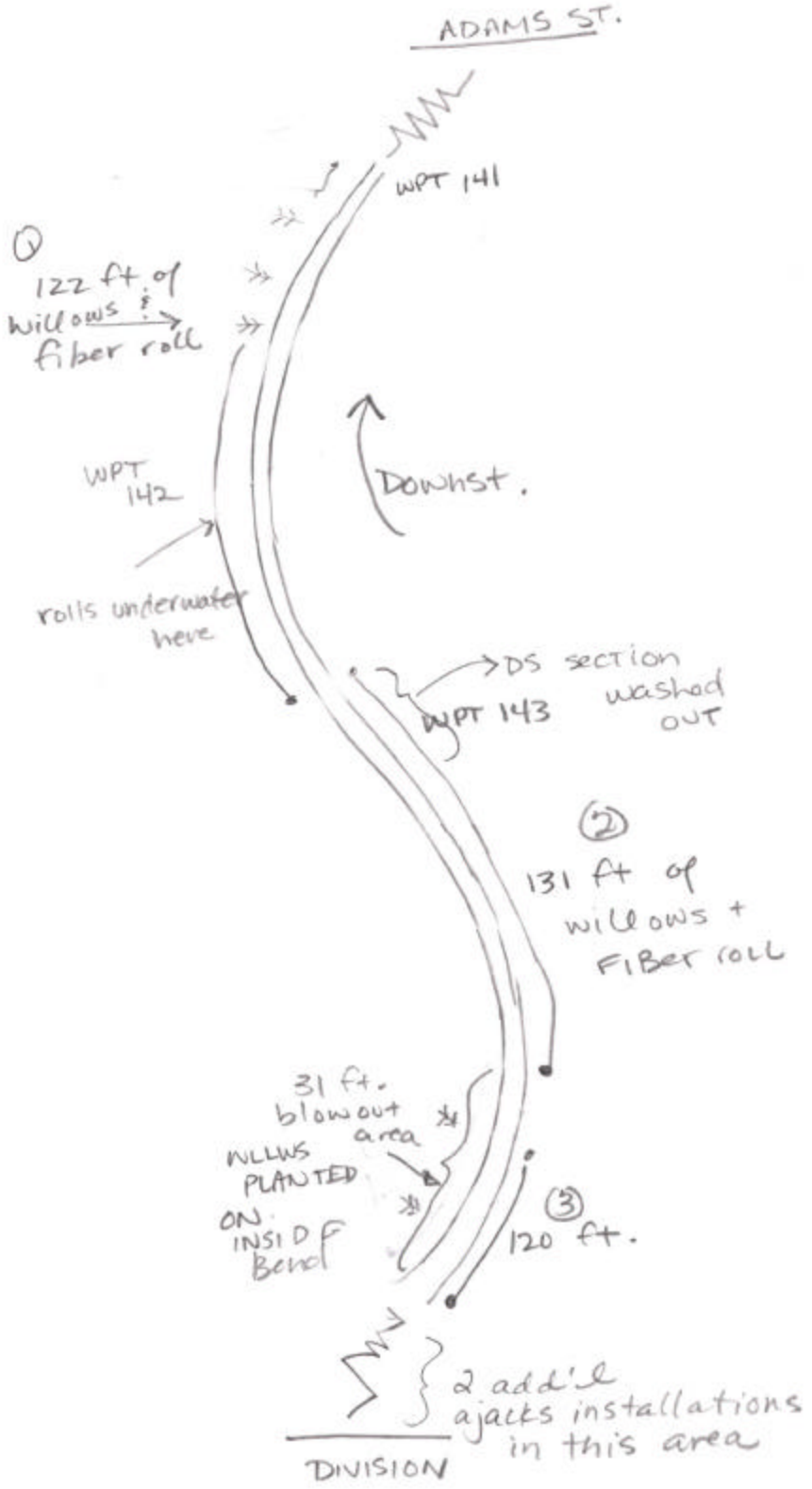
INSTALLATIONS FOUND AT SITE

1. Willows and fiber roll 122', left bank; substrate: D90-12 inches, small cobble; gradient medium; the willow plantings are doing pretty well, stability is very good and the practice looks very good with floodplain developing with low depositional areas in the channel.
2. Willows and fiber roll 131', right bank; pool depth is 0.9 feet; substrate: D90-12 inches, small cobble; gradient is medium; stability is not good, the practice is completely washed out at the downstream end.
3. Two rows of ajacks and fabric 120', right bank, substrate: D90-6 inches; gradient is medium, stability is pretty good; the willows are planted on the inside of the bend and the ajacks limit the flow in the reach.

GENERAL NOTES AND INFORMATION

This project consists of ajacks, fiber roll, willow plantings and fabric used to stabilize the banks. Besides the installations listed above, two additional ajacks installations were found downstream; both looked good, although the downstream installation had a little head cutting.

DOCUMENTATION (Site sketch from day of visit)



DOCUMENTATION (continued):

Looking upstream at the channel in the area of installation 1. There are willows and fiber roll on the left bank, and the substrate is small cobble. The willow plantings are doing pretty well, stability is very good and the practice looks good with floodplain developing with low depositional areas in the channel.

An upstream view of the stakes and fiber roll of installation 2 on the right bank. Stability was not good at this installation and fiber rolls were washed out at the downstream end.

Erosion on the left bank across from installation 2.

Looking upstream at the row of ajacks and fabric on the right bank. Syability is pretty good here, but these ajacks limit the flow in the reach.

18 inch culvert inlet pipe on the outside bend of the right bank (installation 3). Ajacks and fabric can also be seen here.

A view from the left bank of the ajacks and fabric of installation 3

Stream Restoration Inventory / Phase 2
Report of Restoration Field Verification

Project #: 216
Name: Stony Creek

SITE VISIT DETAILS

Team: Kent Taylor, Don Roseboom, Tim Straub, Randy Stowe, Cathy Pollack
Date: 08/12/03
Start Location: SW of Randall Rd, Hopps, south edge of Elgin – Stevens Road at top of site

SUBMITTED INFORMATION

Original installation date: 1999
Type of Project: Bank stabilization, Instream restoration, Riparian Buffer Restoration; Meander construction

INSTALLATIONS FOUND AT SITE

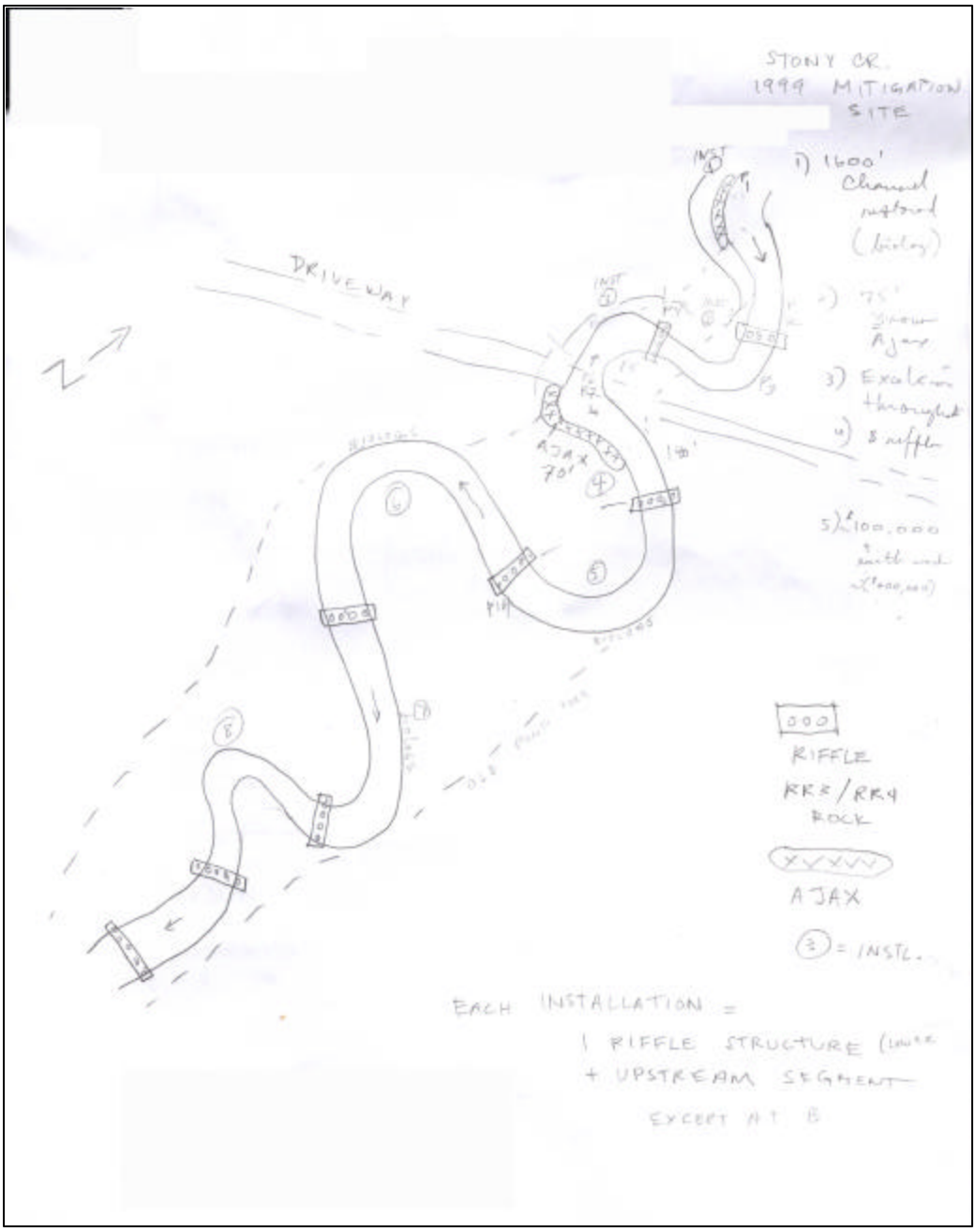
55. Riffle/Meader installation; 87'; pool depth 1.5'-2.0'; substrate small cobble; medium gradient; planting survival good/excellent; stability good; bank 3:1; biologs on outside and 50 ft. length ajacks at top of project area on the right bank.
56. Riffle/meander installation; 173 ft. length; pool depth 0.8 to 1 ft.; substrate small cobble 1 to 2 inches; medium gradient; planting survival good/excellent; stability good; biologs on left (outside bend)
57. Riffle/meander; 70 ft. biologs on right bank; 245 ft. length to bridge; pool depth 0.8 to 1 ft.; substrate cobble and artificial large rock; medium gradient; planting survival good/excellent; stability good; 75 ft. from riffle to start of biologs – in good condition – ends at 145 ft. on right bank; large willows present
58. Riffle/meander; 70 ft. ajacks right bank; 140 ft. length; pool depth 1.2 ft.; substrate cobble/silt; medium gradient; planting survival good/excellent; stability good
59. Riffle/meander; biologs throughout on outside left bank; 235 ft. length; pool depth 1.2 ft.; substrate cobble/silty; at 140 ft. there is undercutting on the left bank, vegetation needs burning
60. Riffle/meander; biologs right bank; 265 ft. length; pool depth 1.8 to 2.2 ft.; substrate cobble; medium gradient; planting survival good; stability good; bankfull depth 2 ft.; width 16 ft.; biologs washed out (2.2 ft. hole there)
61. Riffle/meander; biologs left bank; 170 ft. length; gravel/silt/cobble; planting survival good/excellent; stability good; gradient medium to low; stakes but no biologs present on the left bank; submerged, aquatic vegetation present
62. Riffle/meander; 155 ft. length; pool depth 1.8 to 2.1 ft.; substrate silty sand/cobble; medium gradient; planting survival good; stability good; some slumping on left bank upstream from riffle 7.

63. Riffle/meander; 90 ft. length; pool depth 1.2 to 1.6 ft.; substrate silty with cobble; medium/low gradient; planting survival good; stability good; point bar is vertical for 2 ft. from riffle 8.

GENERAL NOTES AND INFORMATION

This is a mitigation site where a 1600' channel that had been converted to a pond was restored to a meandering stream. There are nine installations at this site; all installations are riffle structures with an upstream segment.

DOCUMENTATION



DOCUMENTATION (continued):

The ajacks at the upstream end of the site (part of installation 1).

Don leaning into the undercut bank at installation 5.

Riffle #2 where pool depth was 0.8'-1.0', the substrate was small cobble, and planting survival was good.

Looking upstream at the ajacks on the right bank at installation 4. Pool depth here was 1.7', substrate was cobble and silt, and planting survival was good.

This photo was taken of riffle 3 where pool depth was 0.8'-1.0', the substrate was cobble and artificial large rock, and planting survival was good.

The biolog washout on the right bank at installation 6. Note the stakes with nothing behind them.

This photo was taken of the stakes at installation 7. The biologs were gone.

View of riffle #7 looking downstream.

This photo was taken of riffle 6.

Stream Restoration Inventory / Phase 2
Report of Restoration Field Verification

Project #: 217
Name: Fox Mill Creek

SITE VISIT DETAILS

Team: Don Roseboom, Tim Straub, Jeff Mengler, Cathy Pollack, Laura Barghusen
Date: 11/17/03
Start Location: Church parking lot on LaFox Road north of Route 38

SUBMITTED INFORMATION

Original installation date: mid-1990's
Type of Project: Remeandered farm ditch with buffer plantings

INSTALLATIONS AND CONDITIONS FOUND AT SITE

64. Slumping on the left bank, 45 ft., gradient steep, pool depth 10", creek substrate was fairly hard and reed canary grass on banks.
65. Slumping on the left bank, 30 ft., gradient steep, pool depth 10", creek substrate hard and reed canary grass on banks.
66. Mild to medium erosion and slumping on the right bank, 120 ft., gradient steep, pool depth 1 ft., creek substrate hard and reed canary grass on banks.
67. Riffle; gradient steep, pool depth 1 ft., creek substrate hard, bank stability not good.
68. Severe slumping on the right bank, 25 ft., gradient steep, pool depth 1 ft., creek substrate soft and silty, stability not good.
69. Slumping on right bank, 60 ft., gradient steep, pool depth 1 foot, creek substrate soft and silty, stability not good.
70. Riffle; gradient steep, pool depth 1 ft., creek substrate bimodal hard pan clay with 3" cobble, bank stability not good.
71. Slumping on the right bank, 105 ft., gradient steep, creek substrate soft and silty with some large rocks, stability not good.
72. Slumping on the outside meander bend (right bank), 260 ft; fish rocks occur at 35 ft. and 50 ft., rock grade control structures occur at 70 ft., 180 ft, and 225 ft. Submerged boulders occur at 260 ft. The gradient is steep at the upstream end of the slumping, but is medium at the downstream end; soft and silty sediments at the upstream end become cobble at the downstream end; stability is not too good at the upstream end, but better at the downstream end. Willows and reed canary grass were growing on the banks throughout the extent of the slumping.
73. Erosion on apex of meander bend, right bank, 105 ft., gradient medium on the right bank and low on the left bank, pool depth maximum was 1 ft, 6 in and minimum was 5 in. The substrate was soft and silty. Stability was good in the stretch upstream of the meander bend.

74. Erosion on the right bank, 24 ft., gradient medium, stability was good between installation/condition 10 and 11.
75. Meanders become tighter, and buffer species improve, switch grass seen in buffer.

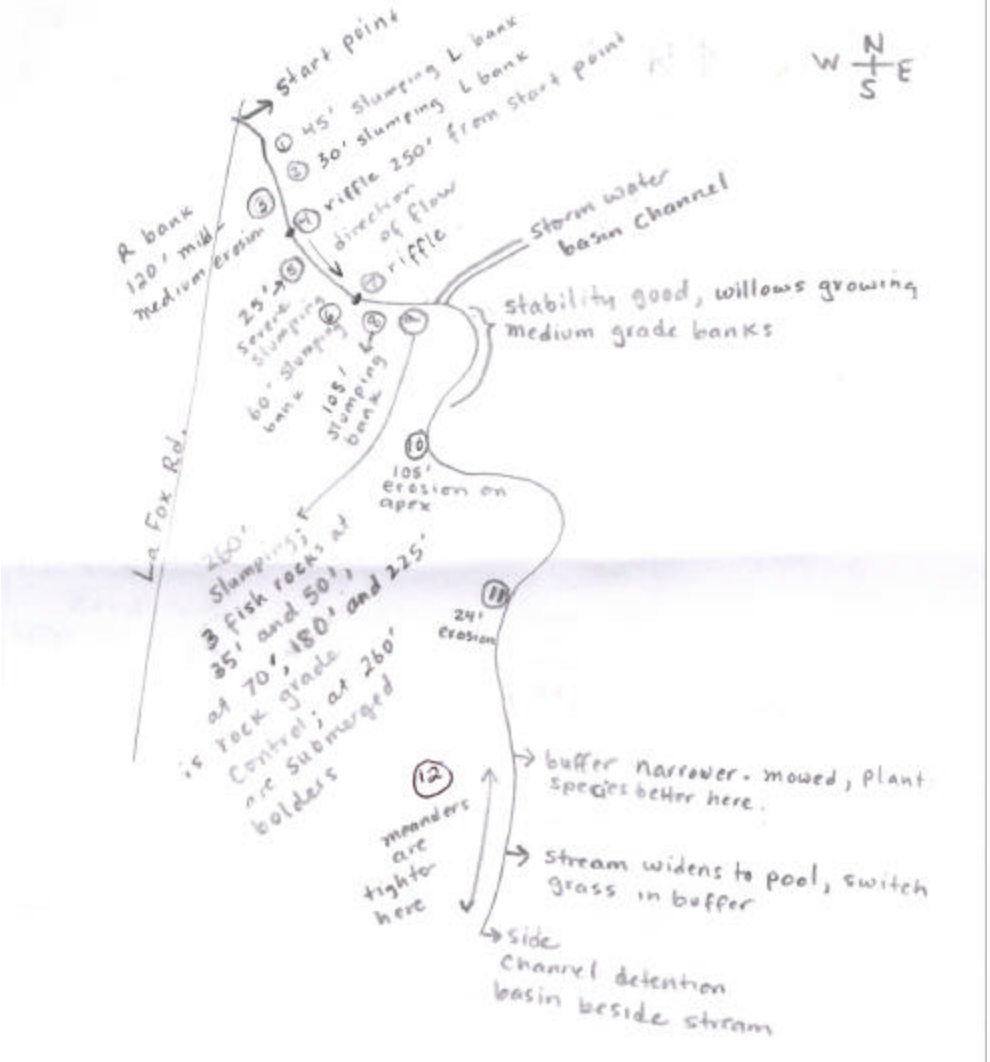
GENERAL NOTES AND INFORMATION

This is a remeandered farm ditch with buffer plantings. The upstream end of the project had very steep banks and extensive bank slumping. Further downstream the banks were not as steep and stability was good. The plantings at the upstream end of the project do not seem to have survived. The willows present have come in on their own. The buffer species at the downstream end of the project looked better.

DOCUMENTATION

SITE MAP

Sketch the site, indicating upstream/downstream, direction of north (if possible), location of installation, major features, length, width, pool depth, and any other information.



DOCUMENTATION (continued):

Close up of a slumping, undercut bank near the upstream end of the project where the gradient was steep and stability was not very good. Buffer species were dominated by reed canary grass.

Looking downstream at the first riffle (installation 4). This riffle was about 250 feet downstream from the start point and pool depth was about 1 foot in the vicinity of the riffle. The bank gradient was steep in this area, and the banks unstable.

25 feet of severe slumping on the right bank just downstream of the riffle pictured above.

Looking downstream at riffles and fish rocks from installation 9. Bank stability began to improve in this area and continued to be good farther downstream. Bank gradient transitioned from steep to medium and continued to be medium to low farther downstream. Some willows could be seen growing on the banks.

Downstream end of installation 9. Stability was good.

105 feet of erosion on the right bank at the apex of the meander bend (installation 10). Stability was generally good downstream of this area, with only a few relatively short erosional areas seen farther downstream.

Near the downstream end of the project the buffer appeared to be mowed closer to the shore, but the plant species seen were of higher quality. Jeff Mengler noted that the entire reach had pond weed and other aquatic vegetation in the stream but that this instream vegetation is covered in silt and probably will not survive for this reason.

Near the far downstream end of the project, the stream widened out into a pool. Depth was about 2 feet next to the bank and was doubtless deeper near the middle. Switch grass was seen in the buffer in this area.

A side channel detention basin (right side of photo) can be seen near the stream (left side of photo) at the downstream end of the project.

Appendix B:
Organization of the Access Database

FIELD_DATA_ENTRY form

The FIELD_DATA_ENTRY form was the main form for data entry and is the most convenient way to look up project specific information. This form combines fields from multiple tables, allowing all the project information, GPS waypoints, installations, and photographs associated with a project to be viewed on a single screen.

SUBFORMS

Three subforms, INSTALLATION_SUBFORM, WAYPOINT_SUBFORM, and PICTURE_SUBFORM, are also included in the forms list. These were created in order to link to the FIELD_DATA_ENTRY form. The subforms are not very useful on their own, although they are essential to the proper functioning of the main data entry form.

TABLES

The database has five tables which contain all of the information about the projects. The tables can be accessed directly if this method of data lookup is more convenient than referring to the FIELD_DATA_ENTRY form.

PROJECT table

The PROJECT table is the general table that contains information about the site visit. There is one record in the PROJECT table for each of the 54 sites that were visited.

The PROJECT table has the following fields:

Field Name	Data Type	Description
PRJ_NUM	Text	The project number. This number corresponds to the project number used in the GIS database. All photographs and drawings are also labeled with this project number.
PRJ_NAME	Text	The name of the project.
DATE	Date/Time	The date that the project was visited in the field.
TM_MEM1 – TM_MEM7	Text	Seven fields containing the names of the members of the project team that were present at the site visit.
ST_TIME	Date/Time	The time that the field checking began on the day of the site visit.
ST_LOC	Text	The location where the field team started the site visit (usually a parking lot or intersection that could be found on a map).
BUFF_SPC	Text	A list of plants found in the vegetated buffer, if applicable. Not filled in for all projects.
PRJ_NOTES	Memo	Miscellaneous notes about the project that were not specific to installations or photographs.

WAYPOINTS table

The WAYPOINTS table stores all the GPS waypoints collected during the site visits. In most cases, each project in the database has many waypoints associated with it. In total, the WAYPOINTS table stores 317 waypoints. The waypoints are stored in the UTM coordinate system, in the NAD 83 map datum.

The WAYPOINTS table has the following fields:

Field Name	Data Type	Description
ID	AutoNumber	A unique identifier automatically assigned to each record in the table.
PRJ_NUM	Text	The key field used to link the waypoint to the associated project. Corresponds to the PRJ_NUM field in the PROJECT table.
WPT	Text	The waypoint number assigned to the waypoint by the Magellan GPS unit. This number is also recorded on the project field sheets.
UTM_E	Text	The east/west coordinate of the waypoint. The format is 16 ###### E, where 16 indicates the zone, ###### indicates the 6 number coordinate, and E indicates E/W.
UTM_N	Text	The north/south coordinate of the waypoint. The format is ####### N, where ####### indicates the 7 number coordinated and N indicates N/S.

INSTALLATION table

The INSTALLATION table contains information about each installation found in the field. An "installation" is considered a single instance of a particular practice, for example "100 feet of lunkers on the right bank." Most projects recorded in the PROJECT table have multiple installations associated with them.

The INSTALLATION table was modified midway through the field work to add additional fields. For this reason, every record does not have information for all the fields in the table. The fields added midway through the field work are indicated with an asterisk in the table below.

The INSTALLATION table has the following fields:

Field Name	Data Type	Description
ID	AutoNumber	A unique identifier automatically assigned to each record in the table.
PRJ_NUM	Text	The key field used to link the installation to the associated project. Corresponds to the PRJ_NUM field in the PROJECT table.
INST_NUM	Number	The number assigned to the installation in the field and recorded on the field data sheet.
INST_TP	Text	The installation type. A brief description of the type of installation, for example "lunkers," or "bank regrading."
INST_LNG	Text	The length (in linear feet) of the installation.
INST_WD	Text	The width (in feet) of the installation, if applicable. Generally used for vegetated buffers or other installations where width is an important aspect.
INST_NTS	Memo	Notes about the installation, including general assessment of the condition or other observations.
POOL_DP*	Text	Pool depth. Usually this should be the measurement of the deepest pool in the stream directly adjacent to the installation.
SUBSTRATE*	Text	Description of the stream substrate (sand, gravel, etc.) If known, this field may have D-50 and D-90 assessments.
PLNT_SVL*	Text	Planting survival. Assessment of how the plantings are surviving on the bank. Not relevant to all installations.
GRAD*	Text	Gradient. Problematic field. Originally designed to indicate the gradient (steep, medium, low) of the stream bank near the installation, but interpreted in the field as the gradient of the stream itself. Should probably be disregarded or used very carefully.
BANK*	Text	Indicates whether the practice is found on the right or left bank.

* indicates a field that was added to the table midway through the field work

PICTURES table

The PICTURES table stores information and descriptions for each digital still photograph taken in the field. Each project recorded in the PROJECT table has many pictures associated with it.

In a few cases, the PICTURES table was used to enter descriptive information about a GPS waypoint or installation where no photograph was taken. In these cases, no picture number is indicated and the pertinent information is given in the notes field. In general, in these unusual cases either a waypoint number or installation number should be included to clarify the notes.

The PICTURES table has the following fields:

Field Name	Data Type	Description
ID	AutoNumber	A unique identifier automatically assigned to each record in the table.
PRJ_NUM	Text	The key field used to link the picture to the associated project. Corresponds to the PRJ_NUM field in the PROJECT table.
PIC_SHT	Number	The number assigned to the photograph by field team and entered on the field data sheet.
PIC_CAM	Text	The number assigned to the photograph by the digital camera.
PIC_FNL	Text	The final number given to the photograph for archival purposes. This is the most important number, as it can be used to look up the photographs in the digital file system. The number is in the form of PRJ_xx, where PRJ is the project number, and xx is the number of the specific photograph.
WPT	Text	A waypoint number (in the form of WPTxxx), which indicates the approximate location where the photographer was standing when the photograph was taken.
INS_NUM	Text	The installation number to which the photograph corresponds. Can be cross-referenced with the INSTALLATION table.
PIC_NOTE	Text	Notes describing what the picture is looking at, why it was taken, the general style (close-up, long shot, etc.) and the aspect (looking upstream, downstream, etc.).

Team_Member_List table

The Team_Member_List table was used as a value list for data entry purposes. The table has only one field, NAME. The table contains the names of 11 people who were involved with the field work and who were listed in fields TM_MEM1 – TM_MEM7 in the PROJECT table.

Photographs

In addition to the photographs taken during the field visits, we also have "before" photographs for many of the sites in our database. These photographs were supplied by the person or agency responsible for the project in most cases. Whenever possible, we tried to take photographs in the field that would correspond to the "before" photographs that we have on file.

SURVEY_PHOTOS

The “before” photographs are stored in .jpg format in a directory titled “Survey_Photos.” Inside this directory are 51 subdirectories. The subdirectories are labeled by project number and name, for example “24_Forked Creek 2.” In this case, the project number (which corresponds to PRJ_NUM in the Access database) is 24, and the project name is Forked Creek 2. Within the subdirectories, the photos have been titled, whenever possible, to give some indication of the content of the photograph.

PHOTOS BY PROJECT

The photographs taken during the field work are stored in .jpg format in a directory titled “Photos by project.” Inside this directory are 54 subdirectories, one for each of the projects visited in the field survey. The subdirectories are labeled by project number and name, for example “3_RockyGlenDam.” In this case, the project number is 3 and the project name is Rocky Glen Dam. Within the subdirectories, the photographs have been titled with the project number and an identifier, for example 3_1, 3_2, 3_3, and so on, are the photographs of the Rocky Glen Dam project. The photograph titles correspond to the PIC_FNL field in the PICTURES table.