WILL COUNTY STORMWATER MANAGEMENT PLANNING COMMITTEE

Countywide Stream Maintenance and Inspection Manual

Effective July 14, 2009

WILL COUNTY STORMWATER MANAGEMENT PLANNING COMMITTEE
58 E. Clinton Street, Suite 500
Joliet, IL 60432
V 815.740.8140 F 815.774.6327

SECTION 1 INTRODUCTION

- **1.1 - Basic Stream History**

Streams are dynamic systems and change continually. Typically, stream channels are naturally formed over thousands of years and tend to reach an equilibrium state where erosion and accretion are generally balanced. Changing the amount of water that enters a stream system, the rate at which that water enters the system and certainly altering the size or course of the stream channel itself will cause the system to become "out of balance" and may have dramatic implications.

The majority of the streams in Will County have been channelized for agricultural purposes or as a result of urbanization. Many of the streams in the County now consist of narrow, trapezoidal channels with steep embankments and narrow floodplain. In many cases, streams have been significantly altered by channelization, creating a confined channel where flood flows can no longer access the natural floodplain. As a result, the increased flow velocities and increased erosional forces associated with flood events stay within the channel and create erosional damage to the stream bed and banks.

Typical streams in Will County show many reaches with little natural meandering and limited diversity of plant species along the channels and within the floodplain. There are some sections of streams which contain a good deal of forest within the floodplain, but these are primarily located in the northern, more urbanized portions of the County. It appears that the majority of the streams which remain closer to their natural courses are located in the northern portion of the County. Urbanization has occurred around the natural meandering of the streams, whereas agriculture has channelized the streams to follow field lines and maximize farmable acreage.

- **1.2 - Stream Terminology**

Aggradation Geologic process by which a stream bottom or flood plain is raised in elevation by the deposition of material.

Bankfull discharge The stream discharge (flow rate, such as cubic feet per second) that forms
and controls the shape and size of the active channel and creates the flood plain. This discharge generally occurs once every 1.5 years on average.

Bankfull stage The stage at which water starts to flow over the flood plain; the elevation of the water surface at bankfull discharge.

Baseflow The portion of streamflow that is derived from natural storage; average stream discharge during low flow conditions.

Boulders Large rocks measuring more than 10 inches across.

Channel A natural or artificial waterway of perceptible extent that periodically or continuously contains moving water. It has a definite bed and banks that serve to confine the water.

Channel roughness Physical elements of a stream channel upon which flow energy is expended
including coarseness and texture of bed material, the curvature of the channel, and variation in the longitudinal profile.
Channelization Straightening of a stream channel to make water move faster.

Cobbles Medium-sized rocks which measure 2.5 to 10 inches across.

Confined channel A channel that does not have access to a flood plain.

Degradation Geologic process by which a stream bottom is lowered in elevation due to the net loss of substrate material. Often called downcutting.

Downcutting See Degradation.

Flood plain The flat area of land adjacent to a stream that is formed by current flood processes.

Gabions A wire basket filled with rocks; used to stabilize streambanks and to control erosion.

Geomorphology The study of the evolution and configuration of landforms.

Gradient Slope calculated as the amount of vertical rise over horizontal run expressed as ft/ft or as percent (ft/ft * 100).

Gravel Small rocks measuring 0.25 to 2.5 inches across.

Hydrology The study of the properties, distribution, and effects of water on the Earth's surface, soil, and atmosphere.

Incised channel A channel with a streambed lower in elevation than its historic elevation in
relation to the flood plain.

Intermittent stream A stream in contact with the ground water table that flows only certain
times of the year, such as when the ground water table is high or when it receives water from surface sources.

Meander A winding section of stream with many bends that is at least 1.2 times longer, following the channel, than its straight-line distance. A single meander generally comprises two complete opposing bends, starting from the relatively straight section of the channel just before the first bend to the relatively straight section just after the second bend.

Nickpoint The point where a stream is actively eroding (downcutting) to a new base elevation. Nickpoints migrate upstream (through a process called headcutting).

Perennial stream A steam that flows continuously throughout the year.

Point bar A gravel or sand deposit on the inside of a meander; an actively mobile river feature.

Pool Deeper area of a stream with slow-moving water.

Reach A section of stream (defined in a variety of ways, such as the section between tributaries or a section with consistent characteristics).

Riffle A shallow section in a stream where water is breaking over rocks, wood, or other partly submerged debris and producing surface agitation.

Riparian The zone adjacent to a stream or any other waterbody (from the Latin word ripa, pertaining to the bank of a river, pond, or lake).

Riprap Rock material of varying size used to stabilize streambanks and other slopes.

Run A fast-moving section of a stream with a defined thalweg and little surface agitation.

Scouring The erosive removal of material from the stream bottom and banks.

Stream-Forming Flow The discharge that is most effective in shaping and maintaining the natural stream channel.

Substrate The mineral or organic material that forms the bed of the stream; the surface on which aquatic organisms live.

Surface fines That portion of streambed surface consisting of sand/silt (less than 6 mm).

Thalweg The line followed by the majority of the streamflow. The line connecting the lowest or deepest points along the streambed.

Turbidity Murkiness or cloudiness of water caused by particles, such as fine sediment (silts, clays) and algae.

Watershed A ridge of high land dividing two areas that are drained by different river systems. The land area draining to a waterbody or point in a river system; catchment area, drainage basin, drainage area.

- **1.3 - Agricultural Watersheds**

  - **1.3.1 - Increase Farmable Land**

    Channelizing streams on agricultural land is often completed to alter the natural meandering course of streams in attempts to "square up" the agricultural fields for maximum farmable area and ease of operations.

  - **1.3.2 – Channelization for Drainage**

    Channelizing streams on agricultural land also is often completed to allow for agricultural drain tiles to be gravity drained into them. This may result in steeper embankments and separation of the stream from its natural floodplain. The natural floodplain was then turned into agricultural land, with very little buffer, to maximize the farmable land.

- **1.4 - Urbanizing Watersheds**

  - **1.4.1 – Increased Imperviousness**

    Development of land within a stream's watershed results in an increase in the amount of impervious land within the watershed. This reduces the amount of infiltration of stormwater into the soils, and increases the volume and frequency of stormwater to the stream during a rainfall event. The stormwater is also conveyed more quickly to the stream in an urbanized area.

  - **1.4.2 – Lack of Riparian Buffers**

    Development of land immediately adjacent to streams does not provide a good vegetated riparian buffer. Filtration of stormwater prior to conveyance into the stream system helps improve the water quality and further slows the velocity of the water into the stream.

    With this alteration of the hydrologic regime, the increased flow velocity causes significant erosion and sediment transfer downstream. The channel banks tend to erode and eventually fail, causing sediment, trees, and other vegetation to fall into the stream channel. Increased stormwater runoff volumes and velocities, combined with debris falling into the streams, often leads to blockages and flooding problems at various points along the stream length.

- **1.5 - Field Tiles**

Underground drainage pipes, known as field tiles, have been installed in agricultural areas to maximize the amount of farmable land. Field tiles drain standing surface water from low areas on the property and also may lower the water table to aerate the root zone, allowing crop plants to grow. Field tiles, once constructed of clay but now usually plastic, are trenched into the ground at varying depths, crossing fields and open land.

Maps of precise locations of where these tiles exist are not common. A drain tile field investigation, involving probing into the ground with metal rods and excavating narrow trenches at strategic locations, must be performed to precisely locate the existing field tile locations.

Field tile systems require periodic maintenance to maintain their effectiveness. Over time, tiles will become filled with sediment and will not flow as originally intended. Older clay tiles will occasionally collapse, causing a "blowout" as the water traveling through the tile will erode out the land where the breakage has occurred. Tile repairs are necessary to maintain the integrity of the system and ensure that it continues to function as intended.

The field tile network may be quite extensive and drain a considerable amount of property, including offsite areas. Field tiles encountered during stream maintenance must be treated cautiously to ensure that the function of the tile is not disrupted.

- **1.6 - Separation from the Floodplain**

In the natural condition, low frequency, heavy rainfall events will overburden the stream channel. The flow of water will then overtop the stream banks and flow onto land adjacent to the stream. This land is called floodplain and is a natural part of the stream system. When natural streams are channelized, they are often lowered. The channel can then convey more stormwater and the stream banks will not be overtopped as frequently as they are in the natural condition. This "separates" the channel from the floodplain. Flood flows that are separated from the floodplain remain confined to the stream channel. This increases the velocity of the water and therefore substantially increases the erosional forces on the channel banks and bottom. Bed and bank erosion will occur and eventually cause bank collapse.

- **1.7 - Review Agencies Involved – Federal, state, local**

In planning stream maintenance work, potential impact to wetlands and floodway/floodplains must be considered. Stream maintenance projects have the possibility of involvement by a number of federal and state agencies, depending on the nature and extent of the project.

  - **1.7.1 – Federal**
    Most minor debris clearing operations strictly involving the removal of material with minimal, if any, ground disturbance and no placement of fill material within or near a stream, may be performed as a "maintenance activity" and likely would not need formal involvement by the U.S. Army Corps of Engineers (Corps), the agency given responsibility under the Clean Water Act for regulating the discharge of dredge and fill material into "waters of the United States".

  - **1.7.2 – State**
    The Illinois Department of Natural Resources – Office of Water Resources (IDNR-OWR) has jurisdiction over floodway modifications in urban

watersheds greater than 1 square mile. Stream maintenance activities with the potential to alter the floodway should be presented to the IDNR-OWR for review. The IDNR-OWR will issue permits for appropriate uses within the floodway portion of the floodplain. These appropriate uses include construction modification, repair or replacement of structures dikes, dams, storm and sanitary outfalls, fencing built parallel to the direction of flow, bridges and culverts, regarding without fill to create positive drainage to the watercourse. See Section 3708 Floodway Construction in Northeast Illinois - of the Illinois Administrative Code for complete details on allowable uses of the IDNR-OWR.

In addition, potential impacts to wildlife species and their habitats should be considered with any project involving a water course.

- **1.7.3 – Local**
  Because local regulations vary throughout Will County, the local agencies should be consulted during the planning process to determine regulations and permitting requirements. Municipalities, Townships, Highway Departments, Soil and Water Conservation Districts and other local agencies should be contacted.

- **1.8 – Possible Permits**

  - **Army Corp of Engineers Sect. 404**, Clean Water Act
  - **Illinois Environmental Protection Agency Sect. 401**, Water Quality Certification
  - If State Funding is Involved: **Illinois Department of Natural Resources**, approval under the Interagency Wetland Policy Act
  - IDNR-OWR Floodway Construction – Section 3708 Floodway Construction in Northeast Illinois
  - If applicable, approval by **local municipality** wetland ordinance

SECTION 2 IDENTIFICATION OF PROBLEMS

- **2.1 - Chronic Problems vs. Single Events – Review History of Problem**

Often, chronic problems within a watershed stem from years of past abuses. If buffers are not respected around stream channels and development is allowed to occur in very close proximity to stream channel banks, accelerated and uncontrolled erosion can result. Accumulations of eroded sediments reduce channel capacities and create channel overtopping events more frequently than if the sediment deposits were not within the channel.

Lack of even occasional maintenance of stream channels and particularly bank slopes can lead to significant debris accumulation and flow impediment. Trees along stream banks should be inspected for damage. Large woody debris can create a blockage or create a redirected stream flow that creates additional damaging bank erosion. It is important to remove obstructions before significant damage occurs.

- **2.2 - Culverts vs. Bridges**

Debris blockage of culverts occurs frequently because culverts tend to constrict the channel. Culverts are often used at minor stream crossings and can be as small as 12" diameter openings. It is common for small branches and other debris to wash downstream, and become blocked at a stream crossing with a culvert. If there is no maintenance program to remove these blockages, the area upstream of the crossing can become impounded with water. If the situation becomes severe the stream may overtop the crossing, or flood adjacent property upstream of the crossing.
Bridges are usually associated with major stream crossings, and are usually much less restrictive than culverts. The bridge opening usually allows small branches and other debris to wash through the bridge without being blocked. Bridges with piers are more restrictive and can cause blockages to occur.

The blockage of a culvert or bridge can also result in erosion which can undermine the crossing. Because both culverts and bridges are associated with stream crossing, they should be monitored frequently for blockages to make sure the crossing is not endangered.

- **2.3 - Problem Documentation – Stream Assessment (Field Inventory/Checklist)**

The following is an example of a checklist that can be used to assist in the identification and ranking of problem areas:

- **EXAMPLE**

Figure 2 Stream visual assessment protocol worksheet

USDA

Stream Visual Assessment Protocol

Owners name *Elmer Smith* Evaluator's name *Mary Soylkahn* Date *6-20-99*

Stream name *Camp Creek* Waterbody ID number ______

Reach location *About 2,000 feet upstream of equipment shed*

Ecoregion ______ Drainage area *2,200 acres* Gradient *1.2 % (map)*

Applicable reference site *Cherry Creek north of the Rt 310 bridge*

Land use within drainage (%): row crop *40* hayland *30* grazing/pasture *20* forest *10* residential ______

confined animal feeding operations ______ Cons. Reserve ______ industrial ______ Other ______

Weather conditions-today *clear* Past 2-5 days *clear*

Active channel width *15 feet* Dominant substrate: boulder ______ gravel *X* sand *X* silt ______ mud ______

Site Diagram

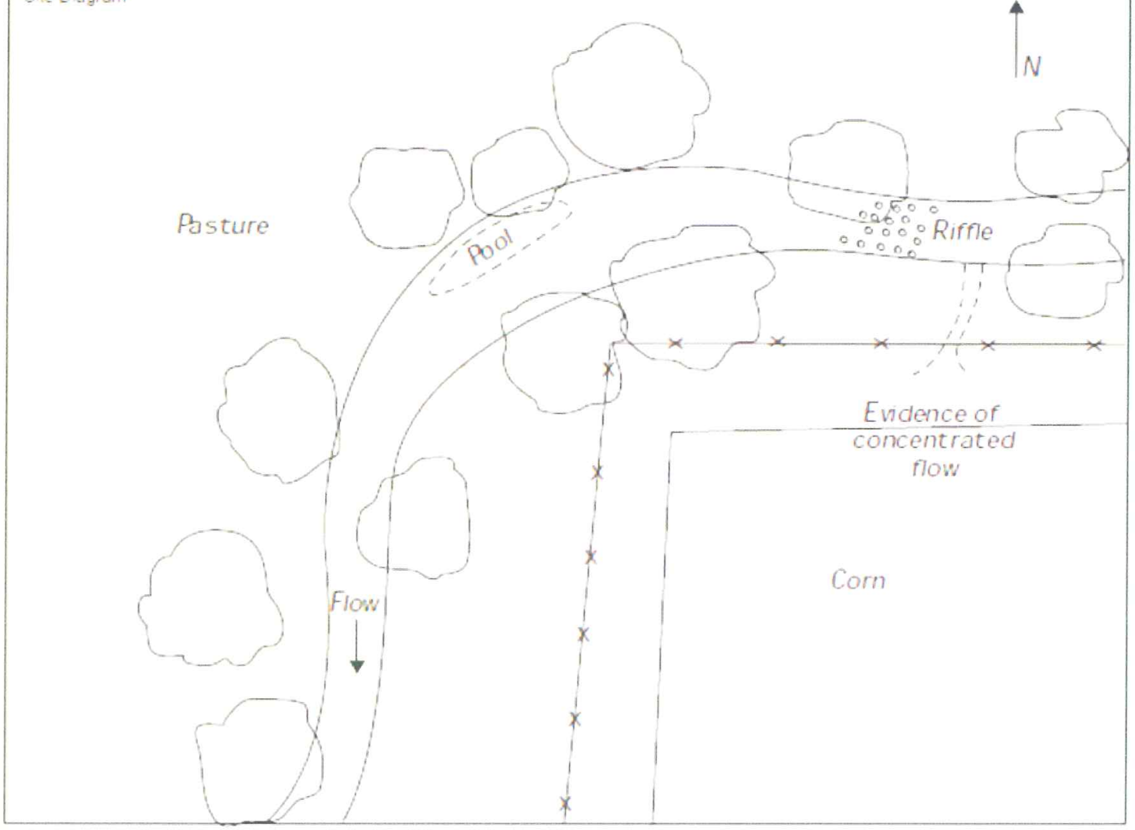


Figure 2 Stream visual assessment protocol worksheet Continued

Assessment Scores

Channel condition	8
Hydrologic alteration	10
Riparian zone	1
Bank stability	5
Water appearance	3
Nutrient enrichment	7
Barriers to fish movement	10
Instream fish cover	3
Pools	3
Invertebrate habitat	7

Score only if applicable

Canopy cover	3
Manure presence	1
Salinity	
Riffle embeddedness	5
Marcroinvertebrates Observed (optional)	10

Overall score
(Total divided by number scored)
76/14 5.4

<6.0	**Poor** (circled)
6.1-7.4	**Fair**
7.5-8.9	**Good**
>9.0	**Excellent**

Suspected causes of observed problems This reach is typical of the reaches on the property. Severely degraded riparian zones lack brush, small trees. Some bank problems from livestock access. Channel may be widening due to high sediment load. Does not appear to be downcutting.

Recommendations Install 391-Riparian Forest Buffer. Need to encourage livestock away from stream using water sources and shade or exclude livestock. Concentrated flows off fields need to be spread out in zone 3 of buffer. Relocate fallen trees if they deflect current into bank-use as stream barbs to deflect current to maintain channel.

- **2.4 – Ranking System**

Once a variety of stream maintenance projects have been identified, they should be ranked to determine their priority. The stream condition can be ranked by a determining the severity of the erosion in the stream. Stream erosion can be ranked as follows:

  - Severe
  - Minor
  - Stable

In addition to the stream condition, if there is debris blockage, the impact of the debris can be ranked based on the impacts to the surrounding area. In general, a blockage that causes flooding of adjacent properties and houses will be high priority. Blockages that cause damage to the stream, increasing erosion, should be prioritized next. Blockages that don't appear to be causing an impact to the stream or adjacent property would be the lowest priority.

Additional factors must be considered while prioritizing stream maintenance projects. Site accessibility, cost, funding, and cost-sharing and grant opportunities should all be considered when determining the priority of stream maintenance projects.

- **2.5 – Local vs. Streamwide Problem**

Prior to beginning a stream maintenance project, the engineer should determine if the stream problem is a local problem or a streamwide problem. A local problem can be "fixed" without a major impact upstream or downstream of the project location, while a stream wide problem requires a more complex solution.

To determine if a problem is local or streamwide an analysis of the channel equilibrium should be conducted. If the channel is in equilibrium, a local repair should fix the problem without impacting upstream or downstream. If the channel is not in equilibrium there is a streamwide problem, and a local project will have a minor, temporary impact to the problem.

SECTION 3 CONSIDERATION OF CORRECTIVE ACTION

- **3.1 - Project Goals**

Identifying the goal of a given maintenance or restoration project is largely an exercise in envisioning the future condition of a stream and identifying the scale of both the restoration and its consequent impacts, both upstream and downstream. Future conditions may include hydraulic, hydrologic, environmental, or ecological improvements to both a stream and its tributary area. Care should be taken to ensure underlying problems are addressed, and not simply their visible symptoms. Maintenance goals may consist of environmental changes at the project site, at locations upstream and downstream of the site, or both.

Physical improvements at the site locations may include:

- Erosion control/undercutting prevention
- Bank or shoreline protection/stabilization
- Removal of debris or unwanted flow barriers
- Raising of channel bed
- Improving site vegetation/aesthetics
- Aquatic habitat improvements

Upstream or downstream improvements may include:

- Reducing backwater effects
- Increasing downstream flow
- Reducing flow velocity
- Flood control
- Aquatic habitat improvements
- Sediment management
- Water quality improvement

Once goals for the site and the project's scope of impact are identified restoration options are chosen accordingly.

- **3.2 - Available Options**

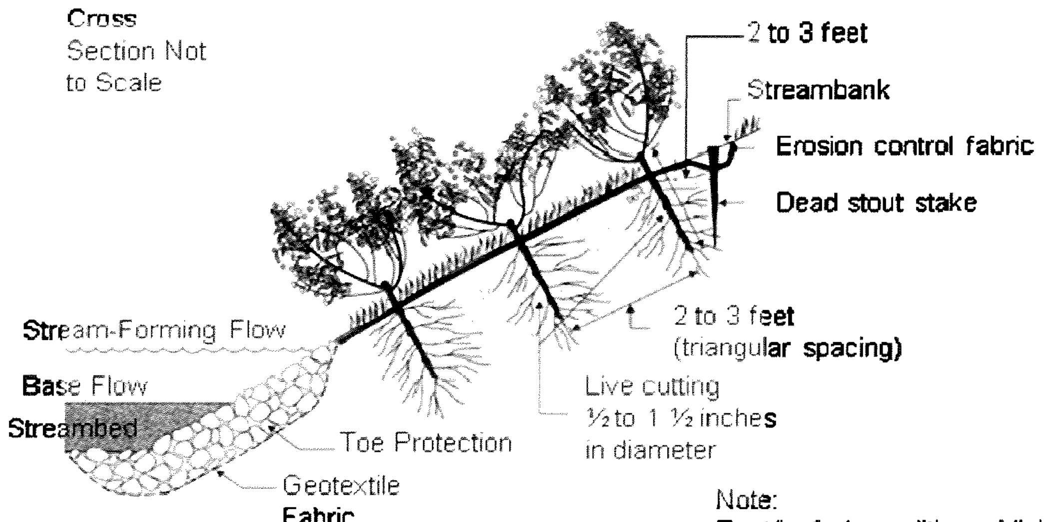
Streambank maintenance and restoration options are typically classified as either bioengineering improvements or structural improvements. Soil engineering improvements involve improvements to the physical characteristics of the banks, channel, and adjacent areas, including stabilization, vegetation, and protection measures. Structural improvements are those which have a more substantial impact on the cross sectional flow area of the stream at the maintenance site, resulting in more substantial changes in flow velocities, volumes, and water surface levels both onsite and upstream or downstream. A brief summary of recommended techniques is provided below.

- 3.2.1 - BioEngineering

Live Stakes

Live staking involves the insertion and tampering of live, rootable vegetative cuttings into the ground. If correctly prepared, handled and placed, the lives stake will root and grow.

A system of stakes creates a living root mat that stabilizes the soil by reinforcing and binding soil particles together and by extracting excess soil moisture. Most willow species root rapidly and begin to dry out a bank soon after installation.



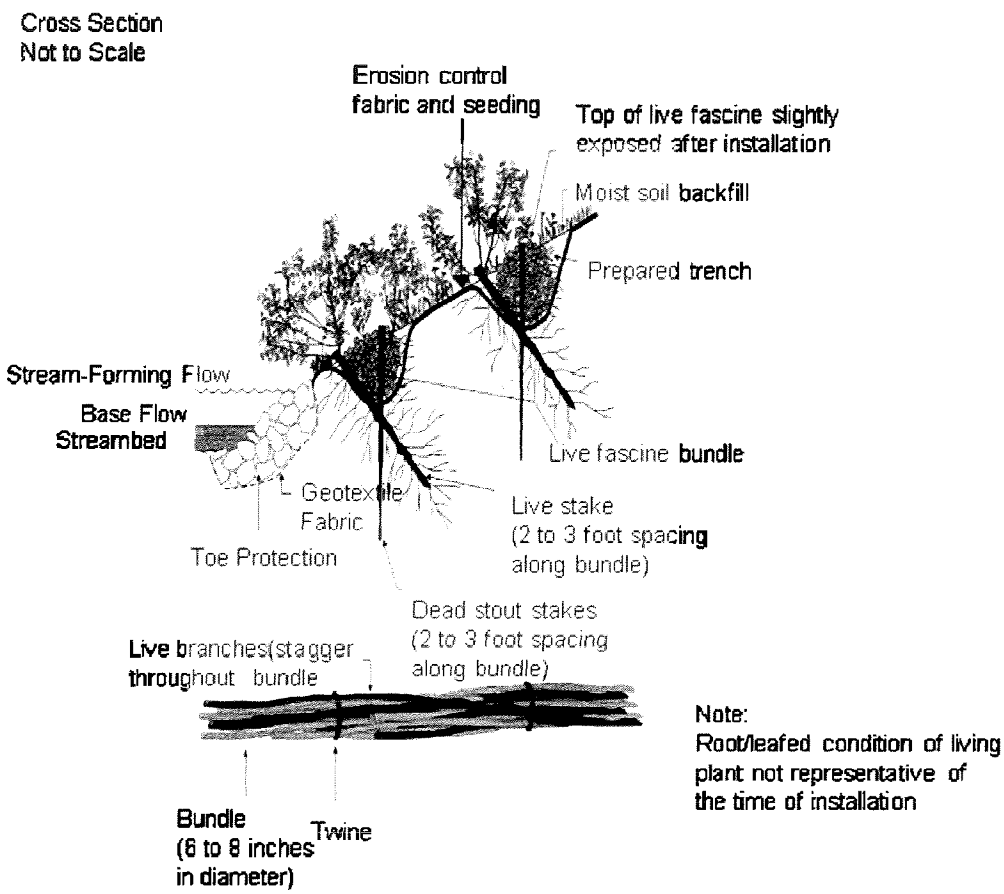
(210-vi-EFH-December 1996)

Applications and effectiveness

- Effective streambank protection technique where site conditions are uncomplicated, construction time is limited, and an inexpensive method is needed.
- Appropriate technique for repair of small earth slips and slumps that frequently are wet.
- Can be used to peg down and enhance the performance of surface erosion control materials.
- Enhance conditions for natural colonization of vegetation from the surrounding plant community.
- Stabilize intervening areas between other soil bioengineering techniques, such as live fascines.
- Produce streamside habitat.
- Recommended slope ≤ 3:1. Practice is not applicable for slopes ≥ 2:1.

Live Fascines

Live fascines are long bundles of branch cuttings bound together in cylindrical structures. They should be placed in shallow contour trenches on dry slopes and at an angle on wet slopes to reduce erosion and shallow sliding.

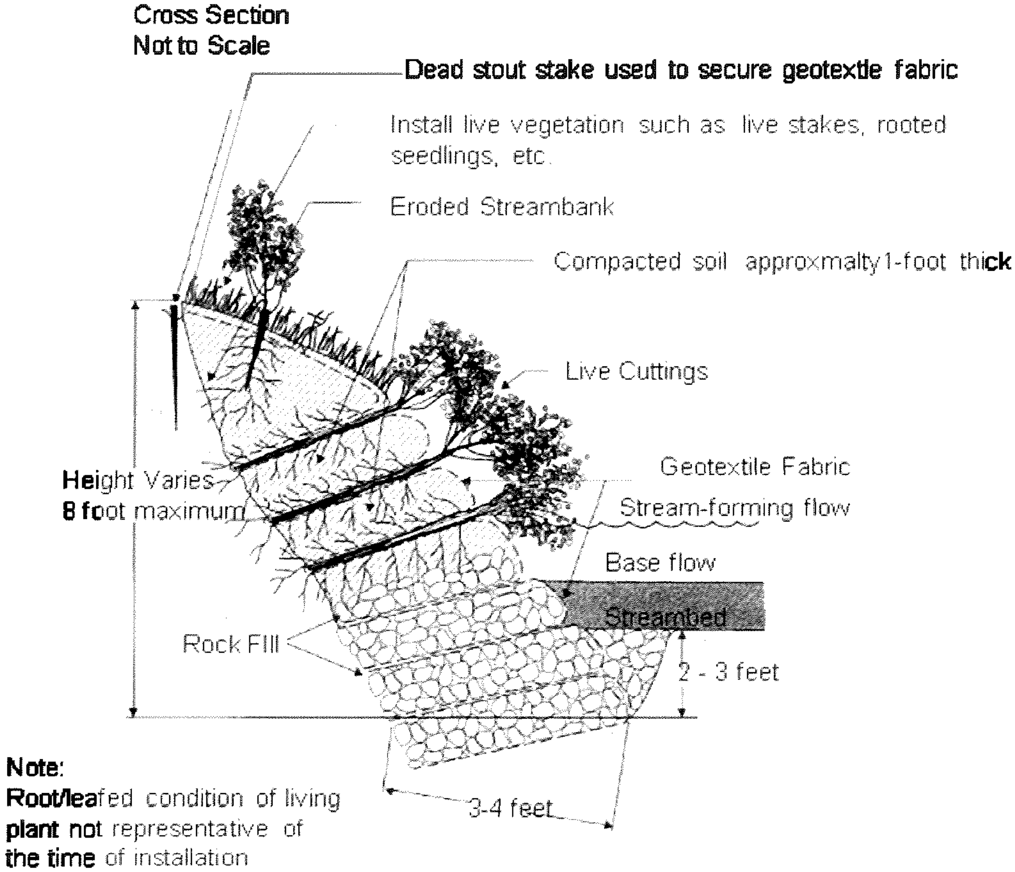


Applications and effectiveness

- Apply typically above bankfull discharge (streamforming flow) except on very small drainage area sites (generally less than 2,000 acres).
- Effective stabilization techniques for streambanks. When properly installed, this system does not cause much site disturbance.
- Protect slopes from shallow slides (1 to 2 foot depth).
- Offer immediate protection from surface erosion.
- Capable of trapping and holding soil on streambank by creating small dam-like structures, thus reducing the slop length into a series of shorter slopes.
- Serve to facilitate drainage where installed at an angle on the slope.
- Enhance conditions for colonization of native vegetation by creating surface stabilization and a microclimate conducive to plant growth

Vegetative Geogrids

Vegetative geogrids are similar to branchpacking except that natural or synthetic geotextile materials are wrapped around each soil lift between the layers of live branch cuttings.

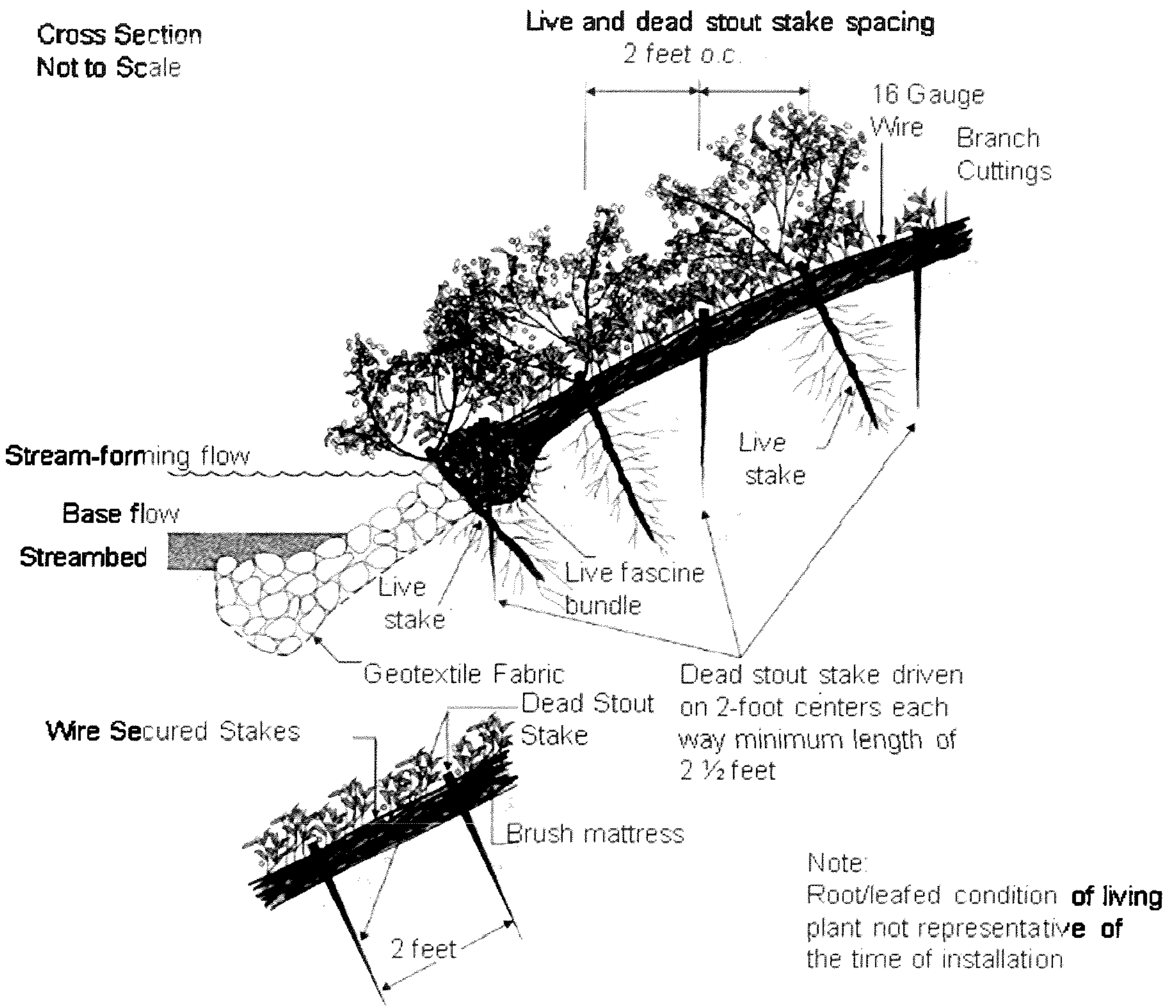


Applications and effectiveness

- Used above and below stream-forming flow conditions
- Drainage areas should be relatively small (generally less than 2,000 ac) with stable streambeds.
- The system must be built during low flow conditions.
- Produce a newly constructed, well-reinforced streambank.
- Useful in restoring outside bends where erosion is a problem
- Capture sediment, which rapidly rebuilds to further stabilize the toe of the streambank.
- Function immediately after high water to rebuild the bank.
- Produce rapid vegetation growth.
- Enhance conditions for colonization of native vegetation.
- Benefits are similar to those of branchpacking, but a vegetated geogrid can be placed on a 1:1 or steeper slope.

Brushmattress

A brushmattress is a combination of live stakes, live fascines, and branch cuttings installed to cover and stabilize streambanks. Application typically starts above stream-forming flow conditions and moves up the slope.

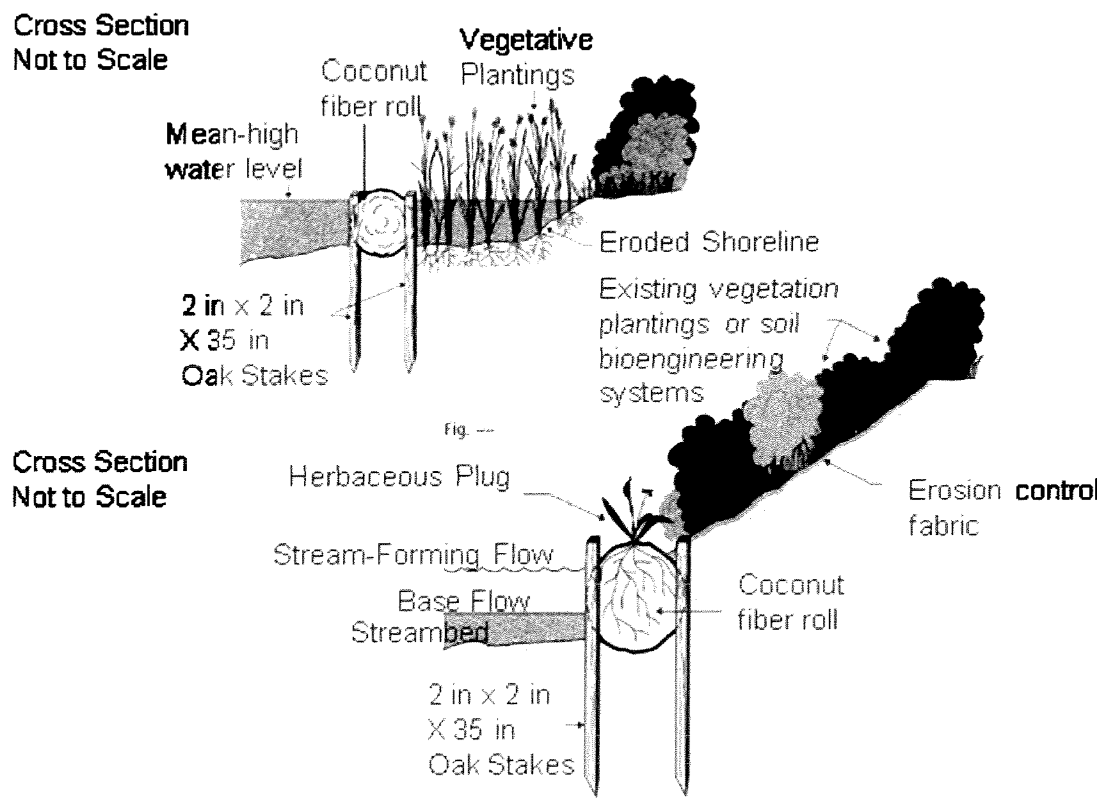


Applications and effectiveness

- Forms an immediate, protective cover over the streambank.
- Useful on steep, fast flowing streams.
- Captures sediment during flood conditions.
- Rapidly restores riparian vegetation and streamside habitat.
- Enhances conditions for colonization of native vegetation.
- Benefits are similar to those of branchpacking, but a vegetated geogrid can be placed on 1:1 or steeper slope

<u>Coconut Fiber Rolls</u>
Coconut fiber rolls are cylindrical structures composed of coconut husk fibers bound together with twine woven from coconut. This material is most commonly manufactured in 12-in diameters and lengths of 20 feet. It is staked in place at the toe of the slope, generally at the stream-forming flow stage.

The fiber rolls function as breakwaters along the shores of lakes and embayments. In addition to reducing wave energy, this product can help contain substrate and encourage development of wetland communities.



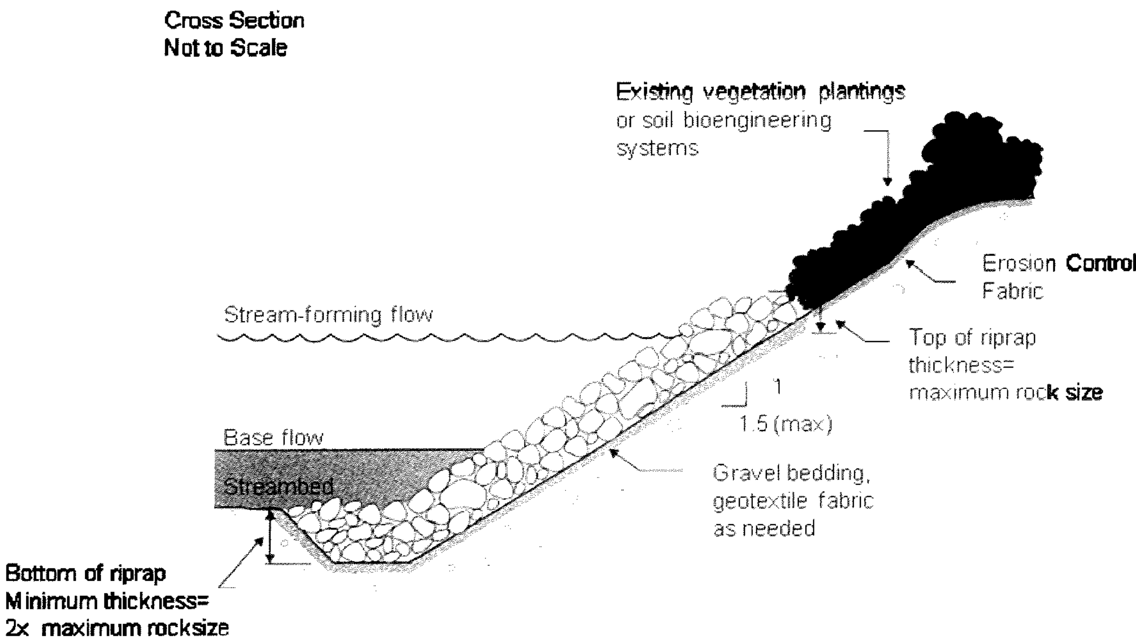
Applications and effectiveness

- Protect slopes from shallow slides or undermining while trapping sediment that encourages plant growth within the fiber roll
- Effective in lake areas where the water level fluctuates because it is able to protect the shoreline and encourage new vegetation.
- Flexible, product can mold to existing curvature of streambank.
- Produce a well-reinforced streambank without much site disturbance.
- Prefabricated materials can be expensive
- Manufacturers estimate the product has an effective life of 6 to 10 years.

- ### 3.2.2 - STRUCTURAL

<u>Rock Riprap</u>

Rock riprap, properly designed and placed, is an effective method of streambank protection. The cost of quarrying, transporting, and placing stone and the large quantity of stone that may be needed must be considered. Gabion baskets, concrete cellular blocks, or similar systems can be an alternative to rock riprap under many circumstances.

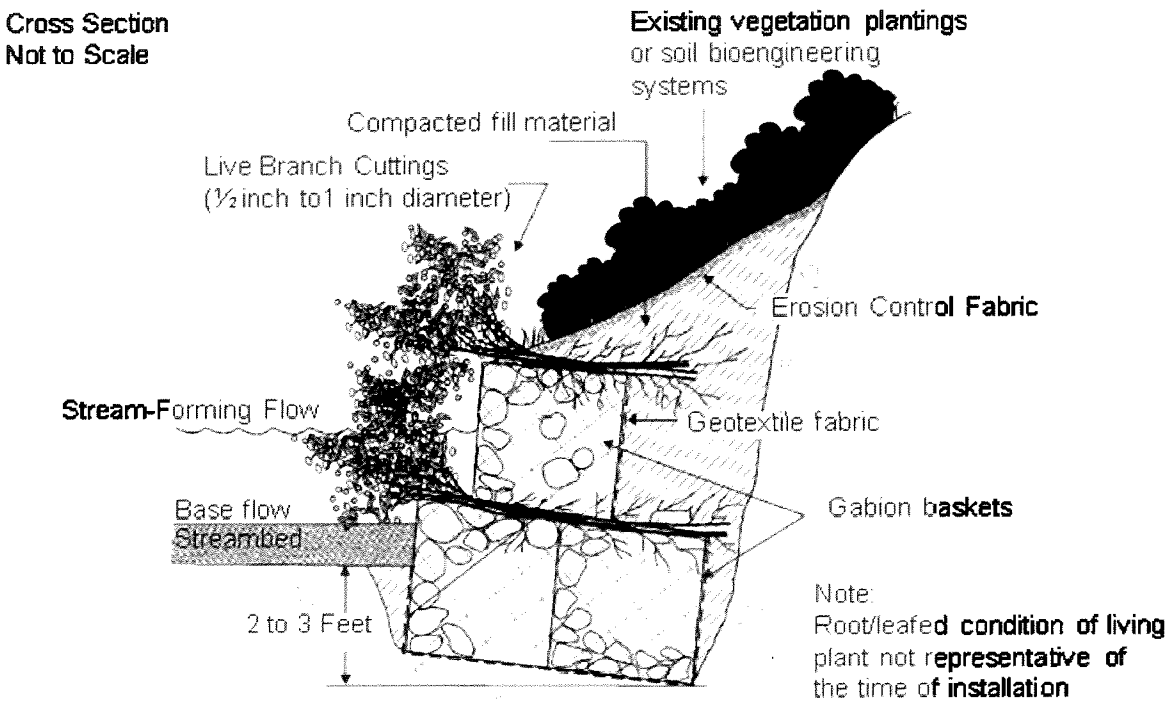


Applications and effectiveness

- Provides long-term stability.
- Has structural flexibility. It can be designed to self-adjust to eroding foundations.
- Has a long life and seldom needs replacement, low maintenance.
- Is inert so does not depend on specific environmental or climatic conditions for success.
- May be designed for high velocity flow conditions.
- Typically only recommended for toe protection (up to baseflow line.)
- Shade tolerant design

Gabions

Gabions are stone filled wire baskets which can be used for stream bank stabilization. The baskets are stacked along the stream bank or placed along the toe to provide structural integrity to the stream bank.



Applications and effectiveness

- Yield to earth movements yet remain structurally sound.
- Will not suffer catastrophic failure even when slight changes occur to the foundation.
- Highly permeable, so groundwater does not get trapped behind the units.
- Efficiency increases with age.
- Bound together as a monolithic unit, so the wire mesh is extremely strong under tension.
- The first layers of gabions can be laid in water or mud.
- Gabions do not need to cure as do concrete alternatives.

• 3.3 - SUITABILITY OF CORRECTIVE ACTIONS

Choosing among the wide variety of maintenance and restoration measures for the most suitable solution should weigh a number of factors. Physical characteristics including the channel slope, flow rate, flow velocity, width, and floodplain or channel roughness, among others should be addressed. In addition, the scale and lifetime of the desired impacts should be weighed. Some maintenance techniques provide more temporary effects, addressing the 'symptoms' of a damaged channel, while others promote long term, systemic changes to a stream. Finally, cost-effectiveness should always be weighed since a number of techniques may be applicable with varying effectiveness at varying cost.

• 3.4 - COST AND SCHEDULE

Actual cost for a project is driven by the labor, equipment, and materials needed to complete the work. These are project-dependent, but we are including many examples of the labor, equipment and material needed for most stream maintenance projects. The following costs and schedules assume a 1,000 linear foot channel on a typical tributary stream with a base flow of 30 cfs. The channel is 5 feet wide with a water depth of 1 foot.

- Set project limits – Survey Crew
    - $5,000 to $10,000
    - 3 to 5 days
    - Assume project boundary only, no layout.
- Clearing and Grubbing – Laborers, chain saws, axes, hydro axes, rubber tired skid loader, dump truck, disposal site.
    - $10,000 to $20,000/acre
    - 1 day
    - Assume crew of 10 laborers.
    - Selective clearing of non-native species.
    - Assume 25 feet each side of bank.
- Dredging and Excavating – Rubber tired Grade-All, dump truck, skid loader, track carriers.
    - $50 to $120/Cu. Yd.
    - 1 day
    - Assume 185 Cu. Yd. of dredging.
    - Offsite disposal available at Village owned facilities.
- Dewatering – Laborers, pumps, temporary dams, dewatering plan.
    - $10,000 to $20,000/week
    - Duration of project
- Bank Stabilization – Laborers, rubber tired skid loader, seed, erosion blanket, silt fence, boulders, A-Jacks, gabion baskets, etc...
    - $150 to $300/LF for grading, seeding and erosion control blanket
    - 3 to 5 days
    - Assume grading the channel banks to 4:1 slope

        - $300 to $500/LF for gabions to "hard armor" channel bank.
        - 1 to 2 weeks
    - Planting – Laborers (finishing crew), "Harley rake", rubber tired skid loader, seed, plugs.
        - $5,000 to $7,000/acre for seeding and blanket (NAG SC150 or eq.)
        - 1 day
        - Assume 0.55 acres with a 4:1 slope
        - $10,000 to $15,000/acre for 4,000 plugs per acre
        - 1 day
        - Assume 0.55 acres with a 4:1 slope

The size of the project will dictate the number of laborers, amount of equipment, quantity of materials, etc…

Make sure to determine if the project needs to be dewatered when estimating costs for a stream maintenance project. Inspect the project site to determine what equipment can be used; heavily wooded sites with limited access will limit the machines that can be used. Generally speaking, if a project requires a good deal of hand work, it will take longer and cost more.

- **3.5 - IMPACTS UPSTREAM AND DOWNSTREAM**

Stream maintenance or restoration can have very positive effects both upstream and downstream of the project site. Removal of unwanted debris can reduce backwater effects upstream, decreasing flooding and flood risk. Additionally, maintenance or restoration can have a positive effect for downstream areas by allowing streams to flow at the flow rate and water surface elevation intended. This will allow better future analysis of stream impacts by future development, and will also often return streams to a state (flow, velocity, etc.) more befitting of native vegetation and wildlife.

- **3.5.1 Water Quality Benefits:**

    http://www.epa.state.il.us/water/tmdl/303-appendix/2008/2008-final-draft-303d.pdf

    Another benefit of stream maintenance/restoration projects is the overall improvement in water quality. The establishment of healthy riparian areas along the banks of streams will help limit the amount of eroded sediments that reach the water, preserving water clarity while simultaneously preventing chemicals contained within the soil from leaching into the water. Sediment often carries organic matter, animal or industrial wastes, nutrients, and chemicals. The most troublesome nutrient element is phosphorus.

    Additionally, the establishment of a healthy layer of herbaceous vegetation along stream channels will serve as a filter strip for overland stormwater runoff as it makes its way to the stream from adjacent upland areas. Stormwater runoff picks up many pollutants from upland areas and transports them into the stream.

Vegetated riparian buffer areas will filter out many of the contaminants that would otherwise degrade water quality.

SECTION 4 EXECUTION OF CORRECTIVE ACTIONS

- **4.1 - Site Access/Ownership**

Access to streams may be an issue in parts of Will County. While project sponsors and intergovernmental agreements may be relatively easy to identify and enact in areas of public agencies, the majority of stream channels in Will County traverse private property. In some situations, legal plats may call out the edge of private property parcels to be the edge of the stream channel. But where is that exactly? Is it intended to be the top of bank? Or is it at the elevation of the water level? And just what elevation of water level is considered the "normal water elevation?" In other cases, plats of survey of privately-owned parcels show stream channels within the parcel boundaries. Access to the channel in these reaches will require agreements with the landowner and may result in securing maintenance and access easements. In any event, investigations need to be conducted and these questions need to be answered to fully understand access issues with respect to property rights during the planning for stream maintenance.

- **4.2 - Debris Discarding**

Depending on the extent of the maintenance activity and the width and length of the channel and work area, significant amounts of debris may be removed from the channel. Even temporary placement of the removed debris near the channel edge is an invitation for its re-entry into the channel, either through vandalism or weather. It is therefore important and highly recommended that a plan for permanently removing and discarding the materials be spelled out before any material is removed. Avoiding to the extent possible the "double handling" of materials will ensure maximum efficiency of the removal operation. Typically not hazardous waste, the removed debris will often be mainly vegetation materials and will be classified as landscape waste. This material is not appropriate for a standard refuse landfill and must be taken to a landscape waste facility. Chipping and burning of materials may also be considered. In all cases, debris stockpiles need to be kept out of the floodway/floodplain and wetlands.

- **4.3 - Construction Process**

Instream work should be accomplished using the smallest equipment feasible for the task. If possible, work should be accomplished without the use of machinery in the channel. Often much work can be accomplished with hand tools (axes, chain saws, loppers) so that logs or trees can be cut into small lengths and dragged out of the channel by hand or dragline/winch. In some cases, heavy equipment may be able to be placed at the top of slope and reach down into the channel with minimum disruption to the channel bottom or in particular, the bank slopes. Confining work to one side of the channel only with help minimize disruptions as well.

- **4.4 - Erosion Control During Construction**

If construction involves the disturbance (clearing, grading, excavation, etc.) of an acre or more of land, coverage under a National Pollutant Discharge Elimination System (NPDES) permit is necessary. For activities considered to be "routine maintenance", a permit may not be necessary. In any event, proper erosion control is necessary to help streams maintain capacity to convey flood waters and is also important to maintain water quality. Seeding and mulching is an inexpensive method to limit erosion of soil from storm water runoff. For work involving bank slopes, it may be necessary to use erosion control fabrics to protect the exposed soil until vegetation can become established. Erosion control fabrics should be properly secured to withstand anticipated stream flows following storm events.

- **4.5 - Contractor Selection Tips**

Difficulty may be encountered in finding a contractor interested in bidding on stream maintenance work that has any prior experience in such work. Therefore, it is advisable to hold a pre-bid walk through of not only the proposed maintenance project area, but also representative "clean" sections of the stream to provide a reference to demonstrate how the end product of the work should appear. The contractor should have experience working in riparian environments, and should have low impact equipment available. Another consideration might be to have a knowledgeable Will County representative available during project activity times to field questions that likely will arise.

Winter is an ideal time for performing stream maintenance activities. Lower water flows and frozen ground conditions may provide easier access to certain areas and minimize the potential for excessive ground disturbance by vehicles and equipment. Wildlife species utilizing streams and riparian buffers are less active during the winter months and will be less affected by the activities.

- **4.6 - Post-project Monitoring** - (Adaptive Management Program)

Post-project monitoring is a crucial part of a Countywide Stream Maintenance Program. Inspection, planning, design and construction of stream maintenance projects become much more effective and efficient when each project is monitored after completion. Post-project monitoring should include weekly inspections for the first month, monthly inspections up to 6 months and inspection after rainfall events in excess of 0.5 inches for the year after the project is completed.

Post-project monitoring should include adapting to changes or unexpected results in the stream. A general outline for post-project monitoring follows:

Basic Adaptive Management Plan Principals

Plan:

- Identify management issues (e.g. weed infestations)
- Identify management goals (e.g. weeds managed, native seeding establishment)
- Determine management strategies available (e.g. herbicide, hand pulling, burning)
- Select appropriate management action (e.g. hand removal)
- Determine what will be monitored and how (e.g. establish a fixed point in field)
- Determine how change and success will be evaluated (e.g. absence of weeds one month or one year after removal)

Do:

- Carry out action (e.g. remove weeds)
- Complete prescribed burn

Monitor:

- Monitor results (e.g. revisit site to determine success of activities)

Review:

- Assess previous management strategy and modify plan as necessary to adapt to current site conditions
- Return to Planning – begin again, **Adapt** to new site conditions.

Project Goals and Objectives

This plan is designed to be adaptive to changing site conditions observed through periodic monitoring of the site. The monitoring visits are important to determine the annual tasks needed. Those tasks are then completed and then evaluated for effectiveness. New tasks are then defined as necessary to achieve the project goals and objectives.

- ### 4.7 Design Guides

The following are selected references to assist in identifying and designing stream maintenance projects:

The Virginia Stream Restoration & Stabilization Best Management Practices Guide, 2004 (www.dcr.vi.virginia.gov/soil_and_water/documents/streamguide.pdf)

Stream Corridor Restoration: Principles, Processes, and Practices, 1998 (www.nrcs.usda.gov/technical/stream_restoration/newgra.html)

Field Manual of Urban Stream Restoration, 1998 (Prepared by the Illinois State Water Survey)

DuPage County Stream Maintenance Program Report, 1991. (Prepared by: Randolph J. Stowe and the Environmental Concerns Department)

Applied River Morphology, 1996 (By Dave Rosgen)

Riparian Area Management – A Citizens Guide (Prepared by Lake County Stormwater Management Committee)

Streambank and Shoreline Protection Manual, 2002 (Prepared by Lake County Stormwater Management Committee, Lake County Planning, Building and Development Department and the USDA – NRCS) (www.co.lake.il.us\stormwater)

SECTION 5 PREVENTATIVE MAINTENANCE

- **5.1 - Inter-governmental Agreements / Maintenance Easements**

In areas where preventative maintenance activities are proposed, it will be necessary to respect property ownership rights. Stream segments requiring maintenance may be under private ownership or under control of any of a number of public entities including but not limited to municipalities, townships, park districts and forest preserve districts. Depending upon the ownership of the particular stream reaches, formal agreements regarding the transfer of property rights associated with the establishment of an easement will be necessary. The agreements establishing maintenance easements may be permanent or temporary duration.

- **5.2 - Public Education and Outreach**

Holding public meetings for property owners provides an opportunity to educate and explain how people can participate in stream maintenance projects. Presentations to local community groups such as municipal environmental committees can help spread the word about the importance of stream maintenance. Presentations of a visual nature can be useful to display "before" and "after" views of a stream maintenance project emphasizing how dramatic the results can be.

Educating property owners on what a healthy stream system looks like and encouraging them to maintain healthy stream banks is a good start. Simply educating people to avoiding the mowing, clearing and stripping streambank vegetation is an excellent starting point. Explaining how rooted vegetation along banks significantly helps control bank erosion. Preventing the dumping of brush, weeds and grass clippings into streams and along banks also will help prevent the formation of debris jams. Historically, landowners tend to place materials too close to stream edges, particularly landscape waste. This practice should be completely discouraged.

- **5.3 – Volunteer Work Days – Coordination with Public Works, Environmental Committees**

There are volunteer groups which regularly perform environmental clean-up work, including stream maintenance projects. These groups can be contacted as part of a stream maintenance program. Examples of the type of work which can be accomplished through coordination with these groups are a cleanup of a stream corridor, removal of debris jam, and planting of buffer plantings adjacent to a stream.

These volunteer groups should be used in coordination with public works and environmental committees of the local municipalities. The selection and prioritization of projects should remain in the hands of the local municipality or agency, but the number of projects which can be implemented can be increased if volunteer groups are consulted and used when feasible.

When incorporating volunteer labor into your project, it is advisable to remind participants to wear appropriate clothing for conducting work in and around streams. Minimum dress and accoutrements for volunteers includes:

- High-top work boots with non-skid soles
- Hat or scarf (sun protection)
- Long pants
- Long-sleeve shirt
- Safety goggles/glasses
- Heavy leather gloves
- Ear plugs (if chain saws and/or wood chippers are used)
- Sunscreen
- Insect repellant
- First-aid kit
- Life jacket and tow rope (if river conditions allow use of boats)
- Rubber boots and/or waders (helpful to access the water)

Additionally, safety concerns should be addressed with all volunteers. There should be a brief training on how to identify poison ivy and discussions on what to do if an injury occurs. Remind each volunteer that they are responsible for his or her own safety at the cleanups and must maintain a safe environment at all times. It is strongly recommended that each volunteer sign a disclaimer as an acknowledgement of their responsibilities.

- **5.4 - Vegetation Management**

The health of vegetation along channel banks is closely related to the incidence of debris blockages within stream channels. Debris blockages can occur from a variety of causes and may be chronic, requiring ongoing maintenance or may be the result of an immediate occurrence that may be resolved by removal of the obstructing material. For example, an incidence of fly dumping can be significant enough to create an immediate blockage of a channel or youthful indiscretion will result in the placement of materials with the specific intent of damming a stream flow. More typically, however, is that the general lack of maintenance of channel-side vegetation creates a chronic condition of a gradual but continual decline in the health of the vegetation. This leads to periodic death of trees and shrubs resulting in tree limbs and even entire trees falling down into the stream channel artificially blocking the flow. A single tree falling perpendicular to the stream channel flow will act as a debris catcher and accumulate lots of smaller debris as flows continue to pass. Eventually this accumulation has the potential to completely block or divert the normal water flow. The redirection of flows can have a devastating effect on the banks if allowed to occur.

- **5.5 - Stream Enhancement**

Enhancement to the health of an existing stream can lessen the chances of channel blockages or bank-eroding flow diversions. For instance, stream side vegetation can be managed and maintained to promote a healthy mix of trees and groundcover vegetation through selective clearing and allowing some sunlight to penetrate the overstory canopy. This will promote better erosion control and reduce the incidences of dying trees falling into the stream. A closed canopy created by dense tree/shrub growth along stream banks does not allow the sunlight penetration to the surface that is needed to support a healthy herbaceous groundcover layer.

- **5.6 - Funding Opportunities / Grants**

Funding for stream maintenance projects can be difficult to come by, until the problem has deteriorated to the point where residents are impacted. By this time, the problem may have developed into a stream wide problem, costing considerably more than would have been necessary for regular stream maintenance. With a Stream Maintenance Program in place, staff members may be more successful in procuring funds for regular stream maintenance.

Grant opportunities exist from state and federal agencies, and should be explored to open up further opportunities for funding of stream maintenance projects. There are grant finding organizations which can be used to notify the local agencies of potential grant opportunities available.

Local Project Field Inspection – Data to be Collected

Municipality	
Stream Name	
Location	
Date	
Name of Inspector	
Local Contact	
Type of Problem • Debris blockage • Stream bank erosion	
Stream Condition Problems • Habitat loss • Water Quality Impact • Flooding • Bridge/culvert damage	
Is this a one-time problem or recurring problem?	
How many properties are impacted?	
How many homes, garages, business buildings are impacted?	
Level of Severity of Problem	Lowest 1 2 3 4 5 Highest
Maintenance/Enhancement Goals	
Potential Stream Maintenance/Enhancement Projects	
Will potential projects require easements or land purchase?	
Additional comments	
Photos (photos should show upstream and downstream side of the inspected area - include high water mark, culverts, bridges if applicable)	