SECTION 5.4

LOGJAM REMOVAL AND RIVER RESTORATION

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LOGJAM REMOVAL AND RIVER RESTORATION

Logjams restrict the flow and conveyance of natural streams and ditches which can cause increased flooding, destruction of property and wildlife habitat, and erosion and sedimentation. However, not all in-stream structures cause problems. Submerged and overhanging logs provide important wildlife habitat. In many cases, the ripples caused by obstructions oxygenate the water to improve water quality. It is therefore useful to classify in-stream obstructions based on severity, and employ management techniques based on each category.

Localized logjam removal practices (Practices 401 and 402) are considered superior over large-scale river restoration techniques (Practice 403) because they maintain streams' natural meander geometry with long-term environmental and economical benefits. Because of their non-interference with the geometry of the stream channel and in-channel sediments, localized logjam removal practices are also institutionally more acceptable (usually no permits required) and easier to implement than large-scale river restoration works such as that described in practice 403.

Large-Scale River Restoration (Practice 403) may be accomplished in various ways. The best documented of these methods is the "Palmiter Technique". The Palmiter Technique combines clearing & snagging and inexpensive streambank protection measures to restore the stream channel to its perceived original, non-obstructed capacity. It includes removing logjams and severely leaning trees and using some of the removed material for protection of eroding streambanks. The technique also involves removing or raking of sediment bars, when needed, and revegetating the banks with trees to provide shade.

Effectiveness of large-scale river restoration or clearing & snagging projects in reducing flooding is limited only to small annual floods. **Often times, the effect of these activities on reducing flood stages of larger less frequent floods is negligible or at best limited to 2 or 3 inches of stage reduction.** In most cases, similar hydraulic benefits may be achieved by following the American Fisheries Society Stream Obstruction Removal Guide, i.e., removing only localized logjams, at a fraction of cost and time. (See "Maumee Master Plan" and "Urban Surface Water Management" references for more details.)

Regardless of their effectiveness and despite their drawbacks (in particular, a lengthy and expensive permitting process), large-scale river restoration/clearing and snagging projects are still popular and are pursued by many jurisdictions. So long as the safeguards described in Practice 403 are adhered to, the project may be implemented with minimal impact to the environment.

In all cases, access routes for stream and ditch work should be selected to minimize disturbances to wetlands, floodplains, and riparian areas. All disturbed areas should be restored or replanted with native plant species.

The obstruction classification system used in this manual is based on the "American Fisheries Society Stream Obstruction Removal Guidelines" (see Section 6, References). Five conditions are described: Condition 1 (one) is the least severe, Condition 4 (four) is the most obstructive, and Condition 5 (five) describes special cases. The following discussions are taken from the above-noted document and a document entitled: "MRBC Obstruction Removal Assistance Program".

Condition 1

Minor flow impedance is present, but these obstructions are normally washed downstream or are naturally relocated during moderate flooding events. The obstructions do not pose a significant flood damage risk, and the overall conveyance is acceptable and expected to stay that way. It is recommended that obstructions in this class be left alone unless they are associated with or are within eye-sight of larger obstructions, in which case they may be removed using hand-held tools (Practice 401 Logjam Removal Using Hand-held Tools).

Exhibit 5.4a: Illustration of a Condition 1 Logjam (Source: American Fisheries Society Obstruction Removal Guidelines)

Condition 2

Stream or ditch segments contain small logjams that may be inter-locked and occasionally span the entire width of the stream. Logjams are isolated, but adjacent land use is such that a major obstruction at this location may cause damaging floods in the future. It is recommended that logjams be removed with hand-held tools such as axes, chain saws, and portable winches (Practice 401), unless the logjams are associated with, or are in close proximity to, larger obstructions that require heavy machinery to remove (Practice 402). The extent of the work should be limited to cutting, relocating, removing, or, if appropriate, securing (parallel to the streambanks) any free logs or affixed logs that are crossway in the channel. Isolated or single logs that are embedded, lodged, or rooted in the channel, but do not span the channel or cause any impediment to flow, do not need to be removed. Rooted stumps that do not pose potential blockage problems should remain in place where they will continue to protect the bank against erosion.

Exhibit 5.4b: Illustration of a Condition 2 Logjam (Source: American Fisheries Society Obstruction Removal Guidelines)

Condition 3

Stream or ditch segments contain large accumulations of lodged trees, root wads, and/or other debris that are inter-locked and frequently span the entire width of the stream. Large amounts of fine sediments have not yet covered or become lodged within the obstruction. Some flow can still move around the obstruction, though the flow is somewhat impeded. These obstructions pose an unacceptable flooding risk. It is recommended that stretches in this condition be restored using hand-held tools (Practice 401) if possible. Heavy machinery such as small tractors, bulldozers, log skidders, or other low ground pressure equipment may be used so long as they are not equipped for excavation (Practice 402). The extent of work shall be the same as Condition 2.

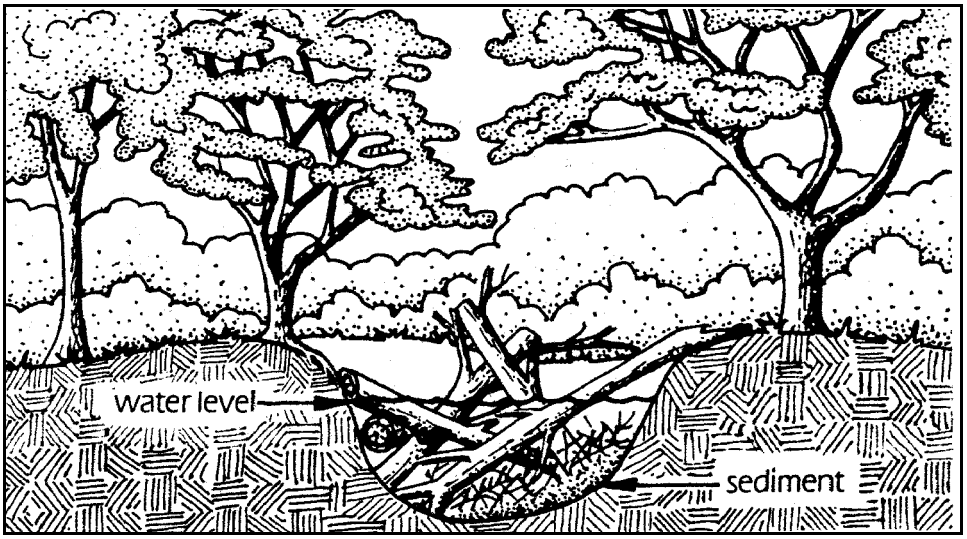

Exhibit 5.4c: Illustration of a Condition 3 Logjam (Source: American Fisheries Society Obstruction Removal Guidelines)

Condition 4

Stream or ditch segments contain major blockages that have caused severe and unacceptable flow conditions. Bank erosion and upstream ponding are evident. Existing flood potential will likely increase if the obstructions are not removed. The use of heavy machinery (Practice 402) is likely the only effective way to remove obstructions in this category. The extent of work shall be the same as Condition 2.

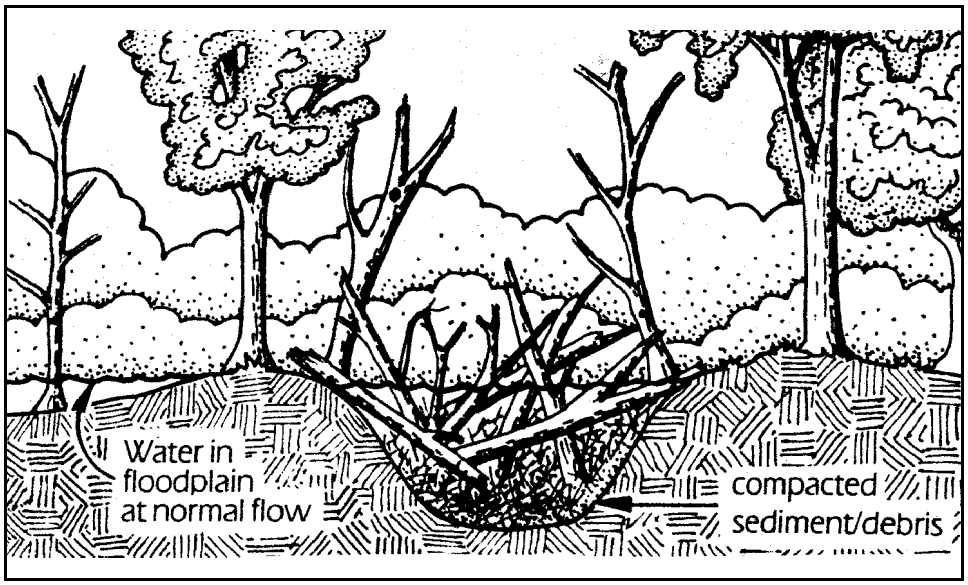

Exhibit 5.4d: Illustration of a Condition 4 Logjam (Source: American Fisheries Society Obstruction Removal Guidelines)

Condition 5

Stream or ditch segments possess unique, sensitive, or valuable ecological resources including rare plants and animals, and rare habitat. These include scenic or recreational rivers. The extent of obstructions may be similar to one of the four conditions described above. Removal of logjams in these streams must be approached on a case by case basis. Generally, obstruction removal using hand-held tools (Practice 401) is more acceptable than using heavy machinery.

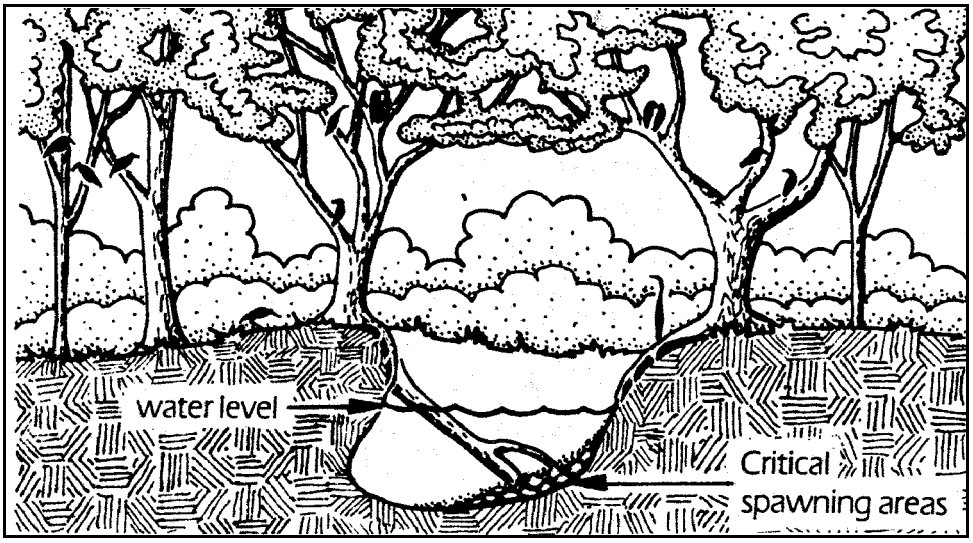

Exhibit 5.4e: Illustration of a Condition 5 Logjam (Source: American Fisheries Society Obstruction Removal Guidelines)

PRACTICE 401
LOGJAM REMOVAL USING HAND-HELD TOOLS

DESCRIPTION

- Removing logjams from natural streams and man-made ditches using hand-held tools.

Exhibit 401a: Logjam Removal Using Hand-Held Tools (Source: CBBEL Files)

PURPOSE

- To remove logjams causing flooding, sedimentation, or destruction of wildlife habitat.

WHERE APPLICABLE

- Streams and man-made ditches classified as Condition 2, possibly Condition 3, and Condition 5 (See Introduction).

ADVANTAGES

- Restores natural flow and conveyance of streams and ditches.
- Reduces erosion, sedimentation, and flood potential.
- May improve wildlife habitat and water quality.

CONSTRAINTS

- May be time consuming and labor intensive.
- Restricted to logjams where use of hand-held tools are practical.
- Usually requires restabilization (See Activity 5.11 Revegetation and Site Stabilization).
- May cause temporary sedimentation.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Hand-tools such as axes, chain saws, hand winches, floats.
- Vegetative Restabilization (See Practice 1102).

Installation

- Hand-held tools that cause the least damage to the environment shall be selected for performing the work.
- Logjams, free logs, and/or affixed logs that are crossway in the channel should be cut, relocated, removed, or, if appropriate, secured parallel to the stream bank.

- Logjams may be disposed of by removing them from the floodplain and/or wetlands, or by piling and cabling logs at secured areas, as appropriate, with minimum amount of disturbance to vegetation.
- Isolated or single logs embedded, lodged, or rooted in the channel that do not span the channel or cause any impediment to flow should not be removed unless they are associated with or are in close proximity to larger obstructions, in which case they may be removed.
- Damaged, severely leaning trees should be removed if they pose a risk of falling and causing additional obstructions.
- Stumps and root systems should be left in place.

Special Considerations

- Employ appropriate siltation and erosion control practices during construction as necessary.
- Logjams that do not restrict the natural flow and conveyance of streams and ditches, and are not likely to cause further blockages, should not be removed.

MAINTENANCE

- Stream conditions should be monitored on a regular basis to avoid costly logjam removal in the future.

REFERENCES

Related Practices

- Practice 107 Clearing and Grubbing.
- Practice 301 Chemical Vegetation Control.
- Practice 302 Mechanized Debrushing Using Hand-held Equipment.
- Practice 303 Mechanized Debrushing Using Heavy Machinery.
- Practice 402 Logjam Removal Using Heavy Machinery.
- Practice 403 Large-Scale River Restoration.
- Practice 1301 Debris Disposal.

Other Sources of Information

- MRBC Obstruction Removal Program.
- American Fisheries Society Obstruction Removal Guidelines.

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PRACTICE 402
LOGJAM REMOVAL USING HEAVY MACHINERY

DESCRIPTION

- Removing logjams from natural streams and man-made ditches using heavy machinery.

Exhibit 402a: Logjam Removal Using Heavy Machinery (Source: NRCS Files)

PURPOSE

- To remove logjams causing flooding, sedimentation, or destruction of wildlife habitat.

WHERE APPLICABLE

- Streams and man-made ditches classified as Condition 2, Condition 3, and Condition 4 (See Introduction).

ADVANTAGES

- Restores natural flow and conveyance of streams and ditches.
- May reduce erosion, sedimentation, and flood potential.
- May improve wildlife habitat and water quality.

CONSTRAINTS

- Potentially more damaging to the environment than hand-held tools.
- May be time consuming and labor intensive.
- Usually requires restabilization (See Activity 5.11 Revegetation and Site Stabilization).
- May cause temporary sedimentation.

DESIGN AND CONSTRUCTION GUIDELINES

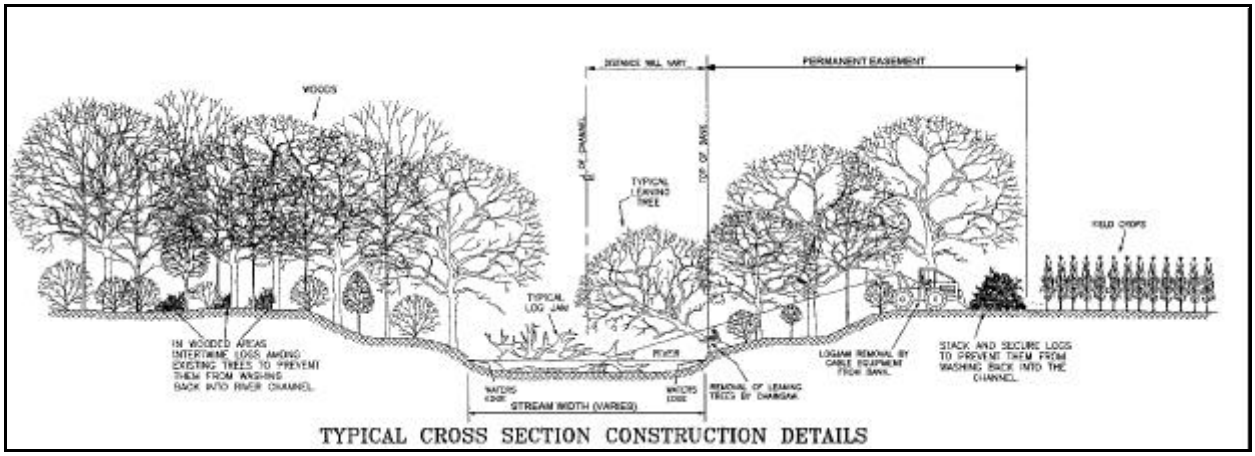
Materials

- Hand-tools such as axes, chain saws, hand winches, floats.
- Backhoes, bulldozers, log skidders, and other heavy, low psi machinery equipped only with brush hooks, snags, or hydraulic thumbs. Machinery equipped with excavation implements may not be used.
- Vegetative Restabilization (See Practice 1102).

Installation

- Machinery that causes the least damage to the environment shall be selected for performing the work.

- Logjams, free logs, and/or affixed logs that are crossway in the channel should be cut, relocated, removed, or, if appropriate, secured parallel to the stream bank.
- Logjams may be disposed of by removing them from the floodplain and/or wetlands, or by piling and cabling logs at secured areas, as appropriate, with minimum amount of disturbance to vegetation.
- Isolated or single logs embedded, lodged, or rooted in the channel that do not span the channel or cause any impediment to flow should not be removed unless they are associated with or are in close proximity to larger obstructions, in which case they may be removed.
- Damaged, severely leaning trees should be removed if they pose a risk of falling and causing additional obstructions.
- Stumps and root systems should be left in place.



TYPICAL CROSS SECTION CONSTRUCTION DETAILS

Exhibit 402b: Typical Cross-Section Construction Detail (Source: NRCS Files)

Special Considerations

- Employ appropriate siltation and erosion control practices during construction as necessary.
- Logjams that do not restrict the natural flow and conveyance of streams and ditches, and are not likely to cause further blockages, should not be removed.

MAINTENANCE

- Stream conditions should be monitored on a regular basis to avoid costly logjam removal in the future.

REFERENCES

Related Practices

- Practice 107 Clearing and Grubbing.
- Practice 301 Chemical Vegetation Control.
- Practice 302 Mechanized Debrushing Using Hand-held Equipment.
- Practice 303 Mechanized Debrushing Using Heavy Machinery.
- Practice 401 Logjam Removal Using Hand-held Tools.
- Practice 403 Large-Scale River Restoration.
- Practice 1301 Debris Disposal.

Other Sources of Information

- MRBC Obstruction Removal Program.
- American Fisheries Society Obstruction Removal Guidelines.

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PRACTICE 403
LARGE-SCALE RIVER RESTORATION

DESCRIPTION

- A technique (Palmiter Approach) which combines clearing & snagging and inexpensive streambank protection measures to restore the stream channel to its perceived original, non-obstructed capacity.

Exhibit 403a: Although trees stabilize the banks, they may become obstructions (Source: Ohio Stream Management Guide)

PURPOSE

- To provide relief from chronic low-intensity nuisance flooding, improve drainage in agricultural areas, reduce bank erosion due to smaller floods, and provide recreation benefits to canoeists as well as to hunters and fishermen.

WHERE APPLICABLE

- Applicable to streams that are obstructed by logjams and sand bars, and have bank erosion problems, particularly where larger structural measures are not justified.

ADVANTAGES

- Maintaining a stream channel's free-flowing characteristics ensures its capability to convey the annual flood.
- May reduce bank erosion and consequently sediment accumulation.
- May improve wildlife habitat and water quality.
- Is less expensive than larger structural measures.

CONSTRAINTS

- Potentially more damaging to the environment than logjam removal alone.
- May be time consuming and labor intensive.
- Usually requires restabilization (See Activity 5.11 Revegetation and Site Stabilization).
- Generally offer benefits similar to logjam removal but are more expensive and involve time delays due to permitting requirements.
- Not effective or appropriate for severe flood problems

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Hand-tools such as axes, chain saws, hand winches, or floats.
- Occasionally, front-end loaders, log skidders, or crawler tractors to help pull or move material.

Installation

- Palmiter approach consists of six basic techniques for restoring and maintaining normal streamflow as follows:

Step 1: Removal of Logjams and Debris

- Start from the upstream end of the stream and work your way downstream.
- Preferably use hand labor with the aid of small tools such as axes, chain saws, hand winches, and floats at time of low river stages to remove all obstacles. Some of the work may be done from boats or barges. Occasionally, tractors, horses, hoists, or front-end loaders may be used to help pull or move material.
- Material removed from the stream can be used to protect eroding banks and to direct streamflow against undesired sand bars. All woody material not used in bank stabilization should be pulled ashore and sold, piled, chipped, burned, or buried (See Practice 1301: Debris Disposal). NOTE: Original version of Palmiter approach includes allowing smaller logs to float on downstream. However, this aspect of the Palmiter's technique is discouraged in this Handbook. Allowing these logs to flow downstream may promote downstream obstructions, contribute to pile-up behind downstream bridges or culverts, or increase hazards downstream.

Exhibit 403b: Fallen trees, logjams, and other debris can partially block stream channels (Source: Ohio Stream Management Guide)

Step 2: Sediment Bar Removal

- Clear vegetation from the sediment bar surface and rake, if necessary. Where a bar is well established, it may be necessary to remove stumps and trees. (However, note that removal of sediment bars are not always necessary. Also, removal of islands with mature trees may be objectionable by agencies in certain settings.)
- Induce erosion of the bar by deflecting the stream current against

it, or by establishing a "pilot channel" through it (Exhibit 403c). Good current deflectors can be made by piling and anchoring brush at selected locations in the channel, or by cutting trees part way through and pushing them over into the channel at appropriate places (Exhibit 403d).

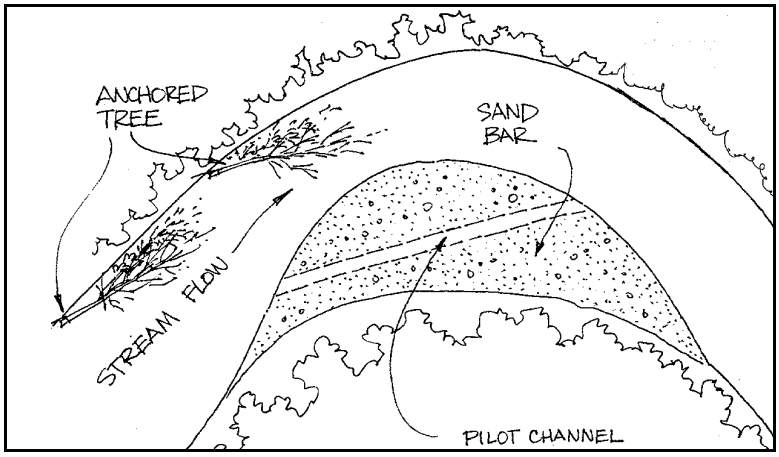

Exhibit 403c: Sand Bar Removal (Source: Ohio Stream Management Guide)

Exhibit 403d: Felled trees anchored to the streambank deflect flows away from the bank to prevent erosion (Source: Ohio Stream Management Guide)

Step 3: Removal of Potential Obstructions

- Severely leaning trees are the most common potential obstructions along a stream.
- Mark all trees or logs to be removed by spraying red, yellow, or orange paint on the upstream side of the trunks.
- Top the tree or cut off overhanging branches to reduce overhanging and to provide more sunlight for ground vegetation and faster growth of young trees. When a tree must be removed, its **stump and roots should be left in place to protect against erosion**.
- Old bridge piers, junked appliances, automobiles, and other kinds of man-made debris can also block streams and should be removed.

Exhibit 403e: Leaving the stumps and roots of severely leaning trees holds the streambank against erosion (Source: Ohio Stream Management Guide)

Step 4: Bank Erosion Protection

- Bank protection is provided in two ways:
  - (1) Removing fallen trees, logjams, and other obstructions (that had been directing the currents against the eroding bank) reduces erosion.
  - (2) Woody, brushy material removed from the channel is placed and secured along the side of eroding bank. These brush piles divert current away from the eroding bank and also reduce velocity of the current along the eroded bank, causing the stream to deposit sedimentation in those eroded areas most in need of fortification.

- Brush piles are placed along the eroded stream reach in a trial and error exercise to determine the most effective locations for placement. The brush is anchored to nearby stumps or trees. Where stream velocities are high, cable or wire is used to secure the brush. Where there are no existing stumps or trees to use as anchors, stakes or posts can be placed in the bank to meet the need.

Exhibit 403f: Anchored brush piles are an inexpensive but effective means of bank protection (Source: Ohio Stream Management Guide)

Step 5: Revegetation (Providing Shade)

- One of the most important steps in stream restoration is revegetation. Roots stabilize the bank and hold the soil together. Trees shade the channel and inhibit the growth of plants in the streambed which slow the flow of water. Maintaining a shade canopy over the stream, therefore, reduces sediment deposition in the main channel.
- The importance of shade is apparent if shade is removed. Within the first year after shade is removed, dense weedy growth appears in the stream channel. Annual maintenance costs increase because this growth must be removed year after year. Shade provides many benefits to a stream and its aquatic life.
- Utilize revegetation techniques described in Practice 1102: Vegetative Stabilization to provide adequate shade.

Exhibit 403g: Streams lacking shade become weed choked (Source: Ohio Stream Management Guide)

Step 6: Maintenance

- Good maintenance is both the final step and the key to success in stream restoration. Periodic examination and maintenance are essential to correct new problems as they arise, check on the success of previous work, and make adjustments where necessary. Without maintenance, the original work is only a short term solution.
- After restoration work is completed, the stream should be inspected following the next few periods of high water. In the absence of severe storms, annual or semi-annual inspections may be adequate. Late winter or early spring, before leaves develop, is an ideal time to look for problems.

Exhibit 403h: Periodic maintenance is an essential part of stream restoration (Source: Ohio Stream Management Guide)

Special Considerations

- Employ appropriate siltation and erosion control practices during construction as necessary.
- Effectiveness of river restoration or clearing & snagging practices in reducing flooding is limited only to small annual floods. Often times, the effect of these activities on reducing flood stages of larger less frequent floods is negligible or at best limited to 2 or 3 inches of stage reduction. Similar hydraulic benefits may be achieved by only removing isolated logjams at a fraction of the cost. (See "Maumee Master Plan" and "Urban Surface Water Management" references for more details.)

MAINTENANCE

- Noted as step 6 (above).

REFERENCES

Related Practices

- Practice 107 Clearing and Grubbing.
- Practice 301 Chemical Vegetation Control.
- Practice 302 Mechanized Debrushing Using Hand-held Equipment.
- Practice 303 Mechanized Debrushing Using Heavy Machinery.
- Practice 401 Logjam Removal Using Hand-held Tools.
- Practice 402 Logjam Removal Using Heavy Equipment.
- Practice 1202 Vegetative Stabilization.
- Practice 1301 Debris Disposal.

Other Sources of Information

- Ohio Stream Management Guide.
- Evaluation of River Restoration Techniques.
- Maumee Master Plan.
- Urban Surface Water Management.
- MRBC Obstruction Removal Program.
- American Fisheries Society Obstruction Removal Guidelines.

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