

**NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATIONS**

RIPARIAN FOREST BUFFER

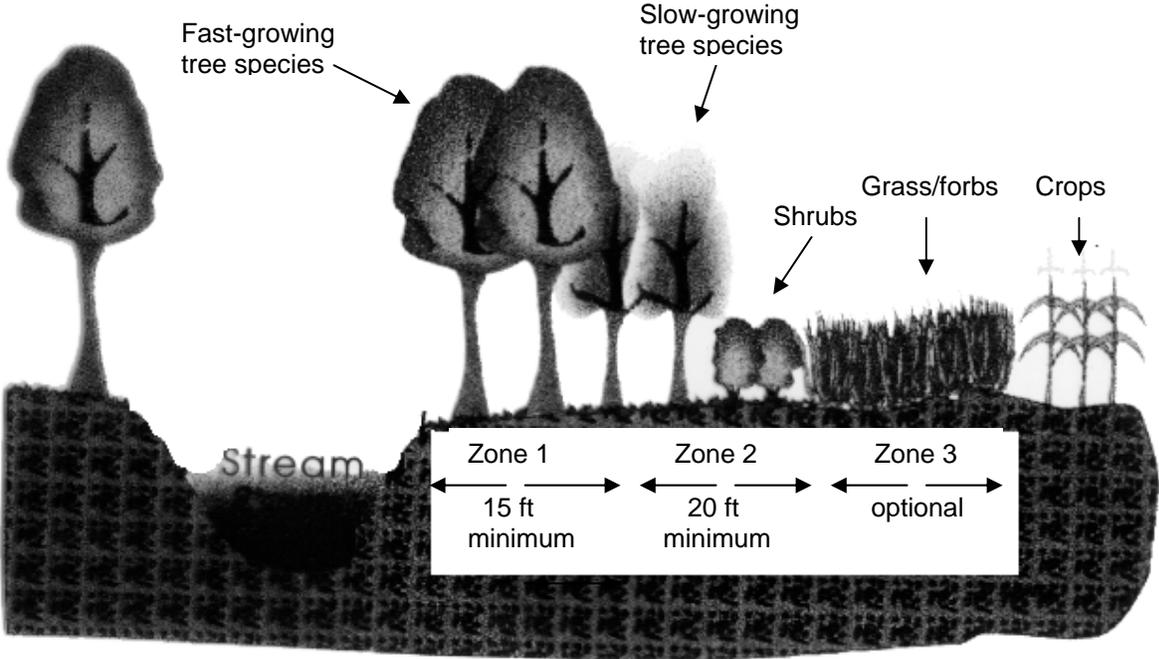
General Specifications

Procedures, technical details, and other information listed below provide additional guidance for carrying out selected components of the main practice and supplements the requirements and considerations.

Specifications Applicable to All Purposes

All buffers will consist of a Zone 1 that begins at the normal bank full or high water line, or at the top of the bank, and extends a minimum distance of 15 feet. The minimum width of the buffer shall be at least 35 feet measured horizontally on a line perpendicular to the water body. See Figure 1 for minimum zone spacing.

FIGURE 1 - RIPARIAN FOREST BUFFER ZONES.



No trees shall be placed within the easement area of overhead transmission lines unless permission has been secured from the appropriate utility company.

Riparian forest buffers will not be located where they will cause snowdrifts to impact roadways or other transportation corridors. Reference Conservation Practice 380, Windbreak/Shelterbelt Establishment, for guidance on set back distances. If local units of government have established more restrictive setback distances, then the more restrictive regulations will apply.

The location, layout, and density of the buffer should complement natural features.

Minimum Design Width of Zones 1 and 2 Combined

When applying these minimums, consider each side of the stream independently. If the floodplain width in the area of the riparian forest buffer varies because of a meandering stream, use an average to determine the floodplain width.

If the geomorphic floodplain is equal to or greater than 333 feet, the minimum design width of Zones 1 and 2 combined is 100 feet.

If the geomorphic floodplain is greater than 119 feet, but less than 333 feet, the minimum design width of Zones 1 and 2 combined is 30 percent of the geomorphic floodplain.

If the geomorphic floodplain is equal to or less than 118 feet or there is no geomorphic floodplain, such as along an intermittent stream or around a water body, the minimum design width of Zones 1 and 2 combined is 35 feet.

Figures 3 through 6 illustrate examples of minimum widths for Zones 1 and 2 along watercourses and water bodies formed under different hydrologic conditions.

Zone 3

Concentrated flow erosion or mass soil movement shall be controlled in the ascent gradient area immediately adjacent to Zone 2 prior to establishment of the riparian forest buffer. This area is delineated and identified as zone 3. Zone 3 shall be designed in accordance with criteria in Conservation Practice Standard 393, Filter Strip, and should most often contain a mixture of native grass and forbs.

Planting Densities and Heights

Planting heights can be estimated on the performance of the individual species (or comparable species) in nearby areas on similar sites or predetermined and documented heights using Kansas Forestry Technical Note KS-10 for planting recommendations and attributes. Planting density specifications are located on Table 1.

Table 1 – Tree/shrub spacing

Plant Types & Heights	In-Row Spacing (ft)	Between-Row Spacing (ft)
Small Shrubs (<10')	3 - 6	10 - 15
Large Shrubs/Small Trees (10' – 25')	6 - 12	10 - 15
Large Trees (>25')	8 - 15	10 - 15

1. Plant List

Refer to Kansas Forestry Technical Note KS-10 for planting recommendations and attributes

2. Site Preparation, Care, Handling, and Planting Requirements for Woody Planting Stock

Refer to Kansas Forestry Technical Note 9.

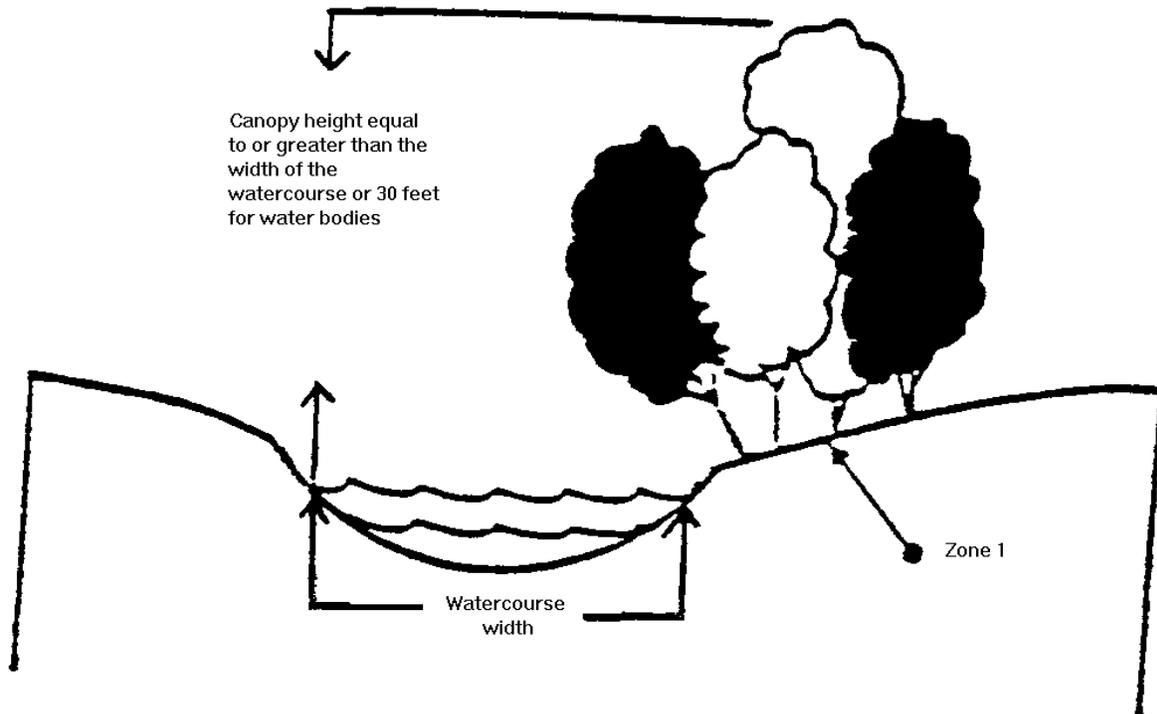
3. Buffer Width Guide for Selected Wildlife Species

Widths include the sum of buffer widths on one or both sides of water courses or water bodies and may extend beyond riparian boundaries. Refer to Table 2 for selected wildlife species.

4. Tree Height for Moderating Water Temperatures

Effective tree heights will account for summer shadow lengths to the surface of the water body for moderating water temperatures. For planning purposes, the effective tree height will be the mature height of trees in Zone 1 plus the height from the edge of the bank to the normal flow line. For determining tree heights, refer to Kansas Forestry Technical Note KS-10 for average tree heights and attributes.

FIGURE 2 - CANOPY HEIGHT FOR WATER TEMPERATURE CONTROL.



5. Considerations

Complex ownership patterns of riparian areas may require group planning for proper buffer design, function, and management.

Joining of existing and new buffers increases the continuity of cover and will further moderate water temperatures. A mix of species with growth forms that are tall and wide-crowned will increase moderation effects. For watercourses, buffers established on both sides will enhance multiple values.

Consider species that re-sprout when establishing new rows nearest to watercourses or bodies. For detritus and large woody debris, use species that will meet the specific requirements of fish and other aquatic organisms for food, habitat, migration, and spawning.

Avoid planting layouts and locations that would concentrate flood flows or return flows. Low, flexible-stemmed shrubs will minimize obstruction of local flood flows. Shrubs can be used as a transition between the tree and grass/forb plantings of Zones 2 and 3.

Consider the positive and negative impacts wildlife may have on the successful management of the riparian and stream buffer system. Temporary control methods of these kinds of local species, if needed, should be used cautiously and within state and local regulations.

Consider the type of human use (rural, suburban, and urban) and the aesthetic, social, and safety aspects of the area to determine the vegetation selection, arrangement, and management. For example, avoiding shrubs that block views and pruning low tree branches near recreation trails allow for ease of patrolling and safety considerations.

Species selection criteria to improve aesthetics include seasonal foliage color, showy flowers and fruit, foliage texture, form, and branching habit. The layout and design should be appropriate for the setting as determined by adjacent land uses. A landscape analysis can help determine specific aesthetic requirements.

6. Woody Vegetation Establishment Methods

The following methods may be considered for the establishment of woody vegetation.

- **Natural regeneration** is the process in which plant materials grow naturally on a restored or enhanced wetland site or riparian area. This is also referred to as natural colonization or natural re-vegetation. This method requires that plant propagules or seed of the desired species be present on the site or that they will be carried to the site by water, wildlife, or wind. Upstream or adjacent plant sources must be examined during planning to determine the best species to encourage.
- **Tree/shrub planting** is the process of mechanical or hand planting of tree/shrub seedlings for the establishment of woody vegetation on a site. This method can include the use of bare root seedlings or containerized seedlings.
- **Live cuttings** - This method involves the use of woody cuttings as the source of plant materials for establishment. It requires the harvesting of live cuttings during the dormant season, storage of cuttings just above freezing with high humidity, and planting on the site in the spring. Hand planting of cuttings is normally required. This method is normally used only where soil moisture is not a limiting factor during the growing season.
- **Direct seeding** is the planting of tree/shrub or seeds/nuts by hand or by mechanical means to establish a stand of trees and/or shrubs. This method is normally limited to the larger nut species such as oak, hickory, pecan, and walnut. Refer to Table 3 for guidance in determining direct seeding rates.

Additional information is found in the Kansas Forestry Technical Note KS-9; National Forestry Manual; Chapters 13 and 16 of the NEH 650; and Construction Specification 380, Windbreak/Shelterbelt Establishment.

Determining Appropriate Plant Community

The objective is to enhance or restore wetland/riparian area functions and values by enhancing or restoring woody vegetation. The landowner decides if he or she wants to enhance or restore the potential natural community (PNC) or a desired plant community (DPC) that will restore those functions and values to the wetland/riparian area under consideration. This requires knowledge of like sites (also called comparison sites or reference sites), vegetative communities, and the functions and values associated with those communities.

If necessary, conduct a plot sample of the closest available functioning wetland/riparian area.

Comparison site descriptions can be performed by using a sample plot. A 26-foot radius circular plot (represents 1/20th acre) should be used. Estimates of relative dominance of individual tree species can be determined by the following formula:

$$\text{Relative Dominance} = \text{Species \% Cover} \div \text{Total \% Cover}$$

A dominant species is defined as having greater than 50 percent relative dominance. An angle gauge can be used in identifying basal area occupied by different tree species within the sample plot.

A site inventory of resources is necessary to determine which plant species are suitable for the site under consideration. This inventory includes water supply, substrate (soils), water depth, slope, growing season length, adjacent habitat and land uses, wind and wave energy, currents and velocities, and costs. Refer to

Kansas Forestry Technical Note KS-10, for conservation tree/shrub plantings. In developing a planting plan, include plant species that match the wetland/riparian area objectives and that will perpetuate themselves in a wetland/riparian area landscape setting.

Natural regeneration is an establishment method that can be considered for wetland sites and for riparian areas, specifically on hydric soils or those soils that are frequently flooded. Refer to Table 4 to assist in making a determination for the use of natural regeneration as an establishment technique. Upstream or adjacent plant sources should be examined during the planning process to determine the best species to encourage. If the planner is unsure as to the ability of the site to vegetate naturally, he or she may want to leave the site to its own resources for a period of 12 months to determine its natural capacity. If the area does not begin to vegetate naturally with desired woody species during this period, an alternative establishment method should be considered.

7. Criteria for Establishment

The establishment of tree/shrub plantings is more than a one-year commitment. The certification of a tree/shrub planting does not mean that the planting is established. During the establishment period, replanting, watering, weed control, livestock exclusion, and animal damage control are necessary considerations in the establishment of woody plantings.

Usually a minimum of three years of maintenance is necessary after the initial planting to get the trees/shrubs adequately growing to compete with other vegetation. We have to consider the purpose for which the woody planting is intended in our evaluation of the planting. The questions that have to be answered are these: (1) Does the number of surviving trees/shrubs provide adequate cover? (2) Does the practice function properly as designed? (3) Does the practice address other resource concerns as planned?

The requirements for replanting of failed plantings during the first three years of establishment should be discussed and agreed-to in the operation and maintenance plan to make the landowner fully aware of establishment requirements. An inventory of replanting requirements during annual status reviews is necessary to ensure that establishment requirements are met. If extensive replanting is required, there may be a need to extend the establishment period beyond the minimum three-year period.

Zone 1 of Riparian Forest Buffer plantings is considered established in the following circumstances:

- One or two row plantings – A minimum of 90 percent survival overall at the end of the third growing season without any gaps that would affect the function of the practice as determined by the inspector.
- Three or more row plantings – After the third growing season, a minimum of 80 percent survival is required. If mortality is concentrated and creating a significant gap, the inspector must determine whether the gap will require replanting to maintain the integrity of the practice.

Zone 2 of Riparian Forest Buffer plantings are considered established when the survival for the entire planting (Zone 2) equals or exceeds 70 percent after three growing seasons.

Where natural regeneration is used as the establishment technique, the site shall be monitored for a minimum of three years to document plant and species composition and establishment. The natural regeneration occurring on the site shall result in a minimum established density of 300 trees/shrubs per acre.

Procedure

1. Documentation of tree and shrub establishment should be performed no earlier than August of the third growing season after the initial planting. Plantings that appear to be adequate from visual observation need not be evaluated further. Woody plantings that are obviously marginal or appear to have failed require further evaluation and documentation, particularly where replanting is required for program purposes.

2. A random sampling procedure can be used by sampling 10 percent of the trees/shrubs planted or a minimum of 100 trees/shrubs for smaller plantings (≤ 999 trees).

For example, if 3,000 trees are planted, 300 ($3,000 \times 0.10$) trees need to be checked for survival. If 500 trees are planted, 50 (500×0.10) trees would need to be checked. However since this is a small planting, a minimum of 100 trees would need to be checked for survival.

A suggested sampling method would be to randomly distribute sample plots throughout the planted area. Sample plots can be linear in shape with 10 trees/shrubs per plot for linear type practices such as riparian forest buffers, which are normally designed and planted in rows.

Another example is that if there are 300 trees/shrubs that need to be sampled, check 10 trees per linear plot which are randomly distributed in 30 plots throughout the planting. The number of trees per plot can be varied, with consideration given to ensuring a representative sample for the entire planting area.

3. Higher survival requirements may be needed on critical areas (i.e., Zone 1 for bank stabilization) to meet erosion control or other resource needs. If the function of the practice is greatly reduced because of poor survival, concentrated blocks of plantings with poor to no survival may need to be replanted even though the overall percentage of survival has been attained.

4. Flexibility needs to be practiced when concentrated areas of plantings with poor to no survival were caused by unforeseen circumstances beyond the landowner's control such as soils, planting design, or site-specific factors. Other plant materials may need to be investigated.

8. Operation and Maintenance

For purposes of moderating water temperatures and providing detritus and large woody debris, riparian forest buffer management must maintain a minimum of 50 percent canopy cover.

For providing habitat and corridors for wildlife, manage the buffer to favor food, shelter, and nesting cover that would satisfy the habitat requirements of the indicator or target species.

For purposes of reducing excessive pollutants in surface runoff and shallow groundwater (Zones 1 and 2) or providing habitat diversity and corridors for wildlife (Zone 1 at a minimum), manage the dominant canopy to maintain maximum vigor of overstory and understory species.

Livestock shall be controlled or excluded as necessary to achieve and maintain the intended purpose. Watercourse crossings and livestock watering shall be located and sized to minimize impact to buffer vegetation and function. On established buffers included within grazed areas, set utilization rates of key woody browse to allow woody vegetation to regrow sufficiently for its intended function. Impairment of buffer function by livestock overuse (trampling, compaction, or over-utilization of woody plants) shall require immediate removal of livestock from the riparian area. Refer to Conservation Practice Standard 382, Fencing.

Additional operation and maintenance requirements shall be developed on a site-specific basis to assure performance of the practice as intended.

FIGURE 3. ACTIVE FLOODPLAINS GREATER THAN 333 FEET (102 M) IN WIDTH.

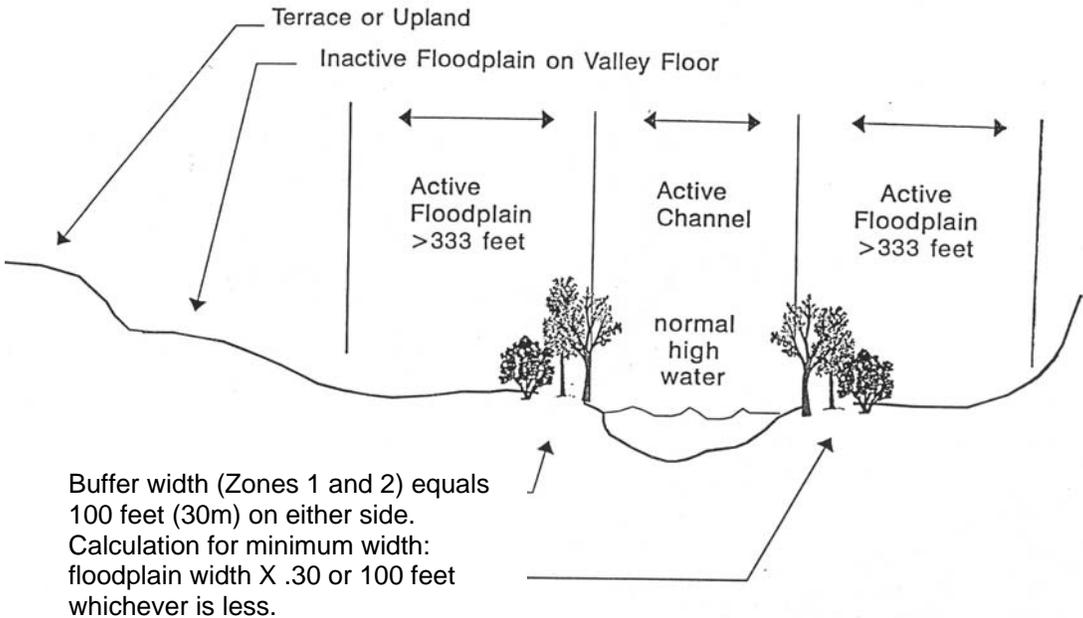


FIGURE 4. ACTIVE FLOODPLAINS LESS THAN 333 FEET (102M).

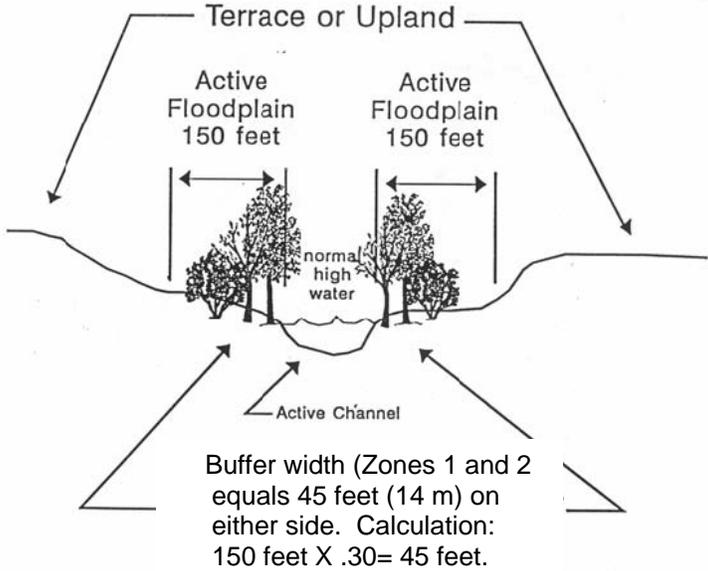


FIGURE 5. INCISED CHANNEL WITH ACTIVE FLOODPLAIN (2-YR 24-HOUR STORM) CONTAINED WITHIN ITS BANKS AND OTHER WATER BODIES SUCH AS LAKES.

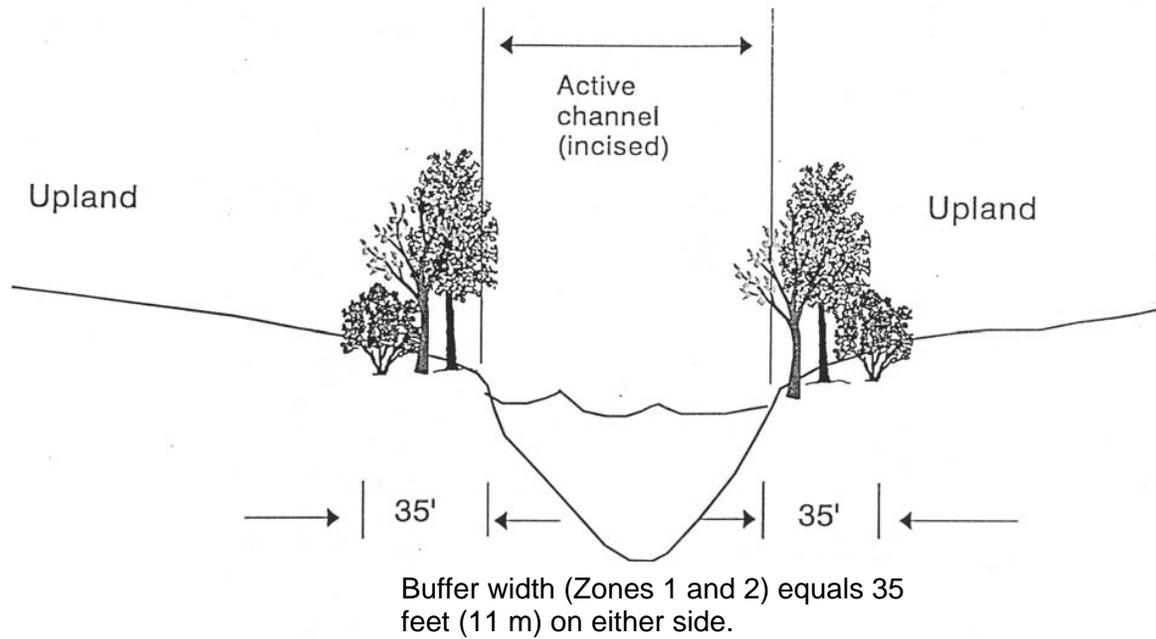


FIGURE 6. ACTIVE FLOODPLAIN ON ONLY ONE SIDE OF THE CHANNEL.

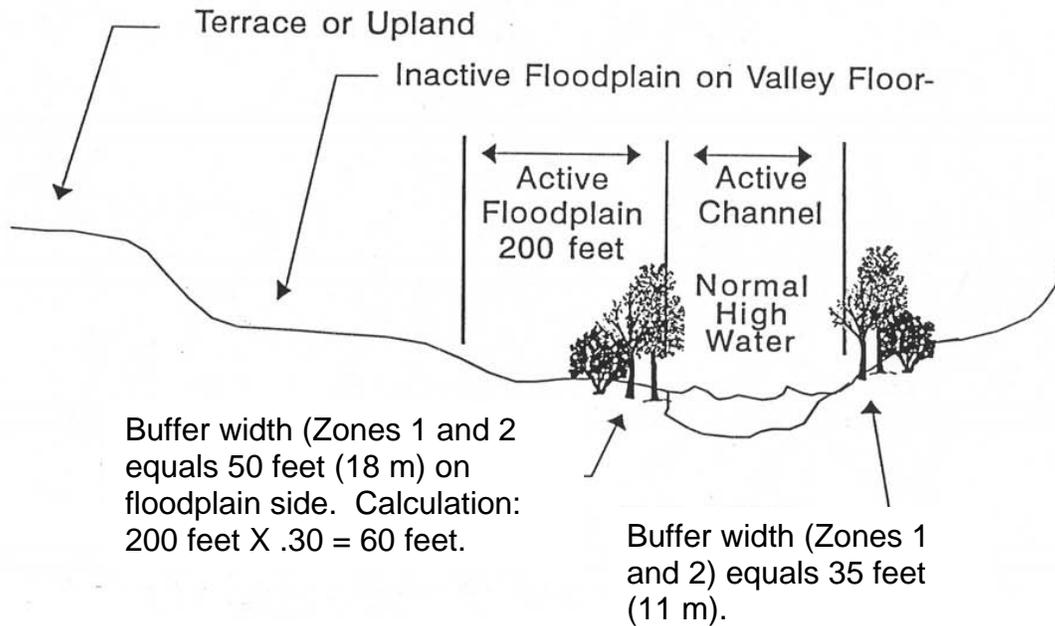


Table 2 - Desired buffer width for selected wildlife species

Species	Desired Width ^{1/} in Feet	Species	Desired Width ^{1/} in Feet
American Avocet	*	Great Horned Owl	N - VW
American Bittern	*	Raccoon	N - VW
Black-tailed Prairie Dog	*	Rainbow Trout	N - VW
Black Tern	*	Redtailed Hawk	N - VW
Burrowing Owl	*	Virginia Opossum	N - VW
Canada Goose	*	White Tailed Deer	N - VW
Ferruginous Hawk	*	Morning Dove	N - W
Lark Bunting	*	Red Fox	N - W
Long-billed Curlew	*	American Elk	VW
Plains Topminnow	*	Bald Eagle	VW
Prairie Chicken	*	Bobcat	VW
Pronghorn	*	Eastern Woodrat	VW
Sandhill Crane	*	Gray Fox	VW
Swift Fox	*	Southern Flying Squirrel	VW
Trumpeter Swan	*	Woodcock	VW
Upland Sandpiper	*	Bobwhite Quail	W
Whooping Crane	*	Cooper's Hawk	W
Western Meadowlark	* - N	Mocking Bird	W
Mink	* - N	Swainson's Hawk	W
Blue Winged Teal	N	Eastern Fox Squirrel	W-VW
Channel Catfish	N	Great Blue Heron	W-VW
Eastern Bluebird	N	Hairy Woodpecker	W-VW
Largemouth Bass	N	Red Bat	W-VW
Mule Deer	N	Smallmouth Bass	W-VW
Pheasant	N	Turkey Vulture	W-VW
Sharptail Grouse	N	Wild Turkey	W-VW
Short-eared Owl	N	Wood Duck	W-VW
Red Headed Woodpecker	N		
Beaver	N - VW		
Coyote	N - VW		

^{1/} * = Avoids Woody Cover
 N = Narrow = 35 feet
 W = Wide = 35 - 100 feet
 VW = Very Wide = > 100 feet

Table 3 – Average number of seeds per pound of selected tree species

SPECIES	AVERAGE NUMBER OF SEEDS PER POUND:	SPECIES	AVERAGE NUMBER OF SEEDS PER POUND:
Black walnut (<i>Juglans nigra</i>)	40	Chinkapin oak (<i>Quercus muehlenbergii</i>)	395
White oak (<i>Quercus alba</i>)	120	Shingle oak (<i>Quercus imbricaria</i>)	415
Northern red oak (<i>Quercus borealis</i>)	125	Pecan (<i>Carya illinoensis</i>)	162
Black oak (<i>Quercus velutina</i>)	245	Bitternut hickory (<i>Carya cordiformis</i>)	156
Bur oak (<i>Quercus macrocarpa</i>)	75	Shellbark hickory (<i>Carya laciniosa</i>)	30
Pin oak (<i>Quercus palustris</i>)	410	Shagbark hickory (<i>Carya ovata</i>)	100
Shumard oak (<i>Quercus velutina</i>)	100		

* The number of seeds per pound varies considerably with moisture content. It can be high for freshly collected acorns/nuts--especially those in the white oak group. All seeds will vary in size and weight from tree to tree. For accurate per acre rates, select a sample size from the seed collection. Count and weigh 100 seeds to determine the correct pounds per acre to equal the chosen seeding rate per acre.

To calculate the amount of seed needed for direct seeding:

- Determine the desired number of trees per acre.
- Determine the percent composition of the desired stand.
- Estimate the percent of sound seed, percent germination (can be derived from woody production manuals) and percent survival (predation may be significant) during the first year.

For example, the goal is to have 1,600 trees of a particular species per acre. The seed used is estimated to be 50 percent sound, the average germination is 30 percent, and the initial survival is estimated to be 50 percent. To meet the desired goal, 21,333 seeds per acre would be required ($1,600 / .50 \times .30 \times .50$). To estimate the number of seeds per pound, make several seed counts to arrive at this figure.

Table 4 - Natural regeneration versus planting key

NOTE: This key is to be used by planners in determining if natural regeneration should be used as an establishment technique for herbaceous or woody vegetation. **This establishment technique can only be used on a wetland site or for specific sites within a riparian area where hydric soils or frequently flooded soils exist.**

1. Hydrology and soil condition marginally altered	Go to 2
1. Hydrology and soil condition significantly altered	Go to A
2. Propagules already exist on site	Go to 3
2. Propagules do not exist on site	Go to 5
3. Desirable species occur on site	Go to 4
3. Desirable species do not occur on site	Go to 5
4. Seed source and crop are adequate to meet planning objectives	Go to B
4. Seed source and crop are inadequate to meet planning objectives	Go to 5
5. Restoration site is adjacent to a surrounding seed wall	Go to 6
5. Restoration site is not adjacent to a surrounding seed wall	Go to A
6. Seed wall contains desirable species	Go to C
6. Seed wall does not contain desirable species	Go to A

A. Natural regeneration is not recommended for site. An alternative method should be selected and used as an establishment technique.

B. Natural regeneration may be recommended for the entire site.

C. Natural regeneration should be no greater than 200 feet from the surrounding seed wall.

Seed wall – Desirable wetland/riparian plants on adjacent lands that have seeds capable of being dispersed to the restoration site by natural drop, wind, water, or animals.

Propagules – Any piece of plant material that will form a new plant (i.e., seeds, nuts, rhizomes, or other vegetative material).