
NORTH DAKOTA FOREST SERVICE

FOREST RESOURCE MANAGEMENT PLAN

Owner(s): City of Grand Forks
Address:

Date: April 15, 2003
Telephone:

FOREST RESOURCE MANAGEMENT IS APPLYING ENVIRONMENTAL AND
ECONOMIC RESOURCE MANAGEMENT PRINCIPLES TO BENEFIT CURRENT
AND FUTURE LANDOWNERS AND THE PUBLIC!

FOREST MANAGEMENT OBJECTIVES

This Forest Resource Management Plan has been prepared to assist non-industrial private forest landowners with managing their woodlands and windbreaks to improve:

- * Fish and Wildlife Habitat
- * Soil Protection
- * Water Quality
- * Timber Resources
- * Recreation Benefits
- * Aesthetic Quality
- * Cultural Resources
- * Threatened and Endangered Species

Legal: Section: Township: Range:

General: Property located on the banks of Red River through the city of Grand Forks in Grand Forks and Falconer Townships

This plan has been prepared by: Tom Nowatzki
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Type of Woodlands:

Windbreaks: Miles:	Acres:
Native Woodlands:	Acres: 89.0
Other types of plantings:	Acres: 10.3
River Miles Managed:	Miles: 12.8
River Miles Restored:	Feet: 4730



Figure 1: Stand Map

Stand #	Description	Acres
1	Bottomland Hardwoods	4.0
2	Bottomland Hardwoods	10.0

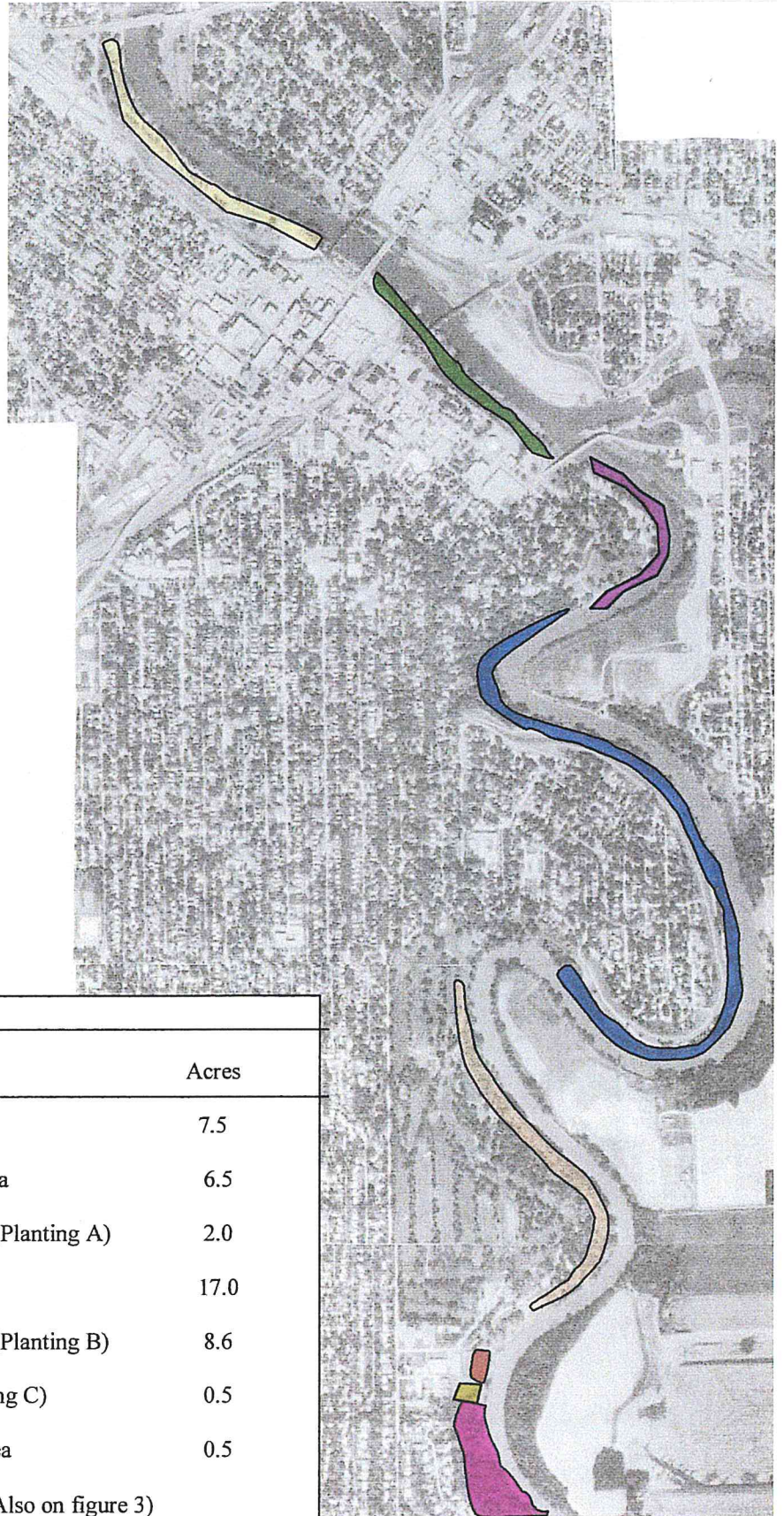










Figure 2: Stand Map

Stand #	Description	Acres
3	Bottomland Hardwoods	7.5
4	Riparian Restoration Area	6.5
5	Bottomland Hardwoods (Planting A)	2.0
6	Bottomland Hardwoods	17.0
7	Bottomland Hardwoods (Planting B)	8.6
8	Riparian Planting (Planting C)	0.5
9	Natural Regeneration Area	0.5
10	Bottomland Hardwood (Also on figure 3)	



Figure 3: Stand Map

Stand #	Description	Acres
 10	Bottomland Hardwoods	8.9
 11	Riparian Planting (Planting D)	3.6
 12	Riparian Planting (Planting E)	4.0
 13	Bottomland Hardwoods	3.0
 14	Riparian Planting (Planting F)	1.6
 15	Riparian Planting (Planting G)	2.3
 16	Bottomland Hardwoods	7.2
 17	Bottomland Hardwoods	6.2

Property Overview:

This management plan was written for the City of Grand Forks in order to provide management recommendations for the Grand Forks Greenway. Only areas with native forest cover, and areas directly adjacent to the river were looked at for this management plan. Areas that have been maintained as parks, golf courses, and the like were not included in this plan.

The main goal of the recommendations in this plan is to improve and maintain the health of the riparian woodlands along the Red River. Healthy riparian woodlands have the potential to provide many benefits to the City of Grand Forks, including increased streambank stability and reduction of riverbank erosion. A healthy riparian forest will also act as a buffer, filtering much of the pollution from urban runoff, before it reaches the river. A forested riparian area also has the potential to provide habitat for many species of wildlife that use these areas for food and cover.

The woodlands that are found throughout the greenway today are in varying conditions of health. Much of the riverbanks are heavily wooded with healthy riparian woodlands, while some areas have been deforested. The reason for this lack of woodlands is due to many reasons. Some areas have been cleared for recreational and urban use, while some have been deforested through natural means such as diseases and flooding.

Dutch elm disease has had a devastating impact to much of the forested areas along the Red River. Areas once dominated by American elm have been totally deforested. This deforestation has led to increased streambank erosion, and the woody debris left by the dead trees can litter parks, catch on bridges, and cause jams in the river that may impede flow.

Extremely large cottonwood trees dominate the landscape through much of the greenway. These large trees are especially adapted to the conditions along the Red River. Cottonwood trees are not only able to tolerate the frequent floods, they actually rely on floods to prepare seedbeds for the next generation of cottonwoods to become established. These trees with their large root masses are able to provide stability to the riverbanks better than any other tree species along the river. Future management along the greenway should encourage the establishment and growth of cottonwood trees.

Frequent flooding in recent years has had a great impact on the health of the forested areas of the Red River. Most of the understory tree seedlings and shrubs have been killed and the forest floor was left void of any vegetation. In response to this flooding, much of the riverbanks have been invaded by tall annual weeds such as ragweed and cocklebur. Today however grasses, sedges, and willows have been able to become reestablished and are slowly crowding out this growth of weeds.

Recent floods throughout the greenway have produced excellent seedbeds for all types of tree species, especially cottonwood, boxelder, and willow. If allowed to develop, these areas will become forested in the future. Management of the greenway forest should concentrate on allowing these areas to develop.

There are several plantings recommended throughout this plan. These plantings are designed to restore degraded areas of riparian forest. Cost-Share money and technical assistance is available to the city of Grand Forks through the Red River Basin Riparian Project. These plantings are simply recommendations. The city can decide to implement this plan as it sees fit.

Stand Number: 1, Bottomland Hardwoods:

BH 11-15''

Acres: 4.0

Age: Uneven

Map Color:

LANDOWNER'S OBJECTIVES:

This stand is to become part of the Grand Forks Greenway. The greenway is to be left in a semi-natural state to be used for flood protection for the city. The greenway will also provide stability to the riverbanks, filter pollution from runoff, provide wildlife habitat, and provide a place for recreational activities.

DESCRIPTION:

Woodland:



This stand is dominated by young boxelder and green ash trees. Pockets of cottonwood can also be found throughout the stand. The trees in this stand are vigorous and free of any major insect and disease problems. The stand also contains a few scattered overmature ash trees that are rotted and are being used by squirrels and woodpeckers as nesting sites.

The stand contains excellent understory regeneration. Boxelder and green ash seedlings can be found throughout the stand. Other species found in the understory include chokecherry, American elm, cottonwood, and sandbar willow.

A snowmobile trail runs down the center of this stand in the winter. This trail is also used by fisherman in the summer months in order to access the Riverside Dam area.

Trees Represented Within the Stand:

OVERSTORY

	BA/A (sqft)	TREES/ ACRE	AVE. HEIGHT (feet)	AVE. DBH (inches)	CORDS/ ACRE	BDFT/ ACRE
Cottonwood	48	98	55	12.8	4	1540
Boxelder	34	398	30	6.6	2	120
Green Ash	12	76	30	6.3	1	0
American Elm	8	21	35	9.5	1	60

UNDERSTORY	Trees/Acre	Shrub Species	Stems/Acre
Green Ash	5400	Sandbar Willow	400
Boxelder	5400		
American Elm	200		
Cottonwood	400		
Chokecherry	200		

Soils:

The soils that underlie this stand are composed of Cashel silty clay loam, 1 to 6 percent slopes (43B). This soil is suited to all of the commonly grown trees and shrubs. For more information on this soil, please see **Appendix A**.

Wildlife Values:

This stand has the potential to provide habitat for many species of wildlife. This stand is located on the edge of the city and is offers more seclusion to wildlife that is shy of populated areas. While inventorying the stand several squirrels and a woodchuck were spotted among the overmature and rotting ash trees. This stand also provides habitat for white-tailed deer and several species of songbirds.

River Condition:

The river through this reach is in good condition. They are well vegetated and there was little erosion occurring. The banks alongside the dam are heavily armored with riprap to prevent erosion when the fast moving waters reach flood conditions.

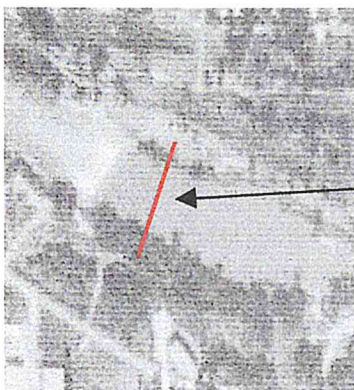


Figure 4: River Reach

Figure 5: Reach Profile

RECOMMENDATIONS:

There are 2 recommendations for this stand:

1. **Protect from destructive practices.**
2. **Monitor for insect and disease problems.**

1. **Protect from destructive practices.**

This stand should be protected from destructive cutting, clearing, fire, mowing and compaction. Cooperation with the local fire department and adjacent property owners will limit the chances of a wildfire. Although the moist, shady conditions in well developed, riparian areas are not usually a great fire risk.

2. **Monitor for insect and disease problems.**

This stand should also be monitored for insect and disease outbreaks. Early detection and management for such problems generally lead to better results. Common insect and disease problems are listed in **Appendix C**.

Stand Number: 2, Bottomland Hardwoods:

BH 11-15''

Acres: 10.0

Age: Uneven

Map Color: 

LANDOWNER'S OBJECTIVES:

This stand is to become part of the Grand Forks Greenway. The greenway is to be left in a semi-natural state to be used for flood protection for the city. The greenway will also provide stability to the riverbanks, filter pollution from runoff, provide wildlife habitat, and provide a place for recreational activities. This stand is located along the riverside park area so is also used by high numbers of people for recreation.

DESCRIPTION:

Woodland:



This stand is located between the Red River and the Riverside Park. The riverside park is a popular recreation area for the citizens of Grand Forks and receives heavy use.

This stand is dominated by large, mature cottonwood trees. But it also contains a nice mix of other bottomland hardwood trees, such as green ash, boxelder, peachleaf willow and bur oak.

Dutch elm disease has killed most of the American elm trees that were once found in this stand, but several mature American elms, were seen still alive. These trees may have some natural resistance to the disease, or they may have not been infected yet.

The stand is in good condition and contains a well-developed overstory, midstory, and understory.

Natural regeneration has been excellent in this stand. Both in the forested areas and the open grassy areas found within the stand. The grassy areas, found south of the park, contains good tree regeneration. **If left to develop naturally the forested area of this stand will increase dramatically.**

Trees Represented Within the Stand:

OVERSTORY						
	BA/A (sqft)	TREES/ ACRE	AVE. HEIGHT (feet)	AVE. DBH (inches)	CORDS/ ACRE	BDFT/ ACRE
Boxelder	28	530	35	4.6	1	60
Cottonwood	18	4	75	27.8	0	1880
Green Ash	12	376	45	4.3	0	180
American Elm	4	3	50	17.0	0	300
Peachleaf Willow	4	3	40	16.0	0	200
Bur Oak	2	2	50	14.0	0	120

UNDERSTORY	Trees/Acre	Shrub Species	Stems/Acre
Green Ash	3200		
Boxelder	3200		
Cottonwood	1000		

Soils:

The soils that underlie this stand are composed of Cashel silty clay loam, 1 to 6 percent slopes (43B). This soil is suited to all of the commonly grown trees and shrubs. For more information on this soil, please see **Appendix A**.

River Condition:

The riverbanks through this reach are in good condition. The banks are well vegetated and stable with little erosion occurring and cutbanks are small.

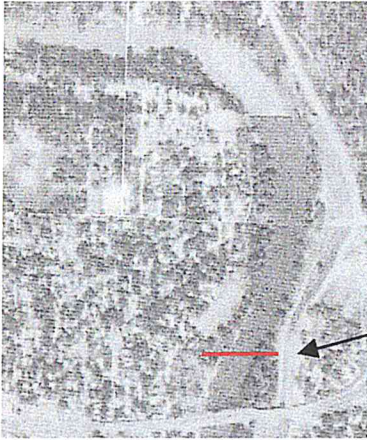


Figure 6: River Reach



Figure 7: Reach Profile

Wildlife Values:

This stand has the potential to provide important habitat to many species of wildlife, including songbirds, waterfowl, deer, rabbits, and other small mammals. The large cottonwood trees provide shade for fish. When large woody debris fall into the river, it also provides habitat for fish.

Beaver have also been active through this reach, but due to the extremely high regeneration, they are not doing any harm to the forest.

RECOMMENDATIONS:

There are 2 recommendations for this stand:

- 1. Protect from destructive practices.**
- 2. Monitor for insect and disease problems.**

1. Protect from destructive practices.

This stand should be protected from destructive cutting, clearing, fire, mowing and compaction. Cooperation with the local fire department and adjacent property owners will limit the chances of a wildfire. The moist, shady conditions common in well developed riparian areas are not usually a great fire risk.

It is important not to mow areas where natural regeneration of trees and shrubs are desired.

2. Monitor for insect and disease problems.

This stand should also be monitored for insect and disease outbreaks. Early detection and management for such problems generally lead to better results. Common insect and disease problems are listed in **Appendix C**.

Stand Number: 3, Bottomland Hardwoods:

BH 11-15''

Acres: 7.5

Age: 75

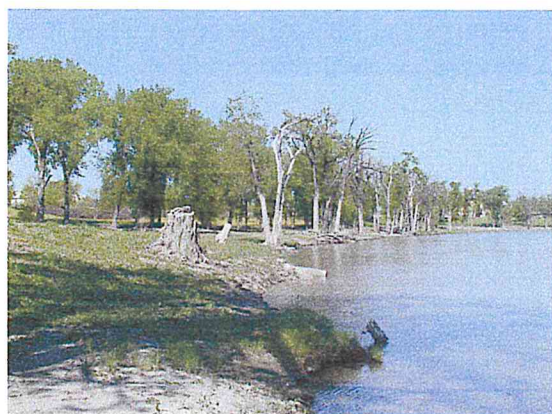
Map Color:

LANDOWNER'S OBJECTIVES:

This stand is to become part of the Grand Forks Greenway. The greenway is to be left in a semi-natural state to be used for flood protection for the city. The greenway will also provide stability to the riverbanks, filter pollution from runoff, provide wildlife habitat, and provide a place for recreational activities.

DESCRIPTION:

Woodland:



This stand consists entirely of large, mature cottonwood, with no understory trees or natural regeneration. Sedges are becoming established in some of the open areas. Dutch elm disease has killed all of the mature elm trees that were once found in the stand.

Some of the cottonwoods right next to the river are declining. These trees have been stressed by recent summer flooding.

Trees Represented Within the Stand:

OVERSTORY

	BA/A (sqft)	TREES/ ACRE	AVE. HEIGHT (feet)	AVE. DBH (inches)	CORDS/ ACRE	BDFT/ ACRE
Cottonwood	70	30	75	22.6	0	6380

UNDERSTORY

	Trees/Acre	Shrub Species	Stems/Acre
Boxelder	600		

Soils:

The soils that underlie this stand are composed of Cashel silty clay loam, 1 to 6 percent slopes (43B). This soil is suited to all of the commonly grown trees and shrubs. For more information on this soil, please see **Appendix A**.

River Condition:

The riverbank is in excellent condition through this reach. The large cottonwood and elm trees that have been growing along the river through this reach have been providing good stability to the riverbank. There are no cutbanks found on this reach and very little erosion.

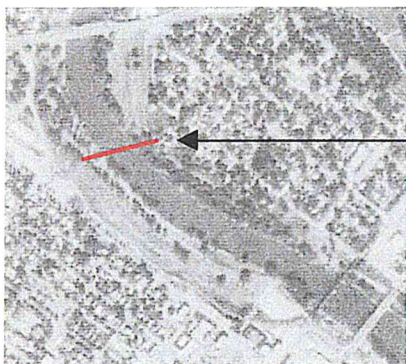


Figure 8: River Reach



Figure 9: Reach Profile

Wildlife Values:

The large cottonwood trees of this stand shades the river from the afternoon sun. This shade is important for many aquatic organisms, including fish. The shade provided by large cottonwood trees along the river helps maintain cooler water temperatures.

These trees also provide important nesting and perch sites for many species of birds.

RECOMMENDATIONS:

There are 2 recommendations for this area:

- 1. Do not mow the forested area along the river.**
- 2. Protect from destructive practices.**

- 1. Do not mow the forested area.**

The large cottonwood trees in this stand are mature to overmature. Many of these trees are declining and will begin to break down. Since there is no understory trees to take their place, this reach is in danger of eventually losing all the forested areas. It will be important to manage this area to encourage the growth of new tree seedlings. The best way to encourage the growth of new tree seedlings in this stand is to discontinue mowing within the forested area along the river.

2. Protect from destructive practices.

This stand should be protected from destructive cutting, clearing, fire, mowing and compaction. Cooperation with the local fire department and adjacent property owners will limit the chances of a wildfire. Although the moist, shady conditions in well developed, riparian areas are not usually a great fire risk.

It is important not to mow areas where natural regeneration of trees and shrubs are desired.

Stand Number: 4, Riparian Restoration

RPR

Acres: 6.5

Age: Uneven

Map Color: 

LANDOWNER'S OBJECTIVES:

This stand is to become part of the Grand Forks Greenway. The greenway is to be left in a semi-natural state to be used for flood protection for the city. The greenway will also provide stability to the riverbanks, filter pollution from runoff, provide wildlife habitat, and provide a place for recreational activities.

DESCRIPTION:



This stand is located in between the DeMers Ave. Bridge and the Minnesota Ave. Bridge. There is no native forest through this reach. The ground is vegetated by mainly sedges. The site is not totally devoid of woody vegetation as the city has been planting trees on the riverbank.

The area has been mowed in the past, this mowing has been limiting the amount of woody vegetation that can become established on the site.

Soils:

The soils that underlie this stand are composed of Cashel silty clay loam, 1 to 6 percent slopes (43B). This soil is suited to all of the commonly grown trees and shrubs. For more information on this soil, please see **Appendix A**.

River Condition:

The riverbank is in excellent condition through this reach. Although some woody vegetation would help to buffer the runoff before it gets to the river, the banks are very stable and establishing woody vegetation may not be necessary.

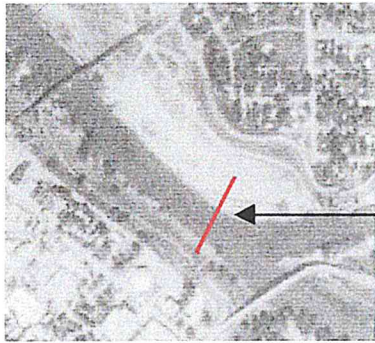


Figure 10: River Reach



Figure 11: Reach Profile

RECOMMENDATIONS:

There are 2 recommendations for this area:

1. Do not mow a 50-foot wide band along river.
2. Protect from destructive practices.

1. Do not mow a 50-foot wide and along the river.

This reach of the river is vegetated with sedges and grasses. By not mowing a 50-foot wide strip along the river through this reach, the sedges and grasses will be allowed to develop deeper root systems that will help keep the riverbanks stable. A strip of taller vegetation along the river will also be better able to filter runoff before entering the river. Leaving a band of vegetation to grow undisturbed will allow for trees and shrubs to establish naturally through this reach. Willows, cottonwood green ash, and boxelder can be expected to become established if this area is left to develop naturally.

2. Protect from destructive practices.

This stand should be protected from destructive cutting, clearing, fire, mowing and compaction. Cooperation with the local fire department and adjacent property owners will limit the chances of a wildfire. Although the moist, shady conditions in well developed, riparian areas are not usually a great fire risk.

It is important not to mow areas where natural regeneration of trees and shrubs are desired.

**Stand Number: 5, Bottomland Hardwoods
(Planting A)**

BH 11-15' Acres: 2.0

Map Color:



Age: Uneven

LANDOWNER'S OBJECTIVES:

This stand is to become part of the Grand Forks Greenway. The greenway is to be left in a semi-natural state to be used for flood protection for the city. The greenway will also provide stability to the riverbanks, filter pollution from runoff, provide wildlife habitat, and provide a place for recreational activities.

DESCRIPTION:



This area is known as Central Park. The riparian forest cover consists of a very narrow band of cottonwood along the river. Much of this reach is not vegetated at all because of recent disturbances, including, flooding, mowing, and cultivation. No sapling sized trees are present. There is very good sandbar willow growth on the north end of the stand. The large cottonwood trees present on the site are overmature and beginning to decline. Once these trees are gone, there will be no mature forest cover on the site.

The exiting forest cover was not thick enough to inventory.

Soils:

The soils that underlie this stand are composed of Cashel silty clay loam, 1 to 6 percent slopes (43B). This soil is suited to all of the commonly grown trees and shrubs. For more information on this soil, please see **Appendix A**.

River Condition:

The riverbank through this reach is experiencing some erosion. Small cutbanks of a few feet are present through most of the reach. The south side of the reach has been mowed and disturbed.



Figure 12: River Reach

Figure 13: Reach Profile

RECOMMENDATIONS:

There are 3 recommendations for this stand:

1. **Establish woody riparian vegetation to provide streambank stability and wildlife habitat.**
2. **Protect from destructive practices.**
3. **Monitor for insects and disease.**

1. Establish woody riparian vegetation to provide streambank stability and wildlife habitat.

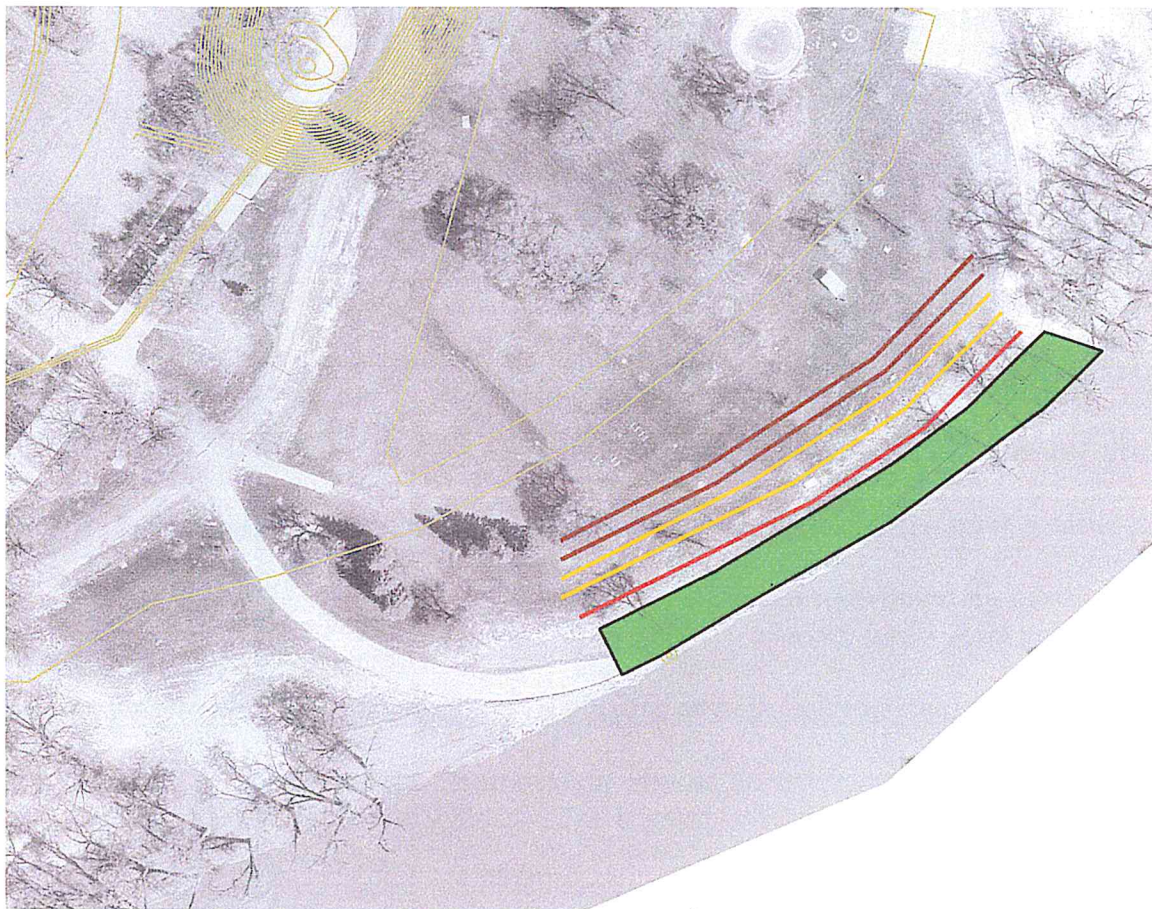
The south portion of this stand has no woody vegetation established at all. A riparian buffer planting should be installed in order to provide extra stability to the riverbank, and to provide wildlife habitat.

Spaces could be left in the planting in order to allow fishermen to access the riverbank. Below is a planting plan and diagram of the proposed planting.

Planting Plan: (Planting A)

Row #	Species	Spacing		Row Length	# of Trees
		Within Row	Between Row		
1-10	Sandbar Willow	3	3	450	1500

11	False Indigo	4	---	450	112
12	Cottonwood	10	10	450	45
13	Cottonwood	10	10	450	45
14	Green Ash	10	10	450	45
15	Green Ash	10	---	450	45



2. Protect from destructive practices.

This stand should be protected from destructive cutting, clearing, fire, mowing and compaction. Cooperation with the local fire department and adjacent property owners will limit the chances of a wildfire. Although the moist, shady conditions in well developed, riparian areas are not usually a great fire risk.

It is important not to mow areas where natural regeneration of trees and shrubs are desired.

3. Monitor for insects and diseases.

This stand should also be monitored for insect and disease outbreaks. Early detection and management for such problems generally lead to better results. Common insect and disease problems are listed in **Appendix C**.

Cost Estimate:

This planting will consist of about 67.5 HLFT. Tree planting often costs about \$17.00 per HLFT resulting in a cost of about \$1,147.50

Total Cost:	\$1,147.50
RRBRP Cost Share:	\$668.50
Greenway Cost:	\$479.00

Stand Number: 6, Bottomland Hardwoods

BH 11-15''

Acres: 16.0

Age: Uneven

Map Color: 

LANDOWNER'S OBJECTIVES:

This stand is to become part of the Grand Forks Greenway. The greenway is to be left in a semi-natural state to be used for flood protection for the city. The greenway will also provide stability to the riverbanks, filter pollution from runoff, provide wildlife habitat, and provide a place for recreational activities.

DESCRIPTION:



Woodland:

This stand is composed of a very narrow band, ranging from 30 to 60 feet, of native riparian forest. The wooded area is confined to the area between the river and the adjacent walking trail.

The stand itself contains a good mix of tree species and size classes. The trees are in good condition with little insect or disease damage besides Dutch elm disease.

Overstory:

The overstory is dominated by large mature cottonwood trees. These trees have extensive root systems that help reduce the amount of erosion occurring to the riverbanks. Other tree species found throughout this reach include green ash, boxelder, and peachleaf willow.

Midstory:

The midstory of this stand is composed entirely of green ash and boxelder saplings. These trees are in good condition, and compose the bulk of the trees in the stand.

Understory:

Like much of the forest floor through the greenway, recent flooding has left a layer of sediment that has created an excellent seedbed for tree regeneration. Cottonwood, green ash, and boxelder seedlings are becoming established in the open areas of this stand. If left un-mowed, these tree seedlings will continue to develop into saplings. Pockets of sandbar willow can also be found establishing along the riverbanks through this reach. Sedges are also rapidly becoming established and are slowly crowding out the weed growth that has been prevalent since recent floods.

Trees Represented Within the Stand:

OVERSTORY

	BA/A (sqft)	TREES/ ACRE	AVE. HEIGHT (feet)	AVE. DBH (inches)	CORDS/ ACRE	BDFI/ ACRE
Cottonwood	38	8	85	28.8	0	3720
Green Ash	32	345	50	5.8	2	0
Boxelder	30	168	35	6.7	1	120
Peachleaf Willow	2	2	50	14.0	0	60

UNDERSTORY

	Trees/Acre	Shrub Species	Stems/Acre
Green Ash	2000	Sandbar Willow	1800
Boxelder	800		
American Elm	200		
Chokecherry	200		

Soils:

The soils that underlie this stand are classified as Cashel silty clay loam, 1 to 6 percent slopes (43B). This soil is suited to all of the commonly grown trees and shrubs. For more information on this soil, please see **Appendix A**.

Wildlife Values:

This stand has the potential to provide excellent habitat for many species of waterfowl, songbirds, deer, and small mammals. Deer sign in the stand indicated that they are already using the stand. Deer numbers should be monitored in the future to protect this stand and homeowners yards from being damaged by browsing.

River Condition:



Figure 14: River Reach

Figure 15: Reach Profile

The riverbank through this reach is in good condition. There are small cutbanks found throughout the reach, but it is well vegetated and fibrous rooted willows are rapidly becoming established.

RECOMMENDATIONS:

There are 3 recommendations for this stand:

- 1. Encourage natural regeneration between walking path and river.**
- 2. Protect from destructive practices.**
- 3. Monitor for insects and diseases.**

1. Encourage natural regeneration between walking path and river.

As mentioned above the open areas of this stand are rapidly becoming established to tree seedlings. These areas should be left intact so the regeneration process can go on. This area

should be protected from mowing, construction, and heavy foot traffic by fisherman and recreationalists.

2. Protect from destructive practices.

This stand should be protected from destructive cutting, clearing, fire, and compaction. Any harvesting of forest products should be overseen by a forestry professional to ensure that it is being done in a sustainable manner. Cooperation with the local fire department and adjacent property owners will limit the chances of a wildfire. Although the moist, shady conditions in well developed, riparian areas are not usually a great fire risk.

3. Monitor for insects and diseases.

This stand should also be monitored for insect and disease outbreaks. Early detection and management for such problems generally lead to better results. Common insect and disease problems are listed in **Appendix C**.

**Stand Number: 7, Bottomland Hardwoods
(Planting B)**

BH 11-15''

Acres: 8.6

Age: Uneven

Map Color:

LANDOWNER'S OBJECTIVES:

This stand is to become part of the Grand Forks Greenway. The greenway is to be left in a semi-natural state to be used for flood protection for the city. The greenway will also provide stability to the riverbanks, filter pollution from runoff, provide wildlife habitat, and provide a place for recreational activities.

DESCRIPTION:



This stand is an excellent example of healthy riparian woodland. It is the most diverse stand in terms of species composition and age classes in the entire greenway. The southern end of the stand is very narrow, but the stand widens out to an appropriate size towards the north end.

Overstory:

The overstory of this stand is dominated by large, mature cottonwood near the water. The bank

forms a series of terraces up and away from the river. On the higher terraces, other tree species including boxelder, green ash, American elm, hackberry, and bur oak can be found.

Some Fomes heart rot was seen in overmature green ash trees in the stand. Fomes is recognizable by the white fungal growths on the trunks of the trees. Ash trees with Fomes are less desirable to use for fuel and other wood products.

Dutch elm disease (DED) has killed nearly all of the mature American elm trees in this stand. DED is a fungus that effectively plugs up the vascular system of the tree. The disease is spread from tree to tree mainly by insects called elm bark beetles, which carry the spores on their bodies. DED can also be transferred from tree to tree through the vascular system across root grafts. There are a few maturing American elm trees still alive in this stand. The fact that these trees have not been infected by DED could indicate some natural resistance to the disease, or they simply might not have been infected yet.

American elm trees are typically not affected by the disease until they are about 10 inches in diameter. This is because the elm bark beetles need mature trees with thick bark to bore into. The bark beetles use the mature trees to bore into and lay eggs below the bark. When the eggs hatch the young beetles will bore out through the bark and fly to other trees. For more information on DED please see Appendix D on insects and diseases that have the potential to affect this stand.

Midstory:

This stand contains a healthy midstory of saplings. Pockets of boxelder, green ash, and American elm saplings can be found throughout the higher elevations in the stand.

Understory:

The understory of this stand has been greatly affected by flooding, but is in very good condition. The lowest terrace, closest to the river is covered by sediment deposited during recent floods. This sediment has created a perfect seedbed for pioneer tree species such as cottonwood and willow seedlings to become established. Currently there is a thick growth of cottonwood seedlings becoming established. If these seedlings can become well established before the next summer flood, they will be the next generation of cottonwood that help to greatly stabilize the riverbank.

As you move away from the river up the slope, thick pockets of boxelder and green ash seedlings are becoming well established.

In areas where trees are not becoming established, sedges are taking over the site, slowly out-competing the weeds that have been prevalent on the site since the most recent summer floods. These sedges start growing early in the spring before the annual weeds get a chance to establish. As long as there are no summer floods in the next few years, these sedges will totally cover the open areas along the river.

A good population of shrubs can be found in the highest elevations in the stand. Chokecherry, dogwood, and beaked hazel were found in these areas. These types of shrubs greatly increase the value of the stand for wildlife habitat that rely on fruiting shrubs for food and cover.

Unfortunately, common buckthorn was also found in this stand. Common buckthorn is not a native tree species; it is a Eurasian tree species that has been used as an ornamental shrub in the United States for many years. This tree species has become naturalized in the woodlands of the United States, and when left unchecked it can take over the understory of a stand, choking out native tree and shrub species. Buckthorn was most concentrated on the north end of the stand near the edge of the golf course.

Trees Represented Within the Stand:

OVERSTORY

	BA/A (sqft)	TREES/ ACRE	AVE. HEIGHT (feet)	AVE. DBH (inches)	CORDS/ ACRE	BDFT/ ACRE
Cottonwood	54	15	85	27.5	0	5720
Green Ash	44	737	60	5.8	1	420
Basswood	40	135	70	9.3	0	560
Boxelder	22	318	45	4.9	1	0
American Elm	16	78	40	8.8	1	420
Hackberry	8	27	35	7.5	1	0
Bur Oak	6	7	65	20.0	0	420

UNDERSTORY	Trees/Acre	Shrub Species	Stems/Acre
Green Ash	7000	Redosier Dogwood	200
Boxelder	2800	Beaked Hazel	200
American Elm	800	Common Buckthorn	400
Cottonwood	5200		
Chokecherry	800		

Soils:

The soils that underlie this stand are classified as Cashel silty clay loam, 1 to 6 percent slopes (43B). This soil is suited to all of the commonly grown trees and shrubs in ND. For more information on this soil, please see **Appendix A**.

Wildlife Values:

This stand has the potential to provide excellent habitat for many species of waterfowl, songbirds, deer, and small mammals. Deer sign in the stand indicated that deer are already using the stand. Deer numbers should be monitored in the future, because if numbers become too high, they have the ability to damage the stand.

Beaver have been very active along the banks of the stand, removing high numbers of tree seedlings, mostly green ash and boxelder, but due to the dense growth of seedlings, the beaver are not currently doing any significant damage to the forest.

Nest boxes were noticed throughout the stand. These nest boxes provide valuable nesting sites for many species of wildlife, especially wood ducks. Providing more of these nesting structures in the future may increase the wildlife viewing opportunities along the greenway.

River Condition:

The riverbanks through this reach are very well vegetated and are in good condition, although steep cutbanks can be found throughout much of the reach. It is expected that the banks will continue to cave into the river until a stable slope is reached naturally. The large cottonwood trees found along the riverbank provide valuable stability to the riverbank, and future cottonwood establishment should be encouraged.

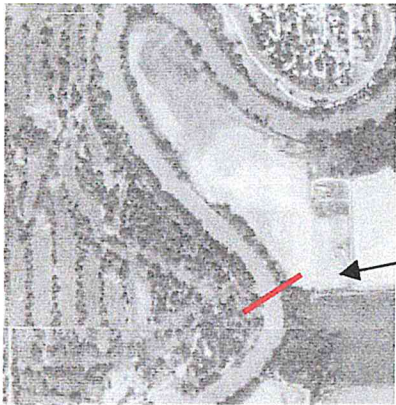


Figure 16: River Reach



Figure 17: Reach Profile

RECOMMENDATIONS:

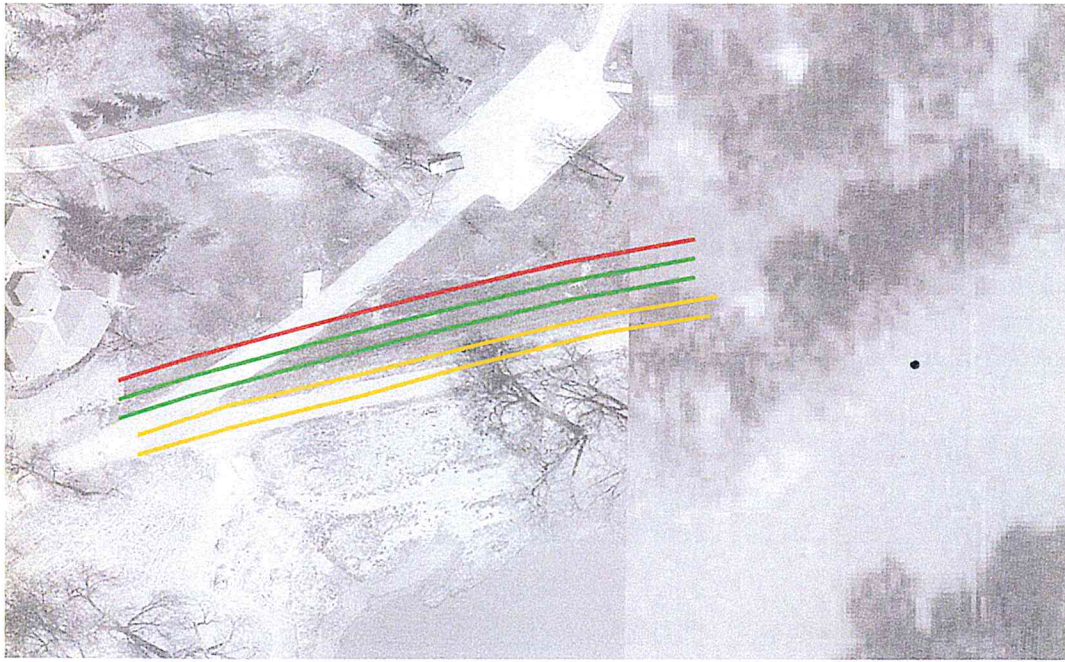
There are 4 recommendations for this stand:

- 1. Plant riparian buffer on south end of stand to widen riparian corridor**
- 2. Remove buckthorn from stand.**
- 3. Protect from destructive practices.**
- 4. Monitor for insects and diseases.**

1. Plant forested riparian planting.

As mentioned the very south end of the stand is too narrow (under 20 feet) to provide adequate riparian benefits. It is recommended to plant trees from just below the clubhouse and 600 feet to the north along the contour of the riverbank to connect with the existing band of woody vegetation.

Five rows of trees spaced 10 feet apart would be adequate to provide the necessary riparian benefits. A planting plan and diagram is found on below.



Planting Plan: (Planting B)

Row #	Species	Spacing		Row Length	# of Trees
		Within Row	Between Row		
1	Cottonwood	10	---	600	60
2	Cottonwood	10	10	600	60
3	Green Ash	10	10	600	60
4	Green Ash	10	10	600	60
5	Redosier Dogwood	4	---	600	150

Cost Estimate:

This planting is composed of 30 HLFT, resulting in a cost of around \$510.00
 The site will have to be cultivated prior to planting in order to kill back the existing sod.

Total Cost:	\$510.00
RRBRP Cost Share:	\$306.00
Greenway Cost:	\$204.00

2. Remove buckthorn from stand.



Common Buckthorn is a shrub or small tree that can reach a height of 25 feet. Twigs are often tipped with a spine, this characteristic makes it easy to identify even when the leaves are gone. Small black fruits are found on female plants and leaves are rounded to a pointed tip and toothed. Upper leaf surface is dark and glossy green. Another characteristic that can be used to identify this plant in your woodland is the plant's tendency to hold its green leaves late into the fall, after all other tree species have lost their leaves.

This shrubby tree was introduced to North America as an ornamental shrub. It is native to Eurasia. The fruit causes a severe laxative effect, quickly distributing the seeds by birds. Common buckthorn invades woodlands and riparian areas, although it may also be found in prairies and open fields. Once established buckthorn crowds or shades out native shrubs and tree seedlings and wild flowers, often completely out-competing them. Common buckthorn control is also of interest to agricultural producers as the shrub is the overwintering site for the soybean aphid and is the alternate host of the crown rust of oats disease.

Control:

As with all invasive species, buckthorns in natural areas are most effectively controlled by recognizing their appearance early and removing isolated plants before they begin to produce seed. With large infestations, the largest seed-producing plants should be removed first.

Chemical control methods are best done during the fall when most native plants are dormant yet buckthorns are still actively growing. This lessens the risk of affecting nontarget plants. The buckthorns' green leaves will provide easy recognition and allow for a thorough treatment at this time.

During the growing season, cutting stems off near ground level and treating them with glyphosate successfully curbs sprouting. Immediately after cutting, a 20%-25% active ingredient glyphosate mixture should be applied to the stumps. Resprouts should be cut and treated again or sprayed with a hand sprayer of 1.5% glyphosate (approved for use over water) solution to the foliage. A foliar application of a glyphosate herbicide using a backpack sprayer is also effective, but is much less selective.

3. Protect from destructive practices.

This stand should be protected from destructive cutting, clearing, fire, and compaction. Any harvesting of forest products should be overseen by a forestry professional to ensure that it is being done in a sustainable manner. Cooperation with the local fire department and adjacent property owners will limit the chances of a wildfire. Although the moist, shady conditions in well developed riparian areas are not usually a great fire risk.

This stand should be protected from too many people using the area. Heavy foot traffic can compact the soil, especially when it is wet. This compaction of the soil makes it difficult for the tree roots to absorb water and nutrients, which will lead to the decline of the trees in this stand. Heavy foot traffic will also limit the amount of natural regeneration that is important for the future of the stand. If this area begins to be used heavily by the public, designated walking trails should be developed.

4. Monitor for insects and diseases.

This stand should also be monitored for insect and disease outbreaks. Early detection and management for such problems generally lead to better results. Common insect and disease problems are listed in **Appendix C**.

Stand Number: 8, Riparian Restoration Planting (Planting C)

RPR

Acres: 0.5

Age: To be planted

Map Color: 

LANDOWNER'S OBJECTIVES:

This stand is to become part of the Grand Forks Greenway. The greenway is to be left in a semi-natural state to be used for flood protection for the city. The greenway will also provide stability to the riverbanks, filter pollution from runoff, provide wildlife habitat, and provide a place for recreational activities.

DESCRIPTION:



This reach of the riverbank is about 450 feet long. It is void of any woody vegetation except for a small patch of sandbar willow and a few damaged trees along the waters edge.

Grasses and sedges are well established, and are out competing weeds.

RECOMMENDATIONS:

There is only one recommendation for this stand:

1. Establish a woody riparian corridor through this reach.

It is recommended to plant a 100 foot wide corridor of riparian vegetation through this reach. The planting should be similar to the one recommended in stand #4.

This planting would be located on the outside of a meander, an area that is naturally prone to erosion. Installing this planting will help to reduce the possibility of having major erosion of the bank developing.

Starting at the waters edge it is recommended to plant a 48-foot wide band of sandbar willow. These willows can be started from cuttings. Above the willows false indigo, peachleaf willow, and cottonwood are recommended.

A planting plan, diagram, and cost estimate follows.

Planting Plan and Diagram: Planting C

Row #	Species	Spacing Within Row	Spacing Between Row	Row Length	# of Trees
1-16	Sandbar willow	3'	3'	450	2400 stakes
17	False Indigo	3'	10'	450	56
18	Peachleaf Willow	8'	10'	450	56
19	Peachleaf Willow	8'	10'	450	56
20	Cottonwood	8'	10'	450	56
21	Cottonwood	8'	10'	450	56



Cost Estimate:

This planting will consist of 2400 sandbar willow live stakes and 22.5 HLFT of trees.

Live stakes generally cost \$1.00 each and tree planting costs about \$17.00 per HLFT, resulting in a cost of \$2,400.00 for the live stakes and \$382.00 for the trees.

Total Cost:	\$2,782.50
RRBRP Cost Share:	\$1,669.50
Greenway Cost:	\$1,113.00

Stand Number: 9, Bottomland Hardwood (Natural Regeneration): BH 0-5''

Acres: 0.5

Age: 1

Map Color: 

LANDOWNER'S OBJECTIVES:

This stand is to become part of the Grand Forks Greenway. The greenway is to be left in a semi-natural state to be used for flood protection for the city. The greenway will also provide stability to the riverbanks, filter pollution from runoff, provide wildlife habitat, and provide a place for recreational activities.

DESCRIPTION:

This square patch measures about 150 feet x 150 feet. The soil here is covered by sediment deposited by last summers floods. The lack of shade-producing mature trees on the site and the fresh layer of sediment have created perfect conditions for natural regeneration of pioneer tree species.

Tree seedlings found on the site include cottonwood, boxelder and sandbar willow. This site should be left undisturbed in order to allow this regeneration to develop. As long as the site is not disturbed by either flooding or people, it should develop into a thick stand of trees. The trees will eventually thin themselves as they reach the sapling stage, or they could be thinned manually once they begin to develop into sapling sized trees.

UNDERSTORY	Trees/Acre	Shrub Species	Stems/Acre
Cottonwood	18400	Sandbar willow	200
Boxelder	800		

Soils:

The soils that underlie this stand are composed of Cashel silty clay loam, 1 to 6 percent slopes (43B). This soil is suited to all of the commonly grown trees and shrubs. For more information on this soil, please see **Appendix A**.

Wildlife Values:

As this stand develops and becomes a thick growth of young cottonwood and willow, wildlife will utilize the area for cover. Many species of birds will use the stand for nesting cover. Deer will feed on the young seedlings during the winter months.

River Condition:

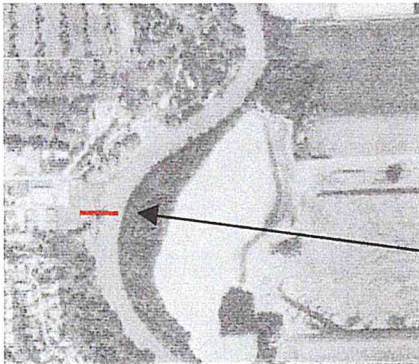


Figure 18: River Reach



Figure 19: Reach Profile

The riverbank through this reach is in good condition. It appears as though this area is used by people fishing from shore. Foot traffic in this area could be very detrimental to the development of the trees and shrubs.

RECOMMENDATIONS:

There are 2 Recommendations for this stand.

- 1. Limit pedestrian traffic through regeneration area.**
- 2. Protect from destructive practices.**

1. Limit pedestrian traffic through regeneration area.

It is recommended to possibly fence off this area to limit the amount of foot traffic on the site. It would be possible to leave an access area for fishermen. Once the trees become developed it would be possible to take the fence down.

2. Protect from destructive practices.

This stand should be protected from practices that will limit the amount of natural regeneration taking place. As mentioned it will be important to limit the amount of foot traffic through the

area, motorized vehicles should also be prohibited. Beaver may also have to be fenced out of the area as the trees develop.

Stand Number: 10, Bottomland Hardwood:

BH

Acres: 6.0

Age: To be planted

Map Color: 

LANDOWNER'S OBJECTIVES:

This stand is to become part of the Grand Forks Greenway. The greenway is to be left in a semi-natural state to be used for flood protection for the city. The greenway will also provide stability to the riverbanks, filter pollution from runoff, provide wildlife habitat, and provide a place for recreational activities.

DESCRIPTION:



The south portion of this stand is very open with just a few scattered mature trees and a good growth of understory trees. The majority of the stand to the north is very thick stand containing a good mix of understory, midstory, and overstory trees.

Overstory:

This stand contains an excellent mix of tree species in the overstory. Cottonwood, green ash, boxelder, peachleaf willow and bur oak were all found in the overstory, and are in good condition.

Midstory:

The midstory of the stand is dominated by boxelder and American elm. As these American elm trees continue to mature, they can be expected to be killed by Dutch elm disease.

Understory:

The understory of this stand is in good condition. Patches of green ash, boxelder, American elm, and cottonwood can be found throughout the stand. These trees should be encouraged, and protected from damage. The only aspect missing from this understory is the lack of shrubs. Fruiting shrubs are important to many species of wildlife who utilize the stand for food and cover.

Trees Represented Within the Stand:

OVERSTORY

	BA/A (sqft)	TREES/ ACRE	AVE. HEIGHT (feet)	AVE. DBH (inches)	CORDS/ ACRE	BDFT/ ACRE
Green Ash	18	63	60	10.2	0	960
PL Willow	4	3	55	15.0	0	1240
American Elm	28	581	30	5.1	1	260
Boxelder	30	182	50	9.9	1	780
Cottonwood	14	3	80	28.0	0	400
Bur Oak	2	1	65	16.0	0	180

UNDERSTORY	Trees/Acre	Shrub Species	Stems/Acre
Green Ash	2000		
Boxelder	1000		
American Elm	400		
Cottonwood	400		

Soils:

The soils that underlie this stand are composed of Cashel silty clay loam, 1 to 6 percent slopes (43B). This soil is suited to all of the commonly grown trees and shrubs. For more information on this soil, please see **Appendix A**.

Wildlife Values:

This stand has the potential to provide habitat for many species of songbirds and waterfowl who use the stand for both food, cover, and nesting sites. Deer and other smaller mammals will also utilize the stand for food and cover. The large trees that hang over the river will also provide shade for fish in the river.

River Condition:

The riverbank through this reach is in good condition. The trees of this stand provide excellent stability to the bank. The trees also help to reduce erosion during flood conditions, and the root systems are reducing erosion at several points along the bank.

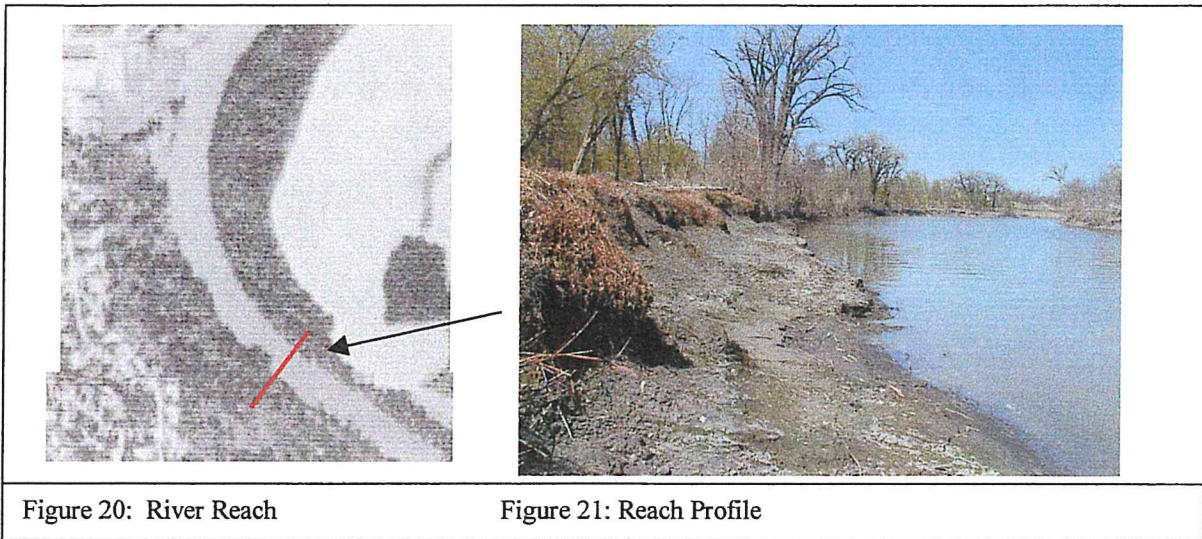


Figure 20: River Reach

Figure 21: Reach Profile

RECOMMENDATIONS:

There are 3 recommendations for this stand:

1. Encourage development of understory.
2. Protect from destructive practices.
3. Monitor for insects and diseases.

1. Encourage development of understory.

It will be important for the development of this stand to encourage this already healthy understory. This may best be accomplished by preventing people from walking in the stand. It may be necessary to create walking trails through the stand, down to the river for fishing access. If this is the case, people should be kept on the trails in order to allow the understory of this stand to continue to develop.

As the large overstory trees decline and are removed, this will allow more sunlight to penetrate to the forest floor, this will also encourage the understory.

2. Protect from destructive practices.

This stand should be protected from destructive cutting, clearing, fire, and compaction. Any harvesting of forest products should be overseen by forestry professionals to ensure that it is being done in a sustainable manner. Cooperation with the local fire department and adjacent property owners will limit the chances of a wildfire.

People using this area should be encouraged to stay on the walking trail. Heavy foot traffic in a forest stand, can compact the soil, especially when it is wet. This compaction of the soil makes it difficult for the tree roots to absorb water and nutrients, which will lead to the decline of the trees in this stand. Heavy foot traffic will also limit the amount of natural regeneration that is important for the future of the stand.

3. Monitor for insects and diseases.

This stand should also be monitored for insect and disease outbreaks. Early detection and management for such problems generally lead to better results. Common insect and disease problems are listed in Appendix C.

Stand Number: 11, Bottomland Hardwood: (Planting D)

BH

Acres: 6.0

Age: To be planted

Map Color: 

LANDOWNER'S OBJECTIVES:

This stand is to become part of the Grand Forks Greenway. The greenway is to be left in a semi-natural state to be used for flood protection for the city. The greenway will also provide stability to the riverbanks, filter pollution from runoff, provide wildlife habitat, and provide a place for recreational activities.

DESCRIPTION:

This area is known as the Koinanea area. The city has mined this area for clay to use on the dike system. The site is not in condition to be managed for its forest resources at the current time. Once the topsoil is replaced and graded, it will be possible to better manage the area for a healthy riparian area.

River Condition:

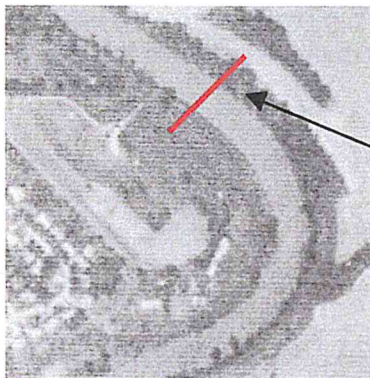


Figure 22: River Reach



Figure 23: Reach Profile

As can be seen in figure 14, the reach profile the riverbanks through this reach consist mainly of steep cutbanks that are around 10 feet high. These banks are unstable and will continue to fall into the river until a stable slope is reached. There is some woody vegetation present in the form of scattered large cottonwood trees and scattered patches of sandbar willow.

RECOMMENDATIONS:

There are 2 recommendations for this planting:

1. Copy planting from stand 12 through this reach.
2. Protect from destructive practices.

1. Continue planting in stand 12 up through this reach.

After all the reclamation work from this area is completed it is recommended to establish a riparian woody corridor in order to add stability to the riverbanks and to act as a riparian buffer. It is recommended to continue the planting from the south up through this stand as well.

If you are interested in implementing this recommendation in the future, please contact the North Dakota Forest Service and the Red River Basin Riparian Project.

2. Protect from destructive practices.

This area should be reclaimed and protected from further destructive practices. Once a planting plan is implemented, care should be taken to keep pedestrian foot traffic out of the stand as much as possible.

Stand Number: 12, Bottomland Hardwood: (Planting Ø) E

BH

Acres: 4.0

Age: to be planted

Map Color: 

LANDOWNER'S OBJECTIVES:

This stand is to become part of the Grand Forks Greenway. The greenway is to be left in a semi-natural state to be used for flood protection for the city. The greenway will also provide stability to the riverbanks, filter pollution from runoff, provide wildlife habitat, and provide a place for recreational activities.

DESCRIPTION:



This portion of the greenway is mostly free of forested cover. There are only a few scattered mature cottonwood and elm trees found here. Sedges are becoming established and should slowly out-compete the weedy growth that has developed on the frequently flooded areas. There is some scattered regeneration of cottonwood found along the river.



A patch of sandbar willow is developing on the north side of the area. This is the type of riparian vegetation that should be encouraged on this site, and others along the entire reach, in order to help stabilize the riverbanks and provide other important riparian benefits. Willow cuttings could be harvested from this area and transplanted to other areas along the bank. To the left is a picture of this patch of sandbar willow. This patch of willow starts growing at the waters edge and continues up the bank about 50 feet.

Soils:

The soils that underlie this stand are composed of Cashel silty clay loam, 1 to 6 percent slopes (43B). This soil is suited to all of the commonly grown trees and shrubs. For more information on this soil, please see **Appendix A**.

River Condition:

The riverbank is in good condition through this reach. There is a small cut bank, which could be stabilized through the use of flood tolerant woody vegetation.

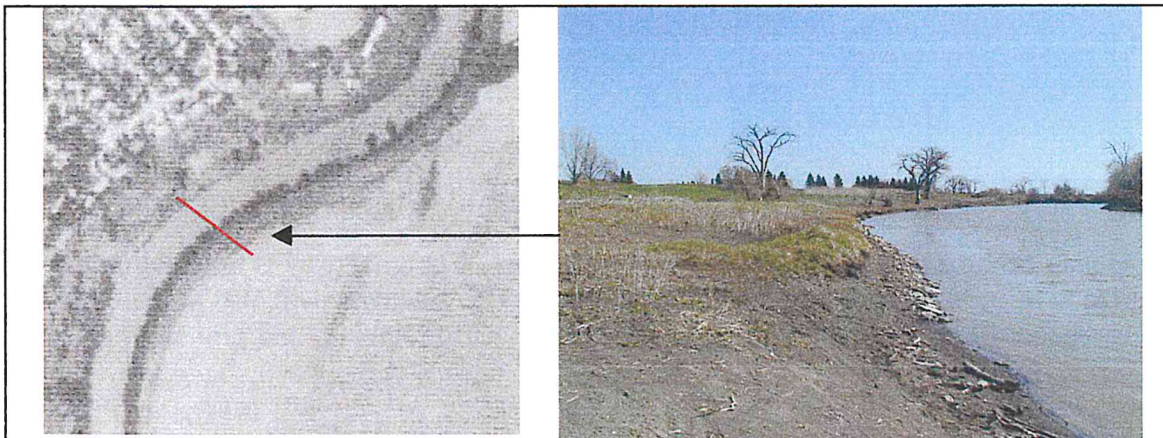


Figure 24: River Reach

Figure 25: Reach Profile

RECOMMENDATIONS:

There are 3 recommendations for this stand:

- 1. Establish woody corridor between river and temporary construction road.**
- 2. Protect from destructive practices.**

3. Monitor for insects, disease, and flood damage.

1. Establish woody vegetation along riverbank.

It is recommended to establish a woody corridor of riparian plant species along the riverbank through this reach. When planning a planting, it is important to observe the locations of the existing vegetation with respect to their locations in relation to the stream and water table. Attempt to match the species you plant with the native woody species and their preferred

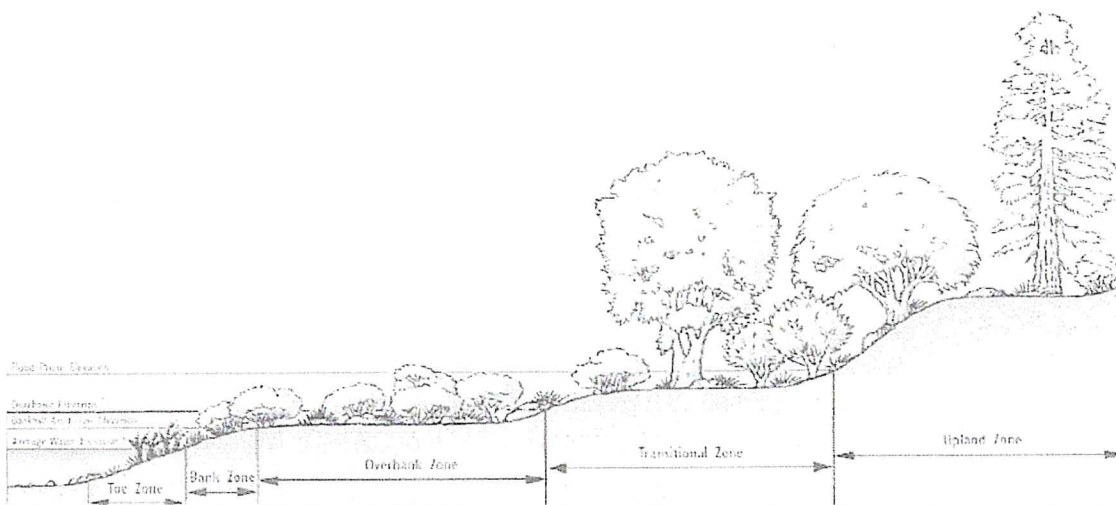


Figure 26: Representative cross section of riparian vegetation

growing zone at the project site. Also it is important to match as close as possible the hydrology where the different species normally grow when planting the project site.

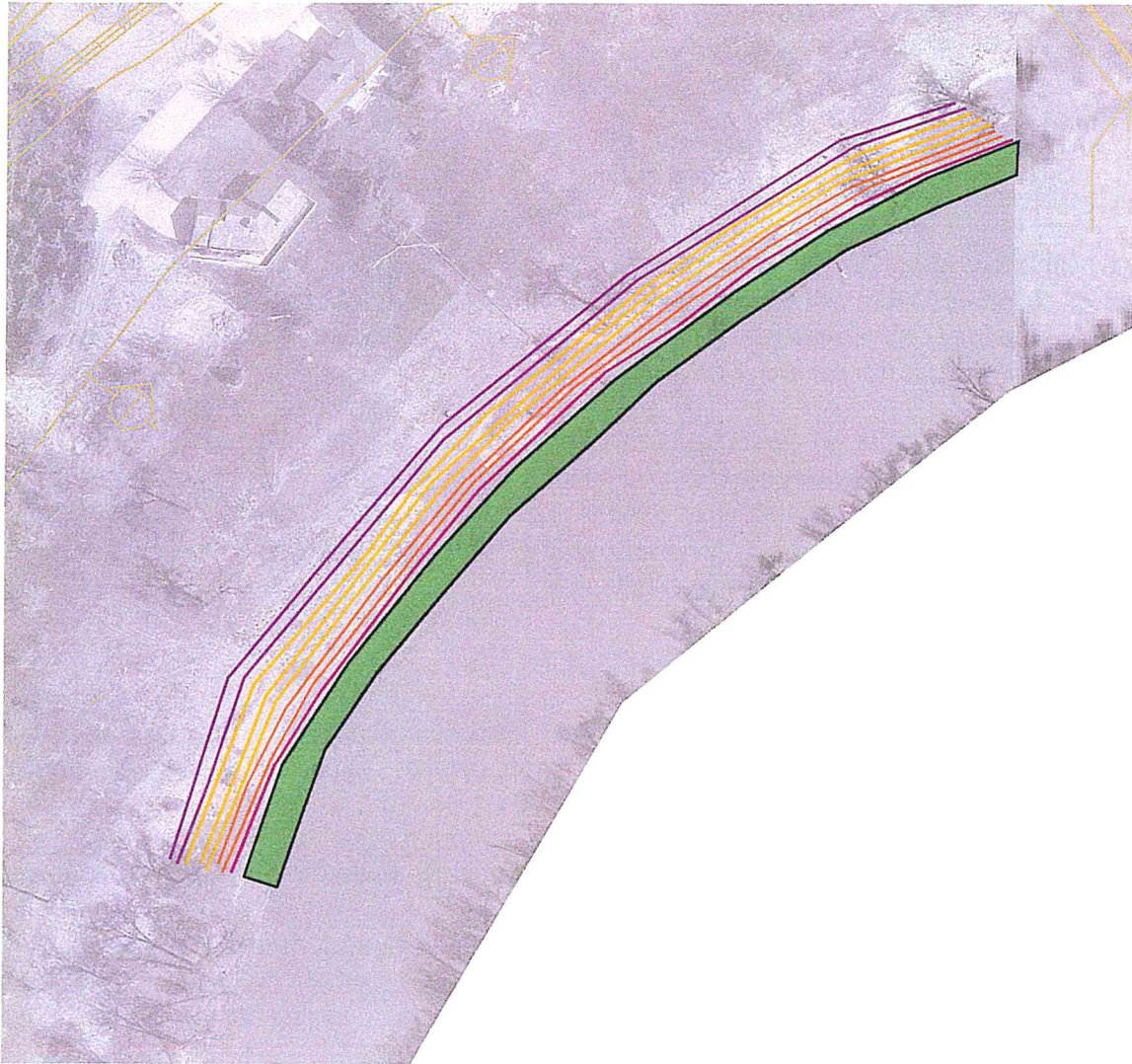
Plants with flexible stems and rhizomatous root systems are usually located from the top of the toe zone through the bank zone. Small to medium shrubs are found in the bank and overbank zones and beyond. Large shrub species and tree species are usually found in the transitional zone and the upland zone.

Large trees and shrubs should not be planted in the zones close to the water because these large stems do not give in high velocity stream flows. In addition, large stems tend to block debris and ice that can cause significant bank erosion. Wetland herbaceous species can be found throughout the streambank cross section, although most emergent aquatics will be found in the toe zone. Figure 26 closely represents the zones often found along the Red River and the types of vegetation suited for each zone.

The areas recommended for this planting will be located in the bank and overbank zones, and the transitional and upland zones. It is recommended to establish a stand of sandbar willow on the bank and overbank zone, and plant trees including peachleaf willow, cottonwood, boxelder, and green ash in the transitional and upland zones. Sedges are already becoming well established throughout the entire riverbank. These should be encouraged where possible.

Planting Plan and Diagram: Planting D ^{NE}

Row #	Species	Spacing		Row Length	# of Trees
		Within Row	Between Row		
1-16	Sandbar willow	3'	3'	1150	6292 stakes
17	False Indigo	3'	---	1150	383
18	Peachleaf Willow		10'	1150	143
19	Peachleaf Willow	8'	---	1150	143
20	Cottonwood	8'	10'	1150	143
21	Cottonwood	8'	---	1150	143
22	Cottonwood	8'	10'	1150	143
23	Green Ash	8'	---	1150	143
24	Green Ash	8'	10'	1150	143



Estimated Cost: Planting $\text{D} \text{E}$

The sandbar willow stakes that are to be used in this planting will be 2-foot stakes. These stakes usually cost \$1.00 to plant each. This planting will utilize about 6,300 2-foot sandbar willow stakes, resulting in a cost of about \$6300.00.

The rest of the planting will be machine planted rooted tree and shrub seedlings. Machine planting rooted tree and shrub stock costs about \$17.00 per hundred linear foot (HLFT)

This part of the planting will consist of about 92 HLFT, resulting in an estimated cost of \$1,564.00.

The Red River Basin Riparian Project will be able to cost share this project with the City of Grand Forks, upon approval of the plan by the RRBRP Advisory Committee.

Total Cost:	\$7,864.00
RRBRP:	\$4,718.60
Grand Forks Cost:	\$3,145.40

2. Protect from destructive practices.

This stand should be protected from destructive cutting, clearing, fire, and compaction. Any harvesting of forest products should be overseen by forestry professionals to ensure that it is being done in a sustainable manner. Cooperation with the local fire department and adjacent property owners will limit the chances of a wildfire.

People using this area should be encouraged to stay on designated walking trails. Heavy foot traffic in a forest stand, can compact the soil, especially when it is wet. This compaction of the soil makes it difficult for the tree roots to absorb water and nutrients, which will lead to the decline of the trees in this stand. Heavy foot traffic will also limit the amount of natural regeneration that is important for the future of the stand.

3. Monitor for insects, diseases, and flood damage.

This stand should also be monitored for insect and disease outbreaks. Early detection and management for such problems generally lead to better results. Common insect and disease problems are listed in Appendix C.

Flooding of the riverbanks has a detrimental effect on young riparian plantings. Small tree seedlings are much more prone to being killed by flooding than trees that are well established, no matter how flood tolerant the tree seedlings are labeled at. This planting should be monitored for flood damage and erosion problems. If part of the planting is killed by flooding, it should be replanted. Summer floods will be much more damaging than spring floods. For more information on flooding of riparian areas, please see Appendix C.

Stand Number: 13, Bottomland Hardwood:

BH 11-15''

Acres: 4.0

Age: 100

Map Color: 

LANDOWNER'S OBJECTIVES:

This stand is to become part of the Grand Forks Greenway. The greenway is to be left in a semi-natural state to be used for flood protection for the city. The greenway will also provide stability to the riverbanks, filter pollution from runoff, provide wildlife habitat, and provide a place for recreational activities.

DESCRIPTION:



Overstory:

This stand is composed of a 100-foot wide band of riparian forest. The stand is dominated by large mature cottonwood. Other tree species found in the stand include American elm, boxelder, and green ash.

The large cottonwood trees in this stand are overmature and are beginning to break down. The tree crowns contain large amounts of dead branches, which can pose a hazard to the public who may be using the stand for recreation.

Windy conditions can cause these large dead branches to fall.

Understory:

The understory in part of the stand has been disturbed and is undeveloped. In areas where there has been some understory development, most of the seedlings have been killed by frequent flooding in recent years. Sedges are becoming established in areas. These sedges will limit the amount of weed growth, making conditions more favorable to tree seedling establishment.

Trees Represented Within the Stand:

OVERSTORY

	BA/A (sqft)	TREES/ ACRE	AVE. HEIGHT (feet)	AVE. DBH (inches)	CORDS/ ACRE	BDFT/ ACRE
Cottonwood	66	15	85	28.5	0	6860
Green Ash	10	26	25	9.6	1	240
Boxelder	8	45	25	7.5	0	60
American Elm	6	15	20	10.7	0	260

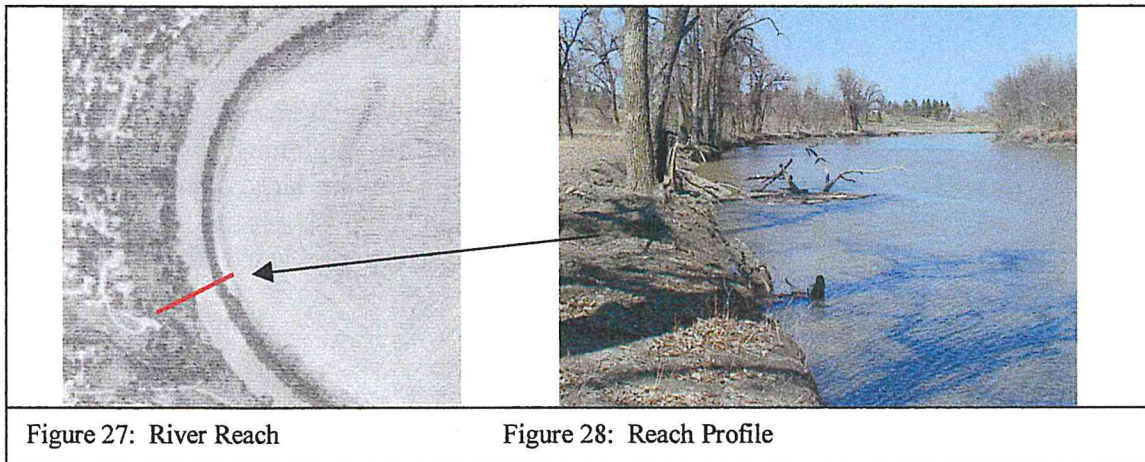
UNDERSTORY	Trees/Acre	Shrub Species	Stems/Acre
Green Ash	200	Snowberry	200
Boxelder	200		

Soils:

The soils that underlie this stand are composed of Cashel silty clay loam, 1 to 6 percent slopes (43B). This soil is suited to all of the commonly grown trees and shrubs. For more information on this soil, please see **Appendix A**.

River Condition:

The large cottonwood trees that dominate this stand have provided excellent bank stability, and the riverbank is in very good condition through this reach. There was very little slumping occurring, and the riverbanks have not formed the large cutbanks that are typical of much of the Red. These cottonwood trees should be encouraged, and new ones should be planted to ensure the future of this grove of cottonwood trees.



Wildlife Values:

The cottonwood tree is rated fair wildlife habitat. It provides summer cover and food to a number of wildlife species, including upland game, song birds, fur bearers, game animals, and small mammals and hoofed browsers. In North Dakota, eastern cottonwoods provide important night roosting cover in winter for the greater prairie-chicken and sharp-tailed grouse. The bark and leaves of the cottonwood seedlings and saplings are eaten by field mice, rabbits, and deer. The cottonwood provides a nesting place for white-throated sparrows and myrtle warblers. They also provide roost sites for turkeys.

RECOMMENDATIONS:

There are 4 recommendations for this stand:

- 1. Interplant cottonwood seedlings into the stand.**
- 2. Monitor for hazard trees.**
- 3. Protect from destructive practices.**
- 4. Monitor for insects and diseases annually.**

1. Interplant cottonwood seedlings into the stand.

Interplanting:

Due to the topography and inaccessibility of some stands, mechanical planting is impractical. However, to facilitate reforestation, hand planting is a viable option. Hand planting allows trees

to be planted in virtually all areas within the stand including eroding stream banks, oxbows, and slopes. If done correctly, hand planting should result in excellent tree survival.

Factors to Consider:

A. Shading - Trees requiring a great deal of sunlight (i.e. aspen, cottonwood) should not be planted under a closed canopy or other shady areas.

B. Water Requirements - Low lying heavy soils which hold water should be planted to species such as spruce, cedar, willow and others commonly associated with high soil moisture contents. These species are adapted to a variety of soils that are compact and contain fluctuating soil oxygen contents.

C. Competition - Without control, hand plants should not be placed in pockets of extreme understory plant growth. Before planting in highly competitive conditions, a chemical treatment of Round Up or other broad-spectrum herbicides should be implemented to allow for tree establishment. Follow up weed control in an interplanted site is critical to enhance the survival of the new seedlings.

Approximately 200 cottonwood seedlings could be planted in the southern half of the stand where understory vegetation is non-existent. Seedlings should be planted about 12 feet from each other, and well away from existing mature trees in order to avoid extremely shady areas.

Estimated Cost:

Handplants are usually obtained and planted for about \$1.00 per tree.

This planting would cost and estimated \$200.00. Upon approval by the project 60% cost share would be available from the Red River Basin Project to implement this recommendation.

Total Cost:	\$200.00
RRBRP:	\$120.00
Grand Forks Cost:	\$80.00

2. Monitor stand for "hazard trees".

A "hazard tree" is a tree with structural defects likely to cause failure of all or part of the tree, which could strike a "target." A target can be any place where people gather, such as on a trail that runs through this stand or a favorite fishing spot. Many of the large, mature cottonwood trees in this stand contain large dead branches that could become a hazard if people begin to use this stand for recreation. Cottonwood is known to have brittle branches that are prone to falling. The stand should be monitored annually and after large storm events. If you are not sure if a tree should be considered a hazard or not, consult with an arborist.

3. Protect from destructive activities.

This stand should be protected from destructive cutting, clearing, fire, and compaction. Any harvesting of forest products should be overseen by forestry professionals to ensure that it is being done in a sustainable manner. Cooperation with the local fire department and adjacent property owners will limit the chances of a wildfire.

People using this area should be encouraged to stay on the walking trail. Heavy foot traffic in a forest stand, can compact the soil, especially when it is wet. This compaction of the soil makes it difficult for the tree roots to absorb water and nutrients, which will lead to the decline of the trees in this stand. Heavy foot traffic will also limit the amount of natural regeneration that is important for the future of the stand.

4. Monitor for insects and diseases.

This stand should also be monitored for insect and disease outbreaks. Early detection and management for such problems generally lead to better results. Common insect and disease problems are listed in **Appendix C**.

Stand 14: (Planting ~~E~~) 

Age: To be planted

Acres: 1.6

Map Color: 

This site has been flooded frequently and there is no permanent woody vegetation established. It is recommend to revegetate the site using pioneer tree species that will be able to stabilize the area and create conditions where other native tree species will have the opportunity to naturally regenerate.

It is recommended to use non-rooted material that will be able to establish in the wet soils. Species recommended for planting include cottonwood, peachleaf willow, and sandbar willow. These species are easily established from cuttings, and are well adapted to growing in wet conditions.

The use of non-rooted willow material to stabilize streambanks is called bioengineering. Willows are able to tolerate flood conditions better than most tree species, and the thick growth of roots formed under the soils surface provides strength to the soil to reduce erosion of the streambank. The plants are also able to remove water from the soils through transpiration. For more information on bioengineering, please see **Appendix D**.



Planting Directions:

The entire planting is 130 feet wide by 530 feet long and will be separated into three zones.

Zone 1 will be closest to the river and will be 30 feet wide by 530 feet long. This zone will be planted to sandbar willow cuttings, at a 3 foot spacing starting at the edge of the river. 1,760 2-foot sandbar willow stakes will be necessary.

Zone 2 will be 43 feet wide by 530 feet long, and will be planted to peachleaf willow cuttings or seedlings. Peachleaf willow is the native willow tree species that can be found all along the Red River. It is often able to grow in frequently flooded soils where other tree species are not able to survive. These trees should be planted at a 6-foot spacing. 618 peachleaf willow seedlings or cuttings will be necessary.

Zone 3, the zone farthest from the river will be planted to cottonwood cuttings or seedlings. This zone is 60 feet wide by 530 feet long. These trees should be planted at a 6 foot spacing. 880 cottonwood seedlings or cuttings will be necessary for this part of the planting.



The picture to the left shows the condition of the planting site. It was very open at the time the picture was taken, but annual weeds can be expected to take over the site during this summers growing season.

Planting Plan: Planting E F

Row #	Species	Spacing		Row Length	# of Trees
		Within Row	Between Row		
1-10	Sandbar Willow	3	3	530	1,760
11-17	Peachleaf Willow	6	6	530	680
18-28	Cottonwood	6	6	530	880

Planting Site Preparation:

The weedy vegetation present on this planting site should be sprayed with Roundup or other glyphosate herbicide the season prior to planting in order to help reduce the weed growth that will be competing with trees planted on the site. It may be necessary to spray the site more than once, and be followed up with a spray treatment just prior to planting if weeds are green before the planting is installed.

Once the trees become established, they should be able to compete with the annual weeds on the site.

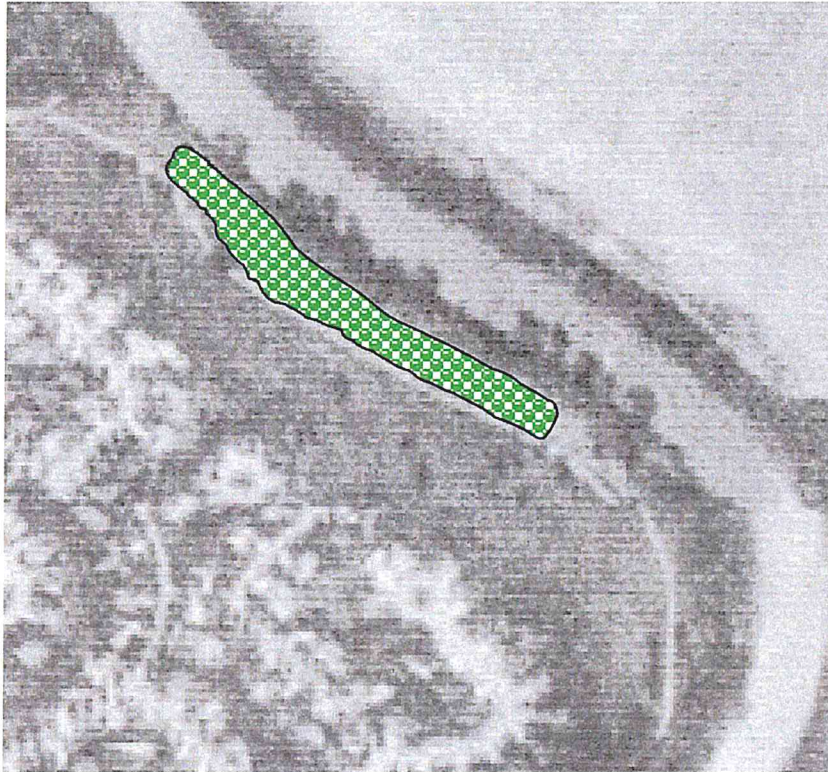
6

Stand: 15 (Planting ~~F~~) Riparian Buffer Planting

Age: To be planted 2004

Acres: 2.3

Map Color: 



The reason for planting this riparian buffer planting is to widen the woody corridor along the river in order to better protect the riverbank from erosion. Also since there is very little woody vegetation becoming established in the understory of the stand, these trees will eventually produce seed that will help regenerate the understory of this stand. Only very flood tolerant tree and shrub species will be used since this area is prone to flooding during wet periods

Widening the zone of woody vegetation along this reach will also help filter runoff from the adjacent storm water drains. There are several storm water drains that release water down the riverbank through the length of the planting. These areas should be planted to willow stakes in order to reduce the amount of gulling and improve water quality.

Areas where gullies have already formed should be reshaped and stabilized with rock and planted to willows.

This planting will consist of five rows of flood tolerant trees and shrubs. Each row should be 12 feet apart and trees should be spaced 10 feet from each other within the row.

Planting Plan: Planting #6

Row #	Species	Spacing		Row Length	# of Trees
		Within Row	Between Row		
1	Peachleaf Willow	10		1550	155
2	Peachleaf Willow	10	12	1550	155
3	Cottonwood	10	12	1500	150
4	Cottonwood	10	12	1500	150
5	False Indigo	10		1500	150

Soils:

The soils that underlie this stand are composed of Cashel silty clay loam, 1 to 6 percent slopes (43B). This soil is suited to all of the commonly grown trees and shrubs. For more information on this soil, please see **Appendix A**.

Planting Directions:

Planting Site Preparation:

It is very important that the planting site be properly prepared before planting. The site should be tilled sufficiently enough to kill the sod and maintain the entire site in a reasonably weed free condition prior to tree and shrub planting. Avoid tilling soils that are wet, to minimize compaction.

Nonselective herbicides may be used to kill sod grasses and other herbaceous species prior to tillage. Follow guidelines found on the herbicide label.

Be alert to potential water erosion during the fallow period. Seed an annual cover crop of oats or spring grains to control erosion while minimizing water usage. Oats and spring grains will die over winter but must be seeded early enough to attain a 4 to 6 inch height prior to freeze up to provide soil protection.

It may be desirable on this site to till only 5 to 8 foot wide strips in the sod where trees/shrubs will be planted while leaving and maintaining the existing vegetation between the rows. This will reduce wind, water erosion, provide easier site access, as well as provide wildlife benefits.

Estimated Cost:

Tree planting generally costs about \$16.00 per hundred linear feet (HLFT). This planting consists of 76 HLFT, resulting in an estimated cost of \$1200.00.

Upon approval, the Red River Basin Riparian Project would be able to provide 60% cost share for this planting. The resulting breakdown of the costs of planting are shown below.

City of Grand Forks Cost:	\$480.00
RRBRP Cost:	\$720.00
Total Cost:	\$1200.00

Stand Number: 16, Bottomland Hardwoods:

BH'

Acres: 6.0

Age: 45

Map Color: 

LANDOWNER'S OBJECTIVES:

This stand is to become part of the Grand Forks Greenway. The greenway is to be left in a semi-natural state to be used for flood protection for the city. The greenway will also provide stability to the riverbanks, filter pollution from runoff, provide wildlife habitat, and provide a place for recreational activities.

DESCRIPTION:

This bottomland hardwood stand is located along the banks and immediate flood plain of the Red River. The most fertile area within any forest is the bottomland. This area consists of the draws and flatlands where water availability is most abundant. Generally, the trees in this area benefit from rich alluvial deposits moved from the slopes above during heavy rains and flood events.

This stand is also classified as a riparian forest. Riparian forests are forest communities that exist adjacent to rivers and streams. They can vary in width from a few feet to several hundred feet. Riparian forests differ from upland forests in that they can be expected to flood nearly every spring and tree species found here are able to tolerate brief periods of flooding much better than upland trees. Some tree species found in riparian areas actually depend on flooded areas to establish the next generation of seedlings.

Healthy wooded riparian areas provide many important benefits. They help reduce flood damage, filter sediment and chemicals from surface and subsurface runoff, and add biodiversity to the landscape. Generally, when riparian woodlands are removed, erosion of riverbanks becomes a problem and water quality suffers. For more information on riparian areas, please see **Appendix B**.

Flooding:

The trees in this stand, and all throughout the greenway are bottomland trees. Bottomland trees are adapted to growing in wet conditions found in these areas, but in recent years flooding along the Red River has become more frequent and the intensity of these floods have increased. This frequent flooding has the potential to create stressful growing conditions that may lead to the decline in health and vigor of the trees in this stand. Flooding of the understory also may reduce the amount of natural regeneration in the stand. This regeneration is very important for the future of the stand, and the value of the stand as wildlife habitat. For more information on flooding, please see **Appendix E**.

Woodland:

This stand consists of a narrow band of forest, 100 feet or less wide. In some places the band of forest is less than 30 feet wide. The stand itself is in poor condition. Small diameter American elms, are the most common tree species. These trees have not become large enough to become infected by Dutch elm disease. As these elms continue to mature, they can be expected to die from DED. There were very few mature American elms in the stand left alive.

There is also a good sized population of smaller diameter green ash and boxelder found within the south side of the stand. Most of these trees are 6 to 8 inches in diameter and in good condition. These trees represent the future of the stand. As they continue to mature they will produce large amounts of seed that will germinate on the forest floor if frequent summer flooding does not continue.

The banks of the river through this reach are lined with very large, mature to overmature cottonwood trees. These trees are extremely old, but because of their size and the fact that the center of most of these trees appears to be rotten, they could not be accurately aged. One of these trees was measured to have a diameter of 68 inches and was about 95 feet tall.

Most of the mature trees in this stand would be considered to be in fair to poor condition. All the trees show signs of stress caused by high water, frequent summer floods, ice flow damage, Dutch elm disease, heavy pedestrian traffic, and strong winds.

Many of the mature trees show signs of heart-rot, and contain broken branches and broken tops.

The understory of this stand is very poor. Recent summer floods have killed most of the green ash and boxelder seedlings present. Floods have also deposited thick layers of silt. This open understory has become overtaken by a thick growth of annual weeds. These weeds can out-compete young tree seedlings and prevent them from becoming established.

Trees Represented Within the Stand:

OVERSTORY

	BA/A (sqft)	TREES/ ACRE	AVE. HEIGHT (feet)	AVE. DBH (inches)	CORDS/ ACRE	BDFT/ ACRE
Boxelder	22	202	25	4.7	1	0
American Elm	32	230	35	7.0	2	180
Green Ash	32	138	30	8.0	1	420
Cottonwood	38	35	95	35	0	3580
Peachleaf Willow	12	15	30	12.0	0	180

UNDERSTORY	Trees/Acre	Shrub Species	Stems/Acre
Green Ash	800	Redosier Dogwood	400
Boxelder	600	Snowberry	200
American Elm	200		

Soils:

The soils that underlie this stand are composed of Zell-LaDelle silt loams, 1 to 15 percent slopes (79D), and Cashel silty clay loam, 1 to 6 percent slopes (43B). For a detailed description of these soils and a soils type map, please see **Appendix A**.

River Condition:

The riverbank through this reach of river is in poor condition. It lies on the inside of a large meander. Much of the area directly adjacent to the river is characterized by high cutbanks that are typical along the Red. In areas where large cottonwood trees are growing there has been less soil eroding into the river and the banks are more stable. The forest along this reach of river is very narrow, and not developed enough to provide adequate bank stabilization during high water events. There has been some beaver activity along the reach, but they have not been so active as to be destructive.

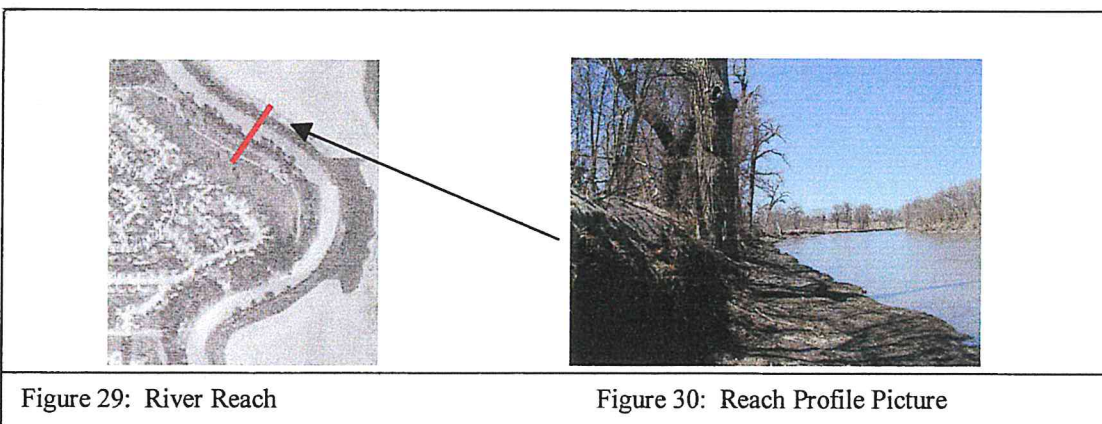


Figure 29: River Reach

Figure 30: Reach Profile Picture

Wildlife Values:

This stand offers the public a good location to view native wildlife, especially birds. Many species of songbirds, shore birds, and waterfowl can be easily viewed from the adjacent walking trail. If additional riparian woodland habitat could be established along this reach, it would increase these opportunities.

RECOMMENDATIONS:

There are 2 recommendations for this stand:

- 1. Protect stand from destructive practices.**
- 2. Monitor for insects and diseases.**

1. Protect from destructive activities.

This stand should be protected from destructive cutting, clearing, fire, and compaction. Any harvesting of forest products should be overseen by forestry professionals to ensure that it is being done in a sustainable manner. Cooperation with the local fire department and adjacent property owners will limit the chances of a wildfire.

People using this area should be encouraged to stay on the walking trail. Heavy foot traffic in a forest stand, can compact the soil, especially when it is wet. This compaction of the soil makes it difficult for the tree roots to absorb water and nutrients, which will lead to the decline of the trees in this stand. Heavy foot traffic will also limit the amount of natural regeneration that is important for the future of the stand.

2. Monitor for insects and diseases.

This stand should also be monitored for insect and disease outbreaks. Early detection and management for such problems generally lead to better results. Common insect and disease problems are listed in Appendix C.

Stand Number: 17, Bottomland Hardwoods:

BH 11-15''

Acres: 6.0

Age: 35

Map Color: 

LANDOWNER'S OBJECTIVES:

This stand is to become part of the Grand Forks Greenway. The greenway is to be left in a semi-natural state to be used for flood protection for the city. The greenway will also provide stability to the riverbanks, filter pollution from runoff, provide wildlife habitat, and provide a place for recreational activities.

DESCRIPTION:

Woodland:



This bottomland hardwood stand is located along the banks and immediate flood plain of the Red River. The most fertile area within any forest is the bottomland. This area consists of the draws and flatlands where water availability is most abundant. Generally, the trees in this area benefit from rich alluvial deposits moved from the slopes above during heavy rains and flood events.

This stand is also classified as a riparian forest. Riparian forests are forest communities that exist adjacent to rivers and streams. They can vary in

width from a few feet to several hundred feet. Riparian forests differ from upland forests in that they can be expected to flood nearly every spring and tree species found here are able to tolerate brief periods of flooding much better than upland trees. Some tree species found in riparian areas actually depend on flooded areas to establish the next generation of seedlings.

Healthy wooded riparian areas provide many important benefits. They help reduce flood damage, filter sediment and chemicals from surface and subsurface runoff, and add biodiversity to the landscape. Generally, when riparian woodlands are removed, erosion of riverbanks becomes a problem and water quality suffers. For more information on riparian areas, please see **Appendix B**.

Flooding:

The trees in bottomland areas are well adapted to growing in the wet conditions found in these areas, but in recent years flooding along the Red River has become more frequent and the intensity of these floods have increased. This frequent flooding has the potential to create stressful growing conditions that may lead to the decline in health and vigor of the trees in this stand. Frequent flooding of the understory also may reduce the amount of natural regeneration in the stand. This regeneration is very important for the future of the stand, and the value of the stand as wildlife habitat. For more information on flooding, please see **Appendix C**.

This stand contains a nice mix of bottomland hardwood trees. Trees found within the stand include green ash, boxelder, American elm, and cottonwood. While this stand does contain a mix of age classes, boxelder trees of about 35 years of age dominate the stand. Tree sizes range from 2-inch diameter saplings to 30 inch and larger diameter cottonwood.

Forest stands can be broken down into three components, the overstory, midstory, and understory. It is important for a healthy stand to contain all three of these components to ensure the most benefits are received and to ensure the longevity of the stand.

Overstory:

The overstory of this stand contains many large trees that range from mature to overmature and declining. The large overstory trees form a closed canopy that creates intense shade on the forest floor. Fungal heart rot was seen in many of the overmature trees, especially the green ash, cottonwood, and boxelder.

A 12" diameter cottonwood was aged to be about 35 years old and growing about ½ inch in diameter annually for the last 10 years.

Boxelder is the most common tree species in the stand. There are several large overmature boxelder in this stand that should be left for wildlife. These trees are hollow and provide nesting sites for several species of cavity nesting birds, homes for squirrels, and woodpeckers are able to find insects in the rotted wood.

There are several extremely large cottonwood trees found along the riverbanks throughout this stand. One such tree had a trunk diameter of 5.3 feet, 116 feet tall with a crown spread of about 85 feet. These large trees, could not be aged, but are estimated to be over 100 years old.

Dutch elm disease (DED) has killed nearly all of the mature American elm trees in this stand. DED is a fungus that effectively plugs up the vascular system of the tree. The disease is spread from tree to tree mainly by insects called elm bark beetles, which carry the spores on their bodies. DED can also be transferred from tree to tree through the vascular system across root grafts. There are a few maturing American elm trees still alive in this stand. The fact that these trees have not been infected by DED could indicate some natural resistance to the disease, or they simply might not have been infected yet.

American elm trees are typically not affected by the disease until they are about 10 inches in diameter. This is because the elm bark beetles need mature trees with thick bark to bore into. The bark beetles use the mature trees to bore into and lay eggs below the bark. When the eggs hatch the young beetles will bore out through the bark and fly to other trees. For more information on DED please see **Appendix D** on insects and diseases that have the potential to affect this stand.

Midstory:

The midstory of this stand contains a mix of saplings in the 1 to 4 inch range. These trees will provide the next generation of overstory trees. American elm, green ash, and boxelder make up the bulk of these saplings.

Understory:

The understory component of a forest stand is often overlooked, but it may be the most important component of the stand. Besides being the future overstory trees of the stand, the understory is very important for wildlife habitat. Many species of wildlife rely on a thick understory to

provide both thermal cover and escape cover, as well as for food in the form of nuts, fruits, and browse. Many species of birds will also use the thick understory of a stand for nesting cover. The understory of this stand becomes thicker, more diverse the farther up the slope, and away from the river, you go. This is directly related to flooding frequency.

The understory of this stand is in good condition. Excellent regeneration of both green ash and boxelder were found to be vigorously growing. Good numbers of shrubs such as dogwood, chokecherry, and snowberry were also found. A patch of sandbar willow was seen on the north side of the stand. Once located, stands of sandbar willow such as this one could be used to collect willow cuttings to establish in other areas along the river.

Unfortunately, common buckthorn was also found in this stand. Common buckthorn is not a native tree species, it is a Eurasian tree species that has been used as an ornamental shrub in the United States for many years. Unfortunately, this tree species has become naturalized in the woodlands of the United States, and when left unchecked it can take over the understory of a stand, choking out native tree and shrub species. Buckthorn was most concentrated on the south side of the stand, near the storm water drain.

Trees Represented Within the Stand:

OVERSTORY

	BA/A (sqft)	TREES/ ACRE	AVE. HEIGHT (feet)	AVE. DBH (inches)	CORDS/ ACRE	BDFT/ ACRE
Boxelder	72	198	30	10.1	3	1540
Green Ash	28	201	30	8.7	1	620
Cottonwood	32	39	70	16.5	2	1440
American Elm	2	2	35	14.0	0	120

UNDERSTORY	Trees/Acre	Shrub Species	Stems/Acre
Green Ash	5600	Redosier Dogwood	200
Boxelder	1600	Snowberry	600
American Elm	200	Sandbar Willow	200
Chokecherry	200	Buckthorn	200

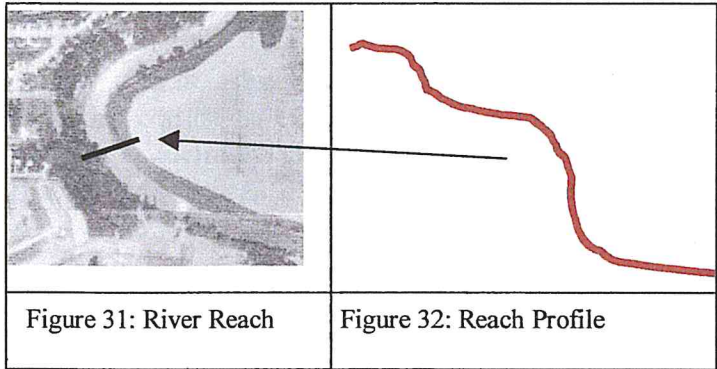
Soils:

The soils that underlie this stand are composed of Zell-LaDelle silt loams, 1 to 15 percent slopes (79D), and Cashel silty clay loam, 1 to 6 percent slopes (43B). For a detailed description of these soils and a soils type map, please see **Appendix A**.

River Condition:

The riverbank through this reach of river is in fair condition. Much of the reach is characterized by high cutbanks. In areas where large cottonwood trees are growing there has been less soil eroding into the river. This is typical of most riverbanks along the Red. This reach of river is

very well vegetated with a healthy riparian forest. There has been some beaver activity along the reach, but they have not been so active as to be destructive.



Wildlife Values:

This stand provides habitat for many species of wildlife. Deer and other small mammals will potentially use the stand for food and cover. Many species of songbirds will use the stand for nesting cover and for food in the form of seeds and berries. Many cavity nesting birds, such as wood ducks, and other animals that rely on old, overmature trees for nesting sites will utilize the old overmature boxelder and cottonwood trees.

RECOMMENDATIONS:

There are 4 recommendations for this stand:

- 1. Remove buckthorn from stand.**
- 2. Manage for natural regeneration development.**
- 3. Protect from destructive activities.**
- 4. Monitor for insects and diseases.**

1. Remove buckthorn from stand.

Common Buckthorn is a shrub or small tree that can reach a height of 25 feet. Twigs are often tipped with a spine, this characteristic makes it easy to identify even when the leaves are gone. Small black fruits are found on female plants and leaves are rounded to a pointed tip and toothed. Upper leaf surface is dark and glossy green. Another characteristic that can be used to identify this plant in your woodland is the plant's tendency to hold its green leaves late into the fall, after all other tree species have lost their leaves.

This shrubby tree was introduced to North America as an ornamental shrub. It is native to Eurasia. The fruit causes a severe laxative effect, quickly distributing the seeds by birds. Common buckthorn invades woodlands and riparian areas, although it may also be found in prairies and open fields. Once established buckthorn crowds or shades out native shrubs and tree seedlings and wild flowers, often completely out-competing them. Common buckthorn control



is also of interest to agricultural producers as the shrub is the overwintering site for the soybean aphid and is the alternate host of the crown rust of oats disease.

Control:

As with all invasive species, buckthorns in natural areas are most effectively controlled by recognizing their appearance early and removing isolated plants before they begin to produce seed. With large infestations, the largest seed-producing plants should be removed first.

Chemical control methods are best done during the fall when most native plants are dormant yet buckthorns are still actively growing. This lessens the risk of affecting nontarget plants. The buckthorns' green leaves will provide easy recognition and allow for a thorough treatment at this time.

During the growing season, cutting stems off near ground level and treating them with glyphosate successfully curbs sprouting. Immediately after cutting, a 20%-25% active ingredient glyphosate mixture should be applied to the stumps. Resprouts should be cut and treated again or sprayed with a hand sprayer of 1.5% glyphosate (approved for use over water) solution to the foliage. A foliar application of a glyphosate herbicide using a backpack sprayer is also effective, but is much less selective.

2. Manage for natural regeneration.

The understory of this stand is in good condition. A dense growth of ash and boxelder seedlings are present, but the intense shade created by the thick canopy of overstory trees may create conditions where the seedlings are not able to develop. Where natural regeneration is established, thinning the older, taller, decadent trees will release the seedlings from this competition. This thinning of the older trees must be done carefully to avoid creating large gaps in the stand that will be prone to erosion from floodwater. Another benefit of opening small portions of the canopy is the establishment of a rotational cycle. This cycle of thinning small portions of the overstory over establishing tree seedlings will extend the life span of a forest stand indefinitely.

To encourage natural regeneration in areas where it is not occurring, the site may have to be prepared. In many forest stands, sod and other dense grasses dominate the ground surface and prevent tree and shrub seeds from reaching mineral soil. Removing this dense mat of grasses and exposing the mineral soil will enhance the survival of seeds dropped from the overstory trees.

3. Protect from destructive activities.

This stand should be protected from destructive cutting, clearing, fire, and compaction. Any harvesting of forest products should be overseen by a forestry professional to ensure that it is being done in a sustainable manner. Cooperation with the local fire department and adjacent property owners will limit the chances of a wildfire.

This stand should be protected from too many people using the area. Heavy foot traffic can compact the soil, especially when it is wet. This compaction of the soil makes it difficult for the tree roots to absorb water and nutrients, which will lead to the decline of the trees in this stand, and increased erosion. Heavy foot traffic will also limit the amount of natural regeneration that is important for the future of the stand. If this area begins to be used heavily by the public, designated walking trails should be developed.

4. Monitor for insects and diseases.

This stand should also be monitored for insect and disease outbreaks. Early detection and management for such problems generally lead to better results. Common insect and disease problems are listed in **Appendix C**.

GENERAL LAND MANAGEMENT CONCERNS

Cultural Resources

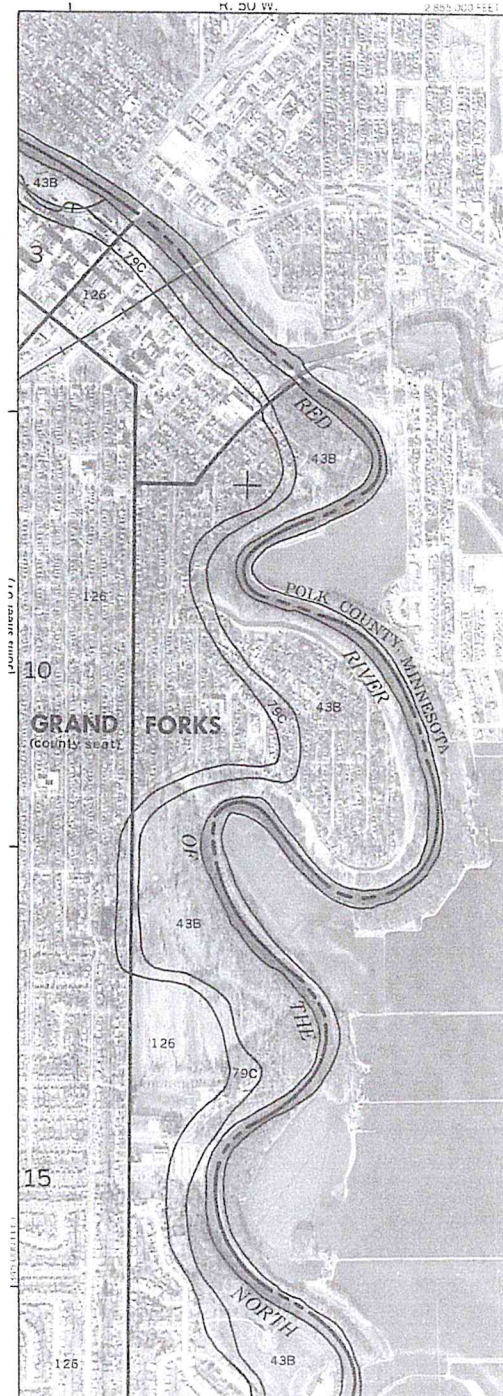
During the examination of the forest resources on this property, no cultural resources were detected. Before any active management is implemented on this property, a more thorough assessment should be performed to meet the requirements of the National Historic Preservation Act of 1966 as amended in 1992. For further information, please call your closest North Dakota Forest Service office.

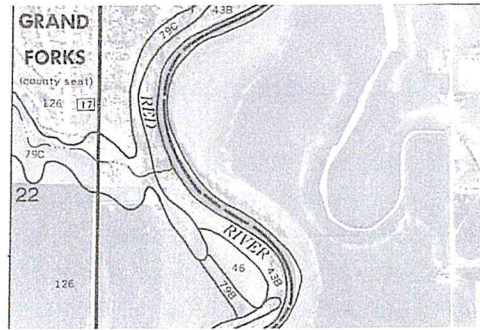
Endangered Species

During the examination of the forest resources on this property, no endangered species were detected. Before any active management is implemented on this property, a more thorough assessment should be performed to meet the requirements of Threatened and Endangered Species Act. For further information, please call your closest North Dakota Forest Service office.

Appendix A

Soils Type Map and Description





Cashel silty clay loam, 1 to 6% slopes (43B)

Nearly of the forested area through the greenway occurs on this type of soil. This deep, nearly level and gently sloping, somewhat poorly drained soil is on flood plains. It is occasionally flooded by stream overflow. Most areas are used for cultivated crops. Some support native hardwoods. Flooding is the main hazard. Streams occasionally overflow in the spring, but the floodwater usually recedes quickly. This soil is suited to all of the commonly grown trees and shrubs. The areas that support native hardwoods make up a large part of the woodland wildlife habitat in the county.

Zell-LaDelle silt loams, 1 to 15% slopes (79D)

These deep soils are along drainageways on glacial lake plains. The moderately sloping and strongly sloping, well-drained Zell soil is on the crest and shoulders of slopes, and the nearly level and gently sloping, moderately well drained LaDelle soil is on stream terraces. In some areas adjacent to streams, slopes are abruptly terminated by short, steep escarpments. Individual areas range from 5 to about 100 acres. They are about 55 percent Zell soil and 35 percent LaDelle soil. The two soils occur as areas so closely intermingled, or so small that mapping them separately is not practical. The Zell soil is generally unsuited to trees and shrubs. Scalp-planted trees and shrubs can be established on this soil, but optimum survival, growth, and vigor are not likely. No critical limitations affect trees and shrubs on the LaDelle soil. Measures that control soil blowing help to protect seedlings from abrasion.

Appendix B

Riparian Areas

Riparian woodlands are forest communities which exist adjacent to streams and rivers. These areas may be a few feet wide in brushy draws or a mile or more wide in the floodplains of major rivers. Riparian vegetation is usually distinctly different from that of surrounding uplands because it is directly influenced by a stream, river or slough, shallow groundwater or rich alluvial soils. The riparian area often represents the transition or interface between the aquatic and the upland habitats.

The functions of riparian woodland areas are highly variable. Generally they serve to stabilize stream beds and banks, protect floodplains from erosion, trap sediments, slow flood waters, provide stream shade and provide food and cover for both terrestrial and aquatic wildlife species. On the plains, riparian woodlands provide for plant and animal diversity.

Erosion and deposition of streambeds and banks are normal and natural processes. Consequently, the streams and rivers of the plains are generally subject to meander. Forest vegetation with well-developed, permanent root systems slows bed and bank erosion. Bank erosion is particularly troublesome on larger streams, and often nothing can be done. On smaller streams, trees on the banks and in the stream channels can significantly reduce channel scour.

Flood plains and overflow areas are subject to erosion and scour during floods. Riparian forests are effective at reducing flow velocities during floods, which prevents the detachment and subsequent scour erosion of flood plain soils.

Riparian forests filter suspended sediments carried in surface runoff. Riparian forests reduce flow velocities, disperse flows and encourage infiltration. The forest provides sediment "trap." Streamside forests function as traps and transformers of nutrients, especially nitrogen and phosphorus. As the riparian forest acts to filter suspended sediment, phosphorus losses are also reduced.

Water temperature is a critical factor affecting the survival of aquatic organisms. Shade from forest vegetation has been shown to be effective at reducing stream temperatures. As riparian forests encourage the infiltration of surface runoff and the subsequent release of cool groundwater to streams, they can help lower stream temperatures.

Riparian woodlands are a source of food and cover for aquatic organisms. A large proportion of food energy for aquatic life in

upland streams comes from leaves, branches, insects and small animals from the streamside vegetation. The roots of trees and large woody debris often provide for a great variety of flow and stream bed conditions. This diversity in habitat leads to greater diversity in aquatic life.

Terrestrial wildlife may require specific types of food and cover provided by riparian forests. While species of the forest may not be critical to the plains environment, they do add greatly to the diversity of the ecosystem.

Diseases:

Armillaria root disease, also called shoestring root rot, can attack hundreds of species of forest, shade, and ornamental trees and shrubs. Oak trees are often weakened by flooding and then attacked by two-lined chestnut borer.

Symptoms of Armillaria root disease include white colored mycelial fans under the bark, shoestring-like rhizomorphs, and honey mushrooms, which are present only in the late summer of fall. Nonspecific symptoms include leaf chlorosis and defoliation.

Branches and main trunks of trees submerged in floodwaters or injured by floating debris will be prime targets for invasion by canker fungi.

Flood Tolerance of Trees:

It is difficult to determine which trees are considered to be flood tolerant. Conclusions from different studies are often contradictory, caused in part by the physiological responses of the tree as it interacts with environmental conditions. Since these environmental conditions are not well understood, as well as the difficulty in categorizing tree species over their entire range, flood tolerance predictions must be carefully evaluated in general terms. A brief review of soil, tree, and flood characteristics indicates the complexity of these interactions.

Floods affect trees in many ways. The way a particular tree responds to flooding may depend on several variables.

Soils:

Soil aeration

Flooding results in poor soil aeration because the supply of oxygen to flooded soil is severely limited.

pH

Flooding of soil increases the pH of acid soils and decreases the pH of alkaline soils.

Organic matter

The rate of decomposition of organic matter in flooded soil tends to be only half that in an unflooded soil. Decomposition in flooded soils produces carbon dioxide, methane, and humic materials. High concentrations of ethanol and hydrogen sulfide are produced in waterlogged soils which can be damaging to root systems.

Sedimentation

Deposits of silt or sand as shallow as three inches may seal over and smother tree roots by limiting the supply of oxygen. Species vary in tolerance to sedimentation, but all seedlings are susceptible to root injury.

Scouring

Strong currents, waves, or suspended particulates may cause soil around the base of the tree to be washed away, exposing tree roots. Exposed roots can lead to not only tree stress but can make the tree more vulnerable to windthrow.

This stand contains tree species that are well adapted to growing in bottomland areas. These tree species are adapted to surviving extended periods of spring flooding and the periodic summer floods that are common along the Red River.

Height

Tree injury increases in proportion to the percent of the crown covered by water. Species that can survive standing in several feet of water for months may die in less than one month when their foliage is completely covered.

Crown Class

Trees in the dominant crown class survive flooding much better than trees in lower crown classes.

Age

Adult trees tolerate flooding better than overmature trees or seedlings of the same species.

Vigor

Tree vigor at time of flooding influences tolerance. Vigorously growing, healthy trees withstand flooding better than less vigorous trees.

Roots

Long-term flooding leads to death and decay of large portions of a tree's root system.

Species Variations

Flood tolerance variations within a species are not well understood. Flood tolerance may be an inherited trait and this may explain some of the discrepancies in reports on survival.

However, it is generally accepted that some species have greater tolerance for flooding than others.

Floods:

Season

Flooding during the growing season usually is more harmful to woody plants than flooding during the dormant season. Trees are most susceptible to flooding in late spring just after the first flush of growth.

Duration

The longer trees are exposed to flooding, the greater the potential for injury. Short periods of flooding during the growing season can be tolerated by most trees. However, if flooding is recurrent and keeps the soil saturated or prevents recovery from previous flooding, injuries will accumulate and serious damage may occur.

Water Level

The depth of water influences flood tolerance. The mortality rate is less for trees in saturated soils than for trees with water covering the soil. After water covers the soil, the depth may have little significance until the lower foliage is covered.

Temperature and Oxygen

Cold water is less injurious than warm water due to cold water's capacity to hold more dissolved oxygen. Rapidly flowing water is less harmful than stagnant water.








Mechanical Injuries

An often-overlooked aspect of flood damage is mechanical injury caused by current, wave action and floating debris. Young tree plantings may be especially damaged by current and wave action. Large ice flows can shear or even large diameter trees.

Chemicals

Floods may carry various chemicals that have been picked up as runoff from agricultural fields and other areas or from sewage released when treatment facilities become unable to handle large volumes of water.

Tree species native or grown in North Dakota that are considered to be tolerant to flooding include: Green Ash, Boxelder, Silver Maple, Hackberry, Cottonwood, most willow species, Bur oak, American elm, and Basswood.

Stand 6 	<ol style="list-style-type: none"> 1. Encourage regeneration. 2. Protect from destructive practices. 3. Monitor for insects and disease. 	16.0	2003	X	2004	X	2005	X	2006	X	2007	X	2008	X	2009	X	2010	X	2011	X	2012	X	
Stand 7 	<ol style="list-style-type: none"> 1. Install planting B. 2. Remove buckthorn. 3. Protect from destructive practices. 4. Monitor for insects and diseases. 	8.6	2003	X	2004	X	2005	X	2006	X	2007	X	2008	X	2009	X	2010	X	2011	X	2012	X	
Stand 8 	<ol style="list-style-type: none"> 1. Install planting F. 2. Protect from destructive practices 	6.0	2003	X	2004	X	2005	X	2006	X	2007	X	2008	X	2009	X	2010	X	2011	X	2012	X	
Stand 9 	<ol style="list-style-type: none"> 1. Limit pedestrian traffic through area. 2. Protect from destructive practices. 	0.5	2003	X	2004	X	2005	X	2006	X	2007	X	2008	X	2009	X	2010	X	2011	X	2012	X	
Stand 10 	<ol style="list-style-type: none"> 1. Encourage understory development. 2. Protect from destructive practices. 3. Monitor for insects and diseases 	6.0	2003	X	2004	X	2005	X	2006	X	2007	X	2008	X	2009	X	2010	X	2011	X	2012	X	
Stand 11 	<ol style="list-style-type: none"> 1. Prepare planting site. 2. Install planting D 3. Protect from destructive practices. 4. Monitor for insects and disease. 	8.6	2003	X	2004	X	2005	X	2006	X	2007	X	2008	X	2009	X	2010	X	2011	X	2012	X	
Stand 12 	<ol style="list-style-type: none"> 1. Install planting D when city is finished with borrow pit. 2. Protect from destructive practices. 	16.0	2003	X	2004	X	2005	X	2006	X	2007	X	2008	X	2009	X	2010	X	2011	X	2012	X	

1. Install planting E.
2. Protect from destructive practices.