

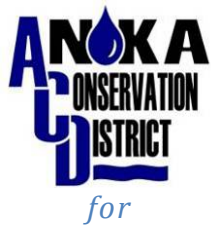


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# Coon Rapids Dam Pool Shoreline Inventory

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*Prepared by:*



*The Minnesota Department of Natural Resources*

December 2012



# Table of Contents

- Executive Summary..... 2
- Methods ..... 2
  - Preparation..... 2
  - Field Work ..... 2
  - Soil Loss Estimation..... 4
- Results ..... 5
- Site Profiles ..... 6
- Complete Inventory Atlas ..... Appendix

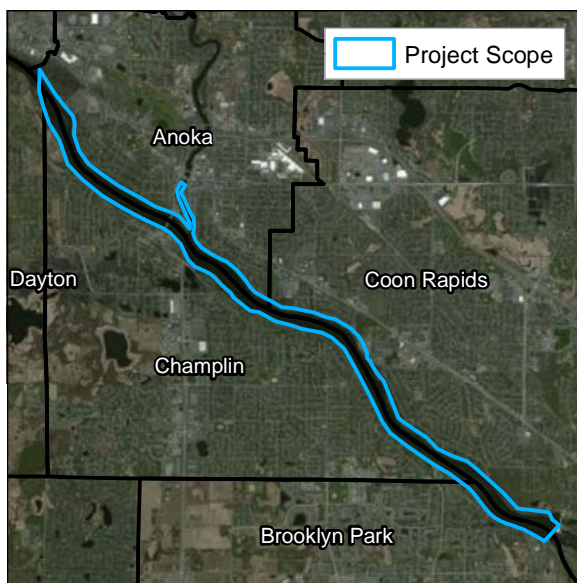
## Executive Summary

Starting in the winter of 2012-2013, the water levels in the Coon Rapids Dam Pool will remain raised all year long as a way to keep invasive carp species from traveling upstream. Landowners along the river were concerned about how the higher water level may affect their shoreline through ice damage and erosion. The purpose of this project was to gather information about current bank conditions in the pool in order to better address residents' concerns about the future and direct the use of available public bank stabilization funding.

A total of 16.2 miles of riverbank was inventoried leading to the identification of 13 project sites, which, if stabilized, would reduce sediment loading to the river by 5,220 tons per year.

## Methods

### Preparation



The project scope was determined primarily by the extent of the pool with the dam fully raised. According to the Army Corps of Engineers, the pool extends 7.1 miles north of the dam when the pool is fully raised. In order to include all potential changes, the current inventory extends 7.5 miles to the Champlin-Dayton border. The Rum River was also inventoried nearly to the dam in Anoka because it could also potentially be affected by the rise of the pool. An atlas of the river was printed for note-taking purposes.

### Field Work

The inventory was conducted on October 16<sup>th</sup> and 17<sup>th</sup>, 2012. The pool was still raised to its full height. Four staff members were on the inventory crew. The first person recorded erosion conditions and estimated a lateral recession rate for the bank. Using the Wisconsin NRCS Direct Volume Method, the entire shoreline was given a 1-4 ranking, ranging from slight to very severe erosion. These erosion classifications were converted to lateral recession rates for use in soil loss calculation (see next page for detailed descriptions).

A second staff member recorded any structures on or near the shoreline and gave them a ranking as either stable, slumping, or failing. It is important to note that the erosion conditions near a structure do not necessarily indicate the stability of a structure. For example, the soil behind a

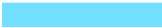



failing retaining wall may still be quite stable. Structures that are typically taken out for the winter months like movable docks and stairways were not recorded. These observations were recorded on a paper map.

Finally, a third person took geo-tagged photos of the entire shoreline for reference. These photos can be viewed just like normal photos, but they also contain XY coordinates and the angle at which they were taken. (They can be mapped using ArcGIS 10.1, or by using the ArcPhoto add-on for older versions). In order to take high quality photos, the boat typically stayed between 50 and 100 feet from shore, but sometimes had to go farther out to avoid shallow water.

The paper atlases were then digitized into three GIS shapefiles; one for erosion condition and recession rate (Recession\_Rate.shp), one for shoreline structures like retaining walls and riprap (Shoreline\_Structures.shp), and one for discrete structures like staircases, permanent docks, and buildings (Point\_Structures.shp).

All of this information was used to create an inventory atlas of the pool which can be found in the appendix to this document. The atlas contains erosion severity, shoreline structures, discrete structures, and photos of the entire shoreline. To find information about structure condition see the shapefiles provided with this document.

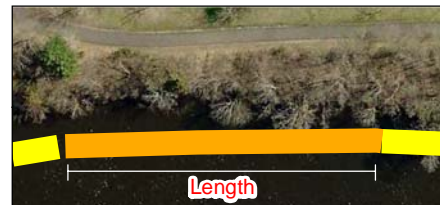
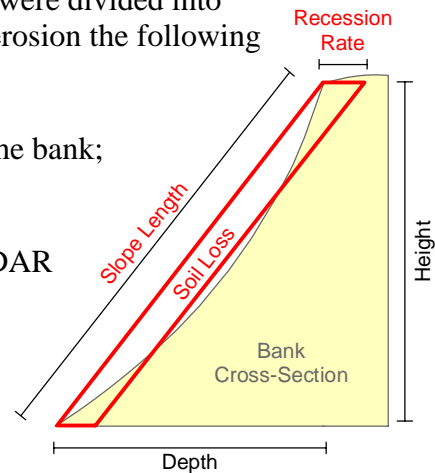
### Wisconsin NRCS Direct Volume Method Recession Rate Classifications

Symbol	Category	Lateral Recession Rate (ft/yr)	Description
	Slight	0.01 - 0.05	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
	Moderate	0.06 - 0.2	Bank is predominantly bare with some rills and vegetative overhang. Some exposed tree roots but no slumps or slips.
	Severe	0.3 - 0.5	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen trees and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross section becomes U-shaped as opposed to V-shaped
	Very Severe	0.5+	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains, and culverts eroding out and changes in cultural features as above. Massive slips and washouts common. Channel cross section is U-shaped and stream course may be meandering.

## Soil Loss Estimation

All sections of shoreline marked either severe or very severe were divided into sites for analysis. For every section of severe or very severe erosion the following variables were calculated:

- **Depth:** horizontal distance from the toe to the top of the bank; calculated using GIS
- **Height:** vertical height; measured with Nov. 2011 LiDAR elevation data
- **Slope Length:** length of diagonal slope; calculated from *depth* and *height* measurements
- **Recession Rate:** yearly lateral recession of bank (.4 ft/yr for severe erosion and .75 ft/yr for very severe erosion)
- **Length:** length of the erosion along the river; calculated using GIS



These variables were used in the equation below to calculate the annual soil loss. Sandy soil weighs approximately 100 pounds per cubic foot.

$$\frac{\text{SlopeLength}(ft) * \text{RecessionRate}(ft / yr) * \text{Length}(ft) * 100(lb / ft^3)}{2000(lb / ton)} = \text{Estimated Soil Loss (tons/year)}$$

## Results

### Erosion

Most of the shoreline inventoried had only limited erosion. About 93% of the shoreline inventoried was rated either slight or moderate erosion (0.0 - 0.2 ft/yr). 3.5% of the shoreline was rated severe (0.3 - 0.5 ft/yr) and another 3.5% was rated very severe (>0.5 ft/yr).

Most of the badly eroding shoreline is located on public property. Although only 26% of the shoreline is public property, it contains 59% of the severe erosion and 93% of the very severe erosion. As a result, public land accounts for 78% of the total sediment loss from this section of river.

Erosion Summary		
Erosion Severity	Length (miles)	%
Slight	11.46	70.5%
Moderate	3.65	22.5%
Severe	0.58	3.5%
Very Severe	0.57	3.5%
Total	16.26	100%

Erosion on Public Land	Severe		Very Severe		Estimated Soil Loss	
	Miles	%	Miles	%	Tons/Year	%
Public Land	0.34	59%	0.53	93%	4081	78%
Private Land	0.23	41%	0.04	7%	1139	22%

### Shoreline Structures

A slim majority of the shoreline had no shoreline structures to protect the bank from erosion (59.4%). Around 20% of the shoreline was protected by a retaining wall, along with another 20% protected by rip rap. Less than 1% of the shoreline was identified as a constructed beach.

There was again a large difference between public and private property. Nearly 90% of public land had no shoreline structure whatsoever. This isn't surprising given that most of the public land is park land, but it does help explain why so much of the public shoreline is eroding.

Shoreline Structures Summary				
Structure Type	Material	Private	Public	Total
None	Vegetation/Bare	49.1%	87.8%	59.4%
Retaining Wall	Boulder	10.4%		7.6%
	Concrete	1.9%	0.1%	1.4%
	Gabion	0.5%		0.4%
	Landscape Block	2.2%		1.6%
	Rail Road Ties	12.1%		8.9%
	Sheet Piling	0.5%		0.4%
	Wood	0.1%		0.0%
	<b>Subtotal</b>	<b>27.7%</b>	<b>0.1%</b>	<b>20.4%</b>
Rip Rap	Concrete	0.8%	3.1%	1.4%
	Rock	21.7%	8.5%	18.2%
	<b>Subtotal</b>	<b>22.5%</b>	<b>11.6%</b>	<b>19.6%</b>
Sand Beach	Sand	0.7%	0.4%	0.6%
		<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

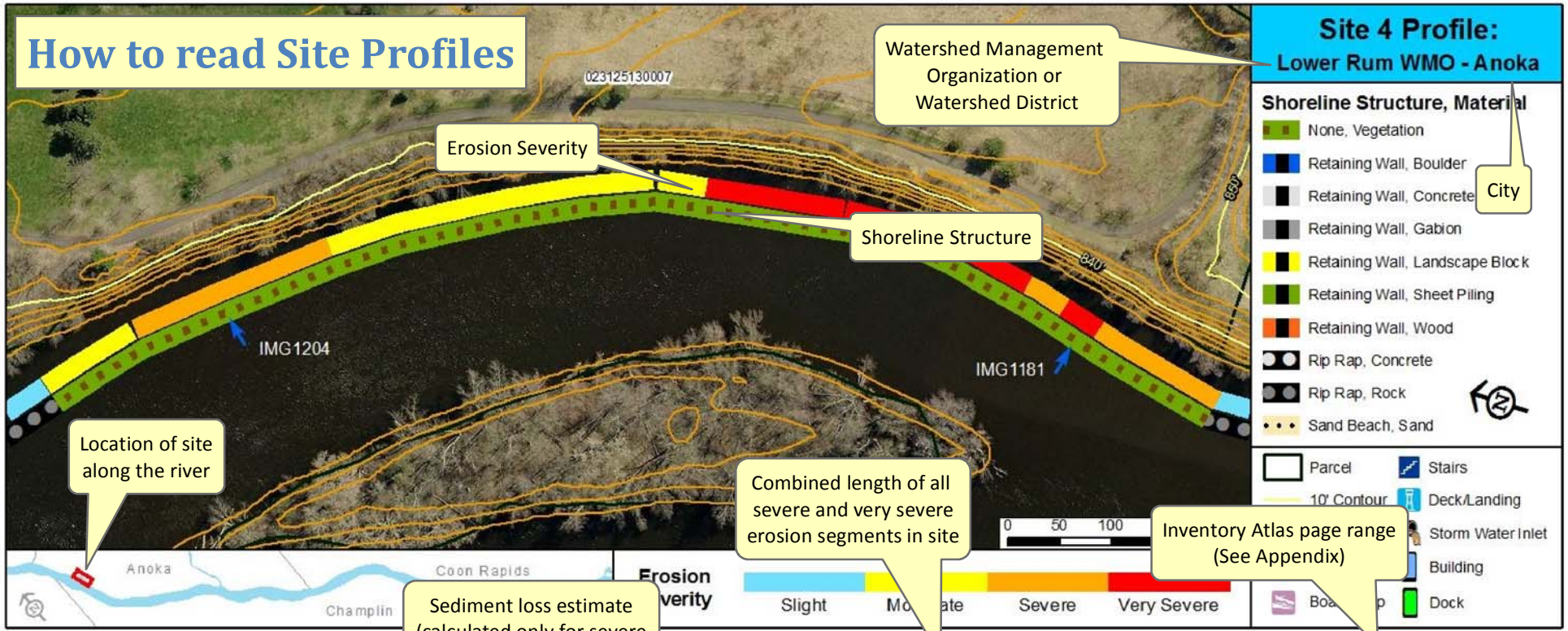
## Site Profiles

Wherever severe or very severe erosion was observed, a site profile was created. The primary purpose of these profiles is to highlight these areas for landowner outreach. The table below is a summary of the 13 sites. Following it are the more detailed site profiles. Each profile includes a detailed map of the site, statistics including soil loss estimates, and potential best management practices to address the problem.

Site #	Watershed	City	Ownership	Estimated Annual Soil Loss	Severe Erosion Length	Typical Slope	Atlas Page #	Photo #	PIN
1	Coon Creek	Coon Rapids	Anoka County	1871 tons	2051'	1.5-2.0 to 1	6-12	31-60	273124210001
2	Coon Creek	Coon Rapids	Anoka-Ramsey Community College	510 tons	312'	1.4 to 1	37-39	178-191	173124130005
3	Coon Creek	Coon Rapids	Private (4 properties)	439 tons	341'	1.4 to 1	33-34	149-159	173124440005 173124440007 173124440008 203124110001
4	Lower Rum	Anoka	City of Anoka	581 tons	738'	2.0-2.5 to 1	103-105	1179-1209	023125130007
5	Lower Rum	Anoka	City of Anoka	51 tons	159'	2.5 to 1	111-112	1255-1265	353225340001
6	West Mississippi	Brooklyn Park	Three Rivers Parks & Private	1142 tons	1446'	1.5-2.0 to 1	201-206	1030-1082	0211921340005 0311921140011
7	West Mississippi	Champlin	Private (2 properties)	209 tons	186'	1.4 to 1	184-185	902-918	3312021410027 3312021410011
8	West Mississippi	Champlin	Private (3 properties)	168 tons	283'	1.5 to 1	174-175	820-833	2812021340012 2812021340011 2812021340010
9	West Mississippi	Champlin	City of Champlin	64 tons	63'	1.8 to 1	165	741-744	2912021140001
10	West Mississippi	Champlin	Private	55 tons	124'	2.0 to 1	172	798-806	2812021340033
11	West Mississippi	Champlin	Private (2 properties)	55 tons	154'	2.0 to 1	171	788-795	2812021310001 2812021320014
12	West Mississippi	Champlin	Private	38 tons	67'	1.8 to 1	166	754-756	2812021230002
13	West Mississippi	Champlin	City of Champlin	32 tons	138'	1.8 to 1	116	1287-1294	1312022220001



# How to read Site Profiles



## Site 4 Profile: Lower Rum WMO - Anoka

- Shoreline Structure, Material**
- None, Vegetation
  - Retaining Wall, Boulder
  - Retaining Wall, Concrete
  - Retaining Wall, Gabion
  - Retaining Wall, Landscape Block
  - Retaining Wall, Sheet Piling
  - Retaining Wall, Wood
  - Rip Rap, Concrete
  - Rip Rap, Rock
  - Sand Beach, Sand
- Other Symbols:**
- Parcel
  - 10' Contour
  - Stairs
  - Deck/Landing
  - Storm Water Inlet
  - Building
  - Dock

**Additional Info:** Located on a cut-bank, this area is likely to be hit by large sheets of ice in the spring. Many slumping and recently fallen trees show the fast pace of soil loss here. Root overhangs of several feet are widespread in the areas marked severe and very severe. A paved City of Anoka bike trail runs along the top of the bank, between 10 and 15 feet away from the steep bank. Within a few years erosion could threaten the integrity of the trail.

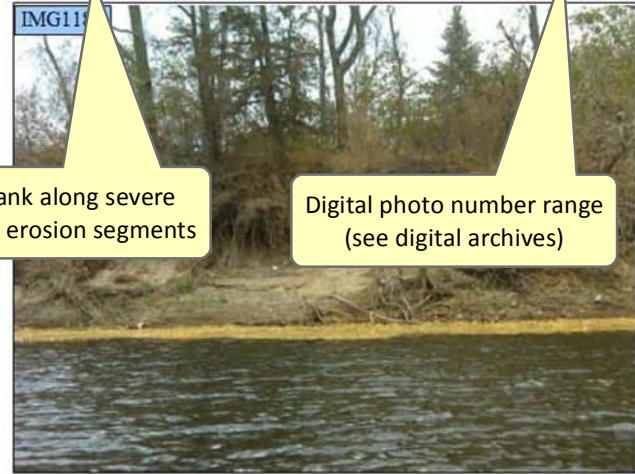
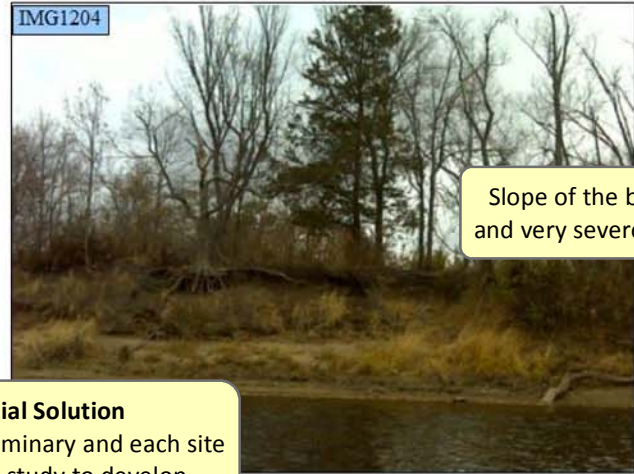
**Potential Solution:** Protect the toe of this bank from ice damage by armering it with large rip rap or boulders several feet above the waterline. Use native plants to cover and stabilize the upper slopes. A turf stabilization material may also be needed for the toe of the bank.

Site Information	Estimated Annual Soil Loss	Severe Erosion Length	Typical Slope	Property Ownership	Atlas Page #	Photo #
	581 tons	738 feet	2.0 -2.5 to 1	City of Anoka	102-105	1179-1209

Sediment loss estimate (calculated only for severe and very severe segments)

Combined length of all severe and very severe erosion segments in site

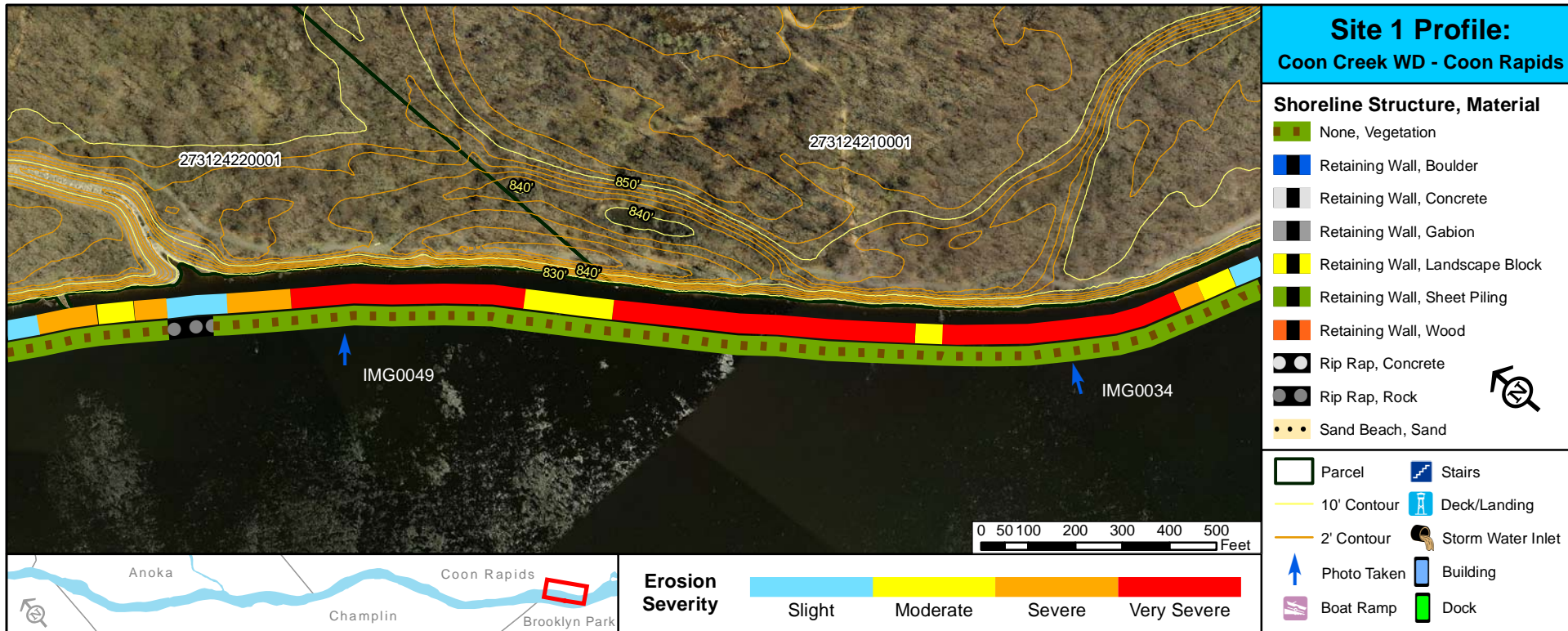
Inventory Atlas page range (See Appendix)



Slope of the bank along severe and very severe erosion segments

Digital photo number range (see digital archives)

**Potential Solution**  
(Solution is preliminary and each site needs more study to develop a finished project plan)

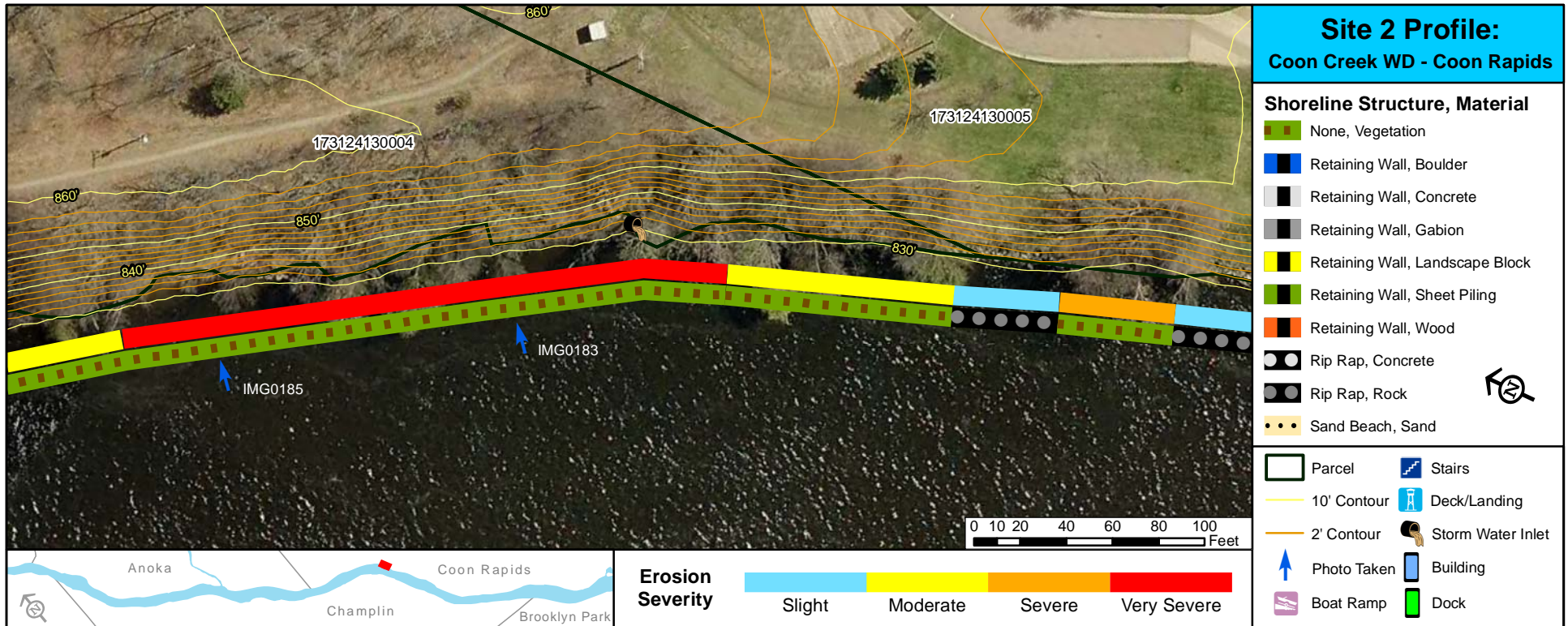


**Additional Info:** This site is located on the outside of a curve in the river, called a cut-bank. This makes it likely to be hit by large ice sheets and moving water during the spring melt. Many fallen trees and vegetative overhangs of several feet show the fast pace of erosion here. The bank varies in height between 12 and 20 feet. A paved bike trail runs along the top of the bank, often 5 feet or less from the edge of the bank. Within a few years the bank could threaten the stability of the trail.

**Potential Solution:** Protect the toe of this bank from ice damage by arming it with large rip rap or boulders. Use native planting on the slope to hold the soil in place. Turf reinforcement material may be necessary on the steepest slopes.

Site Information	Estimated Annual Soil Loss	Severe Erosion Length	Typical Slope	Property Ownership	Atlas Page #	Photo #
	1871 tons	2051 feet	1.5-2.0 to 1	Anoka County	6-12	31-60



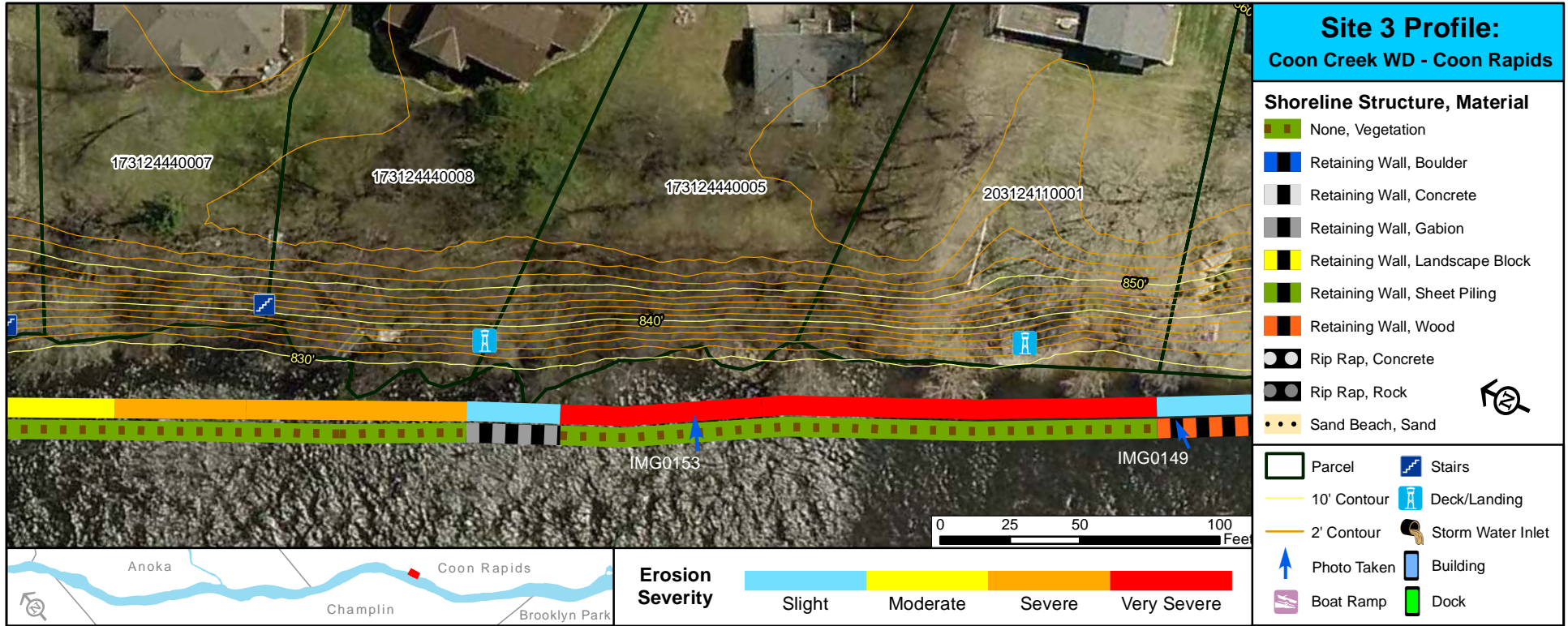


**Additional Info:** This site is located on the outside of a curve in the river, called a cut-bank. It is likely hit by large ice sheets and moving water during the spring melt. As shown in picture 183, a concrete storm water culvert is sticking 5 feet out from the sheer bank. This along with the many slumping trees at the site show the large amount of sediment lost.

**Potential Solution:** Protect the toe of this bank from ice damage by armoring it with large rip rap or boulders. Use native planting on the slope to hold the soil in place. Turf reinforcement material may be necessary on the steepest slopes. This site has the highest ratio of soil loss per linear foot of any site inventoried, which could potentially make it a more cost-effective project.

Site Information	Estimated Annual Soil Loss	Severe Erosion Length	Typical Slope	Property Ownership	Atlas Page #	Photo #
	510 tons	312 feet	1.4 to 1	Anoka-Ramsey Community College	37-39	178-191



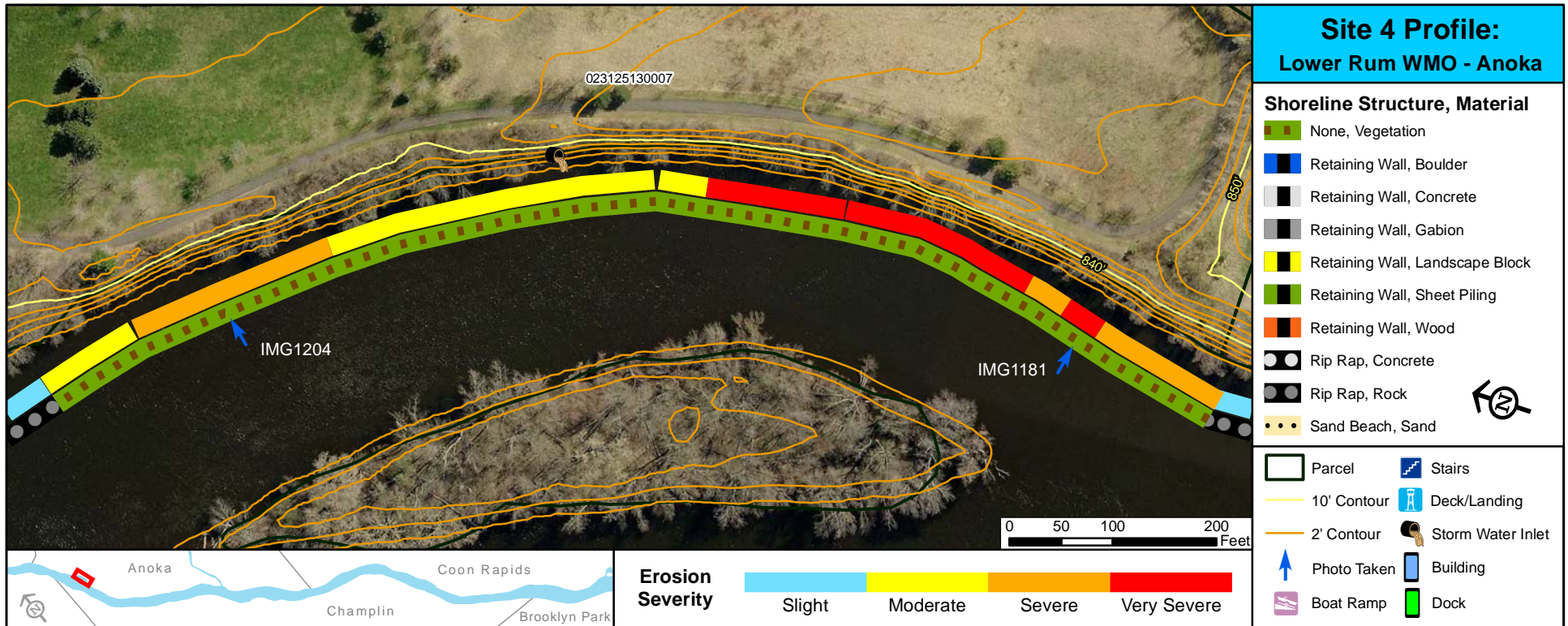


**Additional Info:** At least one large tree has been lost here since the last photo inventory in 2004. Several others are slumping and have their roots exposed. Vegetative overhangs of a few feet are common.

**Potential Solution:** Protect the toe of the bank from ice damage using large rip rap or boulders. The bank is so steep here that grading of the slope might be necessary to produce a stable bank. Native planting with a turf control material might also be an option for some of the slope. This site has a high ratio of soil loss per linear foot, which could make it more cost-effective than other potential projects.

Site Information	Estimated Annual Soil Loss	Severe Erosion Length	Typical Slope	Property Ownership	Atlas Page #	Photo #
	439 tons	341 feet	1.4 to 1	Private	33-34	149-159



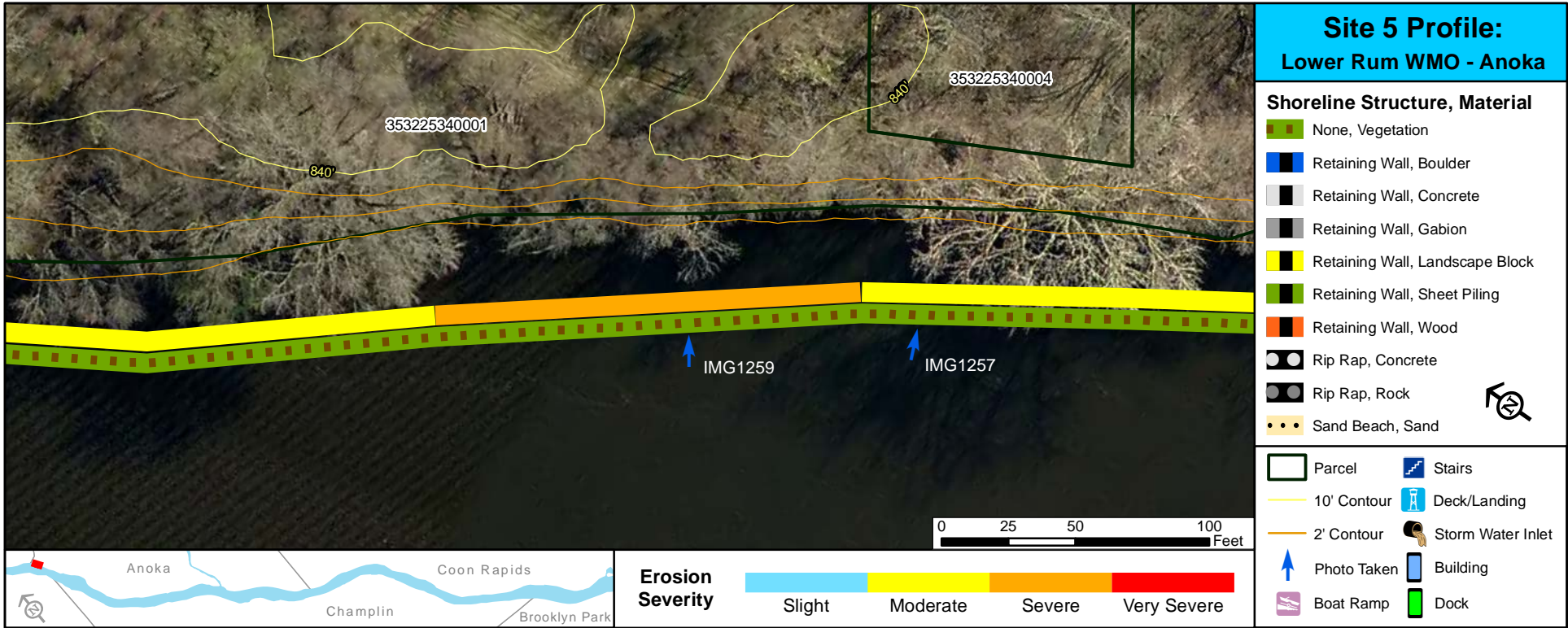


**Additional Info:** Located on a cut-bank, this area is likely to be hit by large sheets of ice in the spring. Many slumping and recently fallen trees show the fast pace of soil loss here. Root overhangs of several feet are widespread in the areas marked severe and very severe. A paved City of Anoka bike trail runs along the top of the bank, between 10 and 15 feet away from the steep bank. Within a few years erosion could threaten the integrity of the trail.

**Potential Solution:** Protect the toe of this bank from ice damage by armoring it with large rip rap or boulders several feet above the waterline. Use native plants to cover and stabilize the upper slopes. A turf stabilization material may also be needed for the steepest sections of the bank.

Site Information	Estimated Annual Soil Loss	Severe Erosion Length	Typical Slope	Property Ownership	Atlas Page #	Photo #
	581 tons	738 feet	2.0 -2.5 to 1	City of Anoka	102-105	1179-1209



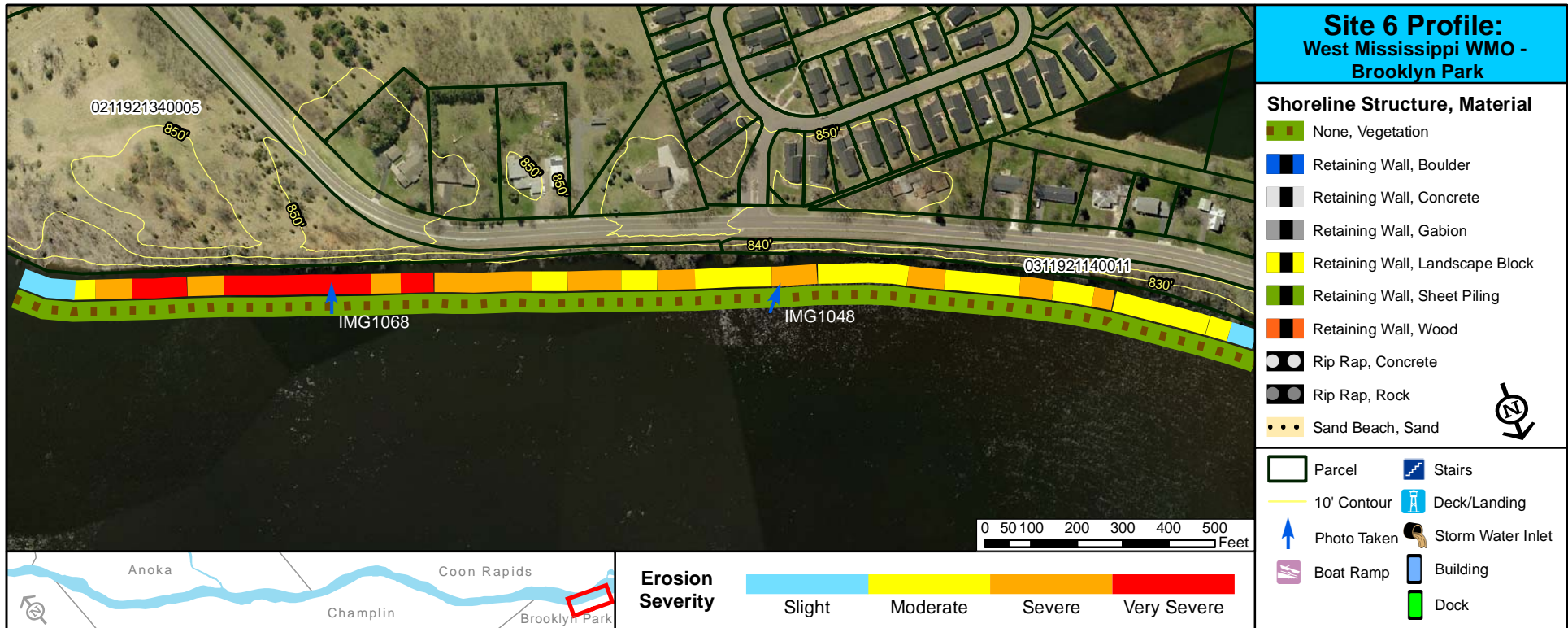


**Additional Info:** This site is located on the northern end of King’s Island in Anoka. It is located on a cut-bank, which likely means it is hit by large ice sheets in the spring. All of the trees along the shoreline have heavily exposed roots and a few are beginning to slump. The bank is only a few feet tall, so the total amount of soil loss here is not as great.

**Potential Solution:** Protecting the bank from ice using rip rap or boulders will help the bank rebuild itself over time. Native plants will help hold the soil in place.

Site Information	Estimated Annual Soil Loss	Severe Erosion Length	Typical Slope	Property Ownership	Atlas Page #	Photo #
	51 tons	159 feet	2.5 to 1	City of Anoka	111-112	1255-1265



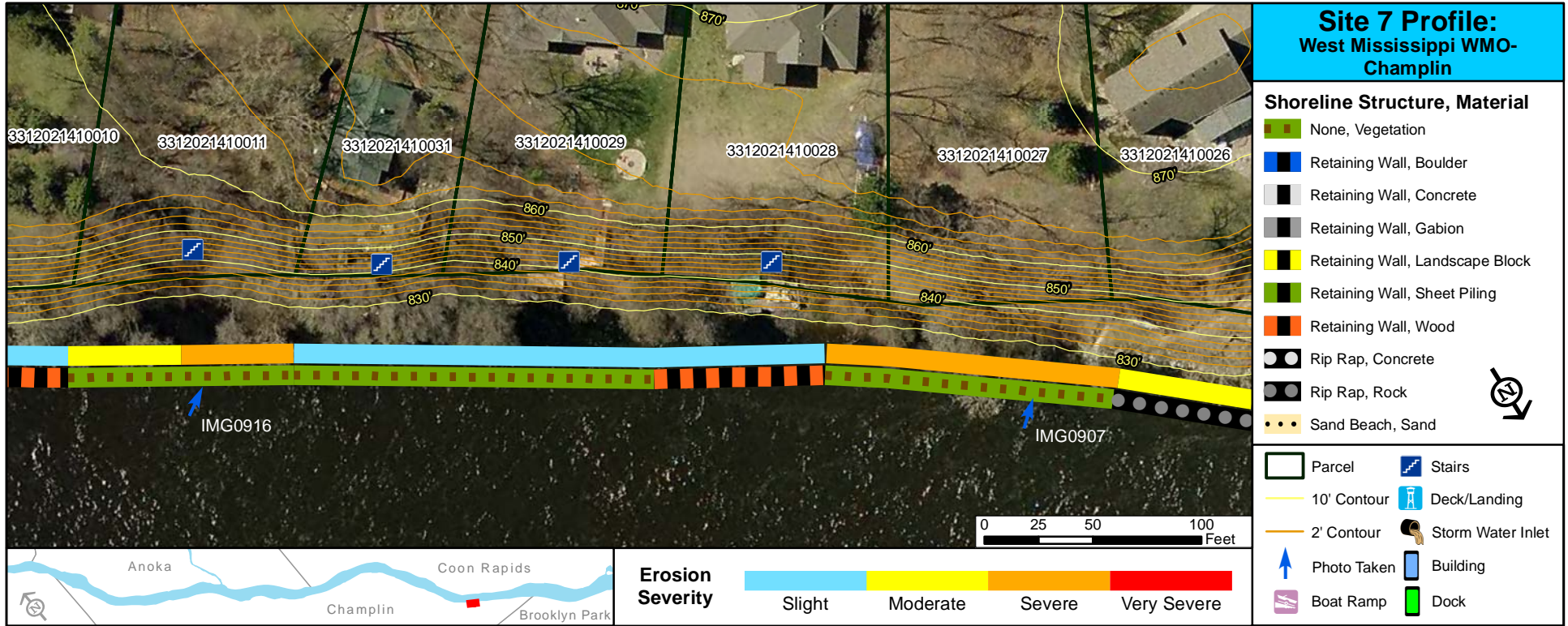


**Additional Info:** Located on a cut-bank, this area is likely hit by large sheets of ice and moving water in the spring. The downstream portion of this site, where erosion is worst, is part of the Coon Rapids Dam Regional Park. Root overhangs of several feet are widespread and the bank is mostly bare. The upstream portion is owned by a local HOA. The erosion is less concentrated here, but a paved bike trail and West River Road are only a few feet from the top of the steep bank.

**Potential Solution:** Protect the toe of this bank from ice damage by armoring it with large rip rap or boulders several feet above the waterline. Use native plants to cover and stabilize the upper slopes. The bank is very steep in some areas, so a turf stabilization material may also be needed.

Site Information	Estimated Annual Soil Loss	Severe Erosion Length	Typical Slope	Property Ownership	Atlas Page #	Photo #
	1142 tons	1446 feet	1.5-2.0 to 1	Three Rivers Park District & Private	201-206	1030-1082





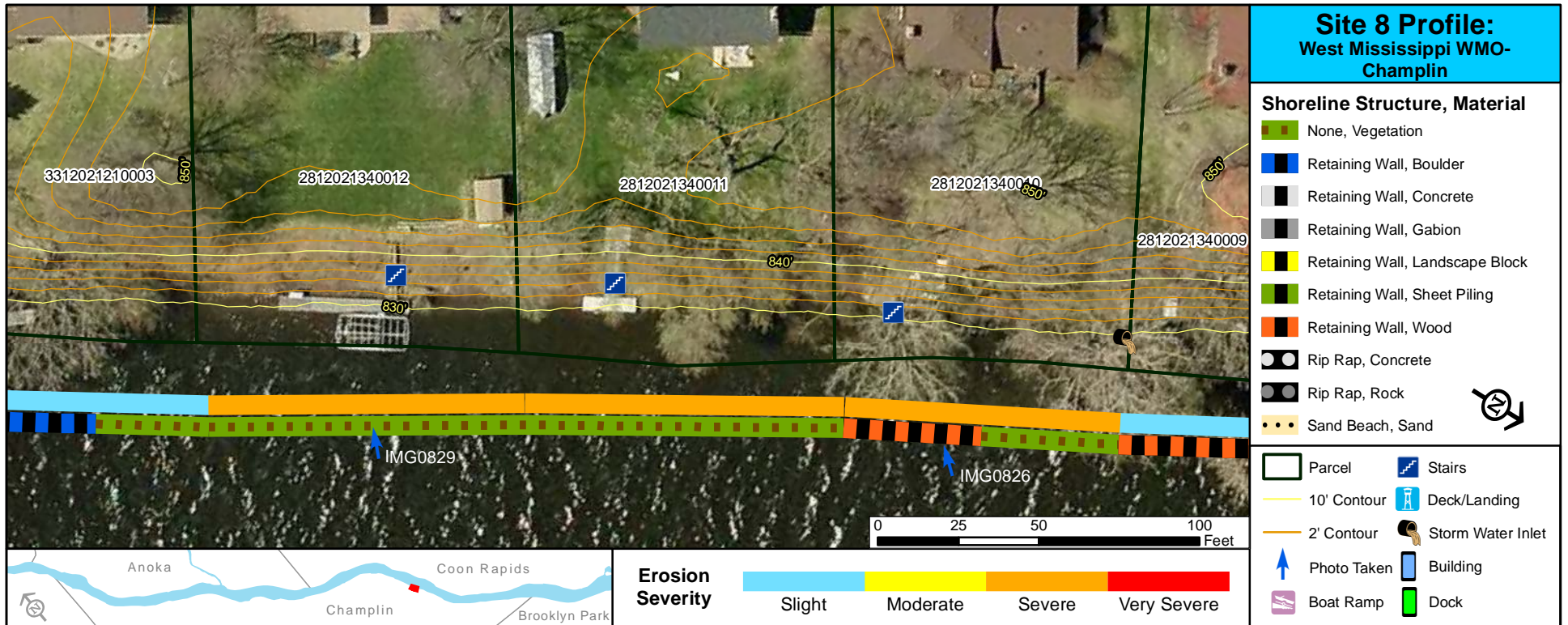
**Additional Info:** Located on a cut-bank, this area is likely to be hit by large sheets of ice and moving water in the spring. Most of the erosion at this site is currently happening above water level. The bank in this location is tall (30+ feet) and very steep. Much of the bank is bare with many exposed tree roots indicating a fast pace of erosion.

**Potential Solution:** Protect the toe of this bank from ice damage by armoring it with large rip rap or boulders several feet above the waterline. Use native plants to cover and stabilize the upper slopes. A turf stabilization material may be needed for the steepest sections of the bank. Some thinning of the tree canopy would allow more sunlight to reach the bank and promote plant growth.

Site Information	Estimated Annual Soil Loss	Severe Erosion Length	Typical Slope	Property Ownership	Atlas Page #	Photo #
	209 tons	186 feet	1.4 to 1	Private	184-185	902-918





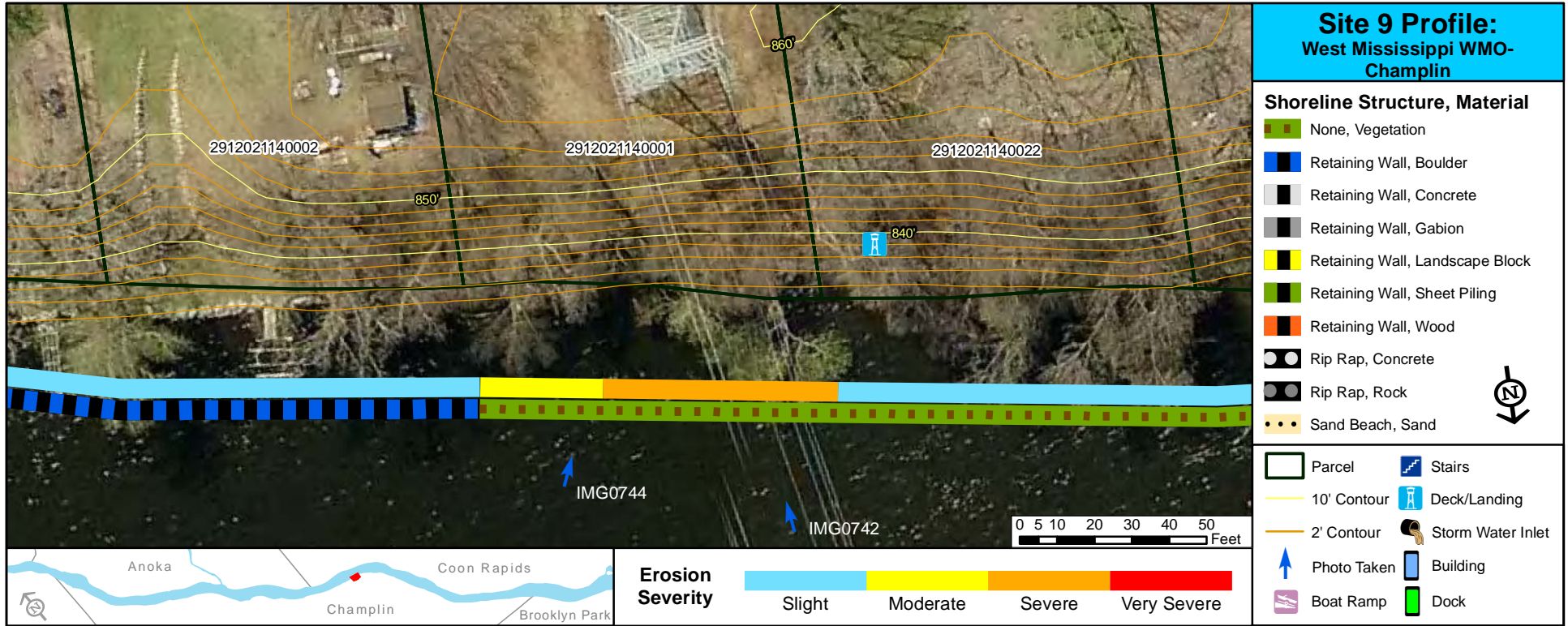


**Additional Info:** The bank here is not particularly high, but it is quite steep. Very few trees are growing on part of the southern end of the bank. This may be the result of or a contributing factor to the erosion. The erosion here seems aggravated by yard waste dumping which smothers vegetation.

**Potential Solution:** Promote plant growth here by disposing of yard waste properly and thinning the tree canopy in some places to allow in more sunlight. Some turf stabilization material may also be necessary to stabilize the steepest sections of the bank.

Site Information	Estimated Annual Soil Loss	Severe Erosion Length	Typical Slope	Property Ownership	Atlas Page #	Photo #
	168 tons	283 feet	1.5 to 1	Private	174-175	820-833

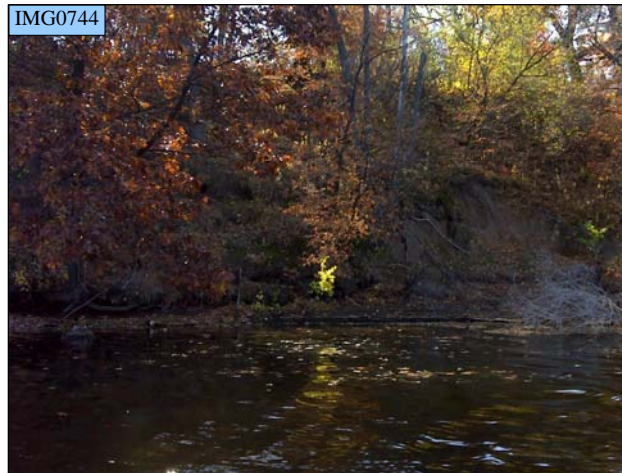


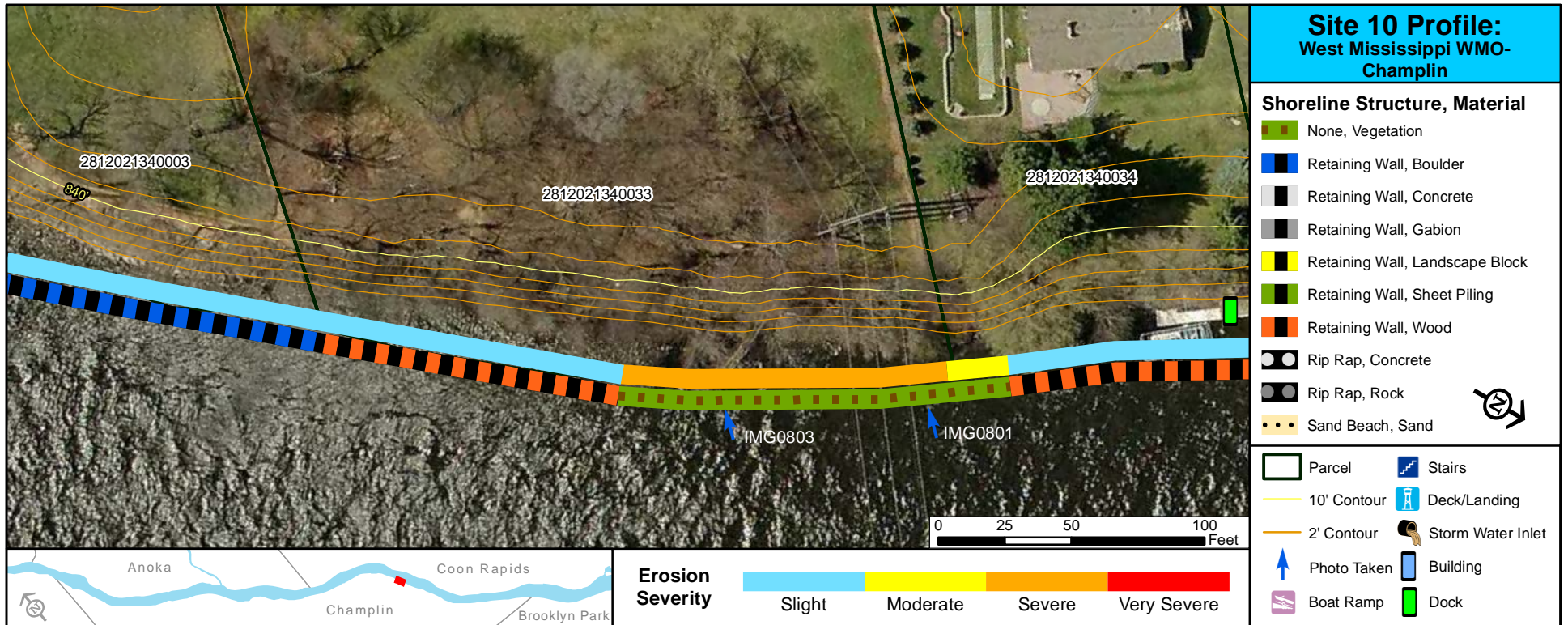


**Additional Info:** The erosion here is located directly below a transmission line. Repeated cutting of trees below the line might be contributing to the erosion here. The base of the tower is approximately 15 feet back from the top of the steep bank.

**Potential Solution:** Protect this bank by armoring the toe with rip rap or boulders. Consider removing trees and planting grass cover to stop repeated cutting of trees. Some turf stabilization material may also be needed on the steepest part of the slope.

Site Information	Estimated Annual Soil Loss	Severe Erosion Length	Typical Slope	Property Ownership	Atlas Page #	Photo #
	64 tons	63 feet	1.8 to 1	City of Champlin	165	741-744



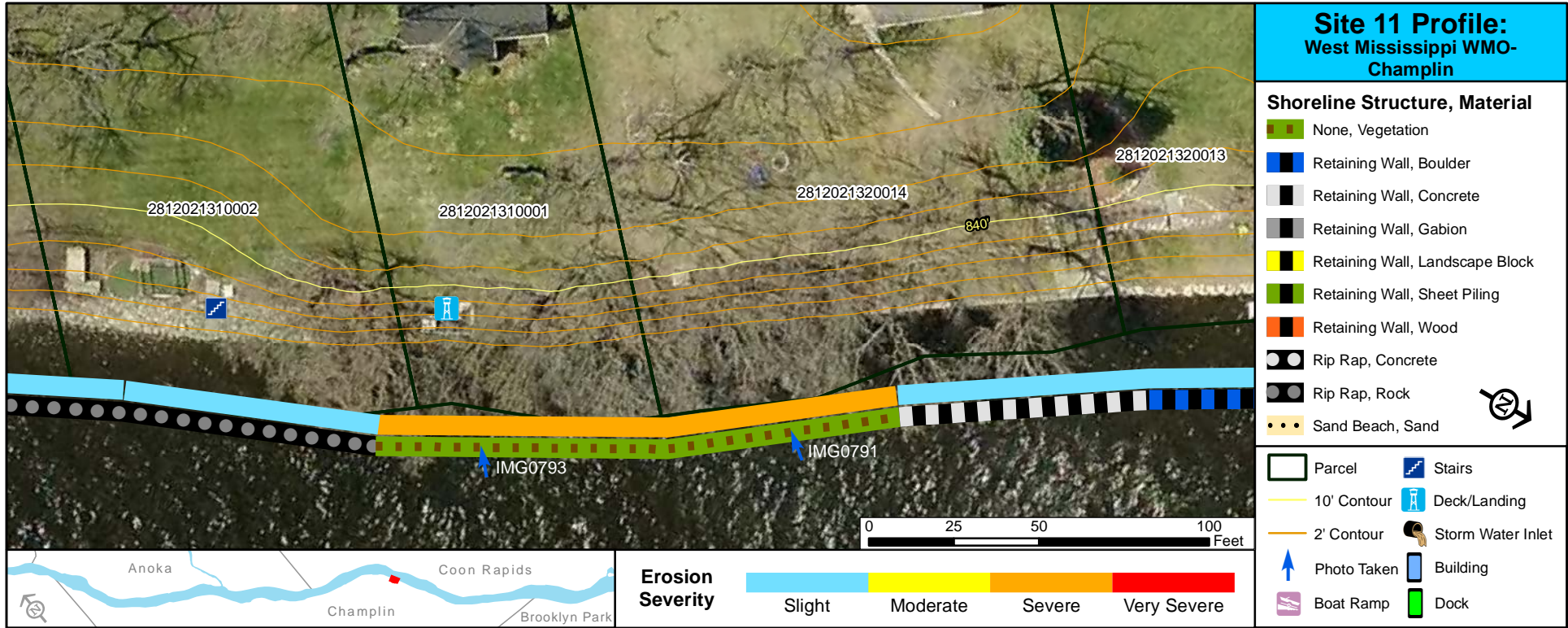


**Additional Info:** The erosion here is located mostly below a power line crossing the river. Repeated cutting of trees away from the line may contribute to the erosion problem here. Yard waste dumping was also apparent here.

**Potential Solution:** Avoid the repeated cutting of trees by replacing them with grass cover. Also, promote more robust vegetation growth by disposing of yard waste properly and potentially thinning the tree canopy to allow more sunlight to reach the plants.

Site Information	Estimated Annual Soil Loss	Severe Erosion Length	Typical Slope	Property Ownership	Atlas Page #	Photo #
	55 tons	124 feet	2.0 to 1	Private	172	798-806

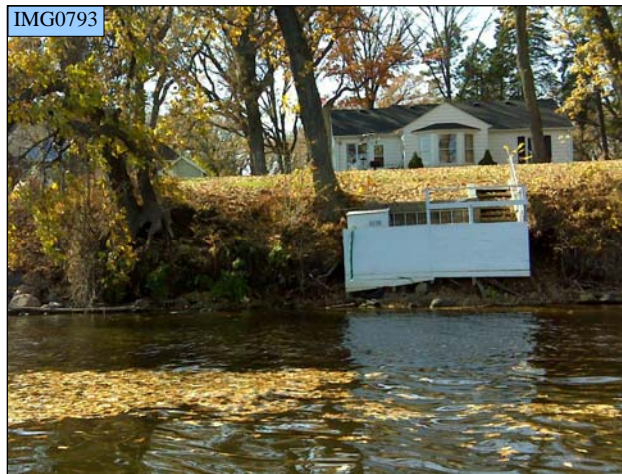


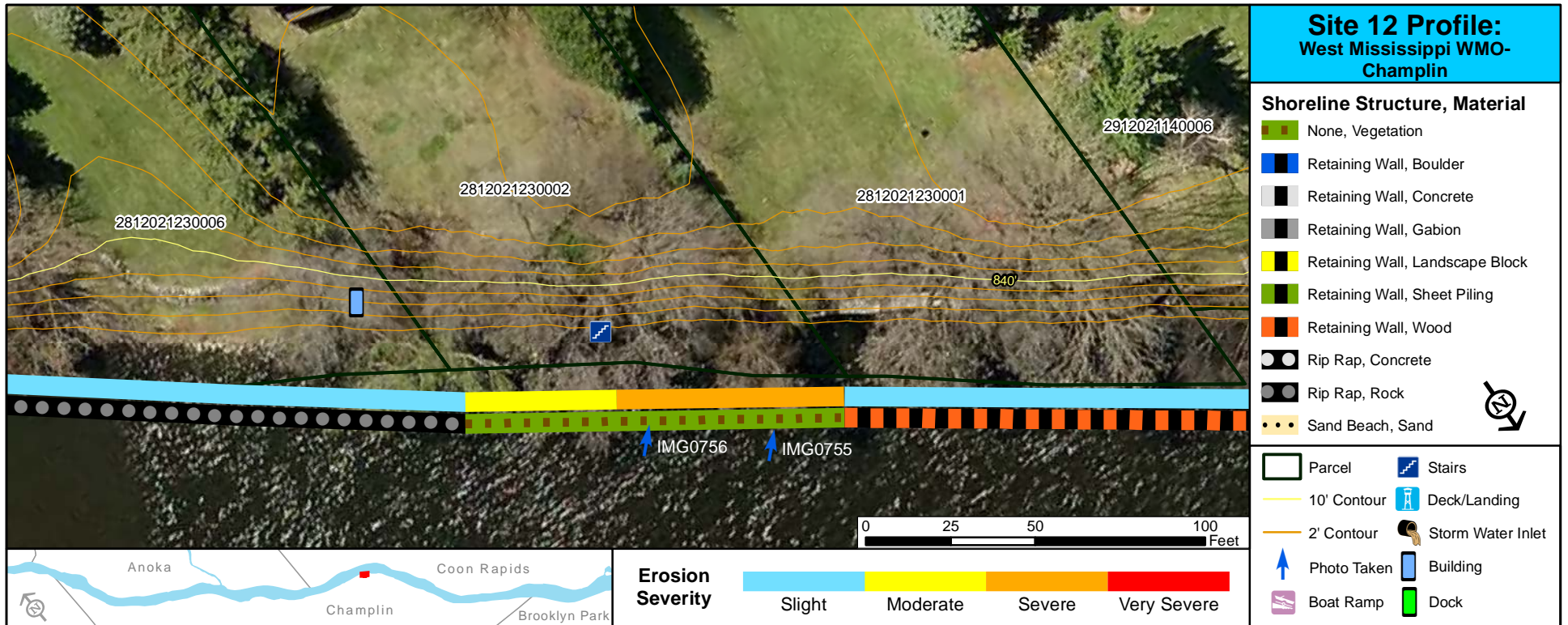


**Additional Info:** Many roots of the large trees along the top of the bank are exposed. These trees could be threatened if the erosion here continues. It appears the grass is mowed all the way to the edge of the bank, which often leads to erosion.

**Potential Solution:** Allow a buffer of un-mowed vegetation to grow along the top of the bank. Some armoring of the toe would also help stabilize the bank.

Site Information	Estimated Annual Soil Loss	Severe Erosion Length	Typical Slope	Property Ownership	Atlas Page #	Photo #
	55 tons	154 feet	2.0 to 1	Private	171	788-795

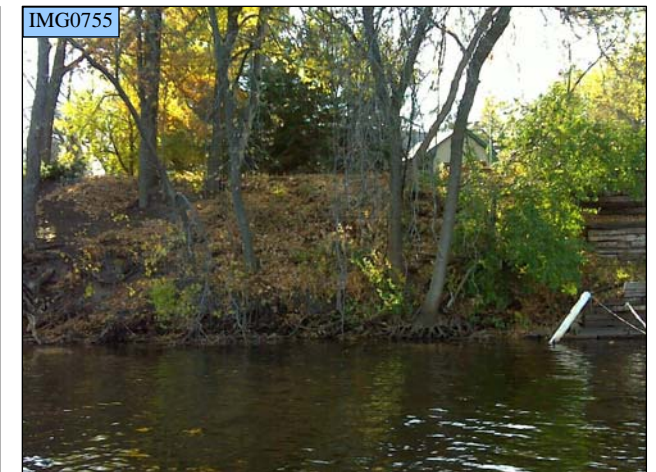


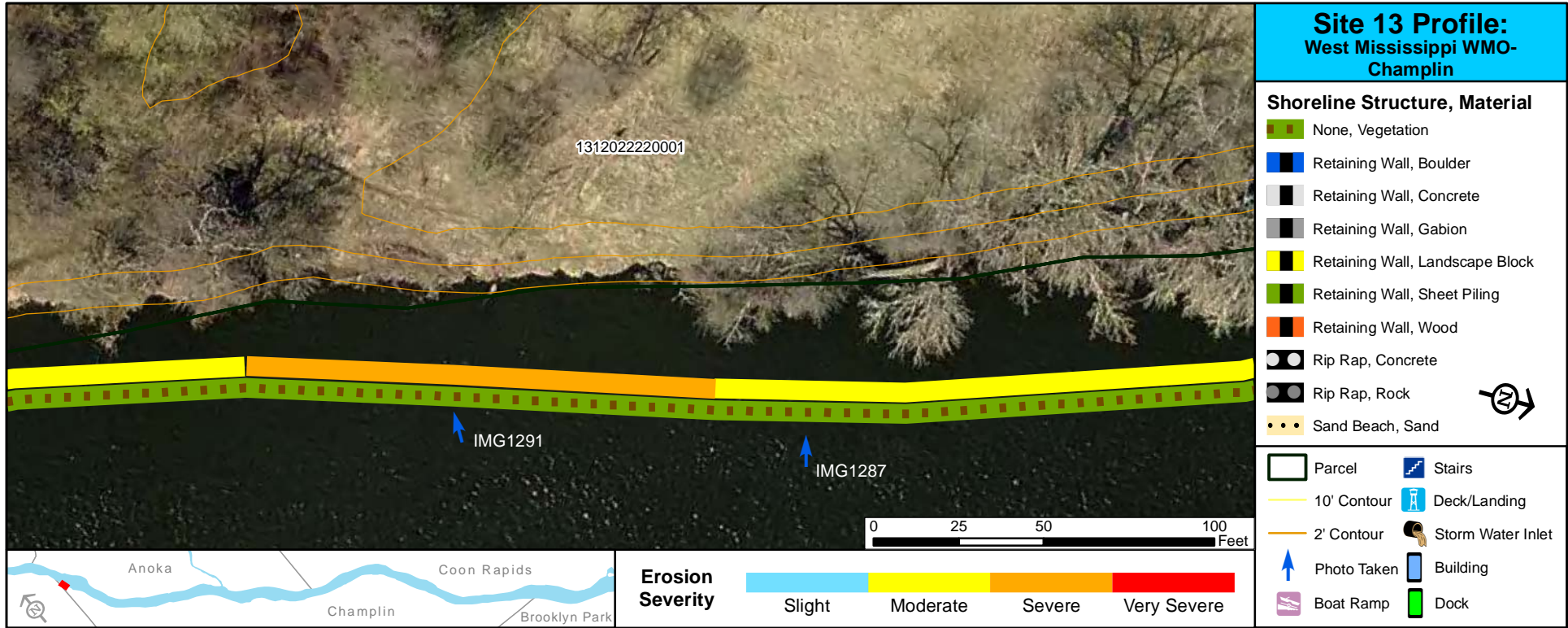


**Additional Info:** This site is marked by several slumping trees and a lot of exposed soil. These trees could be lost in a few years if the erosion continues. It appears the grass is mowed all the way to the edge of the bank, which often leads to erosion.

**Potential Solution:** Promote vegetation growth by thinning the tree canopy to allow more sunlight to reach the ground. Also allow a buffer of un-mowed vegetation to grow along the top of the bank.

Site Information	Estimated Annual Soil Loss	Severe Erosion Length	Typical Slope	Property Ownership	Atlas Page #	Photo #
	38 tons	67 feet	1.8 to 1	Private	166	754-756





**Additional Info:** This site is part of Donnie Galloway Park in Champlin. Most of the shoreline in this park is unprotected and eroding at least moderately. One large tree has fallen recently here and vegetative overhang is widespread. The bank is only a few feet tall, so the total soil loss here is not great.

**Potential Solution:** Because the site is not on a cut-bank, hard armoring may not be necessary. Instead, lining the bank with cut cedar trees might allow sediment to rebuild the bank. Planting native shrubs such as dogwood along the shore would help to hold the soil long-term.

Site Information	Estimated Annual Soil Loss	Severe Erosion Length	Typical Slope	Property Ownership	Atlas Page #	Photo #
	32 tons	138 feet	2.0 to 1	City of Champlin	116	1287-1294



