Temperance River State Park Vulnerability Assessment

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Temperance River State Park, Minnesota

Presented to

Minnesota Department of Natural Resources
Division of Ecological and Water Resources
Minnesota's Lake Superior Coastal Program

and

Department of Commerce
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EXECUTIVE SUMMARY

The Minnesota Department of Natural Resources (MN DNR), Minnesota Department of Transportation, and several coastal counties, cities, and towns manage public access sites along the coast of Lake Superior. These public access sites contain natural and built resources that are potentially vulnerable to lake level change and other natural hazards. To evaluate the vulnerability of these public access sites to natural hazards along the coast of Lake Superior, the MN DNR and the National Oceanic and Atmospheric Administration (NOAA) developed a vulnerability assessment protocol. The protocol standardizes the methodology and data utilized by site managers. The workflow and methods follow five main steps including exposure analysis, sensitivity analysis, potential impact analysis, adaptive capacity analysis, and vulnerability analysis.

This standardized protocol was utilized for a vulnerability assessment of the public access site assets at the Temperance River State Park (TRSP) between Schroeder and Tofte, Minnesota. The TRSP assessment identifies three site assets including the lower campground, a beach, and a retaining wall. The exposure analysis for the TRSP indicated all assets have a moderate exposure rank. The sensitivity analysis for the TRSP indicated the lower campground and retaining wall have moderate sensitivity while the beach has low sensitivity.

The potential impact analysis for the TRSP identifies the lower campground and retaining wall as having a moderate potential impact rank while the beach has a low potential impact rank.

Possible adaptive capacity measures were identified for the TRSP, including living shoreline engineering designs for the beach that facilitates the removal of the retaining wall to enhance the beach and better protect the lower campground.

The identified adaptive capacity strategies ultimately decrease the vulnerability rank of the lower campground from moderate to low, the beach from low to minimal, and the retaining wall from moderate to minimal.

The vulnerability assessment for the TRSP site and reduction of the vulnerability rank of the assets is dependent upon implementing the highest impact adaptive capacity strategies. The assessment was also based on a desktop analysis that could be further enhanced by site manager knowledge of the assets. This assessment can also be re-evaluated by site managers as necessary when adaptive capacity strategies are implemented or for any new assets that might be identified or built on the site. As new datasets become available or old datasets are updated, this new information can be integrated into the assessment.

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1.0 INTRODUCTION

Public access sites along the Lake Superior coast are vulnerable to fluctuating lake levels and other natural hazards. Temperance River State Park (TRSP) is no different. But how vulnerable is it?

To answer that question, the Minnesota Department of Natural Resources (MN DNR) and National Oceanic and Atmospheric Administration's Office for Coastal Management (NOAA OCM) followed a standardized process documented in "Vulnerability Assessment Protocol for Minnesota's Public Access Sites" (MN DNR and NOAA OCM 2022a). The five steps in the process as outlined in Figure 1 are:

1. Exposure Analysis (see Section 9, Glossary, for a definition of exposure)
2. Sensitivity Analysis (see Section 9, Glossary, for a definition of sensitivity)
3. Potential Impact Analysis
4. Adaptive Capacity Analysis (optional analysis based on site and asset[s])
5. Vulnerability Analysis

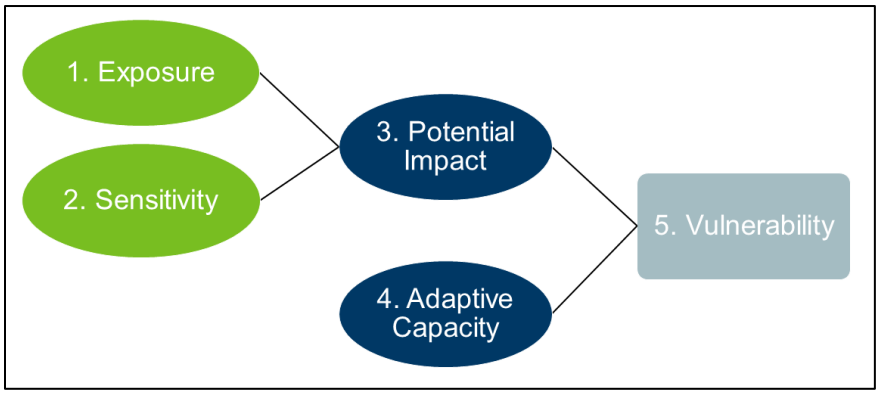

Figure 1. Vulnerability Analysis Process Adapted from Glick et al. (2011) and NPS (2016)

This report documents the findings. It is one of five pilot sites chosen for protocol application. For information about other sites or the protocol itself, contact mlscp.dnr@state.mn.us.

1.1 Site Background

TRSP is located along State Highway 61 between Schroeder and Tofte, Minnesota. The area became a state park in 1957 and features campsites on both sides of the river, numerous hiking trails and picnic areas, and beach access where the Temperance River meets Lake Superior (Figure 2).

Figure 2. Temperance River State Park Location Map

The TRSP assessment identified three site assets (Figure 2) including the lower campground, beach, and retaining wall (Table 1). The assets were mapped utilizing a geo-referenced PDF provided by the MN DNR available online at https://gdrs.dnr.state.mn.us/gdrs/apps/pub/us_mn_state_dnr/mndnr_geopdf_download/State_Parks/Temperance%20River%20GEO.pdf.

Table 1. Temperance River State Park Site Assets

Asset	ID	Measurement
Lower Campground	TR1	4.36 acres
Beach	TR2	0.34 acres
Retaining Wall	TR3	280 feet

1.2 Methods

To assess vulnerability at TRSP, the site assessor used the following data sources (MN DNR and NOAA OCM 2022b):

- Geographic Information Systems (GIS) data compiled by MN DNR (MN DNR, NOAA OCM, and Tetra Tech, Inc. 2021), and
- Publicly available GIS data.

The assessor used the information from these sources to answer questions in the protocol's accompanying spreadsheet (Appendix A). There was no site visit, and the assessor had no prior knowledge of the site.

Further detail regarding how to analyze and gather data for the assessment is provided in a separate document utilizing Flood Bay State Wayside as an example (MN DNR and NOAA OCM 2022c). The document provides step-by-step instructions on how to utilize ArcGIS or other software platforms to gather data for input to the spreadsheet.

2.0 EXPOSURE ANALYSIS

The exposure analysis for the TRSP assessment characterized exposure indicators for each of the assets including flooding, storm surge/seiche, lake level rise, historical flooding, erosion, geology, soils, and fish and wildlife habitat.

The flooding indicator analysis characterized:

- Federal Emergency Management Agency (FEMA) flood zones,
- Elevation data of the assets from 2012 light detection and ranging (LiDAR), and
- The elevation data compared to the 500-year flood elevation for Lake Superior.

The storm surge/seiche indicator analysis characterized:

- NOAA Cooperative Observer Program (CO-OP) water level data for comparison to the elevation of the asset,
- Lake Superior bathymetry slope data, and
- Fetch Exposure Index data.

The lake level rise indicator analysis characterized:

- NOAA CO-OP water level data historic minimum and historic maximums, and
- The difference in historic minimum and historic maximum in the NOAA CO-OP water level data compared to the elevation of the asset described above.

The historical flooding indicator analysis characterized:

- U.S. Geological Survey (USGS) stream gage and StreamStats data for streams at TRSP, and
- NOAA Advanced Hydrologic Prediction Service (AHPS) average annual precipitation data.

The erosion indicator analysis characterized:

- North Shore Erosion Mapping tool data from 2000, and
- Coastal Erosion Hazard Mapping (CEHM) data.

The geology indicator analysis characterized:

- Bedrock geology data from the Minnesota Geological Survey, and
- Surficial geology data from the Minnesota Geological Survey.

The soils indicator analysis characterized:

- The erosion factors data for Natural Resources Conservation Service (NRCS) mapped soils at TRSP, and
- North Shore Red Clay Soils data.

The fish and wildlife habitat indicator analysis characterized:

- Scientific and natural area data,

- State aquatic management area data,
- Native plant community data,
- Site of biodiversity significance data,
- National Wetland Inventory (NWI) data, and
- Wildlife management area data.

The results of the exposure analysis indicated all assets have a moderate exposure rank (Table 2, Figure 3). Full results of the exposure analysis are available in the provided TRSP vulnerability assessment spreadsheet (Appendix A).

Table 2. Temperance River State Park Exposure Analysis Results

Asset	ID	Exposure Score Sum	Exposure Score	Exposure Rank
Lower Campground	TR1	15	2.0	Moderate
Beach	TR2	19	2.0	Moderate
Retaining Wall	TR3	16	2.3	Moderate

All assets fall into the moderate exposure rank. Because the beach is low-lying elevation and the retaining wall is meant to protect the lower campground from eroding, the lower campground also had a moderate exposure rank. An "override" was utilized by the assessor for the beach and retaining wall for the flooding indicator because both assets are assumed to be equally impacted by flooding. The override was used to give the assets the same flooding indicator score. An override was also used by the assessor for the historical flooding indicator for the retaining wall because the assessor assumed the retaining wall was built to protect against flooding that had historically occurred. The same reasoning was used by the assessor for the erosion indicator for the retaining wall. The retaining wall also had an override for the fish and wildlife habitat indicator because, while the asset is located within fish and wildlife habitat polygons, it is not actually fish and wildlife habitat itself. Therefore, the fish and wildlife habitat exposure indicator was zero for this asset.

Figure 3. Temperance River State Park Exposure Analysis Results Map

3.0 SENSITIVITY ANALYSIS

The sensitivity analysis for the TRSP assessment characterized sensitivity indicators for each of the assets including flood damage potential, storm resistance and condition, historical damage, protective engineering, infrastructure, fish and wildlife habitat, climate, and water quality.

The flood damage potential indicator analysis characterized:

- FEMA flood zones,
- Elevation data of the assets from 2012 LiDAR,
- User input regarding whether the asset is currently elevated, and
- The elevation data compared to the 500-year flood elevation for Lake Superior.

The storm resistance and conditions indicator analysis characterized:

- User input regarding whether the asset has built resistivity to storms, and
- User input regarding whether the asset has natural resistivity to storms.

The historical damage indicator analysis characterized:

- User input regarding whether the asset has sustained damage in the past, and
- User input regarding the current maintenance level for the asset.

The protective engineering indicator analysis characterized:

- User input regarding whether the asset currently features protective engineering, and
- User input regarding the current condition of any protective engineering elements.

The fish and wildlife habitat indicator analysis characterized:

- Scientific and natural area data,
- State aquatic management area data,
- Native plant community data,
- Site of biodiversity significance data,
- NWI data, and
- Wildlife management area data.

The climate indicator analysis characterized:

- Increases or decreases in precipitation for the site compared to historic levels, and
- Increases or decreases in temperatures for the site compared to historic levels.

The water quality indicator analysis characterized:

- Invasive species (terrestrial and aquatic) data, and
- Buffer protection data for waterbodies on the site.

The results of the sensitivity analysis indicated the lower campground and retaining wall had a moderate sensitivity rank while the beach had a low sensitivity rank (Table 3, Figure 4). Full results of the sensitivity analysis are available in the provided TRSP vulnerability assessment spreadsheet (Appendix A).

Table 3. Temperance River State Park Sensitivity Analysis Results

Asset	ID	Sensitivity Score Sum	Sensitivity Score	Sensitivity Rank
Lower Campground	TR1	19	2.5	Moderate
Beach	TR2	13	1.8	Low
Retaining Wall	TR3	19	2.8	Moderate

The beach was ranked as low sensitivity while the lower campground and retaining wall are ranked as moderate sensitivity. The beach was low sensitivity because natural assets that have a natural resistivity make them better adapted to adjust to potential impacts. The lower campground and retaining wall are built assets that are more sensitive to potential impacts because they do not have natural resistivity like the natural assets. The assessor applied overrides in the sensitivity analysis for the retaining wall for the flood damage potential indicator because the assessor assumed flood damage potential was higher since the retaining wall had to be built. Similar to the exposure analysis, the assessor applied an override to the retaining wall for the fish and wildlife habitat indicator. While the asset is located within fish and wildlife habitat polygons, the asset is not fish and wildlife habitat. Therefore, the fish and wildlife habitat sensitivity indicator was zero for this asset.

Figure 4. Temperance River State Park Sensitivity Analysis Results Map

4.0 POTENTIAL IMPACT ANALYSIS

The potential impact analysis for the TRSP assessment characterized the results of the exposure and sensitivity analyses. The potential impact to the assets was calculated by averaging the exposure and sensitivity scores from the previous analyses. The results of the potential impact analysis indicated the lower campground and retaining wall had a moderate potential impact rank while the beach had a low potential impact rank (Table 4, Figure 5). Full results of the potential impact analysis are available in the provided TRSP vulnerability assessment spreadsheet (Appendix A).

Table 4. Temperance River State Park Potential Impact Results

Asset	ID	Exposure Score	Exposure Rank	Sensitivity Score	Sensitivity Rank	Potential Impact Score	Potential Impact Rank
Lower Campground	TR1	2.0	Moderate	2.5	Moderate	2.3	Moderate
Beach	TR2	2.0	Moderate	1.8	Low	1.9	Low
Retaining Wall	TR3	2.3	Moderate	2.8	Moderate	2.5	Moderate

At this point, the potential impact analysis can be used to characterize the vulnerability of the assets identified at TRSP. The following section (Section 5) presents potential adaptive capacity strategies to lower the vulnerability of the assets at TRSP. Adaptive capacity strategies identified in this document are conceptual and can be updated or removed as deemed necessary by the TRSP site manager.

Figure 5. Temperance River State Park Potential Impact Results Map

5.0 ADAPTIVE CAPACITY ANALYSIS

Based on the potential impact analysis previously described, adaptive capacity strategies for TRSP assets are identified below. Table 5 describes the general adaptive capacity strategy identified for each asset and provides more specific examples of the strategies.

Table 5. Temperance River State Park Adaptive Capacity Options

Asset	ID	Adaptive Capacity Strategy	Adaptive Capacity Strategy Example
Lower Campground	TR1	None	N/A
Beach	TR2	Protect/Engineer; Engineering Downgrade	Living shoreline design and removal of retaining wall
Retaining Wall	TR3	Decommission and Remove; Protect/Engineer	Remove retaining wall and implement living shoreline design to protect campground and beach

No adaptive capacity strategies were identified for the lower campground because the asset is dependent upon adaptive capacity strategies being utilized on the other two assets. Removal and decommissioning of the retaining wall and implementation of a living shoreline design would enhance the beach while also protecting the lower campground and reducing potential impacts.

6.0 VULNERABILITY ANALYSIS

This final vulnerability analysis for the TRSP site sums the potential impacts and subtracts the adaptive capacity scores. Based on the final vulnerability score for each asset, the asset was assigned to one of four categories: high vulnerability, moderate vulnerability, low vulnerability, or minimal vulnerability. By utilizing the adaptive capacity strategies described previously, the vulnerability of the beach and retaining wall can be reduced to minimal while the lower campground vulnerability can be reduced to minimal (Table 6, Figure 6). While the lower campground does not have any adaptive capacity strategies identified, implementing a living shoreline approach and removing the retaining wall would reduce the vulnerability of the asset by making the site as a whole less sensitive to potential impacts.

Table 6. Temperance River State Park Vulnerability Score and Rank

Asset	ID	Potential Impact Score	Potential Impact Rank	Adaptive Capacity Score	Vulnerability Score	Vulnerability Rank
Lower Campground	TR1	2.3	Moderate	0.4	1.9	Low
Beach	TR2	1.9	Low	1.9	0.0	Minimal
Retaining Wall	TR3	2.5	Moderate	2.5	0.0	Minimal

Figure 6. Temperance River State Park Vulnerability Rank Map

7.0 DISCUSSION

While Table 6 above shows the potential reduction of vulnerability of assets at TRSP, this reduction is dependent upon implementing the highest impact adaptive capacity strategies identified in Table 5. Site managers at TRSP may not have the ability to fund these options or may not be able to implement these actions in a timely fashion. This vulnerability assessment has also been performed as a desktop analysis without a visit to the site itself. Site managers should utilize the best available knowledge of the site and the knowledge of what adaptive strategies are most readily available or feasible in order to fully assess the vulnerability of the assets. As new datasets become available or old datasets are updated, it may behoove the site manager or others interested in the site to integrate it into the assessment. Furthermore, if adaptive capacity strategies are implemented on certain assets, the vulnerability assessment can be redone to update the vulnerability rank of the assets or of any new assets that might be identified or built at the site.

8.0 REFERENCES

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9.0 GLOSSARY

Exposure. The nature and degree to which a system is exposed to direct climate change impacts (Glick et al. 2011). For example, an asset that is sited well above a beach or riverbank will be less exposed to variations than an asset that is sited near the elevation of the lake or river.

Sensitivity. The degree to which a system is affected, either adversely or beneficially, when exposed to climate variations (Glick et al. 2011). For example, an asset with natural resistivity to climate change impacts like a wetland or unobstructed beach will be less sensitive to changes in lake level or storm damage than an asset with built features like a beach with rip rap or a parking lot that do not have natural resistivity to changes.

APPENDIX A: TEMPERANCE RIVER STATE PARK VULNERABILITY ASSESSMENT SPREADSHEET

Step 1. Exposure DATA			Flooding Indicator			Storm Surge/Seiche Indicator				Lake Level Rise	
ID	Asset	Site	FEMA Flood Data	LiDAR Elevation Data	Flood Elevation Data	NOAA CO-OP Data	Slope Data	Fetch Exposure Index Data	Elevation Data	NOAA CO-OP Data	Elevation Data
TR1	Lower Campground	Temperance River State Park	N/A	606.9	2.1	601.8	3.70	245532	5.1	3.616	1.5
TR2	Beach	Temperance River State Park	N/A	606.4	1.6	601.8	3.70	245532	4.6	3.616	1.0
TR3	Retaining Wall	Temperance River State Park	N/A	606.4	1.6	601.8	3.70	245532	4.6	3.616	1.0

Step 1. Exposure DATA			Historical Flooding Indicator		Erosion Indicator		Geology Indicator		Soils Indicator	
ID	Asset	Site	USGS Stream Gage Data	NOAA AHPS Data	Erosion Data	CEHM Data	Bedrock Geology Data	Surficial Geology Data	gSSURGO Data	North Shore Red Clay Soils Data
TR1	Lower Campground	Temperance River State Park	2120	30.7	High	Unknown	Basalt	Barnum Formation	0.15	N/A
TR2	Beach	Temperance River State Park	2120	30.7	High	Unknown	Basalt	Alluvium	0.28	N/A
TR3	Retaining Wall	Temperance River State Park	2120	30.7	High	Unknown	Basalt	Barnum Formation	0.15	N/A

Step 1. Exposure DATA			Fish and Wildlife Habitat Indicator					
ID	Asset	Site	Scientific and Natural Areas?	State Aquatic Management Areas?	Native Plant Communities?	Site of Biodiversity Signficance?	National Wetland Inventory?	Wildlife Management Area?
TR1	Lower Campground	Temperance River State Park	Yes	No	Yes	Yes	No	No
TR2	Beach	Temperance River State Park	Yes	No	Yes	Yes	No	No
TR3	Retaining Wall	Temperance River State Park	Yes	No	Yes	Yes	No	No

Step 1. Exposure Data Scores			Flooding Indicator						Storm Surge/Seiche Indicator						
ID	Asset	Site	FEMA Flood Score	LiDAR Elevation Score	Flood Elevation Score	Flooding Score	Override?	Flooding Score Final	NOAA CO-OP Score	Slope Score	Fetch Exposure Index Score	Elevation Score	Storm Surge/Seiche Score	Override?	Storm Surge/Seiche Score Final
TR1	Lower Campground	Temperance River State Park	0	1	1	1		**1**	2	2	1	1	2		**2**
TR2	Beach	Temperance River State Park	0	3	1	1	**2.0**	**2**	2	2	1	3	2		**2**
TR3	Retaining Wall	Temperance River State Park	0	2	1	1	**2.0**	**2**	2	2	1	2	2		**2**

Step 1. Exposure Data Scores			Lake Level Rise Indicator					Historical Flooding Indicator					Erosion Indicator				
ID	Asset	Site	NOAA CO-OP Score	Elevation Score	Lake Level Rise Score	Override?	Lake Level Rise Score Final	USGS Stream Gage Score	NOAA AHPS Score	Historical Flooding Score	Override?	Historical Flooding Score Final	Erosion Score	CEHM Score	Erosion Score	Override?	Erosion Score Final
TR1	Lower Campground	Temperance River State Park	3	1	2		**2**	1	3	2		**2**	4	0	2		**2**
TR2	Beach	Temperance River State Park	3	3	3		**3**	1	3	2		**2**	4	0	2		**2**
TR3	Retaining Wall	Temperance River State Park	3	2	3		**3**	1	3	2	**3**	**3**	4	0	2	**3**	**3**

Step 1. Exposure Data Scores			Geology Indicator					Soils Indicator				
ID	Asset	Site	USGS Bedrock Geology Score	USGS Surficial Geology Score	Geology Score	Override?	Geology Score Final	gSSURGO Score	North Shore Red Clay Soils Score	Soils Score	Override?	Soils Score Final
TR1	Lower Campground	Temperance River State Park	4	2	3		**3**	1	0	1		**1**
TR2	Beach	Temperance River State Park	4	3	4		**4**	2	0	1		**1**
TR3	Retaining Wall	Temperance River State Park	4	2	3		**3**	1	0	1		**1**

Step 1. Exposure Data Scores			Fish and Wildlife Habitat Indicator											
ID	Asset	Site	Scientific and Natural Areas Score	State Aquatic Management Areas Score	Native Plant Communities Score	Site of Biodiversity Significance Score	National Wetland Inventory Score	Wildlife Management Area Score	Fish and Wildlife Habitat Score	Override?	Fish and Wildlife Habitat Score Final	Exposure Score Sum	Exposure Score	Exposure Rank
TR1	Lower Campground	Temperance River State Park	4	1	4	4	1	1	3		**3**	**15**	**2.0**	**Moderate**
TR2	Beach	Temperance River State Park	4	1	4	4	1	1	3		**3**	**19**	**2.0**	**Moderate**
TR3	Retaining Wall	Temperance River State Park	4	1	4	4	1	1	3	**0**	**0**	**16**	**2.3**	**Moderate**

Step 2. Sensitivity DATA			Flood Damage Potential Indicator				Storm Resistance and Condition Indicator	
ID	Asset	Site	FEMA Flood Data	LiDAR Elevation Data	Asset Elevated?	500 Year Flood Potential?	Built Resistivity?	Natural Resistivity?
TR1	Lower Campground	Temperance River State Park	N/A	606.9	No	No	Yes	No
TR2	Beach	Temperance River State Park	N/A	606.4	N/A	No	No	Yes
TR3	Retaining Wall	Temperance River State Park	N/A	606.4	No	No	Yes	No

Step 2. Sensitivity DATA			Historical Damage Indicator		Protective Engineering Indicator		Infrastructure Indicator	
ID	Asset	Site	Historical Damage?	Current Maintenance Level Data	Protective Engineering?	Engineered Element Condition Data	Critical Infrastructure Present?	Infrastructure Protected?
TR1	Lower Campground	Temperance River State Park	Yes	Good	Yes	Good	Yes	Yes
TR2	Beach	Temperance River State Park	No	None	N/A	None	No	N/A
TR3	Retaining Wall	Temperance River State Park	Yes	Good	Yes	Good	Yes	Yes

Step 2. Sensitivity DATA			Fish and Wildlife Habitat Indicator					
ID	Asset	Site	Scientific and Natural Areas?	State Aquatic Management Areas?	Native Plant Communities?	Site of Biodiversity Signficance?	National Wetland Inventory?	Wildlife Management Area?
TR1	Lower Campground	Temperance River State Park	Yes	No	Yes	Yes	No	No
TR2	Beach	Temperance River State Park	Yes	No	Yes	Yes	No	No
TR3	Retaining Wall	Temperance River State Park	Yes	No	Yes	Yes	No	No

Step 2. Sensitivity DATA			Climate Indicator		Water Quality Indicator	
ID	Asset	Site	Precipitation Change Data	Temperature Change Data	Invasive Species?	Buffer Protection Data
TR1	Lower Campground	Temperance River State Park	0.29	0.21	Yes	None
TR2	Beach	Temperance River State Park	0.29	0.21	Yes	50 Foot Buffer
TR3	Retaining Wall	Temperance River State Park	0.29	0.21	Yes	50 Foot Buffer

Step 2. Sensitivity Data Scores			Flood Damage Potential Indicator							Storm Resistance and Condition Indicator				
ID	Asset	Site	FEMA Flood Score	LiDAR Elevation Score	Asset Structure Elevation Score	500 Year Flood Score	Flood Damage Potential Score	Override?	Flood Damage Potential Score Final	Built Resistivity Score	Natural Resistivity Score	Storm Resistance and Condition Score	Override?	Storm Resistance and Condition Score Final
TR1	Lower Campground	Temperance River State Park	0	1	4	1	2		**2**	1	4	3		**3**
TR2	Beach	Temperance River State Park	0	3	0	1	1		**1**	4	1	3		**3**
TR3	Retaining Wall	Temperance River State Park	0	2	4	1	2	**3**	**3**	1	4	3		**3**

Step 2. Sensitivity Data Scores			Historical Damage Indicator					Protective Engineering Indicator				
ID	Asset	Site	Historical Damage Score	Current Maintenance Level Score	Historical Damage Score	Override?	Historical Damage Score Final	Protective Engineering Score	Engineered Element Condition Score	Protective Engineering Score	Override?	Protective Engineering Score Final
TR1	Lower Campground	Temperance River State Park	4	2	3		**3**	1	2	2		**2**
TR2	Beach	Temperance River State Park	1	0	0.5		**1**	0	0	0		**0**
TR3	Retaining Wall	Temperance River State Park	4	2	3		**3**	1	2	2		**2**

Step 2. Sensitivity Data Scores			Infrastructure Indicator					Fish and Wildlife Habitat Indicator								
ID	Asset	Site	Critical Infrastructure Present Score	Infrastructure Protection Score	Infrastructure Score	Override?	Infrastructure Score Final	Scientific and Natural Areas Score	State Aquatic Management Areas Score	Native Plant Communities Score	Site of Biodiversity Significance Score	National Wetland Inventory Score	Wildlife Management Area Score	Fish and Wildlife Habitat Score	Override?	Fish and Wildlife Habitat Score Final
TR1	Lower Campground	Temperance River State Park	4	1	3		**3**	1	4	1	1	4	4	3		**3**
TR2	Beach	Temperance River State Park	0	0	0		**0**	1	4	1	1	4	4	3		**3**
TR3	Retaining Wall	Temperance River State Park	4	1	3		**3**	1	4	1	1	4	4	3	**0**	**0**

Step 2. Sensitivity Data Scores			Climate Indicator					Water Quality Indicator							
ID	Asset	Site	Precipitation Change Score	Temperature Change Score	Climate Score	Override?	Climate Score Final	Invasive Species Score	Buffer Protection Score	Water Quality Score	Override?	Water Quality Score Final	Sensitivity Score Sum	Sensitivity Score	Sensitivity Rank
TR1	Lower Campground	Temperance River State Park	4	2	3		**3**	4	0	2		**2**	**19**	**2.5**	**Moderate**
TR2	Beach	Temperance River State Park	4	2	3		**3**	4	3	3.5		**4**	**13**	**1.8**	**Low**
TR3	Retaining Wall	Temperance River State Park	4	2	3		**3**	4	3	3.5		**4**	**19**	**2.8**	**Moderate**

Step 3. Potential Impact

ID	Asset	Site	Exposure Score	Exposure Rank	Sensitivity Score	Sensitivity Rank	Potential Impact Score	Potential Impact Rank
TR1	Lower Campground	Temperance River State Park	2.0	Moderate	2.5	Moderate	2.3	Moderate
TR2	Beach	Temperance River State Park	2.0	Moderate	1.8	Low	1.9	Low
TR3	Retaining Wall	Temperance River State Park	2.3	Moderate	2.8	Moderate	2.5	Moderate

Step 4. Adaptive Capacity DATA								
ID	Asset	Site	1. Decommission and Remove	2. Elevate	3. Relocate	4. Protect/Engineer	5. Storm Resistant Design	6. Engineering Downgrade
TR1	Lower Campground	Temperance River State Park	No	No Elevating	No Relocating	N/A	N/A	N/A
TR2	Beach	Temperance River State Park	N/A	N/A	N/A	Living Shoreline	N/A	Yes
TR3	Retaining Wall	Temperance River State Park	Yes	N/A	N/A	Living Shoreline	N/A	N/A

Step 4. Adapt. Capacity Scores

ID	Asset	Site	1. Decommission and Remove	2. Elevate	3. Relocate	4. Protect/Engineer	5. Storm Resistant Design	6. Engineering Downgrade	Exposure Adaptive Capacity Score	Sensitivity Adaptive Capacity Score	Adaptive Capacity Score Sum	Adaptive Capacity Score
TR1	Lower Campground	Temperance River State Park	1	1	1	0	0	0	**1**	**0**	**1**	**0.4**
TR2	Beach	Temperance River State Park	0	0	0	4	0	4	**2**	**2**	**4**	**2.0**
TR3	Retaining Wall	Temperance River State Park	4	0	0	4	0	0	**2**	**1**	**4**	**4.0**

Step 5. Vulnerability Analysis

ID	Asset	Site	Exposure Score	Exposure Rank	Sensitivity Score	Sensitivity Rank	Potential Impact Score	Potential Impact Rank	Adaptive Capacity Score	Vulnerability Score	Vulnerability Rank
TR1	Lower Campground	Temperance River State Park	2.0	Moderate	2.5	Moderate	2.3	Moderate	0.4	1.9	Low
TR2	Beach	Temperance River State Park	2.0	Moderate	1.8	Low	1.9	Low	1.9	0.0	Minimal
TR3	Retaining Wall	Temperance River State Park	2.3	Moderate	2.8	Moderate	2.5	Moderate	2.5	0.0	Minimal