

Grand River Whitewater Park Preferred Alternative



June 2009

fic&h



JJR

OCBa



GREEN GRAND RAPIDS
SPECIAL STUDY
GRAND RIVER WHITEWATER PARK
PREFERRED ALTERNATIVE

PREPARED FOR:

CITY OF GRAND RAPIDS, MICHIGAN

JUNE 2009
PROJECT NO. G080058

“We are fully committed to a clean Grand River. Already the Grand is a top flight fishery; now imagine our river downtown with a kayak course, canoeing and pleasure boating. Think of the opportunities for development along the river with restaurants and cafes looking over the water while the river edges remain accessible for strolling in three seasons. The river has always been at the center of our community and, with its restoration it will again define us as the people of this place.”

~Mayor George Heartwell

January 2009, State of the City Speech

Special Thanks to:

Dyer-Ives Foundation
Grand Rapids Community Foundation
City of Grand Rapids Downtown Development Authority
Wege Foundation

TABLE OF CONTENTS

INTRODUCTION.....	1
BACKGROUND	1
RESEARCH DONE ON OTHER CITIES	2
OVERALL BENEFITS AND CHALLENGES	3
DEVELOPMENT OF CHOICES.....	3
Choice 1 - Enhance Rapids Downstream of 4th Street Dam.....	5
Choice 2 - Diversion Channel Parallel to River.....	5
Choice 3 - Partial Removal of Dam.....	6
Choice 4 - Remove Entire Dam and Replace with Constructed Rapids.....	6
EVALUATING THE CHOICES.....	6
PREFERRED ALTERNATIVE	7
Phase 1 Description	8
Phase 1 Social Benefits and Challenges	8
Phase 1 Environmental Benefits and Challenges.....	9
Phase 1 Economic Benefits and Challenges	10
Phase 2 Description	11
Phase 2 Benefits and Challenges	11
Conceptual Design of Phase 1.....	11
Conceptual Design of Phase 2.....	18
Maintenance	19
Costs	19
Funding Strategies	20
FUTURE WORK	20
LITERATURE CITED.....	25

LIST OF APPENDICES

Appendix 1	Comparison Chart of Existing Whitewater Parks
Appendix 2	Choices
Appendix 3	USGS Information
Appendix 4	Potential Access Site Characteristics
Appendix 5	Aerial and Bird's Eye views of Potential Access Sites
Appendix 6	Cost Estimates
Appendix 7	Funding Strategies
Appendix 8	Contact and Distribution List

INTRODUCTION

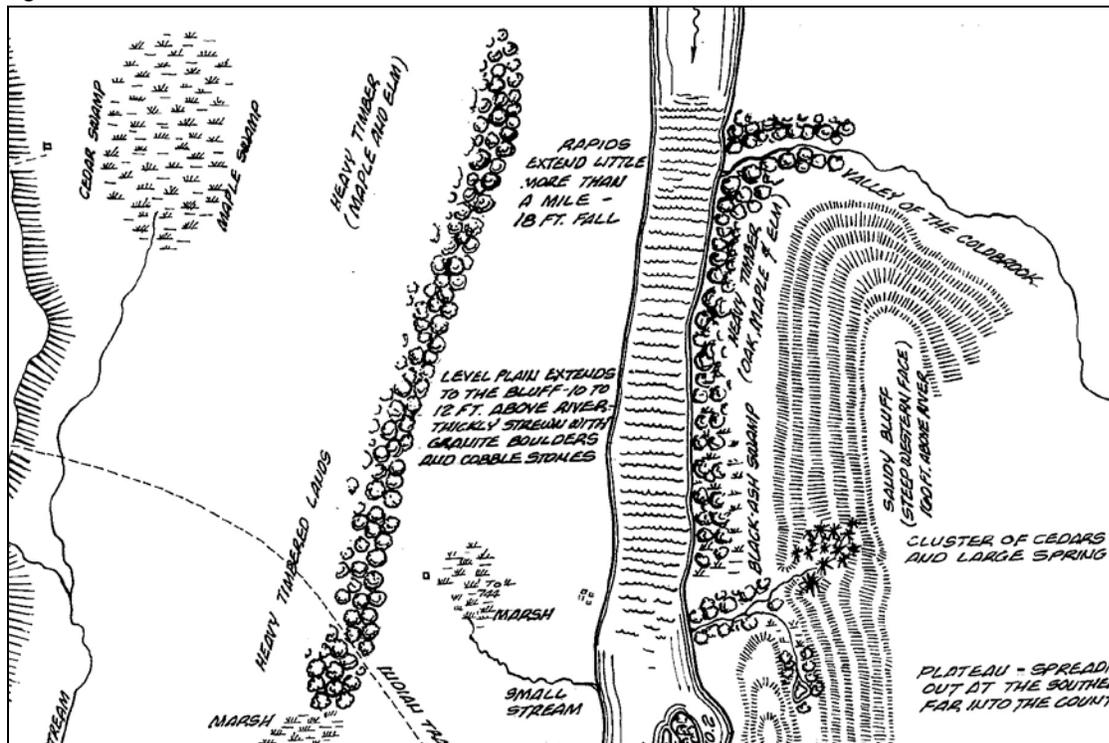
The Green Grand Rapids process, undertaken in 2008-09, serves to update the City of Grand Rapids' city-wide *Master Plan* and the *Parks and Recreation Master Plan* by addressing a range of green infrastructure issues. Several special studies were conducted to illustrate the application of draft Green Grand Rapids recommendations including concept plans for three parks and concepts for expanding recreational opportunities along the Grand River.

This report describes the process and outcomes of the river recreation opportunity special study that addresses the possibility of creating a river "rapids" run for canoes and kayaks in the downtown reach of the Grand River. The idea for restoring the rapids of the Grand River is not new. Grand Action, a non-profit organization of 250 community leaders, began investigating the possibility of restoring the rapids and creating a kayaking course in 2007. A binder of kayaking information was assembled by Grand Action on events and rules, 2008 Olympics, organizations in Michigan and other states, and pictures from other cities that had built courses, now commonly known as Whitewater Parks. The construction of these courses has increased exponentially in the past few years, as indicated by the comparison chart in Appendix 1.

BACKGROUND

Prior to the European settlement of the City, the Grand River ran through small villages, swamps, valleys and bluffs, with over a mile of rapids cascading over an 18-foot fall (Figure 1). This natural condition of the river would be impossible to replicate now, due to the numerous modifications made to the river since then, but the possibility of returning some rapids to Grand Rapids has sparked significant interest.

Figure 1 – Historical Natural Condition of the Grand River



Source: Mapes & Travis. 1976. Pictorial History of Grand Rapids.



The 4th Street dam is located on the Grand River, just upstream from Grand Rapids' downtown area. The original dam was constructed in 1866, possibly to generate power for street lights, but more likely to provide water volume and grade necessary for transportation and manufacturing purposes for the furniture industry. At one point in its history, a sixteen-foot gap furnished enough space for rafts of logs to pass over the dam and down the narrow channel in the rapids (Mapes and Travis, 1986). The dam was reinforced through the years, and is now considered a cast in place concrete gravity dam. Immediately upstream of the dam is a navigable river. The 100-year flood levels above the dam are about 1 foot higher than they would be without the dam.

The condition of the dam appears to be structurally sound. A portion of the dam was removed in the mid-1990s at 6th Street Park to install a storm sewer. That portion of dam was in excellent condition. The need for major repair in the near future is not anticipated.

Five "beautification" dams were installed downstream of the 4th Street dam, shortly after the dam's construction, to maintain even river depth during low and normal river flows.

Although the dam currently has no specific purpose, it does have unintended consequences. The dam supports an important urban fishery, particularly during steelhead and salmon runs. The fish are temporarily concentrated at the dam as they work their way up the Fish Ladder, which is a concrete and steel structure, built by the Michigan Department of Natural Resources (MDNR) in 1974 on the west side of the river. This functional piece of artwork, designed by the artist Joseph Kinnebrew, is the focal point of Fish Ladder Park. Its design allows migrating fish to circumvent the dam and provides visitors a viewing point to watch fish jump up the "ladder" in the spring and late summer. (www.sculpturesitesgr.org). The Fish Ladder is important for tourism. This location is also a popular destination for fishermen.

RESEARCH DONE ON OTHER CITIES

A literature review of publications and case studies on the development of whitewater parks within cities across the nation was conducted to explore a range of options for creating a Grand River "rapids" run. Appendix 1 lists the locations, physical characteristics, cost, and contact information for these whitewater parks. The parks range from carefully placed, native boulders within an existing channel to the first man-made whitewater rafting course in the country where water flow is regulated for beginners and advanced paddlers.

Several examples from other cities are applicable to Grand Rapids and the Grand River, such as:

- Avon Whitewater Park in Colorado offers a spectator viewing terrace and large flat boulders along the river's edge for seating.
- The boat ramp at Buena Vista Park in Colorado provides easy access to large eddies and is a popular put-in and take-out. A river trail enables the paddlers' friends (or dogs) to follow them down stream.
- Lyons Playpark, just outside of Boulder, Colorado, also includes restrooms and a ball field.
- Pueblo Park, Colorado, is within walking distance of shops and restaurants in the Historic Downtown District.
- The East Race in South Bend, Indiana was integrated with an existing fish ladder and is a downtown tourist attraction.
- In Williamston, Michigan, a dam was removed and a new whitewater park, constructed along the Red Cedar, has brought boaters to dine in town and patronize other local businesses.

- Stonycreek Whitewater Park in Johnstown, Pennsylvania, includes stream bank improvements, such as bank regrading and restoration (i.e. re-vegetation, vegetated terraces, boulder toe, seating areas), and improved river access (i.e. put-ins and take-outs and a gravel river trail).
- The City of Flint, Michigan, recently approved the completion of an initial site survey, including conceptual designs and plans, to replace the Hamilton Dam with a whitewater rapids.



Example of how modifications to incorporate whitewater play features would optimize the site for recreational paddling. Strategic boulder placements are designed to be functional during low flow periods and to withstand major floods and ice floes, while maintaining the water retention function of the dams.

OVERALL BENEFITS AND CHALLENGES

The overall benefits and challenges in creating a canoe/kayak “rapids” course are summarized below.

Benefits

- Create a recreational amenity on the Grand River that is attractive to both users and spectators.
- Improve accessibility and safety for the fishermen and other river users.
- Enhance the environment along the river banks.
- Serve as catalyst for economic development by attracting users/visitors to the downtown area.

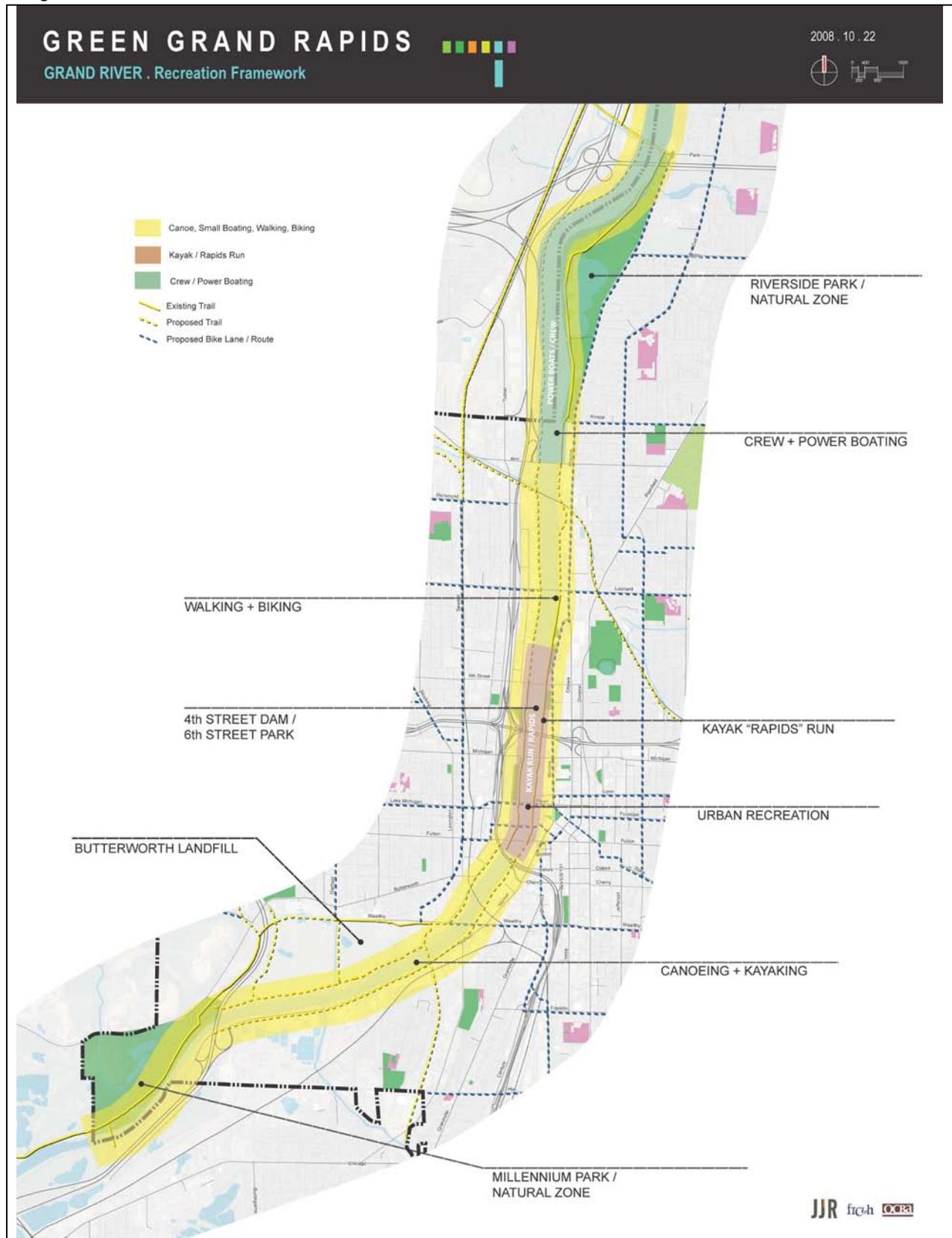
Challenges

- Cost of construction, maintenance, and operation.
- Balancing different interests.
- Estimating a potential return on investment.
- Minimizing the potential impact on flood levels and downstream flooding from placing boulders in the river.

DEVELOPMENT OF CHOICES

One of the first tasks of this study was to assess existing recreational uses/zones on the Grand River. This allowed the project team to identify important stakeholders who needed to be involved in this special study. Figure 2 illustrates the different zones of activity on the River and identifies potentials for expanding river-related recreation opportunities; including a Kayak “Rapids” Run area extending from the 4th Street dam/Sixth Street Park through the downtown area.

Figure 2 – Recreation Framework



An initial Focus Group meeting to discuss river recreational opportunities was held on October 21, 2008. The group explored what other cities have done to increase river usage within downtown areas and identified diverse users to involve in the project, such as fishermen, boaters, business owners, and environmental organizations. A mailing list was created and has been continually updated through the planning process. In addition, a breakout session was held during the Green Gathering #2 (October 2008) to discuss recreational opportunities. Participants identified the creation of a canoe/kayak course in downtown or Monroe North area as a top priority. Other priorities included adding waterfront parks and trailway links to Riverside Park and Millennium Park.

A matrix was created to describe four choices for the configuration of a kayak/canoe course. The matrix listed the design considerations, benefits, challenges, and cost magnitude for each choice. This matrix is included in Appendix 2. The four choices are summarized and illustrated below using photo examples from other cities:

CHOICE 1 - ENHANCE RAPIDS DOWNSTREAM OF 4TH STREET DAM



- Construction occurs south of 4th Street dam downstream to Fulton Street
- Access sites provided on east and west side of river
- Portage route constructed around 4th Street dam

CHOICE 2 - DIVERSION CHANNEL PARALLEL TO RIVER



- Construction concentrated in areas parallel to river on east side (Sixth Street Park) or west side (Fish Ladder)
- Access sites in constructed channel parallel to the river, and upstream and downstream of dam

CHOICE 3 - PARTIAL REMOVAL OF DAM



- Construction concentrated at 4th Street dam area
- Access sites immediately upstream and downstream of dam/rapids
- Portage route constructed around dam/rapids, both sides of the river desired

CHOICE 4 - REMOVE ENTIRE DAM AND REPLACE WITH CONSTRUCTED RAPIDS



- Construction concentrated at 4th Street dam area
- Access sites immediately upstream and downstream of rapids
- Portage route around rapids, both sides of the river desired

EVALUATING THE CHOICES

A workshop held on January 14, 2009, attracted over 80 people from a variety of interest groups to review and discuss these choices. Breakout groups reviewed criteria for evaluation and provided a priority ranking of the choices as the basis for selecting a preferred alternative.

The evaluation criteria included costs (construction, operations and maintenance), revenue potential (user fees, concessions, and equipment rentals), technical feasibility, nature of river experience/user appeal (length of run, challenge level, and the potential for creating a Heritage Water Trail), fishing impacts (habitat enhancements, access points), safety concerns (boaters, fishermen), land use (loss of existing parks/amenities, addition of parks/river access), water issues (water quality, changes in water levels), and hydropower potential, (demonstration site, alternative energy portfolio).

Eight breakout groups reviewed the choices, discussed and added to the evaluation criteria, individually ranked choices, and then pooled the rankings to define the overall group ranking. Reporters from each

group shared their group's rankings and provided an overview of topics discussed as groups tried to come to a consensus.

The meeting resulted in the choices being ranked as follows:

#1 Ranking: Choice 1 - Enhance Rapids Downstream of 4th Street Dam

#2 Ranking: Choice 3 - Partial Removal of Dam

#3 Ranking: Choice 2 - Diversion Channel Parallel to River

#4 Ranking: Choice 4 - Remove Entire Dam and Replace with Constructed Rapids

The groups ranking and results are illustrated below:

Evaluation Criteria Ranking (rank criteria for each choice)	Choice 1 downstream enhancement	Choice 2 diversion channel	Choice 3 partial dam removal	Choice 4 entire dam removal
Group 1	++	xx	xx	xx
Group 2	xx	++	0	xx
Group 3	+	x	++	xx
Group 4	+	xx	++	x
Group 5	x	+	+	xx
Group 6	++	xx	0	0
Group 7	++	+	+	xx
Group 8	+	++	+	xx

	Rank by:	
"++"	most positive	Green
"+"	positive	Blue
"0"	neutral	Yellow
"x"	negative	Orange
"xx"	most negative	Red

PREFERRED ALTERNATIVE

The preferred alternative is a hybrid of the choices discussed at the January workshop and can be constructed in phases. The preferred alternative keeps the 4th Street dam intact to reduce overall costs, avoid possible environmental hazards from the release of contaminants behind the dam, minimize the disruption of the existing fishing experience at the dam and maintain upstream water levels as they are today. As an initial step, the rapids experience downstream of the dam would be improved by reconfiguring the five existing "beautification" dams. The second step of the first implementation phase would include the construction of a portage around the 4th Street dam and the addition of access sites for the put-in and take-out of canoes and kayaks. In the second construction phase, a white water rapids would be constructed by keeping the dam intact and creating a step-like rapids on its downstream side.

A more detailed description of the two phases of the preferred alternative, and their benefits and challenges, is provided below.

PHASE 1 DESCRIPTION

Task 1: Keep the 4th Street dam intact. Modify the five downstream “beautification” dams to provide an exciting and safe rapids run for kayaks and canoes through downtown. Create wave areas where kayaks can complete maneuvers designed for beginner and intermediate paddlers. The reconstructed rapids would create new pools and eddies for holding fish and riffles for fish spawning habitat. The breaks on the west sides of the beautification dams would be maintained to allow power boats to access upstream fishing areas. Rescue ladders would be added to existing flood walls.

Task 2a: Create the shortest possible portage route, around 4th Street dam, on the east side of river to allow paddlers full use of river with minimal portage requirements. Construct landing at south end of floodwall above the dam and connect to path in Sixth Street Park to allow paddlers to exit river and portage around dam. Modify Sixth Street boat ramp, just below the dam, to improve safety for small water craft to re-enter the river.

Task 2b: Provide additional access sites for put-in and take-out. Provide free portaging tools (carts/wheels) or shuttle services (possibly provided for a fee by outfitters) at certain designated times during the peak use periods. Develop water trail educational materials, similar to Downtown’s current and the proposed Riverwalk “Wayfinder” signs. Produce information on “how to use the river”, including information about parking areas, access sites, portage route, mile markers, natural features, man-made highlights, with accompanying brochures, websites, and directional signage. Initiate process to involve the Grand River in the State’s Heritage Water Trail program.

PHASE 1 SOCIAL BENEFITS AND CHALLENGES

Benefits

Whitewater parks are gaining popularity across the country as integral components of urban riverfront redevelopment. They enhance recreation opportunities, provide convenient venues for whitewater competitions and connect the city’s residents to its natural resources. The term “park” is used because the whitewater activity is not associated with “running a river.” Instead, the focus is on “playing” or practicing at specific locations where hydraulic features have been engineered and constructed within the stream channel to support various whitewater maneuvers. A park’s main purpose is to provide easily accessible whitewater recreation within reasonable driving distance from population centers. Whitewater parks are used for a variety of activities including slalom racing and other river-based competitions, company outings, sports training, and boating instruction. In addition to recreational use, a site can also be used by search and rescue teams as a training facility for river rescue exercises.

Public art could be an integral part of the project. The Fish Ladder is an example of functional public art, and other ideas, such as murals on floodwalls and bridge abutments, should be included in future planning. Indeed, the incorporation of public art can enhance the potential to attract project funding.

Social benefits related to completing just Phase 1 of the project include:

- Increasing opportunities for boater access to, and use of, the river.
- Creating a long run that provides a safe whitewater experience.
- Providing paddling opportunities for a broad range of skill levels and challenges.

- Minimizing disruption to fishing at the 4th Street dam.
- Avoiding boater/wader conflicts by keeping the paddlers downstream of the dam.
- Increasing fishable areas and wading areas by adding more boulders and step-type access areas to disperse fishing activity over a greater length of the river.
- Improving aesthetics by removing the straight-line dams and returning the river to a more natural condition with placed boulders.
- Maintaining the area above the 4th Street dam as a well-known urban center for crewing and water skiing (no changes to water level).

Challenges

Fishing in Grand Rapids is part of its vibrant local culture. The Grand Rapids/Kent County Convention & Visitors Bureau website, www.visitgrandrapids.org, quotes from *Field & Stream* Magazine, which named Grand Rapids the nation's sixth best fishing city, "You can hook a salmon and steelhead in the middle of downtown, and the outlying rivers and lakes are teeming with other freshwater species."

Developing a rapids course that accommodates both fishing and padding enthusiasts is possible, but will be one of the most challenging tasks. Additional parking may be needed to accommodate fishermen, paddlers, and activity spectators. Other social challenges to consider in Phase 1 include:

- Maintaining the break in the "beautification" dams to allow boats to climb the rapids to the waters below the dam, as they power upstream from Johnson Park.
- Designing the rapids to eliminate the dangerous "boils" right below the Michigan/Bridge Street "beautification" dam.

PHASE 1 ENVIRONMENTAL BENEFITS AND CHALLENGES

Benefits

The City of Grand Rapids understands the value of protecting natural resources and promoting stewardship of the environment. The development of a whitewater park could support that commitment by bringing residents and visitors into closer contact with the Grand River ecosystem. In addition, whitewater features can be constructed to increase fish habitat providing more areas to spawn. Recent research has shown that salmonids, which include salmon and trout, may increase in abundance in response to placements of instream structures (McGrath, 2003). Whitewater parks are often incorporated into larger river restoration projects aimed at enhancing the ecological value of river corridors. The Heritage Water Trail program, coordinated through Western Michigan University, has created cultural and historical interpretive and informational signs to increase stewardship of the river. The Grand River could join other rivers in Michigan in this program. Efforts have already begun in the Upper Grand River portion, from Jackson to Lansing.

Environmental benefits specific to completing Phase I project include:

- Strategically placing boulders to increase fish habitat, creating pools and eddies to hold fish and riffles for spawning.
- Avoiding any impacts related to the release of contaminated sediments associated with dam removal.
- Keeping open the option of using the 4th Street dam as hydropower demonstration site.

Challenges

The design of Phase 1 must ensure minimal disturbance of the natural fish habitat, especially to fish passage routes and spawning areas. New put-in/take-out access points must also be designed to protect against riverbank erosion. In addition, an anticipated overall increase in the number of people visiting the downtown riverfront may create more wear and tear on the riverwalk and riverfront parks.

PHASE 1 ECONOMIC BENEFITS AND CHALLENGES

Benefits

A whitewater feature on the Grand River is likely to attract an influx of kayakers and paddling enthusiasts from West Michigan and beyond, visiting the rapids every day during the summer. On weekends, large crowds could visit the park to paddle, fish or just to watch.

Downtown Grand Rapids already possesses the infrastructure in the form of hotels, restaurants, and entertainment necessary to capitalize on the expected increase in whitewater visitors. Vail Whitewater Park in Vail, CO drew an estimated \$1.4 million in extra spending during a 5-day competition. Economic impact studies show that several whitewater parks have brought an average of \$2 million per year of economic impact into the local economy (Bardstown Whitewater River Park Report). Because Grand Rapids is located in a region that is relatively devoid of whitewater, a tremendous opportunity exists to attract users who would otherwise have to travel significant distances for reliable whitewater facilities and competitions.

A recent Outdoor Industry Association survey showed 6.4 million Americans kayaked in 2000, a 50% increase in two years. And the number of kayaking "enthusiasts" - those who kayaked at least 10 times per year increased 150% over the same period. ([Joe Miller, "Whitewater Parks Offer Thrilling Turn in City Planning" Newsobserver.com](#))

Phase 1 economic benefits include:

- Creating an opportunity to measure public interest and to assess the cost-benefit of whitewater improvements before embarking on Phase 2 of the project.
- Attracting paddlers, spectators and their spending money to downtown Grand Rapids.
- Providing business opportunities for food vendors, equipment rentals and shuttle system.
- Providing new potential partnerships with environmental and conservationists groups.
- Tie-ins with downtown festivals (Run through the Rapids, Celebration on the Grand, and Labor Day Bridge Walk).
- Avoiding any disruption of tourism at the fish ladder since Phase 1 construction will be downstream of the area.
- Avoiding reductions in upstream water levels to maintain other recreational uses (e.g., regattas) that provide revenue to local businesses.
- No water control features need to be regulated, since a separate diversion channel is not being constructed, which often requires significant funding committed to maintenance.

Economic Challenges

Funding is perhaps the greatest economic challenge given the City's constrained fiscal outlook. Recurring maintenance costs are also an important consideration. A great concern voiced during the focus groups was to design the rapids to minimize potential ice damage to the constructed rapids and the need to use city funds to "fix" the rapids every spring. A variety of funding sources may need to be

assembled (see Appendix 5). With an estimated cost of \$1.2 million, Phase 1 of the preferred alternative will provide a reasonably priced foundation for measuring interest and assessing the cost-benefit of whitewater improvements.

PHASE 2 DESCRIPTION

On the east side of the river, create a stair step type rapids from top of the 4th Street dam downstream to make several shorter drops spread out over a greater distance, preferably toward the east side of the dam, keeping the height of the dam intact. Add rescue ladders on the east side floodwalls. Ensure proper design of the necessary structures to prevent lamprey from migrating upstream. Modifications to the downstream area could also reduce existing fishing hazards on the river bottom and the undertow at the base of the dam.

PHASE 2 BENEFITS AND CHALLENGES

The benefits of continuing with the construction of Phase 2 of the preferred alternative include most of those listed for Phase 1. In addition, however, the creation of a more challenging rapids course would likely:

- Attract paddlers from beyond the region.
- Provide opportunities for whitewater competitions and training courses that could benefit local outdoor businesses.
- Improve fish habitat by allowing them to naturally swim upstream to spawn.

The greatest challenges presented by the construction of Phase 2 include:

- Minimizing conflicts between paddlers going over the rapids at the 4th Street dam and fishermen, especially during the spring and fall salmon runs.
- Controlling lamprey from migrating upstream - The MDNR and the Ludington Biological Station advise that any proposed structure must have at least a 18-24" vertical drop with a metal lip on the top to prevent lamprey migration.
- Designing modifications to the dam so that dangerous pools and undertow are eliminated for the safety of paddlers and fishermen.
- Prevent unsuspecting or novice kayakers from going over the unmodified part of the dam.
- Maintaining use of access sites at dam for power boats.

CONCEPTUAL DESIGN OF PHASE 1

The location for Phase 1, Task 1 of the project is below the existing 4th Street dam. The 4th Street dam is just north of the I-196 overpass. Figure 3 illustrates the extent of the project.

Figure 3 – Phase 1, Task 1, Dam Modifications



Whitewater structures are typically built using boulders, strategically designed and placed in the river to mimic natural morphology and create features in which kayaks and canoes can perform maneuvers.

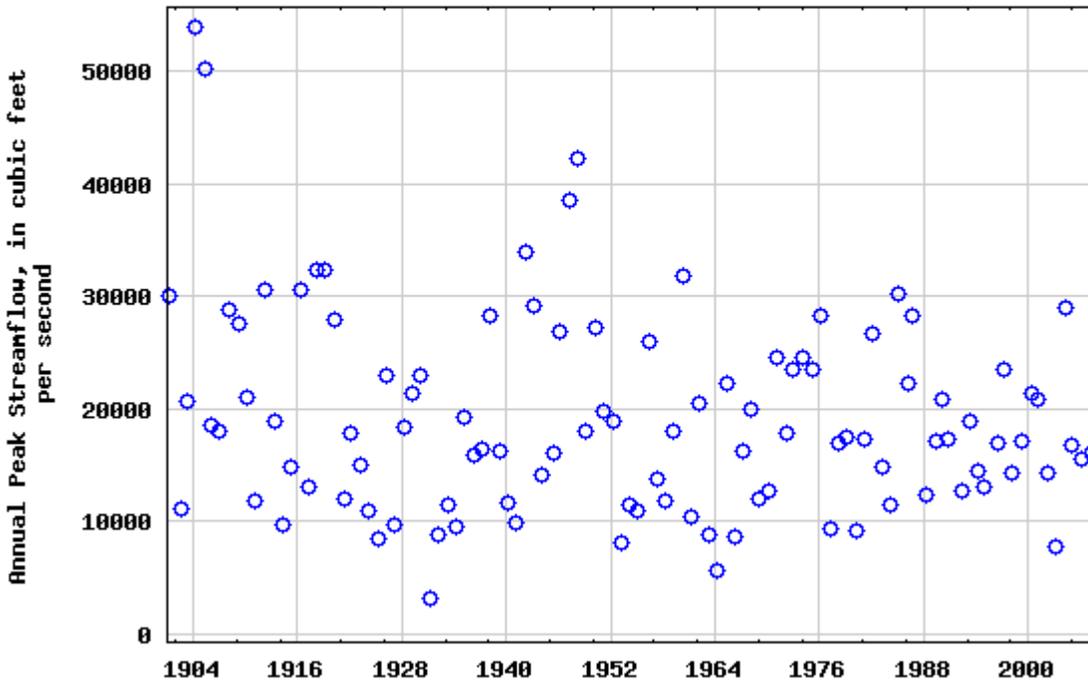
Figure 4 illustrates the concept of dam modification to create these features. These maneuvers include moves such as front and side surfing, cartwheeling, throwing ends, blunt moves, spoofing and splatting, flat spinning, loops, and front flips (REP Feasibility study). Boulders placed to create “U” drop structures create waves, holes, and plunge pools. Deflectors off the banks redirect fast flowing water to channel areas to create eddies along the banks. Different structures are selected to create specific hydraulic features for low, medium, and high flows.

Figure 4 – Profile of Dam Modifications for Navigability and Habitat Improvements

During the Phase 1 design stage, the potential impact of placing boulders in the river on flood levels and downstream flooding must be explored. A design that minimizes any potential downstream impacts is clearly preferred. The design must also take ice floes and potential ice damage into consideration.

Monthly mean flows at this site vary from 1,732 cfs in the summer dry month (August) to 7,579 cfs in the early spring (March) with an annual mean of 3,789, averaged from flows recorded since 1904. The lowest daily mean flow, 381 cfs, occurred in August 1936. The highest daily mean flow, 53,300 cfs, occurred in March 1904. Appendix 3 includes more statistics from USGS that are important for the design of the rapids. Annual peak flows are shown in the USGS graph below. Studies show that this is sufficient flow to support a recreational use.

USGS 04119000 GRAND RIVER AT GRAND RAPIDS, MI



Source: http://nwis.waterdata.usgs.gov/mi/nwis/nwisman/?site_no=04119000&agency_cd=USGS

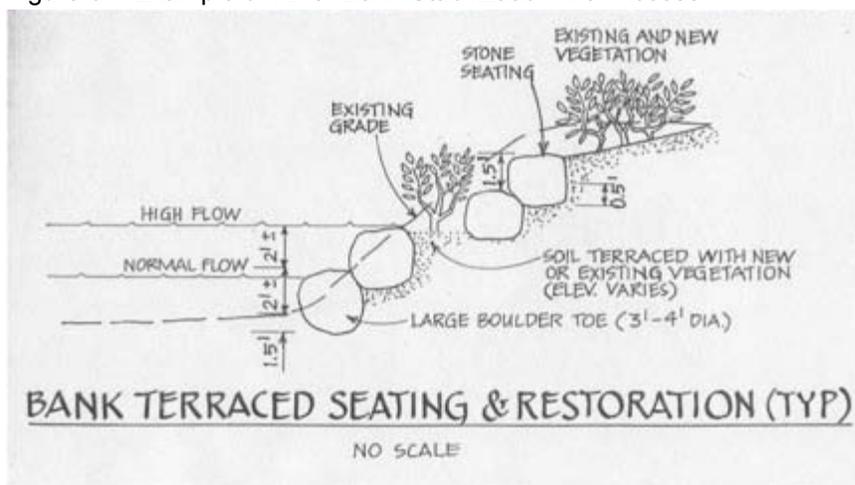
Accessibility

Users of the river need safe areas to put in and take out their watercraft. Figure 5 presents several options for access sites that could be improved or created. Appendix 4 lists the location of the sites, the landowners of those sites, and the attributes associated with each site. Each site has been designated as either a short-term or long-term opportunity for expanding paddlers’ access. Short-term sites are those already owned by the City and not in need of many modifications to become a launch site for small watercraft. Long-term sites would require the City to purchase the site, or an easement, or require significant modifications for the public to be able to use the site. Appendix 5 provides aerial and bird’s eye views of the proposed access sites and depictions of how those sites could be renovated.

Access sites should be equipped with certain amenities, such as parking, viewing areas, restrooms, trash receptacles, and emergency phones. Every access point does not have to have every feature, but these features should be strategically distributed among the access points to provide the greatest benefit to the users while maintaining reasonable construction and site maintenance costs.

In association with the creation of new and improved access sites, Phase 1 of the project would include the naturalization of the adjacent riverbank, bank stabilization, and revegetation. Banks in these areas should be terraced, re-graded, and reshaped to prevent erosion and provide viewing areas, as well as river access. Figure 6 presents an example of a riverbank stabilization technique that includes seating for viewing and steps for access.

Figure 6 – Example of River Bank Stabilization with Access



Source: Avon Whitewater Park

Not all of the proposed access sites are currently owned by the City; as a result, strategies to make those sites available will need to be developed. Other cities have used river overlay districts that contain easements for river access and/or agreements with the landowners for that use. For example, Philadelphia is proposing guaranteed public access to the Delaware River by passing a zoning requirement that all new developments must provide convenient, safe public access to the river from the nearest public street. The incentives include expedited building permits, tax deductions, and payments from a conservation easement (<http://www.planphilly.com/node/3297>).

The focus group and workshop participants stressed the importance of having an easy-to-use portage around the 4th Street dam to facilitate use of the river and avoid the danger of going over the dam. The portage should create a short, easy way to carry watercrafts around the dam. Suggestions included making free portaging tools available, such as wheeled carts, to pull along a path; provide shuttle services (provided for a fee by outfitters) at certain designated times during the peak use periods; and creating more access points to minimize the length of portage and offer choices for lengths of river runs.

The most logical portage route would follow the path within Sixth Street Park (Figure 7). The take-out point would be at the end of the floodwall (Site #6E), and the put-in would be at the existing boat ramp on the east side of the river just below the dam (Site #7E). Signs identifying the access sites, the distance to next site, and the approximate time in reaching those sites could be created consistent with the existing wayfinding signs in the downtown area and those proposed for the Riverwalk.

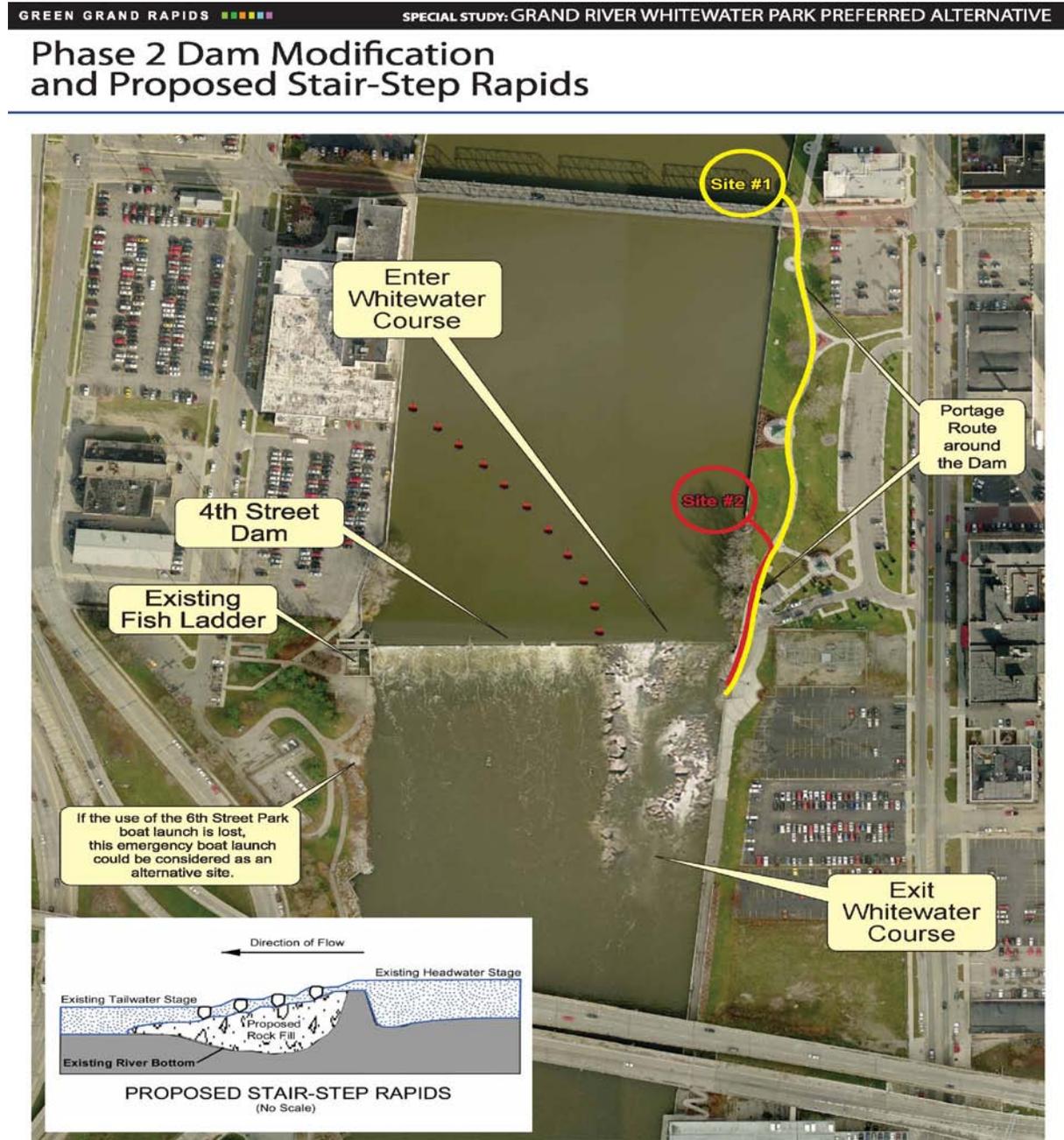
Figure 7 – Portage Around the Dam



CONCEPTUAL DESIGN OF PHASE 2

An aerial view of the extent of Phase 2 of the project is illustrated in Figure 8. The water surface elevation above 4th Street dam will be maintained to allow continued use of that portion of the river for rowing, water skiing, jet skiing, and to keep personal docks in use.

Figure 8 – Phase 2, 4th Street Dam Modification



The white water portion would add larger, hydraulic fall features to the downstream side of the dam, enhancing the experience provided by the smaller, Phase 1 downstream rapids. The fall created by the approximate 8-foot drop at the dam would be spread among 3 or 4 whitewater features to create drop structures each having a hydraulic fall of 2 to 3 feet. The structures would be designed to function at average river flows. They would also be carefully designed to maintain the river's ability to pass normal flood events. Redistributing the fall through several structures allows a longer reach and a more gradual transition along the river to the next rapids. Constructing several structures also allows them to be designed for different levels of paddling abilities.

The preferred alternative envisions that these modifications would occur on the east side of the dam, since the City owns the property at that site and it would not disturb the existing Fish Ladder on the west side. Any proposed alterations to accommodate a river "rapids" run should preserve the Fish Ladder and be coordinated with MDNR's proposed \$1 million improvement project. The design of the proposed alterations should also consider the preservation of the boat launch on the east side, just below the dam, for its continued use by power boaters, emergency rescue, and portaging.

MAINTENANCE

The Phase 1 rapids constructed downstream of the 4th street dam would require little maintenance once in place and could operate without personnel. Outfitters or other river-based businesses could provide services to visitors. Other cities have recruited paddling and fishing groups to remove dangerous tree fall from the river and place logs in-stream for additional fish habitat where it won't impede kayaks and canoes.

The portage and access sites would require a level of maintenance typical of other boat access sites and small parks. The constructed rapids in Phase 2 could require maintenance if logs, other debris, or ice create impediments that make the running of the rapids dangerous.

COSTS

The advantage of a phased approach is that the costs can be spread out over a longer time period. Costs can vary depending on how expansive the project becomes. Multiple whitewater features, spectator viewing areas, walking paths, biking trails, fishing areas, and parking can all be built into the park, but with additional costs.

The preliminary cost estimates are included in Appendix 6 and summarized below.

Phase 1, Task 1 (Modification to "beautification" dams to create rapids course): \$650,000 - \$1,020,000

Phase 1, Task 2A (Portage): \$20,000 - \$30,000

Phase 1, Task 2B (Access Sites and Educational Materials): \$140,000 - \$210,000

Phase 2 (Modification to 4th Street dam to construct the whitewater run): - \$1,950,000 - \$2,800,000

Costs of other whitewater parks are listed in Appendix 1. When available, information is included on the economic impact those parks have had. These revenues offset the original design and construction costs of the parks. For example, Confluence Park in Colorado had a construction cost of \$800,000 and an economic impact of \$1.4 to \$2 million.

FUNDING STRATEGIES

Most existing whitewater parks were funded through county or city departments. Funding is often incorporated into the city or county tax structure. Other funding options include federal, state, and local grants, donations, capital funds, bonds, short-term borrowing, and private foundation grants. Examples of funding strategies other cities have used are listed below. A strategy for the City to pursue is included in Appendix 7.

- Grants
- Voter-approved bond sale
- Contributions from community organizations
- Private and Community Foundation grants
- Partnerships with non-profit environmental organizations
- Contributions from local businesses
- Collaborations with local universities and colleges
- Incremental property taxes
- User fees
- Parking meters and special event parking fees

A few examples of innovative funding options are worth mentioning. A Public/Private Partnership was created to fund a park in Colorado. The Confluence Park project in Denver began with city funding, but because of citywide budget cuts, the project budget was cut in half shortly after the master plan was completed. The landscape architect recommended the city partner with a local nonprofit organization to allow the project to move forward with limited city funding. The nonprofit was able to raise significant funds from the private sector. In addition, part of the selection for hiring the contractor was based on the contractor's ability to donate a portion of its bid to the nonprofit for tax credits. The construction budget ended up being only \$800,000. Rather than putting the project on the shelf, this creative partnership allowed the project to proceed despite limitations in City funding support.

Partnerships with universities could prove to be a long-term relationship. GVSU faculty has already expressed interest in possible student studies in government planning, environment, hydrology, fisheries habitat and engineering.

FUTURE WORK

Feasibility/Preliminary Design Report for Phase 1

For the 4th Street dam and downtown area to be considered as a site for a whitewater park, several issues must be evaluated. A feasibility/preliminary design report would answer the questions about the costs and benefits that the City would realize from this project and provide much more detail about the characteristics of the river. The report would evaluate alternatives to, and refinements of, the basic concepts presented in this Special Study, and should be expected to include:

- Detailed hydraulic model - A complete, up-to-date hydraulic model needs to be developed to enable a proper design of the course.
- Detailed hydrologic analysis - The class rating of the rapids will be planned based on existing hydrology to maximize use throughout the year. Low flows would have to be investigated through USGS and other sources, as they would be essential for the design. The International Rating system classifies rapids as follows (Whiting, 2009):
 - Class 1 (Easy): Fast-moving current with small waves and few obstructions that are easily avoided. Low-risk. Easy self-rescue.

- Class 2 (Novice): Straightforward rapids with wide-open channels that are evident without scouting. Occasional maneuvering is required. Trained paddlers will easily avoid any rocks or medium-sized waves. Swimmers are seldom injured.
- Class 3 (Intermediate): Rapids with moderate, irregular waves, strong eddies and currents. Complex maneuvers and good boat control are required. Major hazards are easily avoided. Scouting is recommended for inexperienced paddlers. Self-rescue is usually easy and injuries to swimmers are rare.
- Class 4 (Advanced): Powerful, turbulent, and predictable rapids with large, unavoidable waves and holes or constricted passages. Fast and reliable eddy turns and precise boat handling are needed to navigate safely through. Scouting is necessary, and rapids may require "must-make" moves above dangerous hazards. Strong Eskimo roll highly recommended, as there is a moderate to high risk of injury to swimmers. Self-rescue is difficult, so skilled group assistance often needed.
- Class 5 (Expert): Extremely long, obstructed, or violent rapids with exposure to substantial risk. Expect large, unavoidable waves and holes, or steep, congested chutes. Eddies may be small, turbulent, difficult to reach, or non-existent. Reliable Eskimo roll, proper equipment, extensive experience, high level of fitness and practiced rescue skills essential for survival. Scouting highly recommended, but may be difficult. Swims are very dangerous and rescues are difficult.
- Class 6 (Extreme): These runs exemplify the boundaries of difficulty, unpredictability and danger, and have almost never been attempted, if ever. The consequences of errors are very severe and rescue may be impossible. Only expert teams with ideal conditions and extensive safety systems should ever consider these rapids.

The class ratings in Michigan are in the range of Class I to Class III, but Class II would be the more likely the design for the Grand River. The whitewater plan should provide top level boating opportunities for expert users while maintaining navigability for all levels of users. Recreational and instruction paddling opportunities should also be provided throughout its length.

- Improvements should be low maintenance and should not affect the City's utility operations or create a flood risk.
- Identification of constructability issues.
- Consideration of safety issues - Safety of all the potential users is a primary design consideration when developing a whitewater park. They are usually fairly accessible for rescue or emergency response personnel, and may even be supervised.
- Evaluation of Insurance needs - A common assumption in the design of a whitewater park is that if the park does not increase the pre-existing level of hazard, then no increase in liability occurs. However, establishing that the level of hazard did not increase is a difficult determination. As a result, the creation of a park will likely result in some level of liability risk. Few injuries at whitewater parks throughout the world have been reported, however the potential for injury related liability must be addressed. Simple measures, such as posting warning signs, clearly marking boundaries where boating is and is not permitted, and design measures that facilitate self-recovery, have been employed by existing facilities to improve user safety. In Reno, at the Truckee River Whitewater Park, commercial outfitters carry a \$1 million insurance policy. The City's insurance rates did not rise. Usually, the parks are not insured individually since they fall under the City's general insurance of parks and recreational facilities. At the Williamston Whitewater Park in Michigan, the City has municipal immunity, and the whitewater course is a free facility in a public park. As a result, there is no special insurance, just the City's basic liability policy ([Recreation Resources, 2004](#)).
- Layout and location sketches of options.

- Identification of property, easements, and access issues - Other design considerations include where access sites will be located and how banks will be stabilized to prevent erosion.
- Parking issues – the City currently manages parking areas to accommodate visitors and users, minimizing conflicts of spaces used by residents and workers in the downtown area. A parking study would identify the most feasible parking areas for this new attraction. Free parking is currently available after 5:00 p.m. on weekdays and all day on Saturday and Sunday.
- Review of accessibility issues (ADA).
- Investigation of regulatory requirements – Permits to be obtained and other ordinances, requirements, and standards to be met need to be identified and evaluated in terms of applicability and degree of difficulty to obtain. Permits could be required from federal, state, and local agencies for the construction portion of the project. Meetings with Army Corps of Engineers and Michigan Department of Environmental Quality early and often in the process be needed. Listed below are those that directly pertain to this project.
- The State of Michigan's Floodplain Regulatory Authority, found in Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act (NREPA), 1994 PA 451, as amended, requires that a permit be obtained prior to any alteration or occupation of the 100-year floodplain of a river, stream, or drain. The U.S. Army Corps of Engineers (USACE) and the Michigan Department of Environmental Quality (MDEQ) share jurisdiction within the floodplain and have consolidated the permitting process under Part 31 into what is known as the “Joint Permit Application”. Modifications to the riverbank for construction of the rapids or an access site would require obtaining a joint permit.
- Other permits could become necessary depending on changes to the scope of the project.
 - Permits from Michigan Department of Environmental Quality
 - Part 301, Inland Lakes and Streams (NREPA, 1994 PA 451)
 - Part 31, Water Resources Protection (NREPA, 1994 PA 451)
 - Part 315, Dam Safety Act (NREPA, 1994 PA 451)
 - Part 91, Soil Erosion and Sedimentation Control (NREPA, 1994 PA 451) – Administered by Kent County Road Commission (CEA), permitted by City of Grand Rapids (MEA, APA).
 - Permits from US Army Corps of Engineers (USACE)
 - The USACE has jurisdiction along the Grand River downstream of the project area (Fulton Street). Therefore, a Section 10 permit of the Rivers and Harbors Act of 1899 would only be required if the project encroached on that area.
 - http://www.michigan.gov/documents/deq/lwm-jpa-usace-jurislist_212983_7.pdf
- Provide detailed total project cost estimates for each option.

Stakeholders need to be kept informed during the feasibility/preliminary design study process. The acceptance of the project by fishermen, boaters, kayakers, and the general public is essential. Key contacts are listed below in the Key Contacts for Future Discussions section and in Appendix 8 that should be notified of meetings and progress on the report.

Appendix 1 lists other facilities around the country that have been built to create whitewater parks and recreational opportunities in rivers through urban areas. If possible, these sites should be visited to ask questions and incorporate their ideas into this process.

Phase 1 tasks will be coordinated with the river revitalization activities, such as the riverwalk extensions and improvements, enhancements to the Fish Ladder, and other riverfront beautification projects. MDNR already has designs for renovating the Fish Ladder, including a viewing window, for a cost of about \$1

million. These designs should be coordinated with any design proposed for the white water course to maximize efficiency and to leverage funding sources.

If these issues for Phase 1 can be adequately addressed, then the City could move on to consider Phase 2 of the project.

Feasibility/Preliminary Design Report for Phase 2

A similar report would be necessary to continue with Phase 2 of the project, with additional considerations, such as:

- Environmental Evaluation – Required testing would include soil borings to determine the amount and type of sediment behind the dam, sampling to determine the level of contaminants in the soils, and potential release of sediments. The conceptual design keeps the top of the dam intact, but any proposed modifications to the dam would require this information.
- Hydraulic Analysis – Changes to the water level is of great concern and needs to be fully understood before modification to the dam occurs. The impact to upstream water levels during normal and flood events, the impacts to the channel bottom, and the impact to the flood protection measures already in place will be studied.
- Fisheries – the Michigan Department of Natural Resources would conduct a study on the impact to the fisheries, including the potential of improved fish passage through a modified dam, as well as to the existing fishery at the dam.
- Constructability issues
- Detailed cost estimates for the options.

Key Contacts for Future Discussions

Building community consensus and support for this type of project is essential, since several strong interest groups could collide and cause dissention. Common ground must be found to continue with the endeavor. For this purpose, a contact list of interested groups and individuals is included in Appendix 8. Key individuals from that list are highlighted below.

- **Grand Rapids Steelheaders** – This well organized group represents 268 families in and around the Grand Rapids area. The organization wants to be involved in all parts of the project, from habitat improvements to feasibility studies.
 - Bob Streck / Dave Nowicki / Trent Slag, TBN Outfitters
- **Paddling Groups** – Several groups have expressed interest in further developing the ideas proposed in this report. Grand Rapids White Water, a non-profit volunteer group, has already launched a website to raise awareness of shared use of the river.
 - Gary DeKock, West Michigan Coastal Kayakers Association
 - Karl Geisel, Grand Rapids Area Sport Paddlers
 - Paul J. Knoerr, Yahoo Group for Canoeing (Vous Crew)
 - Chip Richards, Grand Rapids White Water
- **Grand Action** – This organization initiated the investigation of constructing a rapids course and is interested in participating in its development.
 - Jon Nunn
- **Michigan Heritage Water Trails – Efforts** have started in the Upper Grand River for developing a trail.

- Dave Lemberg, State Coordinator
- James E. Davidson, Mayor of Eaton Rapids for Upper Grand River
- **Colleges and Universities** – Students and faculty have been interested in integrating aspects of the river recreation into their curricula. Students would also be active users of the rapids.
 - Gregory Forbes, Professor, Grand Rapids Community College
 - Kathy Kramer, Aquinas College
 - Neil McDonald, Grand Valley State University
- **Outdoor Recreation Businesses** – Business can supply the equipment to enjoy the rapids and assist with shuttles and portages. Several businesses have expressed interest in using the rapids for touring and training sessions.
 - John Holmes, Bill & Paul's Sporthaus
 - Jake, Manager, Powers Outdoors
 - Mark Crews, Apex Outdoors
 - Steve Kunnath, Ada Village Bike Shop
- **Michigan Department of Natural Resources** – The MDNR supports the removal of the dam for return of original rapids and improved fish habitat, but are concerned about lamprey control and release of contaminated sediments from behind the dam.
 - Jay Wesley, Fisheries Biologist,
 - Scott Hanshue, Fisheries Biologist
- **Ludington Biological Station – USFWS** - The goal of the station is to conduct ecologically sound and publicly acceptable integrated sea lamprey management.
 - Dennis Lavis, Supervisor

LITERATURE CITED

Avon Whitewater Park (<http://www.avon.org/index.asp?nid=491>)

Bardstown, Kentucky, Whitewater River Park Report (<http://www.bardstownboaters.com>)

Fish Ladder information: http://www.sculpturesitesgr.org/sculpture_detail.php?artwork_id=10&location=2

Grand Rapids Downtown Development Authority http://www.grand-rapids.mi.us/index.pl?page_id=1657

Grand Rapids/Kent County Convention & Visitors Bureau website, www.visitgrandrapids.org,

Lacy, Gary M., P.E. 2008. *Conceptual Design Report for the Whitewater Recreation Improvements – Argo Dam Area, Ann Arbor, Michigan*. Recreation Engineering and Planning, Inc. Boulder, CO.

Mapes, Lynn G. and Anthony Travis 1976. *A Pictorial History of Grand Rapids*. Kregel Publications, Grand Rapids, Michigan.

Miller, Joe. 2007. "Whitewater Parks Offer Thrilling Turn in City Planning". Newsobserver.com

McGrath, Claire C., 2003. *Potential Effects of Whitewater Parks on Instream Trout Habitat*. Submitted to Recreational Engineering and Planning, Inc., Boulder, Colorado.

PlanPhilly.com. (<http://www.planphilly.com/node/3297>). PlanPhilly.com is a project of PennPraxis, the clinical arm of the School of Design of University of Pennsylvania.

Recreational Resources REC 4 Whitewater Play-site Feasibility Study.

http://www.sce.com/NR/ronlyres/9591B671-2252-4C13-AFD7-312648C1AA9/0/SDEREC04_Report.pdf

U.S. Geological Survey, <http://wdr.water.usgs.gov/wy2007/pdfs/04119000.2007.pdf>

Whiting, Ken. 2009. River Classifications (<http://www.paddling.net/guidelines/showArticle.html?243>)

www.greengrandrapids.us

Appendix 1 - Comparison Chart of Existing Whitewater Parks

Category	Location	Park Name	Length (mi)	Drop (ft)	Flow Volumes (cfs)	Features	Cost	Funding Source	Web site	Other
Constructed	CO, Avon	Whitewater Park, Eagle River	0.06			Spectator viewing terrace and large flat boulders along the river's edge for seating			http://www.avon.org/index.asp?nid=491	
Constructed	CO, Buena Vista	Buena Vista Whitewater Park			300-2000	Part of downtown development, 4 main whitewater structures			http://www.colorado.kayak.com/Buena_Vista_Playpark.html	
Constructed in-stream	CO, Denver	Clear Creek Whitewater Park	0.15			Through downtown, 7 city blocks of white water activity. 45,000 visitors to Clear Creek Whitewater Park in Golden Colorado in 3 years	\$165,000		http://ci.golden.co.us/page.asp?navid=203	Created an economic impact of \$2.3 million and a significant increase in visitors to the downtown area.*
Dam Modification and Diversion channel	CO, Denver	Confluence Park							www.denver.citysearch.com/profile?id=1822858	http://www.whpacific.com/Sections/Projects/Project.aspx?ProjectID=238#
	CO, Estes Park	Fall River - contact: Estes Park Urban Renewal Authority (EPURA).	2			Expand the River walk	\$13 million spent on downtown projects, sales tax was double at 26 million.	Property tax increment within the urban renewal area (difference between the property tax in the base year of 1982 and the property tax today)		Improvements are a part of the overall West Corridor Plan to extend the Riverwalk amenities to the western half of the central business district.
Constructed in stream, March 2008	CO, Glenwood Springs	Glenwood Springs Whitewater Park - contact: Andrew McGregor-Community Development Director; Andrewm@ci.glenwood-springs.co.us			<2,500 - >20,000			Donations/Sponsors	http://www.glenwoodwhitewaterpark.org/index.html	
Constructed in stream, 2003	CO, Lyons	Lyons Playpark in Meadow Park, Saint Vrain River	0.5	22.5	60-200+	Big pools and eddies			http://boc123.com/Kayak/PlayparkLyons.cfm	

Appendix 1 - Comparison Chart of Existing Whitewater Parks

Category	Location	Park Name	Length (mi)	Drop (ft)	Flow Volumes (cfs)	Features	Cost	Funding Source	Web site	Other
Constructed in 2006	CO, Pueblo	Pueblo Whitewater Park - contact: Pueblo Paddlers president, Bob Walker	0.5	8 drops	204-4000	7 holes, Class III			http://pueblo.us/cgi-bin/qt/tpl_page.html,template=1&content=949&nav1-1&	Arkansas River
River bed: Modified in 2000	CO, Salida	Arkansas River Whitewater Park	0.25			Open year round, Class II	Recreational Engineering and Planning	Arkansas River Trust, donation of materials and labor from of a local contractor. www.arkrivertrust.org	http://www.bardstowboaters.com/added/bardstownwwparkreport.pdf	Economic benefits in Salida, CO correlate to the increased number of visitors, staying in hotels and spending money in local restaurants and in shops.**
River Bed: Modified	CO, Steamboat Springs	Yampa River Whitewater Park	5	50		Class II	Recreational Engineering and Planning		http://www.bardstowboaters.com/added/bardstownwwparkreport.pdf	Open April - June
Constructed 2004	CO, Vail	Vail Whitewater Park				Drew an estimated \$1.4 million in extra spending during 5 day competition	\$130,000 - Recreational Engineering and Planning		http://www.bardstowboaters.com/added/bardstownwwparkreport.pdf	
Constructed 1984	IN, South Bend	East Race Waterway	0.36		450-500	Includes fish ladder, downtown activity. Over 20,000 visit the East Race Whitewater Park each summer in South Bend, IN.	\$5,000,000	Grants and local bonds	http://sbpark.org/parks/erace.htm	Opened in 1984. Ignited a \$50 million development boom in which restaurants, shops, apartments and a chocolate factory replaced a dilapidated industrial area.
	KY, Peduka								www.wky.thinkwestkentucky.com/ecotourism/whitewater/report/?N=D	
	MD, Dickerson									
	MI, Albion									
Dam Modification and Diversion channel	MI, Ann Arbor	Argo Pond								
	MI, Chesaning									
Dam Replacement, planned for controlled flow	MI, Flint		3.5	10			\$1,800,000	City funded \$30,000 study		
Dam Replacement	MI, Mt. Pleasant		0.1	5						
	MI, Petosky									

Appendix 1 - Comparison Chart of Existing Whitewater Parks

Category	Location	Park Name	Length (mi)	Drop (ft)	Flow Volumes (cfs)	Features	Cost	Funding Source	Web site	Other
Dam Replacement	MI, Williamston		0.05				\$767,000	50% MNRTF grant, 50% DDA bond sales	http://homepage.mac.com/enkcarlson/web/williamston.html	Whitewater boaters dine in town and patronize other local businesses. No fee or registration, so no idea how many people have used the rapids or how much they've spent. Primary benefit is community enhancement.
Constructed Bypass channel, controlled flow	MN, Minneapolis	Mississippi Whitewater Park	0.38	25		US Olympic Training Site, draw 50,000 visitors/yr. Had to move 54-inch water main	\$15,000,000	USACE, Minnesota DNR	http://www.whitewaterpark.canoe-kayak.org/MWPDC_Info.html	
Constructed, opened August 2006	NC, Charlotte	U.S. National Whitewater Center, Catawba River	0.76			Largest artificial whitewater river and an official U.S. Olympic Training Site	\$38,000,000		http://usnwc.org/	
Removed dam, constructed, opened 2004	NV, Reno	Truckee River Whitewater Park - contact: Owner: City of Reno (call 334-2262 for information)	0.49			Located in the heart of Reno's bustling downtown, 11 pools for kayak play and a kayak racing course. Home of the Reno River Festival. Class II and III	\$1.5 million. Recreational Engineering and Planning	\$1.5 million from voter-passed statewide bond	http://www.visitrenoahoe.com/reno-tahoe/what-to-do/water-adventures/kayak-park	Year-round access
	NY, Rochester	Lock 32								
Constructed in stream	PA, Johnstown	Stonycreek Whitewater Park	0.17	4	2,200	Remediated river pollution, whitewater drops and pools provide excellent fish habitat	\$575,000	PA DCNR, Regional Partnership, Community Foundation		
Dam Replacement	TX, San Marcos	Rio Vista Whitewater Park					\$400,000 - \$1 million. Recreational Engineering and Planning			Up to 1500 per day on weekends visit the San Marcos, TX park
	UT, Ogden									
River bed: Modified	WI, Wausau	Wausau Whitewater Park	0.37	30		While primarily designed as a 'slalom course', there is a multitude of spots which allow for various 'play' maneuvers. Class III-IV	Don Sorenson	Usage fee: \$10 for ACA members, \$15 for non-members.	www.wausauwhitewater.org	Open April - October

Appendix 1 - Comparison Chart of Existing Whitewater Parks

Category	Location	Park Name	Length (mi)	Drop (ft)	Flow Volumes (cfs)	Features	Cost	Funding Source	Web site	Other
Phase 1 - Constructed in-stream	MI, Grand Rapids	Grand River Rapids Park	0.4	7	1,732-7,579					
Phase 2 - Dam modification, constructed	MI, Grand Rapids	Grand River Whitewater Park	0.04	8	1,732-7,579					
*Article by Bob Berwyn of the Denver Post, "Breckenridge Launches Whitewater Park."										
**From Thomas Palka of the Arkansas River Whitewater Park										

CHOICE 1:			
Enhance Rapids Downstream of 4th Street Dam			
Keep 4th Street dam intact. Modify 5 beautification dams downstream of 4th Street dam to provide an exciting and safe rapids run for kayaks and canoes. Optional construction of portage around dam and adequate access sites for put in and take out required. Create play wave area able to be accessed several ways: float down from right below the dam, hike down the river walk trail, or park car in a staging area and walk down to the river. These waves would be a river wide feature, great for beginner and intermediate play boaters. At most flows, boaters could surf and spin with ease.			
Costs:	Moderate cost (\$100,000-\$500,000) for work in river and access sites.		
	Social	Environmental	Economic
Design Considerations	Interface between boaters and fishing.	Potential for improved fisheries with opportunity for habitat restoration using instream techniques.	Minimal engineering, rearrangement of beautification dams.
	Provide portage around dam with free portaging tools (carts/wheels) made available.		
	Safety issues with undertow at 4th Street dam if put in too close to dam.		Moderate cost for work in river and purchase of parcels for access sites.
	No disruption to Canal Street Park.		Quickly do something, do something more (like options #2-4) in the future
Benefits	Attract people and boaters to downtown Grand Rapids.	Increased recreation use of Grand River	Increase of visitors per year to downtown if properly managed and promoted. Riverside hotels could have a boat launch for ecotourists boating down the Grand staying in hotels rather than camping
	Tie in with downtown festivals.	Purchase parcels for access sites - increase in park and green space.	Good first phase to measure interest and assess the interest
	Provide longer river run, safer than larger rapids, attracting white water and flat water paddlers.	Create Heritage Water Trail with cultural and historical interpretive and informational signs to increase stewardship of river	No disruption to fish ladder
	Less disruption to fishing than removal of 4th St. dam	Keeps option of hydropower demonstration site open - work with Renewable Energy Team	Lower operations & maintenance costs than other choices.
Challenges	Provide convenient access. Lack of a place to take out leads paddlers downstream to Plaster Creek. Existing portage is a serious detriment to the Grand being used as a recreational "water trail."	Not enough elevation difference to create exciting rapids	Availability of funds for purchasing land required for access sites.
	Limited white water challenge may mean limited use.	Minimal improvement to fisheries if dam not removed	Increased costs of long term operations and maintenance costs of portage and numerous access sites, if no significant income generated to hire additional staff.
	Avoid conflicts with fishing activities in same reach.	Low head dams in downtown are sticky and retentive beyond belief	Loss of tax base if parcels bought by the City for access sites.
Links to other sites:			
	http://www.miottawa.org/ParksVI/Parks/hemlockcrossing.htm		
	http://foxcitieswhitewaterpark.com/		
	http://boc123.com/Kayak/PlayparkLyons.cfm		
	http://boc123.com/Kayak/PlayparkGolden.cfm		

CHOICE 2:			
Diversion Channel Parallel to River			
Divert flow from river and construct rapids in separate channel, parallel to river, with controlled flow and access. Potential sites include Sixth Street Park on the east side and the fish ladder on the west side.			
Costs:	Moderately high (\$1 million - \$5 million) for paddling run and access sites. Less cost than projects that directly impact dam. However, due to unexpected costs of design and construction, could be most expensive.		
	Social	Environmental	Economic
Design Considerations	Separate constructed channel to create whitewater course could be excellent.		Extensive design costs and limitations within parks (utilities, permits, etc.)
	Costs too high for maintenance. Not sustainable		Bring in Gary Lacy for conceptual planning process to achieve much greater promise with money spent
	Loss of existing parks and open space. Ensure safety for boaters above and below dam. Short river run compared to other options.	Elimination of open, green, pervious space for channel construction	Minimal engineering downstream with rearrangement of beautification dams.
Benefits	No disruption of dam and fish ladder. Attract boaters to downtown Grand Rapids.	Control of flow for special uses disrupts natural hydrology and could affect river stability.	Control of usage and generate revenue by charging fees for activity.
	Adjustable so that paddlers of various capabilities would enjoy an experience going through it	No disruption of dam and fish ladder.	Bring in people from wider geographic area as a destination
	Potential viewing of all water activities and events from uptown areas.	No-instream modifications or release of sediments.	Attract people and their spending money to downtown Grand Rapids.
	Enhancement of park amenities in multiple park system that includes playgrounds, picnic facilities, and miles of paved & lighted walking/running paths along the Grand River		Marketing of new activity to another user group for reasons to visit Grand Rapids. Riverside hotels could have a kayak launch for ecotourists kayaking down the Grand staying in hotels rather than camping.
Challenges	Preventing boats from going over dam or being impacted by undertow below dam - provide floatable lifelines	Maintain adequate flow over dam during low flow periods if water diverted to channel	High long-term operations and maintenance costs
	Loss of open park space and alternate recreation uses	No improvement to fish passage	Increased revenue from paddlers and spectators might not outweigh loss of revenue from anglers, especially since activities would not be in downtown area.
	Only reaches a small set of paddlers, recreational canoer wouldn't really see a benefit	Excessive litter and wear & tear on the park areas from spectators.	Limited use for money spent, not much draw for flat water paddlers.
	No improvement to safety issues for fishermen at dam.	Disrupting flow will ruin many spawning areas.	Site limitations for construction.
Links to other sites:			
	http://www.sbpark.org/parks/erace.htm		
	http://www.whitewaterpark.canoe-kayak.org/		
	http://www.wausauwhitewater.org		

CHOICE 3:			
Partial Removal of Dam (allow flow though center or east side of dam)			
Create rapids by removing a section of the dam and designing navigable rapids. Optional construction of portage around dam and adequate access sites for put in and take out required. Create play wave area able to be accessed several ways: float down from right below the dam, hike down the river walk trail, or park car in a staging area and walk down to the river.			
Costs:	Moderately high (\$3 million - \$10 million) cost for dam removal, sediment mitigation and access sites.		
	Social	Environmental	Economic
Design Considerations	Design play boat and river run areas. Safety considerations with undertow at dam and deep hole in river on east bank. High current velocities at dam removal point. Interaction between boating and fishing.	Sediments and contaminants above existing dam being released when dam removed.	Solid concrete gravity dam construction will be difficult to remove. Potential impact to floodwalls upstream of dam due to removal of sediment and reduced river bottom elevation.
		Removal of a barrier that would allow lamprey and other invaders to move further upstream - get MDNR comments.	Bring in Gary Lacy for conceptual planning process to achieve much greater promise with money spent
	Provide portage for those who want to avoid rapids.		Minimal engineering downstream with rearrangement of beautification dams.
	No disruption to Canal Street Park.		Separate constructed channel created within the current Grand River channel via maybe construction of an island at the end of the partial dam removal to create whitewater course could be excellent.
Benefits	Attract boating to downtown Grand Rapids. During either the fall or spring run, the interest by the public in paddling whitewater would not be great enough to impact fishing	Some fish passage improvements	Attract people and their spending money to downtown Grand Rapids.
	More challenging rapids than Choices 1 and 2, creating retentive play style standing waves and boofing ledge for surfing (expert) and running (novice).	Create Heritage Water Trail with cultural and historical interpretive and informational signs to increase stewardship of river	Marketing of new activity to another user group for reasons to visit Grand Rapids
	Keep fish ladder intact		Riverside hotels could have a boat launch for ecotourists boating down the Grand staying in hotels rather than camping
Challenges	Negative public perception of lowered water levels for power boats upstream of dam.	Difficult to obtain permits	Lamprey given access to up stream waters could devastate fisheries. 100,000 angler days spent at the dam. At \$35 a day, that equates to \$3.5 million just from angling.
	Conflict between fishing and boating recreation.	Release of sediments and pollutants behind dam	Unknown long-term operations and maintenance costs.
	Safety issues of inexperienced paddlers going over rapids - provide floatable lifelines	Less environmental benefit to fisheries with only partial dam removal	High initial cost.
	Preventing boats from going over dam or being impacted by undertow below dam	Potential release of contaminated sediment behind dam. Limited fisheries improvements	Availability of funds for purchasing land required for access sites. Loss of tax base if parcels bought by the City for access sites
Links to other sites:			
	http://www.jamesriverpark.org/activities-whitewater.htm		
	http://playak.com/article.php?sid=1262		

CHOICE 4:			
Remove Entire Dam and Replace with Constructed Rapids			
Remove dam and construct navigable rapids, offering play areas and quiet areas to create challenging paddling course. Optional construction of portage around dam and adequate access sites for put in and take out required. Create play wave area able to be accessed several ways: float down from right below the dam, hike down the river walk trail, or park car in a staging area and walk down to the river.			
Costs:	High cost (\$5 million - \$20 million) for dam removal, sediment removal and disposal, floodwall improvements and access sites.		
	Social	Environmental	Economic
Design Considerations	Provide portage for those who want to avoid rapids.		Huge undertaking to achieve the stated goal.
	Water levels would drop upstream of the dam		Bring in Gary Lacy for conceptual planning process to achieve much greater promise with money spent
	The removal of the dam would not provide significant increase in flood protection upstream or flood levels downstream.	Removal of a barrier that would allow lamprey and other invaders to move further upstream - get MDNR comments	Minimal engineering downstream with rearrangement of beautification dams.
	No disruption to Canal Street Park. Possible construction of marina and livery site farther upstream to accommodate increased activity	Control and removal of sediment upstream of the dam.	Impact to upstream floodwalls resulting from lowered river bottom elevation, caused by sediment washed down, could compromise the foundations of the floodwalls requiring necessary modifications.
Benefits	Improved aesthetics, returning river to more natural condition	Removal of fish barrier, instream improvement for fish habitat.	Once established in paddle sports, world class whitewater courses can expect to host one Olympic-level international event and two or more national events every two years.
			Potential use of hydropower to meet city's 100% renewable energy goal by 2020.
	Really nice if Grand Rapids actually had a grand rapids		Riverside hotels could have a boat launch for ecotourists boating down the Grand staying in hotels rather than camping
	Enhance safety of fishing area. More challenging rapids. Some limited flood control benefits. Attract boaters to downtown Grand Rapids. During either the fall or spring run, the interest by the public in paddling whitewater would not be great enough to impact fishing	Create Heritage Water Trail with cultural and historical interpretive and informational signs to increase stewardship of river	Revenue at all times since high water attracts paddlers but is less attractive to fishermen. Low water attracts fishermen but is less attractive to paddlers.
Challenges	Loss of fish ladder as tourist attraction. Negative public perception of lowered water levels for power boats upstream of dam.	Release of sediment, contaminants and associated pollutants from behind dam. 1985 EPA Superfund site 1 mile upstream. Plating by-products dumped on north side of Leonard.	Engineering to remove solid construction of dam, control sediment and construct rapids. Removal of sediment and lowering the river bottom upstream of the dam will impact the floodwalls - possibly as far as Knapp St. This could require significant investments in stabilizing the foundation of the floodwalls (City already spent over \$10 million). Excessive costs for benefits received.
	Dependent on whitewater paddlers for success - not enough in Midwest		paddling revenues equal revenue from fishing. 100,000 angler days spent at the dam. At \$35 a day, that equates to \$3.5 million just from angling.
	Building a whitewater course using the entire Grand River would not be the most beneficial to the paddler		
	Educate fishermen about changes to fishing opportunities.	Reduction in elevation of river immediately upstream	Availability of funds for purchasing land required for access sites. Loss of tax base if parcels bought by the City for access sites
Fishing will be impacted because dam barrier will not concentrate fish.	Difficult to obtain permits	Removal of potential source of hydropower	
Links to other sites:			
http://www.avon.org/index.asp?nid=491			
http://ci.golden.co.us/Page.asp?NavID=203			
http://www.trinityrivervision.org/TRVWEB/Default.aspx			



Water-Data Report 2007

04119000 GRAND RIVER AT GRAND RAPIDS, MI

Southeastern Lake Michigan Basin
Lower Grand Subbasin

LOCATION.--Lat 42°57'52", long 85°40'35" referenced to North American Datum of 1927, in NE ¼ sec.25, T.7 N., R.12 W., Kent County, MI, Hydrologic Unit 04050006, on right bank 500 ft upstream from bridge on Fulton Street in Grand Rapids, 1.7 mi upstream from Plaster Creek, and at mile 41.

DRAINAGE AREA.--4,900 mi².

SURFACE-WATER RECORDS

PERIOD OF RECORD.--March 1901 to December 1905, January 1906 to August 1918 (gage heights only), October 1930 to current year. Monthly discharge only for some periods, published in WSP 1307. Gage-height records collected in this vicinity since 1907 are contained in reports of the National Weather Service.

REVISED RECORDS.--WSP 924: 1938(M). WSP 1387: 1901-05, 1940.

GAGE.--Water-stage recorder. Datum of gage is 585.70 ft above sea level (levels by City of Grand Rapids). March 1901 to August 1918, nonrecording gage at Fulton Street Bridge and Oct. 1, 1930 to Oct. 26, 1953, water-stage recorder at sewage pumping station 1 mi downstream at datum 2.99 ft higher.

REMARKS.--Records good except for estimated daily discharges, which are fair. Moderate diurnal fluctuation at low and medium flow caused by powerplants upstream from station. Several measurements of water temperature were made during the year. Satellite telemetry at station.

Water-Data Report 2007

04119000 GRAND RIVER AT GRAND RAPIDS, MI—Continued

DISCHARGE, CUBIC FEET PER SECOND
WATER YEAR OCTOBER 2006 TO SEPTEMBER 2007
DAILY MEAN VALUES

[e, estimated]

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	2,300	3,670	6,880	5,930	e4,000	e3,730	8,600	7,110	3,270	1,930	1,080	2,210
2	2,700	3,600	8,370	6,710	e3,800	4,260	8,230	7,490	3,260	1,830	1,050	2,290
3	3,540	3,570	9,210	7,330	e3,330	4,940	8,420	7,630	3,540	1,760	949	2,040
4	3,470	3,380	9,870	7,500	e3,520	5,710	9,490	7,480	4,140	1,860	904	1,860
5	3,590	3,190	10,100	7,900	e3,430	e5,940	9,980	7,130	5,150	1,740	891	1,840
6	3,490	3,150	10,100	8,260	e3,470	e5,620	10,000	6,690	5,460	1,790	1,050	1,710
7	3,370	3,110	9,750	8,720	e3,410	e5,180	9,630	6,060	5,570	1,680	1,120	1,680
8	3,280	3,040	8,980	9,080	e3,390	e4,970	9,090	5,420	5,620	1,540	1,170	1,700
9	3,180	3,030	8,030	9,240	e3,410	e4,950	8,420	5,240	5,320	1,470	1,230	1,680
10	3,000	3,090	7,100	9,230	e3,280	5,710	7,730	5,150	4,720	1,440	1,180	1,710
11	2,920	3,770	6,540	8,970	e3,210	e7,440	7,190	5,570	4,270	1,430	1,240	1,710
12	3,040	3,790	7,070	8,570	e3,130	e9,300	7,470	5,910	3,880	1,410	1,380	1,730
13	3,360	3,990	8,780	8,100	e3,080	11,300	8,690	5,710	3,660	1,310	1,460	1,900
14	3,110	3,940	9,330	7,670	e3,120	14,000	9,770	5,180	3,530	1,260	1,180	1,810
15	3,080	3,960	9,570	7,510	e2,990	15,700	10,100	4,720	3,360	1,360	1,270	1,710
16	2,830	3,880	9,610	7,380	e3,030	15,900	9,920	e4,490	3,140	1,210	1,240	1,600
17	3,070	3,890	9,410	7,220	e2,980	15,300	9,440	e4,620	2,870	1,310	1,140	1,630
18	3,640	4,930	8,900	7,050	e2,960	14,200	8,910	4,720	2,760	1,350	1,040	1,550
19	3,790	5,820	8,160	7,040	e2,970	12,900	8,170	4,470	2,680	1,350	1,120	1,500
20	3,960	6,050	7,380	6,980	e2,990	11,400	7,320	4,180	2,740	1,400	1,940	1,440
21	4,020	5,810	6,690	6,670	e3,030	10,200	6,660	3,930	2,640	1,220	2,720	1,410
22	4,140	5,570	6,880	6,190	e3,130	10,700	6,200	3,730	2,320	1,170	3,290	1,340
23	4,500	5,260	7,390	5,940	e3,170	11,800	5,790	3,550	2,180	1,110	3,490	1,360
24	4,480	4,850	7,480	5,790	e3,120	12,500	5,210	3,460	2,120	1,100	3,620	1,290
25	4,410	4,590	7,400	5,640	e3,150	13,100	5,030	3,330	2,010	1,150	3,730	1,290
26	4,260	4,270	7,250	4,980	e3,190	13,300	5,270	3,440	1,900	1,240	3,640	1,380
27	4,150	4,120	7,060	4,790	e3,190	12,900	6,280	3,460	1,910	1,220	3,540	1,510
28	3,990	4,020	6,670	4,710	e3,170	12,100	6,800	3,640	1,840	1,270	3,040	1,660
29	3,900	4,350	6,320	4,410	---	11,100	7,170	3,730	2,060	1,190	2,830	1,540
30	3,820	5,670	5,910	4,350	---	10,100	6,760	3,670	2,360	1,260	2,280	1,470
31	3,720	---	5,670	4,170	---	9,250	---	3,460	---	1,150	2,170	---
Total	110,110	125,360	247,860	214,030	90,650	305,500	237,740	154,370	100,280	43,510	57,984	49,550
Mean	3,552	4,179	7,995	6,904	3,238	9,855	7,925	4,980	3,343	1,404	1,870	1,652
Max	4,500	6,050	10,100	9,240	4,000	15,900	10,100	7,630	5,620	1,930	3,730	2,290
Min	2,300	3,030	5,670	4,170	2,960	3,730	5,030	3,330	1,840	1,100	891	1,290
Cfsm	0.72	0.85	1.63	1.41	0.66	2.01	1.62	1.02	0.68	0.29	0.38	0.34
In.	0.84	0.95	1.88	1.62	0.69	2.32	1.80	1.17	0.76	0.33	0.44	0.38

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1901 - 2007, BY WATER YEAR (WY)

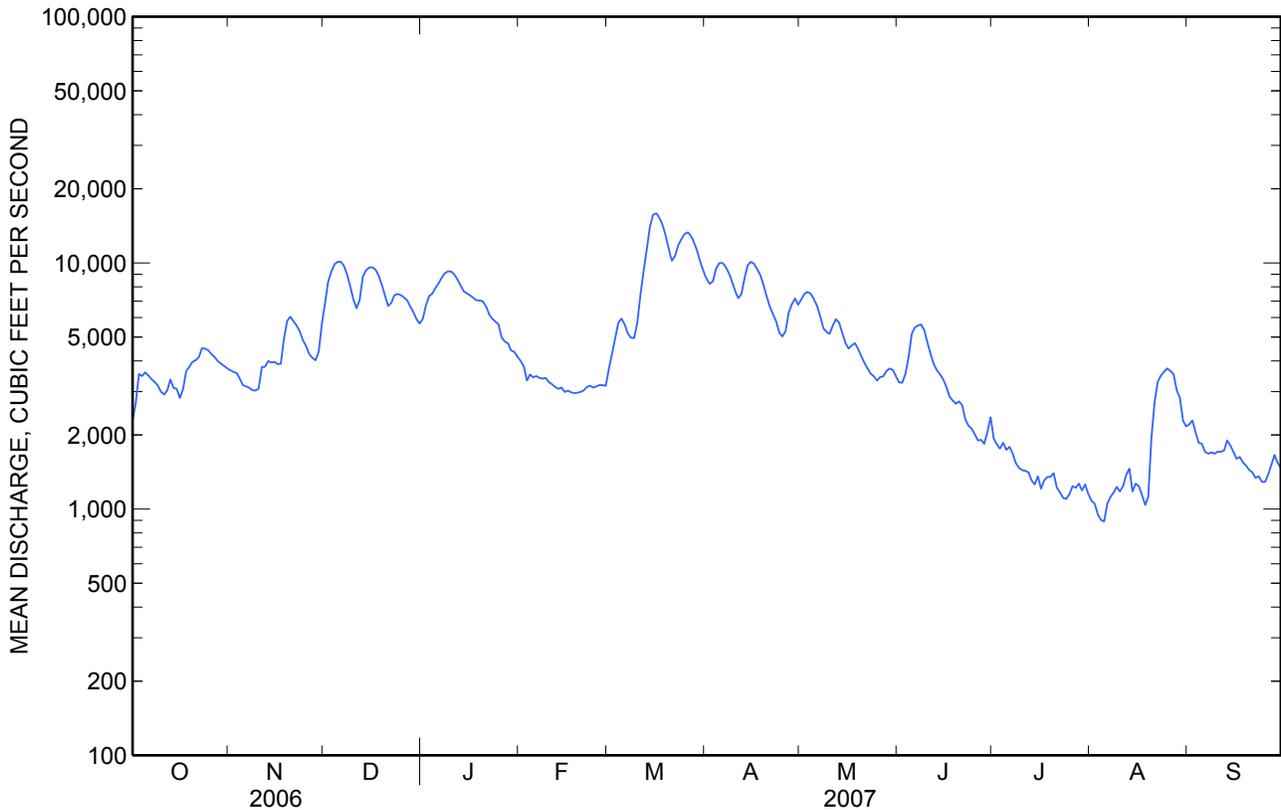
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean	2,392	2,936	3,416	3,784	4,382	7,579	6,866	4,905	3,420	2,176	1,732	1,934
Max	13,630	7,966	8,794	12,020	14,720	21,580	17,900	15,650	15,670	7,885	5,225	7,600
(WY)	(1987)	(1991)	(1991)	(1973)	(1938)	(1904)	(1947)	(1956)	(1905)	(1994)	(1994)	(1975)
Min	906	1,004	1,080	1,069	1,079	1,858	1,759	1,459	930	650	617	949
(WY)	(1965)	(1931)	(1964)	(1963)	(1963)	(1931)	(1931)	(1931)	(1934)	(1934)	(1934)	(1964)

04119000 GRAND RIVER AT GRAND RAPIDS, MI—Continued

SUMMARY STATISTICS

	Calendar Year 2006		Water Year 2007		Water Years 1901 - 2007	
Annual total	1,720,780		1,736,944			
Annual mean	4,714		4,759		3,789	
Highest annual mean					6,314	1943
Lowest annual mean					1,264	1931
Highest daily mean	15,600	Mar 17	15,900	Mar 16	53,300	Mar 27, 1904
Lowest daily mean	1,310	Aug 23	891	Aug 5	381	Aug 9, 1936
Annual seven-day minimum	1,380	Aug 19	1,010	Aug 1	438	Aug 8, 1936
Maximum peak flow			16,100	Mar 16	54,000	Mar 28, 1904
Maximum peak stage			13.93	Mar 16	^a 22.49	Mar 28, 1904
Instantaneous low flow			806	Aug 5		
Annual runoff (cfsm)	0.962		0.971		0.773	
Annual runoff (inches)	13.06		13.19		10.51	
10 percent exceeds	8,350		9,240		7,640	
50 percent exceeds	3,990		3,800		2,600	
90 percent exceeds	1,910		1,350		1,200	

^a Present datum; from graph based on gage readings.



Appendix 4 - Potential Access Site Characteristics

Site ID#	Name	Description of Location	Existing Access	Type of Existing or Potential Access	Restrooms	Parking	Number of Parking Spaces	Ownership	Trash Collection	Signage	Distance from upstream access	Distance from downstream access
1E	Riverside Park Boat Launch #1	North end of park	Yes	Exists for all access	Open in Summer, Port-A-Johns in winter	Yes	50	City	Yes	Yes	n/a	1 mile (2E)
2E	Riverside Park Boat Launch #2	Middle of park	Yes	Exists for all access	Open in Summer, Port-A-Johns in winter	Yes	100+	City	Yes	Yes	1 mile (1E)	1/2 mile (3E)
3E	Riverside Park Boat Launch #3	South end of park	Yes	Exists for all access	Port-A-John	Yes	25	City	Yes	Yes	1/2 mile (2E)	1 1/2 mile (4E)
4E	Canal Street Park	Middle of park	No, but could be easily used for access	None now, kayak/canoe possible (short-term)	In summer	Yes, in Canal Street Park and along Monroe Ave.	40, 2 handicap	City	Yes	Yes	1 1/2 mile (3E)	1/4 mile (5E)
5E	6th Street Bridge										1/4 mile (4E)	1/10 mile (6E)
6E	6th Street Park - Above Dam										1/10 mile (5E)	1/10 mile (7E)
7E	6th Street Park - South Boat Ramp	Just below 4th St Dam	Yes	Power Boat, will need to be made safer for small watercraft. Most popular with fishermen (short-term)	Open in Summer, Port-A-Johns in winter	Yes, in 6th Street Park and Monroe Ave. Possible in City and Herald Publishing Company, LLC. Lots	Numerous	City	Yes	Yes	1/10 mile (6E)	1/2 mile (8E)
8E	Lyon Street/Boardwalk	Road End-Grand Center	Yes	N/A (long-term)				Street ROW			1/2 mile (7E)	1/4 mile (9E)
9E	Fulton Street	Kinko's	No	N/A (long-term)	Potentially, depends on how site is developed	Existing ticket booth lot for businesses	70, until site is developed	City and Eenhorn-Springlake LP	Not currently	No	1/4 mile (8E)	1/2 mile (10E)
10E	201 Market	Railroad Crossing	Yes	Loading dock (long-term)	No	No	N/A	City	No	No	1/2 mile (9E)	n/a
1W	Kent County Road Commission	Possible clearing area with river frontage	No	N/A (long-term)	No	No	N/A	KCRC	No	No	n/a	1 1/8 mile (2W)

Appendix 4 - Potential Access Site Characteristics

Site ID#	Name	Description of Location	Existing Access	Type of Existing or Potential Access	Restrooms	Parking	Number of Parking Spaces	Ownership	Trash Collection	Signage	Distance from upstream access	Distance from downstream access
2W	Fish Ladder Park	Just below 4th St Dam	Yes	Current power boat access for emergency only, potential for kayak/canoe slightly downstream (long-term)	Port-A-John	Yes	20	City	Yes	Yes	1 1/8 mile (1W)	1/4 mile (3W)
3W	Bridgewater Place	Just north of Michigan	No	Kayak/Canoe (short-term)	No	Yes, possibly in lots south of Michigan	200+	City	No	No	1/4 mile (2W)	1/8 mile (4W)
4W	Ah-Nab-Awen Park	Center of park, stage area	No	Kayak/Canoe (short-term)	Open in Summer, Port-A-Johns in winter	Yes	200+	City	Yes	No	1/8 mile (3W)	1/4 mile (5W)
5W	GR Public Museum	Just north of carousel	Yes, steps already exist down to river edge	Small craft (short-term)	No	Possible in Front Street parking ramp	200+	City	No	No	1/4 mile (4W)	1/8 mile (6W)
6W	Grand Valley State University	Just north of Fulton	No	N/A (long-term)	No	Possibly in GVSU Fulton Street lot	100+	GVSU	No	No	1/8 mile (5W)	1/2 mile(7W)
7W	Wealthy/Front Pump Station	Abandoned pump station just south of Wealthy	No	N/A (long-term)				City			1/2 mile (6W)	3/4 mile (8W)
8W	Butterworth	Existing boat ramp	Yes, currently closed to public	All (coordinate with development of park)	No	No	N/A	City	No	No	3/4 mile (7w)	n/a

City of Grand Rapids Green Infrastructure Master Plan

Appendix 5 Grand River Access Points

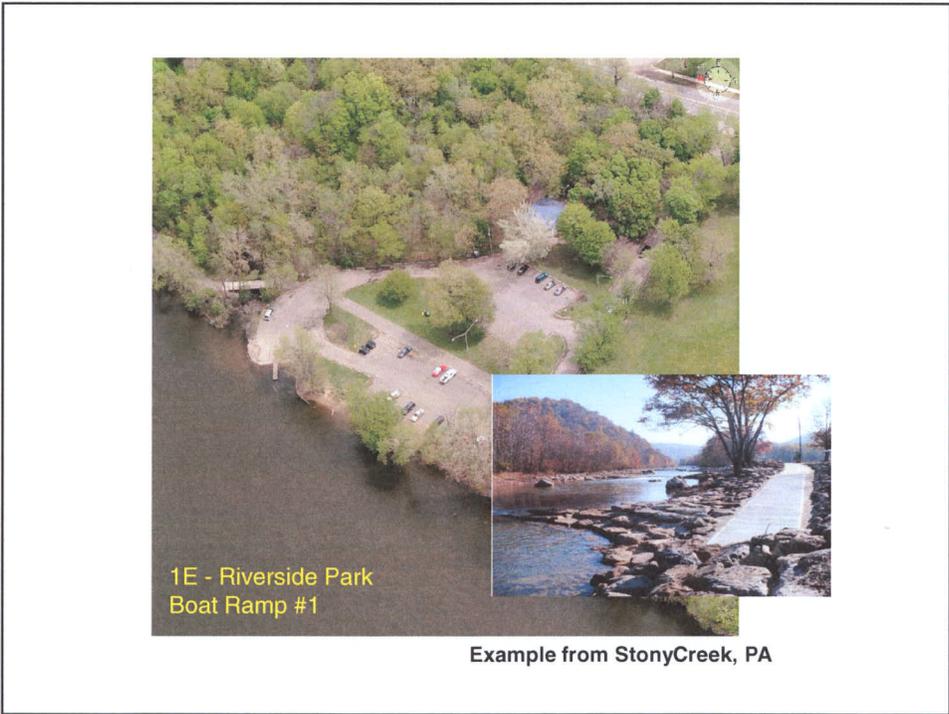
List of Existing and Potential Access Sites

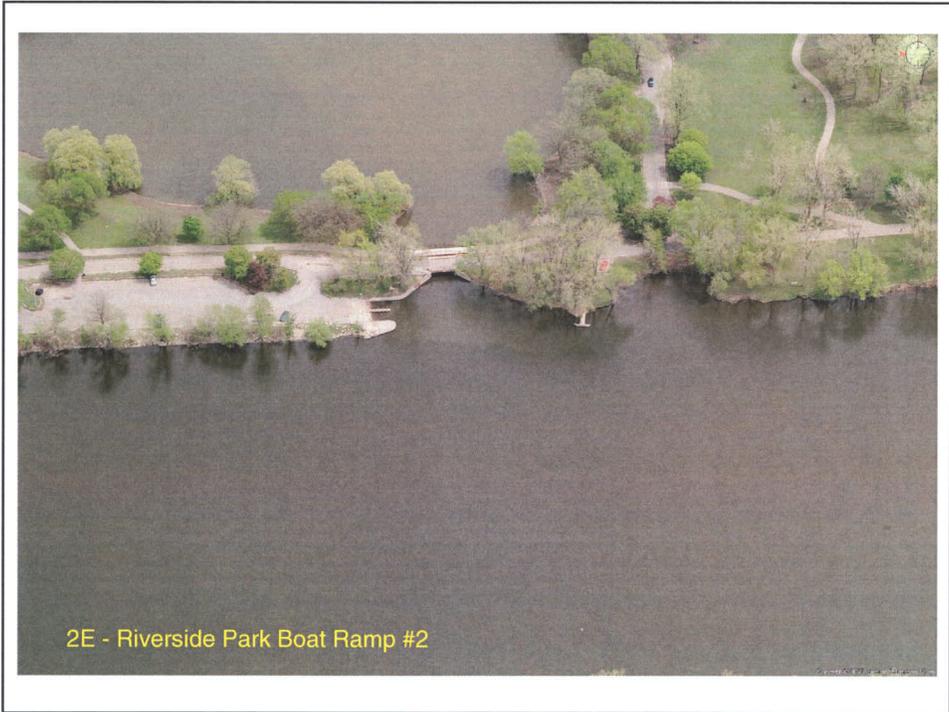
East Side of River

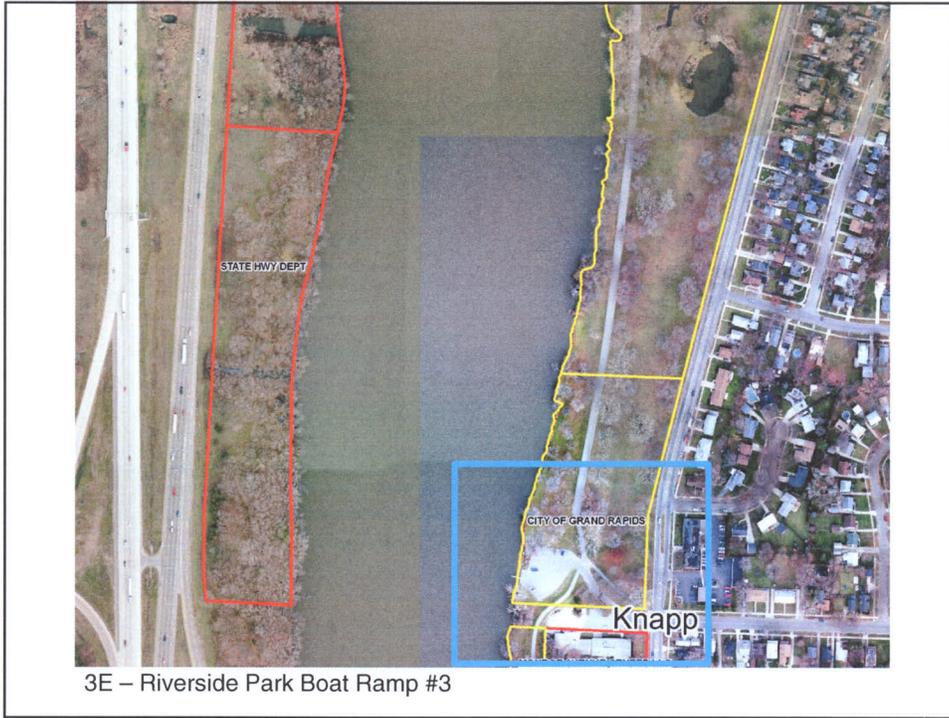
- 1E -Riverside Park, Boat Ramp #1
- 2E - Riverside Park, Boat Ramp #2
- 3E - Riverside Park, Boat Ramp #3
- 4E - Canal Street Park
- 5E- 6th Street Bridge
- 6E – 6th Street Park, Above Dam
- 7E – 6th Street Park, South Boat Ramp
- 8E – Lyon Street
- 9E - Fulton Street
- 10E - 201 Market

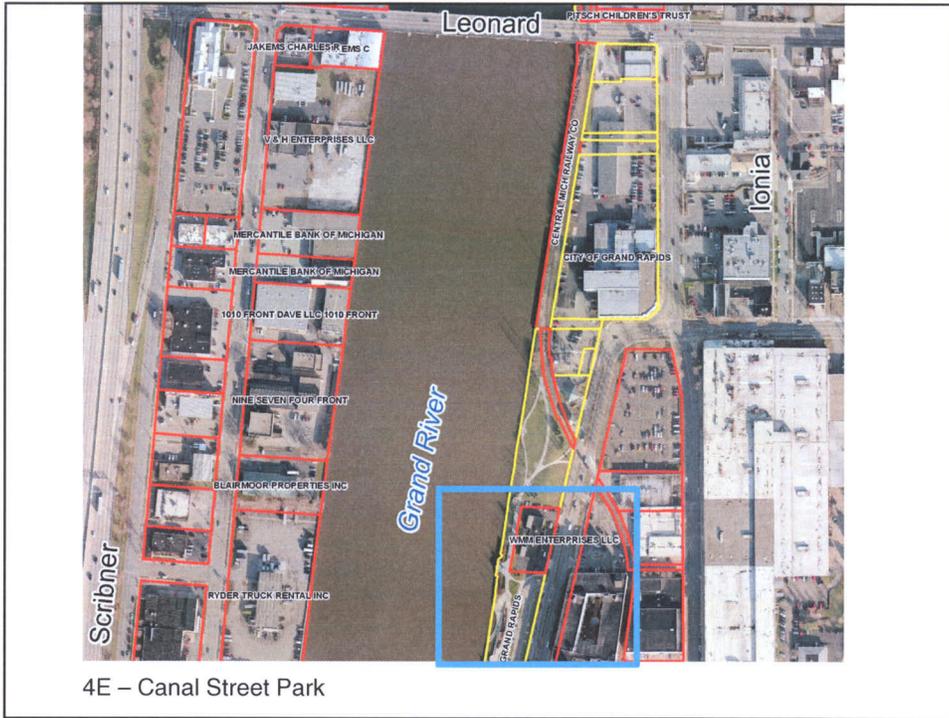
West Side of River

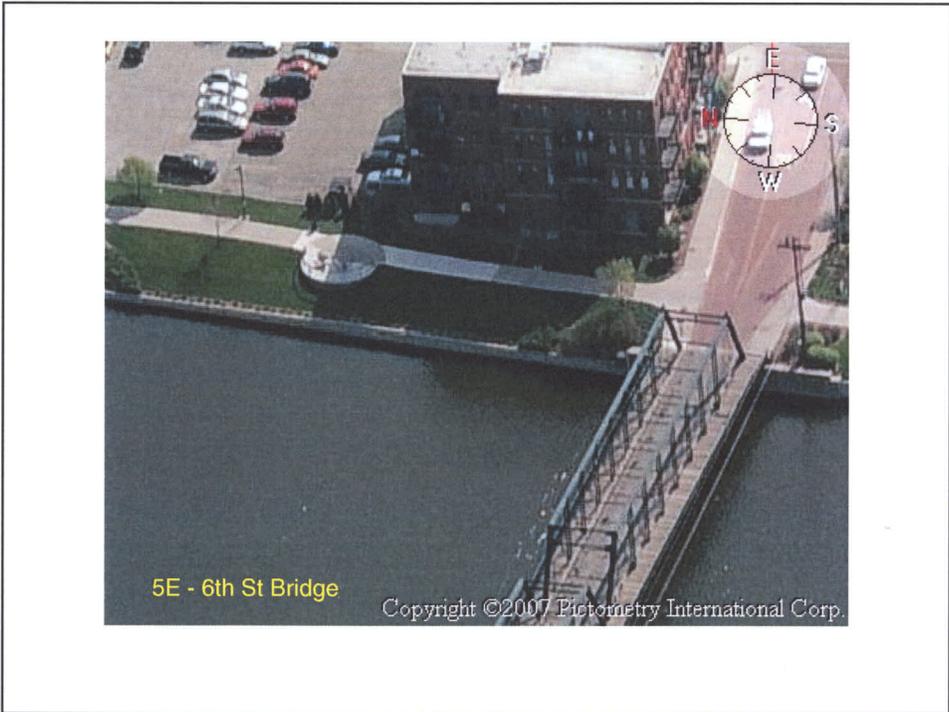
- 1W - Kent County Road Commission
- 2W - Fish Ladder Park
- 3W - Bridgewater Place
- 4W - Ah-Nab-Awen Park
- 5W – Grand Rapids Public Museum
- 6W - Grand Valley State University
- 7W – Wealthy/Front Pump Station
- 8W – Butterworth

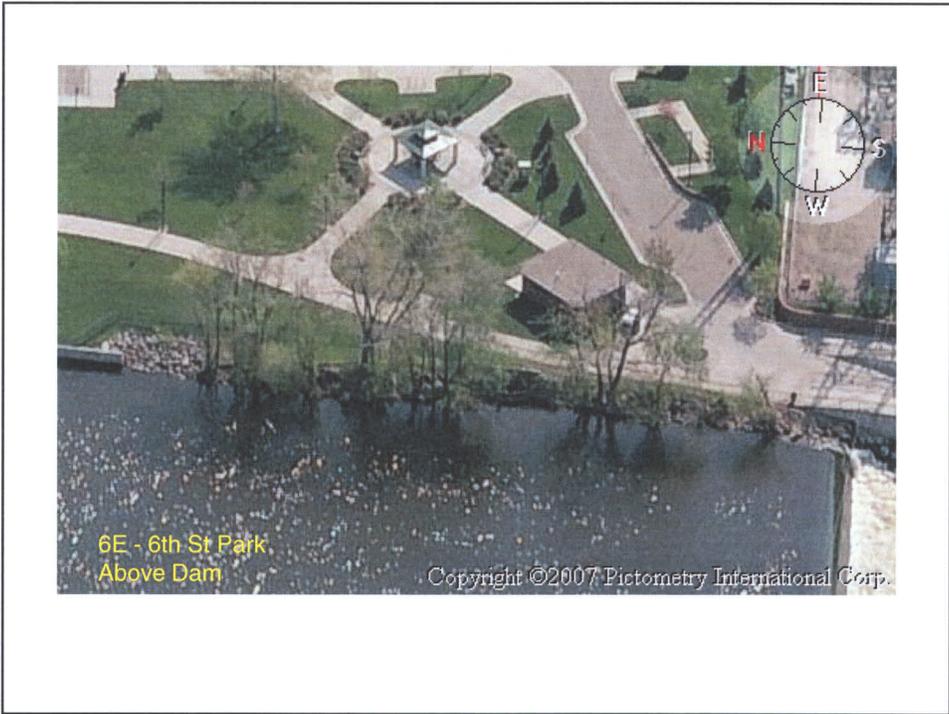


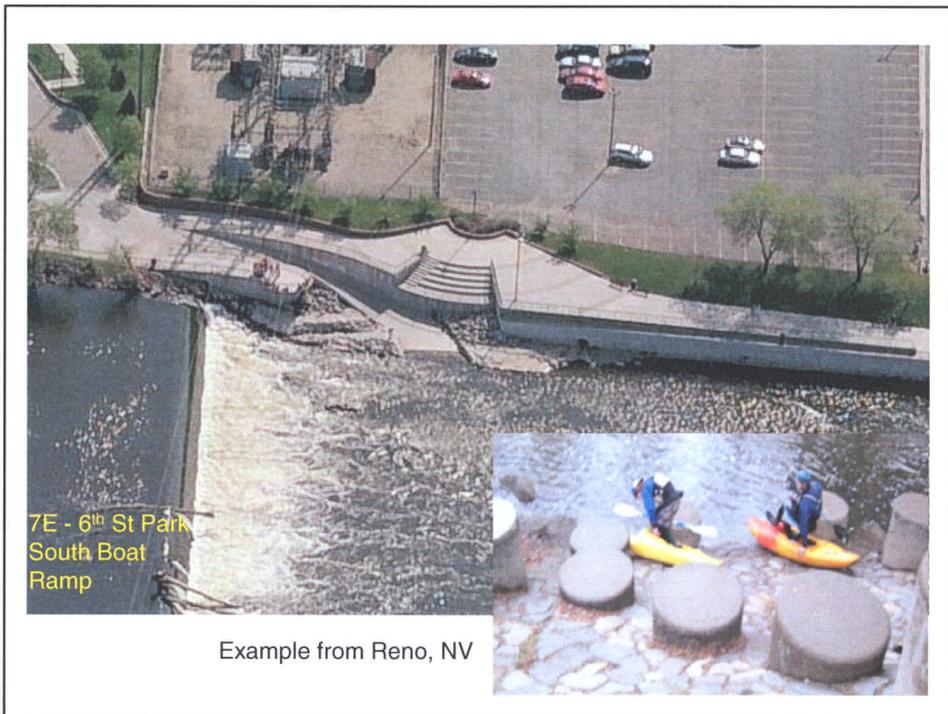


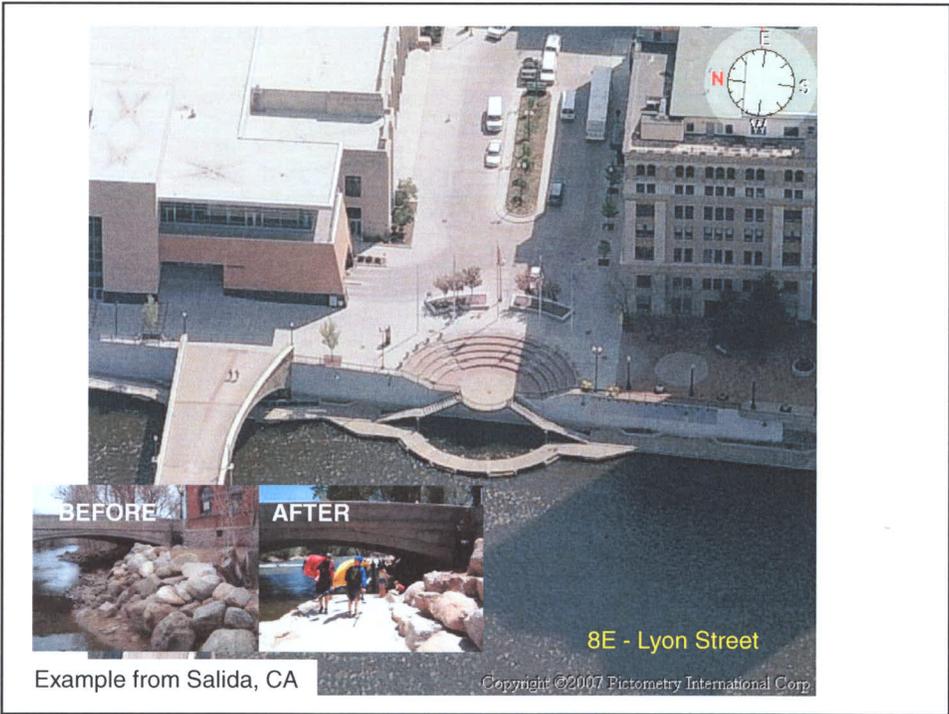
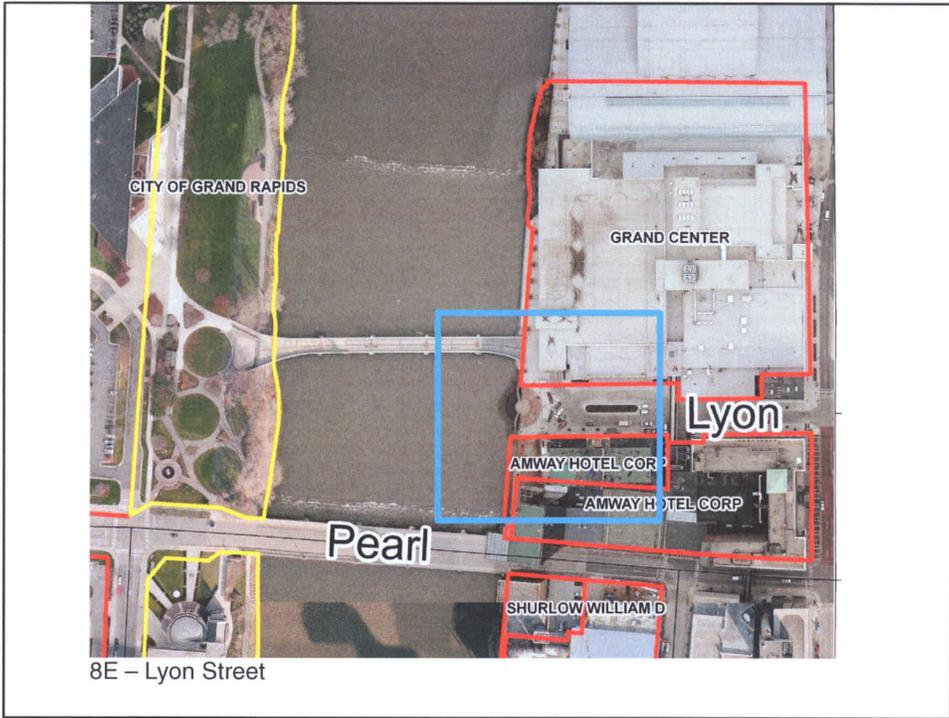


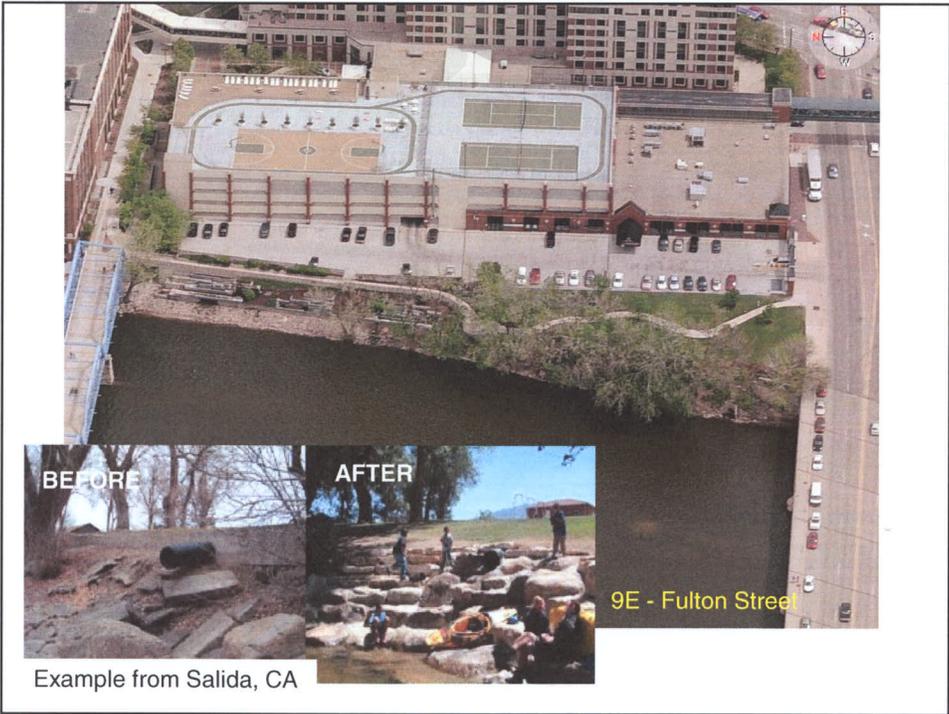
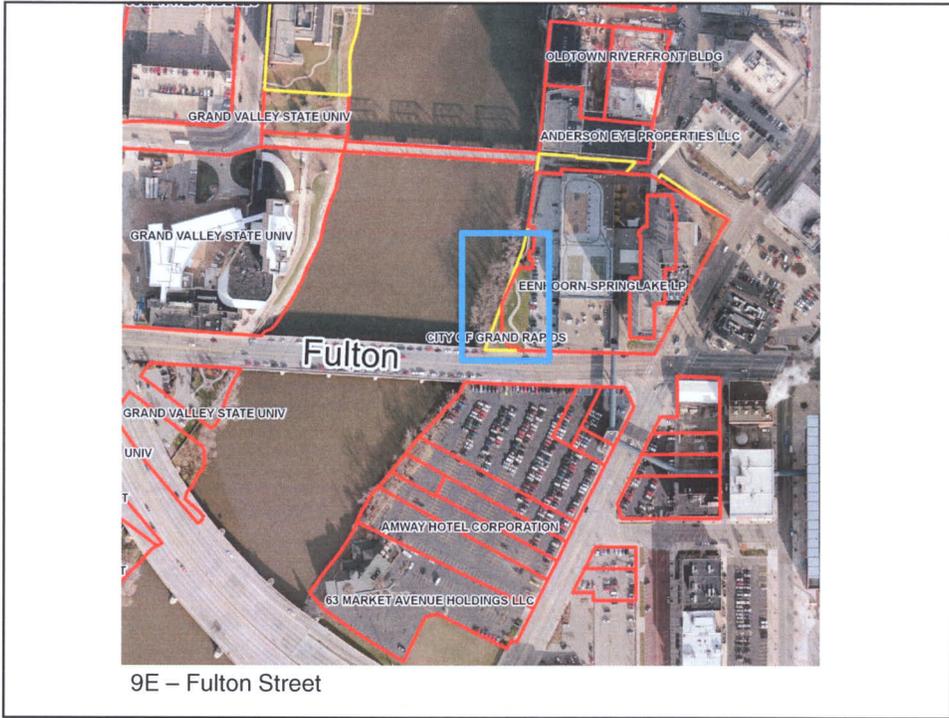


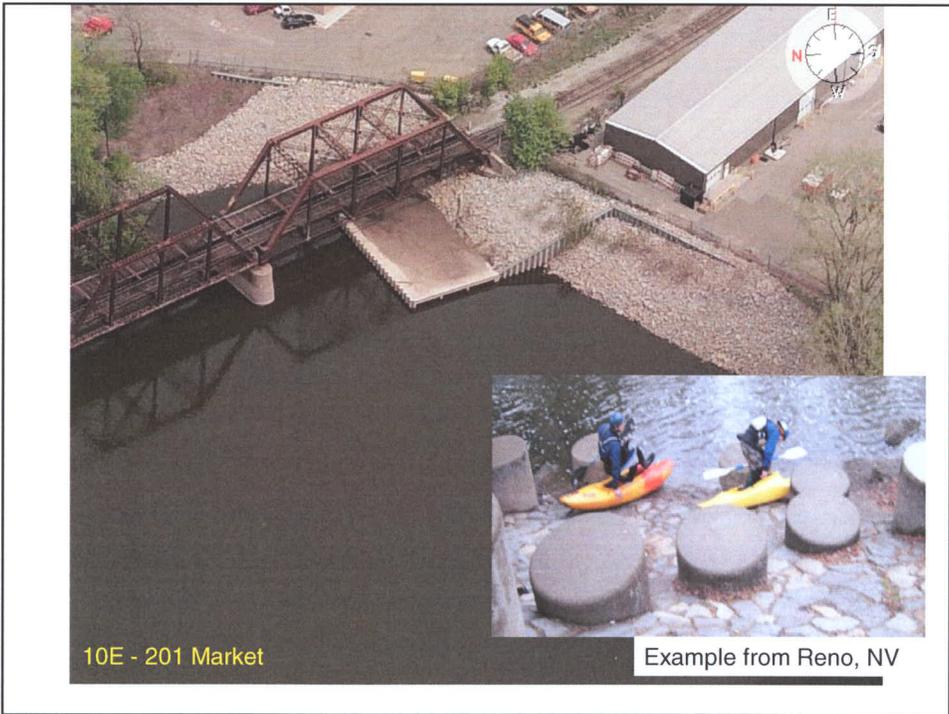
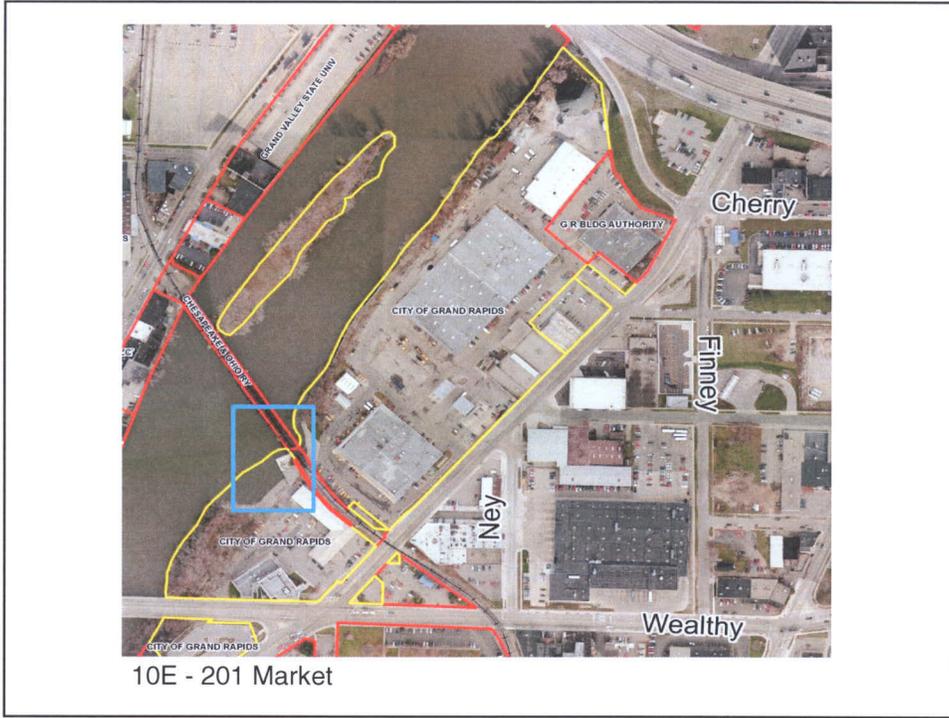


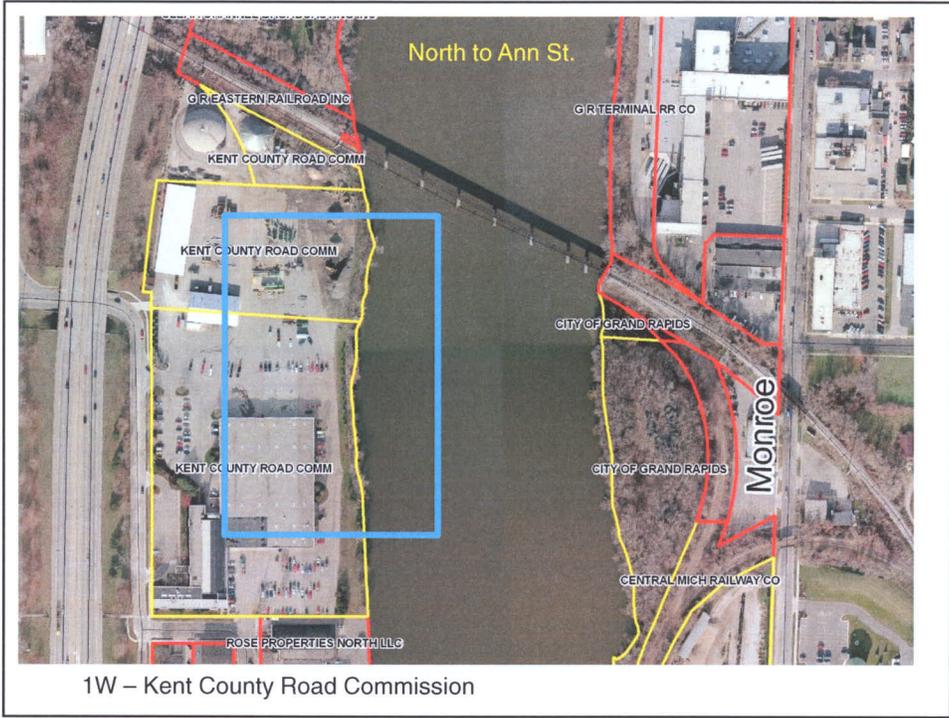








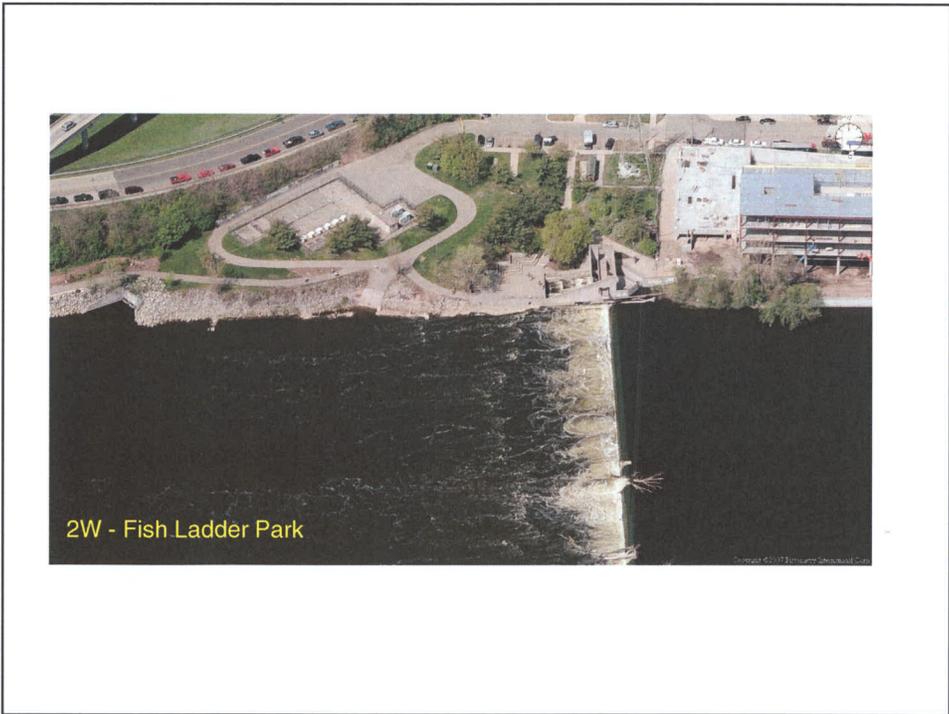




1W – Kent County Road Commission

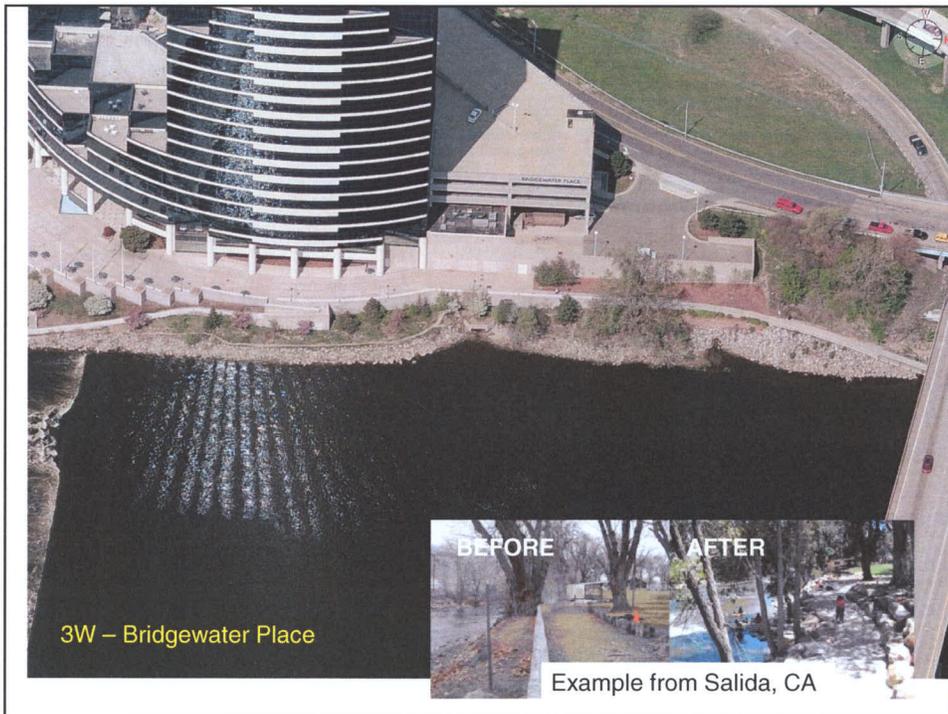


1W - Kent County Road Commission





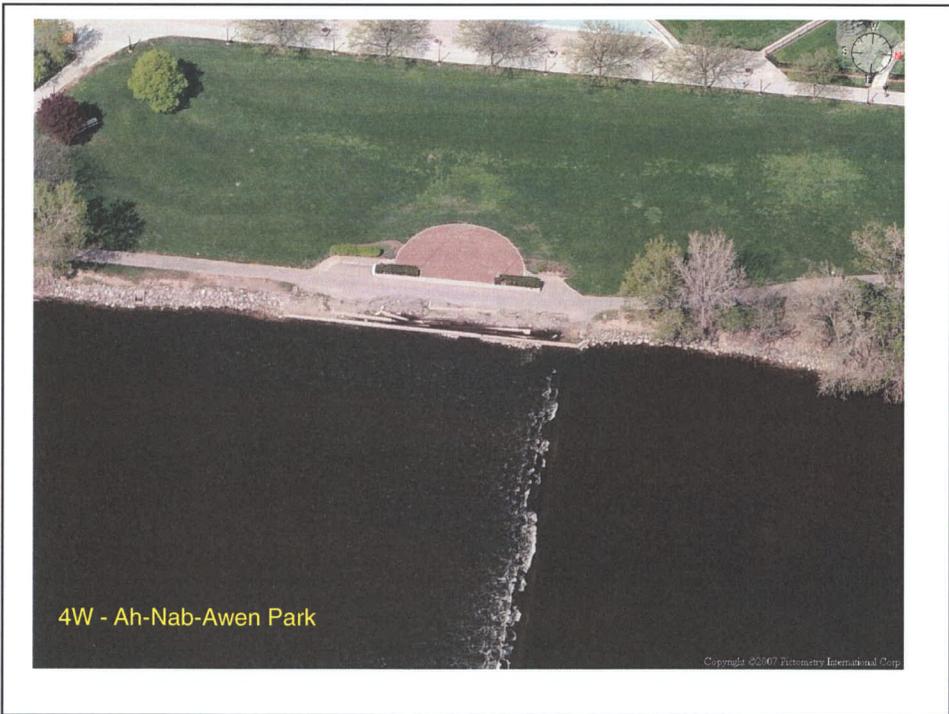
3W – Bridgewater Place

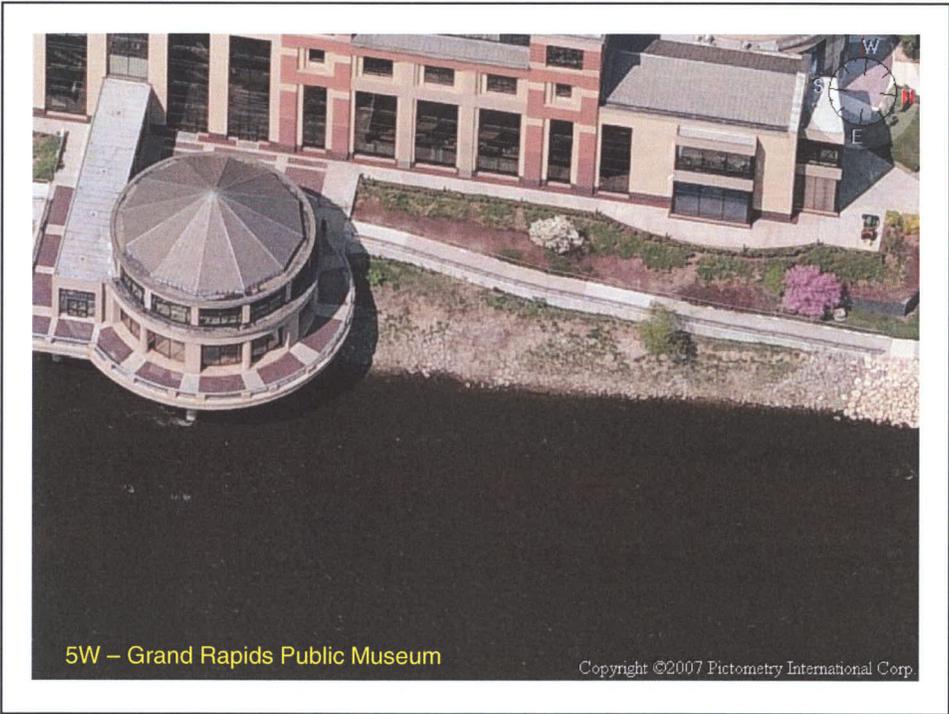


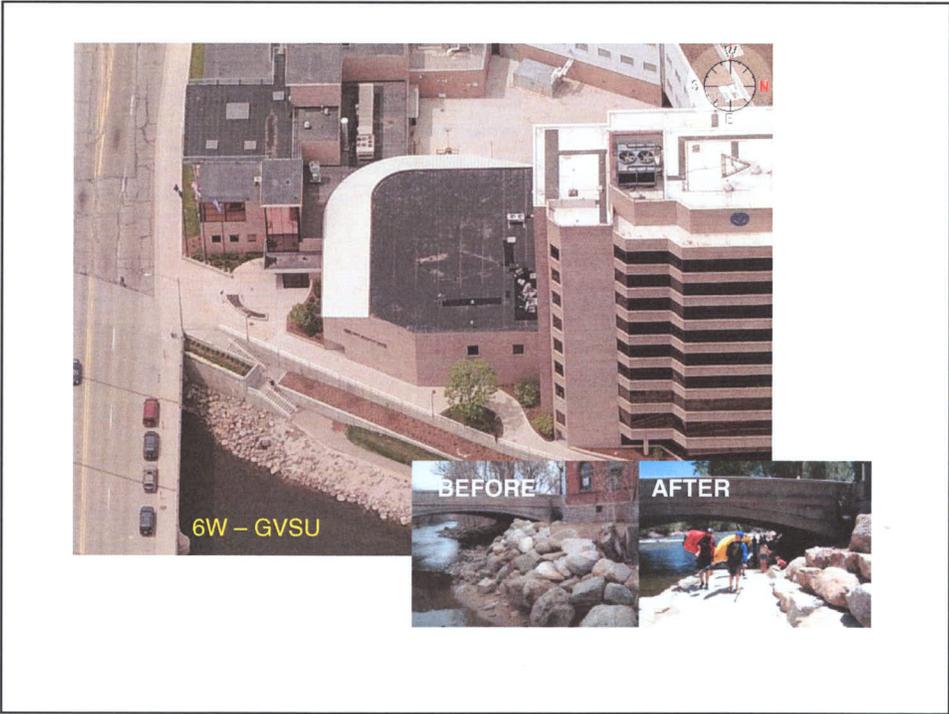
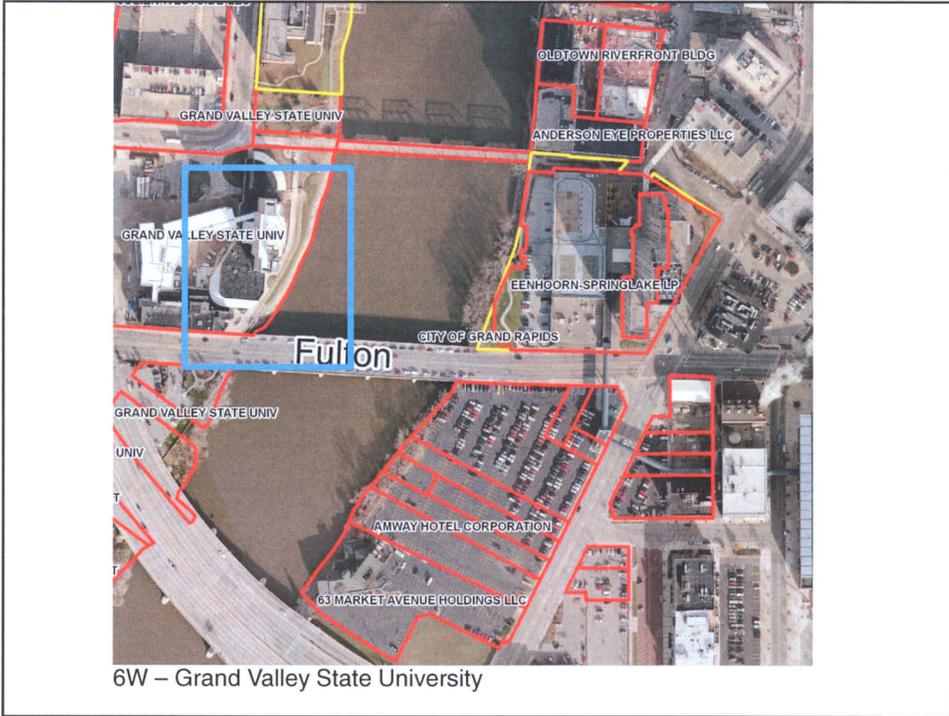
3W – Bridgewater Place

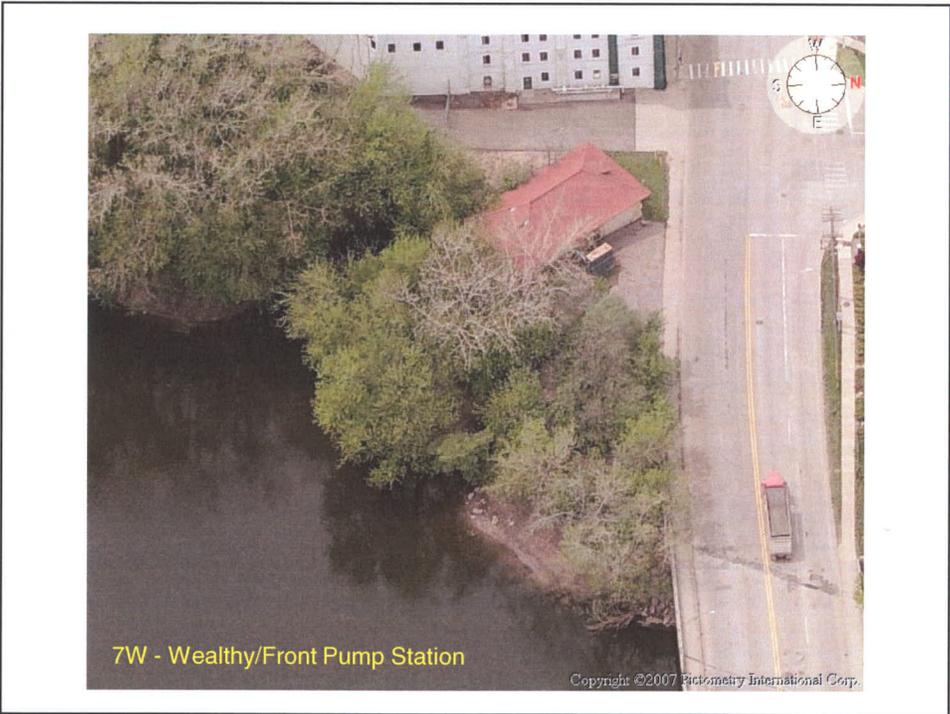
BEFORE AFTER

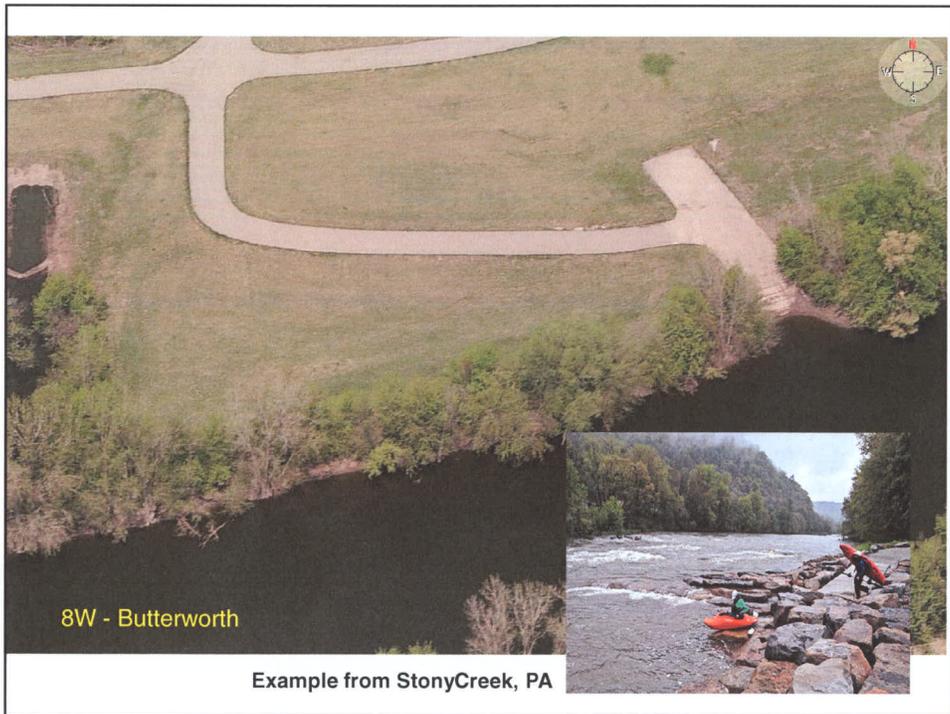
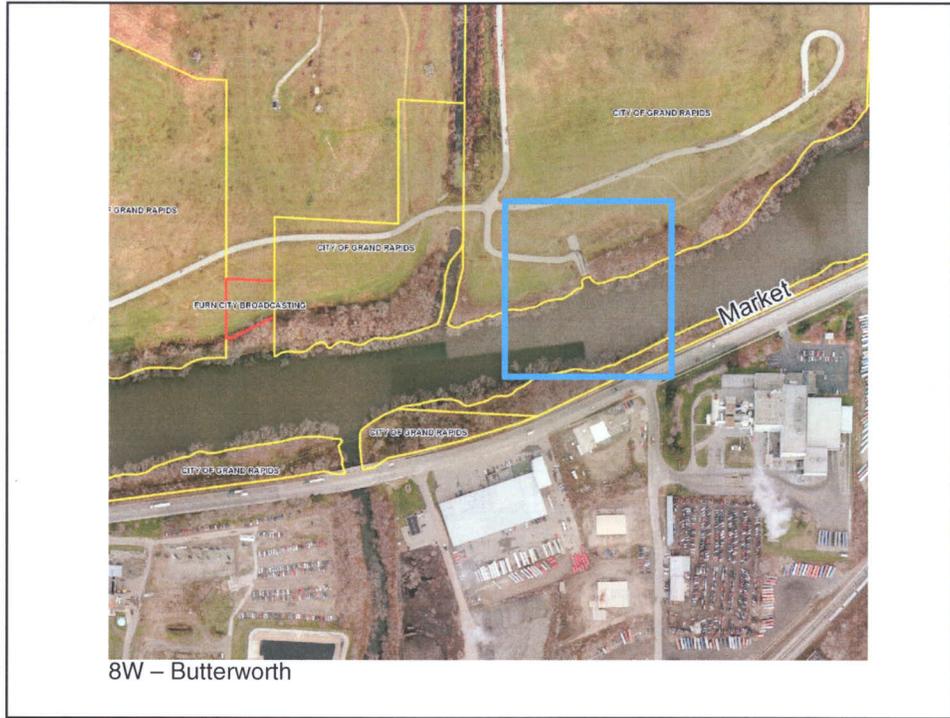
Example from Salida, CA











Appendix 6 - Estimated Costs

Phase 1: Modifications to Downstream Dams, Access Sites, and Portage Route

Description	Unit Cost	Unit	Estimated Quantity	Total Cost
DESIGN				
Feasibility Study	\$ 20,000.00	lump sum	1	\$ 20,000.00
Modeling	\$ 15,000.00	lump sum	1	\$ 15,000.00
Conceptual designs	\$ 25,000.00	lump sum	1	\$ 25,000.00
Engineered designs	\$ 125,000.00	lump sum	1	\$ 125,000.00
Permits	\$ 1,000.00	lump sum	1	\$ 1,000.00
CONSTRUCTION				
Construction Phase 1, Task 1 - Downstream enhancements				\$ -
Mobilization	\$ 25,000.00	lump sum	1	\$ 25,000.00
Dam 1 - boulders	\$ 75.00	cyd	555	\$ 41,625.00
Dam 2 - boulders	\$ 75.00	cyd	700	\$ 52,500.00
Dam 3 - boulders	\$ 75.00	cyd	1150	\$ 86,250.00
Dam 4 - boulders	\$ 75.00	cyd	1650	\$ 123,750.00
Dam 5 - boulders	\$ 75.00	cyd	3750	\$ 281,250.00
All other materials	\$ 25,000.00	lump sum	1	\$ 25,000.00
Task 1 Subtotal				\$ 821,375.00
Construction Phase 1, Task 2A - Portage route				
Portage around 4th Street dam	\$ 25,000.00	each	1	\$ 25,000.00
Task 2A Subtotal				\$ 25,000.00
Construction Phase 1, Task 2B - Additional access sites and Educational materials				
Access sites (average)	\$ 20,000.00	each	8	\$ 160,000.00
Educational Materials	\$15,000	each	1	\$ 15,000.00
Task 2B Subtotal				\$ 175,000.00
Total				\$ 1,021,375.00
Contingencies (utilities, etc.)				20%
				\$ 204,275.00
GRAND TOTAL				\$ 1,225,650.00

Appendix 6 - Estimated Costs
Phase 2: Modifications to 4th Street Dam

Description	Unit Cost	Unit	Estimated Quantity	Total Cost
DESIGN				
Feasibility Study	\$ 30,000.00	lump sum	1	\$ 30,000.00
Modeling:	\$ 40,000.00	lump sum	1	\$ 40,000.00
Conceptual designs	\$ 25,000.00	lump sum	1	\$ 25,000.00
Engineered designs	\$ 190,000.00	lump sum	1	\$ 190,000.00
Permits	\$ 5,000.00	lump sum	1	\$ 5,000.00
CONSTRUCTION				
Construction Phase 2 - Modification of 4th Street Dam				\$ -
Mobilization	\$ 20,000.00	lump sum	1	\$ 20,000.00
Construction materials	\$ 1,000,000.00	lump sum	1	\$ 1,000,000.00
Boulders and naturalization materials	\$ 75.00	cyd	7500	\$ 562,500.00
Renovate portage around 4th Street dam	\$ 25,000.00	lump sum	1	\$ 25,000.00
Subtotal				\$ 1,897,500.00
Contingencies (utilities, etc.)	20%			\$ 379,500.00
Total				\$ 2,277,000.00

Appendix 7 – River Recreation Funding Strategy

An initial strategy for phasing river recreation improvements, and potential funding sources for development of a kayak course, access sites, and portage route on the Grand River through downtown Grand Rapids, are outlined below. The availability of funding will affect implementation phases. The phasing sequence may also be modified to address changes in opportunity or demands. Phase 1 tasks 1 and 2 may be constructed concurrently, depending on available funding and City resources for maintenance and operations.

Phase 1, Task 1 - Modifications to downstream “beautification” dams (\$821,375)

The modification to the downstream dams is the first priority for improvement, as described in the report.

Potential Funding Sources

US Fish & Wildlife - Partners for Fish & Wildlife Program

The Partners for Fish & Wildlife Program provides funding for dam removal and habitat improvement. It promotes and implements habitat improvement projects that encourage public understanding and participation. Habitat restoration programs have assisted thousands of private landowners across the Nation. Funding is used for dam removal and remediation of sites to reduce environmental hazards and obstruction to river flow. Dam removals can open new areas, providing miles of river and stream habitat for fish and wildlife.

- Average award: \$25,000 (may go higher for special projects).
- Required Match: 50% of the total project cost
- Contact: (703) 358-2201
- <http://www.fws.gov/partners>

Michigan Department of Environmental Quality, Nonpoint Source Grants

Michigan's Nonpoint Source (NPS) Program assists local units of government to restore water bodies impaired by NPS pollution and protect high quality waters from impairments caused by NPS pollution. Funds are available through the EPA Clean Water Act Section 319 for implementing nonpoint source activities in approved watershed management plans that provide in-stream improvements. Monies could be spent to modify the dams if in-stream habitat improvement, streambank stabilization, and improvements to fish passage are highlighted.

- Funding range is \$100,000 - \$500,000
- Required match – 25% of total project cost
- Applications are typically due in October
- http://www.michigan.gov/deq/0,1607,7-135-3313_3682_3714-198563--,00.html

Phase 1, Task 2 – Access Sites and Portage around 4th Street Dam (\$200,000)

The modification and establishment of access sites and portage routes are relatively low-cost improvements, which can proceed independently, as funds are raised.

Potential Funding Sources

EPA, Environmental Education

The Grants Program supports environmental education projects that enhance the public's awareness, knowledge, and skills to help people make informed decisions that affect environmental quality. This funding could pay for signs at the access sites to inform users of the efforts that have improved water quality in the Grand River and to inform them about invasive species.

- Most grants are in the \$15,000 to \$25,000 range.
- Applications are typically due in December
- Contact: Megan Gavin, Chicago, gavin.megan@epa.gov
- <http://www.epa.gov/enviroed/grants.html>

Michigan Department of Natural Resources, Michigan Natural Resources Trust Fund

The objective is to provide grants to local units of government and to the state for acquisition and development of lands and facilities for outdoor recreation or the protection of Michigan's significant natural

resources. Funding could possibly be used for the dam modification, ensuring that the recreation aspects are highlighted.

- Development projects: \$15,000 to \$500,000. No minimum/maximum limits on land acquisition grants.
- Required match – 25% of the cost of the project
- Applications are typically due in April for development of lands. Acquisition applications are typically due August 1, 2009.
- Contact: Grants Management, Deborah Apostol (517-335-3046), apostold@michigan.gov
- http://www.michigan.gov/dnr/0,1607,7-153-10366_37984_37985-124961--,00.html

Michigan Department of Natural Resources, Waterways Program Grants

Program objectives are to provide design and construction assistance for recreational boating facilities in the state. Funds are available for preliminary engineering studies and infrastructure improvement projects at recreational boating access site/launch facilities.

- Applications are typically due in April.
- Required match – 50% of total project cost
- Boating Access Sites/Launches, Jordan Byelich, 517-241-1533, byelichj@michigan.gov
- http://michigan.gov/dnr/0,1607,7-153-10366_37984_37985-124962--,00.html

Community Organizations

Various community organizations fund small projects that rely on volunteer assistance. Non-profit organizations often serve as fiduciaries for local agencies and can help administer programs and grants. They also have a volunteer base that is looking for ways to contribute to the community in time and labor. Organizations could adopt access sites to monitor and maintain, similar to the Adopt-a-Highway program.

- Rotary Clubs
- Elks Lodges
- Jaycees
- Schrems West Michigan Trout Unlimited
- Grand Rapids Steelheaders

User Fees

- Parking meters and special event parking fees
- Charge for entrance into whitewater park area, although most public whitewater parks do not charge admission.

Phase 2 - Modifications to 4th Street dam (\$2,000,000 - \$3,000,000)

This phase can be undertaken if and when the community clearly supports this effort and funds become available.

Potential Funding Sources

US Fish & Wildlife - Partners for Fish & Wildlife Program

The Partners for Fish & Wildlife Program provides funding for dam removal and habitat improvement. It promotes and implements habitat improvement projects that encourage public understanding and participation. Habitat restoration programs have assisted thousands of private landowners across the Nation. Funding is used for dam removal and remediation of sites to reduce environmental hazards and obstruction to river flow. Dam removals can open new areas, providing miles of river and stream habitat for fish and wildlife.

- Average award: \$25,000 (may go higher for special projects).
- Required Match: 50% of the total project cost
- Contact: (703) 358-2201
- <http://www.fws.gov/partners>

Michigan Department of Natural Resources, Inland Fisheries Grant

Protect, maintain and/or enhance inland aquatic environments that support (or are capable of supporting) a significant public fishery; rehabilitate degraded inland fish communities that support public fishery; provide additional or more diverse fishing opportunities; foster educational and interpretive communication and interest in fish, fishing and fisheries management.

- Grant funds available October 2010
- Required Match: 50% of total project cost
- Contact: Application Functions: Fisheries, Christian LeSage, (517-241-3624), lesagec@michigan.gov
- http://michigan.gov/dnr/0,1607,7-153-10366_37984_37985-124963--,00.html

Michigan Department of Natural Resources, Land and Water Conservation Fund (LWCF)

Land and Water Conservation Fund is a federally funded program that provides grants for planning and acquiring outdoor recreation areas and facilities, including trails. The objective is to develop land for public outdoor recreation. Funds can be used for ROW acquisition and construction. These funds are administered by the Michigan Department of Natural Resources. The goal of this program is to encourage nationwide creation and development of public outdoor recreational opportunities. Eligible projects include land acquisition, development of recreational facilities, and non-nature based outdoor recreation elements. The program encouraged development of land for outdoor recreation: trails, community outdoor recreation, universal access, and green technology for outdoor recreation.

- Minimum grant of \$30,000 (total project \$60,000); maximum grant of \$75,000 (total project \$150,000).
- Required match - 50% of total project cost.
- Local government must have a 5-year MDNR approved Recreation Plan.
- Applications are typically due in March.
- Contacts: Grants Management, Jim Wood, (517-373-9125), woodj@michigan.gov
Grants Management, Christie Bayus, (517-355-2253), bayusc@michigan.gov
- http://www.michigan.gov/dnr/0,1607,7-153-10366_37984_37985-125326--,00.html

The following strategies apply to all components of the project.

National Park Service - Rivers, Trails and Conservation Assistance Program

The Rivers, Trails and Conservation Assistance Program (RTCA) is a National Parks Service program that provides technical assistance via direct staff involvement, to establish and restore greenways, rivers, trails, watersheds and open space. The RTCA program provides only for planning assistance—there are no implementation monies available. Projects are prioritized for assistance based upon criteria that include conserving significant community resources, fostering cooperation between agencies, serving a large number of users, encouraging public involvement in planning and implementation and focusing on lasting accomplishments. Assistance could be provided to develop the Grand River as a Heritage Water Trail, incorporating the development of additional river access sites and the extension of the existing riverwalk. RTCA often acts as a catalyst to help assemble the necessary pieces to achieve on-the-ground conservation success, helping identify resources, navigate the planning process, and convert ideas into actions. Program staff often provides assistance in conceptual planning, organizational development, and capacity building.

- Applications are typically due in August
- <http://www.nps.gov/ncrc/programs/rtca/index.htm>

State Revolving Loan Fund

Initially funded with federal and state money, and continued with funds generated by repayment of earlier loans, state revolving funds may provide low-interest loans for local governments to fund acquisition of land for community improvement programs. This type of strategy creates a pool of capital reserved for the acquisition of land. This type of funding can be used for acquiring lands with eventual resale to conservation minded buyers, which will in turn replenish the revolving loan funds. A benefit of the revolving fund is that it can be used to quickly respond and acquire desired properties. There may be instances when the fund cannot cover the total acquisition costs to the property owner. Property owners would be encouraged to donate the remaining value of the property or receive payments over time through a lease purchase agreement. A possible scenario is the City's purchase of a parcel of land for an access site, then the resale of that land to a conservation organization or outdoor business to continue to maintain the site and provide public access to the river.

Bonds

Local bond measures, or levies, are usually initiated by voter-approved general obligation bonds for specific projects. Bond measures are typically limited by time based on the debt load of the local

government or the project under focus. Funding from bond measures can be used for right-of-way acquisition, engineering, design and construction of pedestrian, bicycle, and other recreational facilities. General obligation bonds are essentially IOUs issued by cities, states and other public entities to finance large public projects. The issuer agrees to repay the amount borrowed plus interest over a specified term, typically 20 to 30 years. General obligation bonds may require approval by the legislature, voters or both. Through bonding, large amounts of money can become available within a relatively short period of time to implement an improvement program. Bonds increase a government's debt and reduce its debt capacity, which may conflict with other capital needs.

General Fund Appropriation (Tax Levy)

Money collected from property taxes, which are assessments charged to real property owners based on a percentage of the assessed property value, are allocated for government operations and outstanding debt. A local government may allocate tax levy dollars for community improvement purposes. This strategy could also be applied as a millage. A benefit of this strategy in comparison with bonding is that interest costs are eliminated. In addition, the tax levy can provide a steady stream of financing while broadly distributing the tax burden. Limitations to this strategy may include political opposition to the use of the tax levy for improvement purposes, money allotted may be too little to successfully implement an improvement program, and competition with other government programs for general fund dollars.

Property Tax Exemptions

Renaissance Zone 2: Furniture Center – Sixth Street Bridge, east and west of River

By law, Renaissance Zones waive the following local and state taxes applicable to Grand Rapids:

- Michigan Business Tax
- Michigan Personal Income Tax (for GR Renaissance Zone residents only)
- Operating Property Tax Levies (except debt taxes)
- City Income Tax (for GR Renaissance Zone residents and businesses only)

These taxes represent nearly all state and local taxation on a Grand Rapids business or resident. Potential incentives exist for private development of these sites as river-related activities, alleviating the cost to the city for the improvements.

Downtown Development Authority - DDA

The Downtown Development Authority (DDA) is a development agency responsible for many improvements in the downtown area. DDA projects have contributed greatly to the growth and development of downtown. Using incremental property taxes collected from downtown properties, the DDA has financed many public improvements, which have led to unprecedented private investment (Grand Rapids DDA website). Tax Increment Financing (TIF) is a tool that uses future gains in taxes to finance current improvements that will create those gains. When a public project is constructed, surrounding property values generally increase and encourage surrounding development or redevelopment. The increased tax revenues are then dedicated to finance the debt created by the original public improvement project. Riverfront improvements can often be included as part of larger efforts aimed at business improvement and retail district beautification. Business Improvement Districts collect levies on businesses in order to fund area-wide improvements that benefit businesses and improve access for customers. These districts may include provisions for river improvements, such as river walks, watercraft launching sites, landscaping, and ADA compliance.

City or Regional Sales Tax

Local sales taxes can be earmarked partially or exclusively for river improvements. Sales tax is the assessments charged on the retail price of purchased merchandise. A dedicated percentage of revenue generated by a sales tax can be used to fund a river improvement program. This funding strategy can provide a steady stream of funding for a river improvement program, but objections to a sales tax generally revolves around the increased financial impact on lower income households and the reduction of funds in an economic slowdown. Although cities cannot levy or retain local taxes in Michigan, other innovative ideas, such as convention surcharges and riverfront hotel rooms and restaurant fees, could be introduced as part of the "Green" movement in the City

Public/Private Partnerships

Private sector participation can help to help finance river improvement projects. The most widely identified advantages of public/private partnerships is greater efficiency brought about by competitive market forces and the incentive to innovate business practices. Private sector groups have also been shown to

establish lower operating costs than public systems and can provide more accessible financing for local agencies. The Grand Action Committee is a successful example of this concept. The Committee is made up of local philanthropists who have spearheaded past fundraising drives to make major improvements in the City. Many forms of public/private partnerships exist with varying levels of private sector participation. Smaller scale partnerships could be simply having the constructed rapids bear names of the prominent businesses in and around the waterfront (Founder's Falls, Amway Ambush, e.g.).

Private and Community Foundations and Other Non-profits

Various corporations and foundations support public works such as river improvements and waterfront development. The competition for these funds has become brisk, but the opportunities are available. Grand Rapids has been fortunate to have such enormous support from local philanthropists.

First Name	Last Name	Affiliation	Title	10/21/08	10/22/08	1/14/09
Haris	Alibasic	City of Grand Rapids	Executive Office			
Landon	Bartley	City of Grand Rapids	Planning Dept.			X
Tom	Bartnick					X
Ed	Bolt					X
Rich	Bowman	The Nature Conservancy	Director of Government Relations			
Michelle	Braat-Slyhouse	City of Grand Rapids	Parks Dept.			
Tom	Briggs	Grand Rogue Paddle Sports				X
Mark	Bryson					X
Peter	Clemo					X
Mark	Crews	Apex Outdoors				
James	Davidson	City of Eaton Rapids	Mayor			
Gary	De Kock	kayak enthusiast				X
Eric	DeLong	City of Grand Rapids	Deputy City Manager			
Rick	DeVries	City of Grand Rapids	Assistant City Engineer			X
Susan	DeVries	Resident				X
Ben	DeVries					X
Connie	Dimond	JJR				X
Josh	Duggan					X
Paul	Eberhart	Coldwater River Watershed Council				
John	Eberly	WMCKA				X
Travis	Ernst					X
Morgan	Ernst					X
Jeremy	Espinoza					X
Mark	Fitzpatrick	Ada Township Parks & Recreation	Director	X		X
Gregory	Forbes	Grand Rapids Community College	Professor, Biological Sciences	X		X
Jay	Fowler	City of Grand Rapids, DDA	Executive Director		X	X
Ken	Freestone	West Michigan Strategic Alliance	Green Infrastructure Project Manager			
Karl	Geisel	Grand Rapids Area Sport Paddlers				X
Kris	Guiles	GR Steelheaders	Captain			X
Walt	Gutkowski	City of Grand Rapids	City Commissioner			
Scott	Hanshue	Michigan Department of Natural Resources	Fisheries			
Jim	Harger	GR Press				X
Ted	Hartman					X
George	Hartwell	City of Grand Rapids	Mayor			
Steve	Heintzelman	Steelheaders				X
Shani	Hendrick					X
Pete	Hess					X
Brad	Hoiem					X
Jon	Holmes	Bill and Paul's Sporthaus				X
Kristine	Huizon	Frey Foundation				X
John	Hunting					
Anson	Jaynes	Concerned Citizen				
James	Jendrasiak	City Commission				X
Shelly	Jewell	kayak enthusiast		X		
Andy	Johnston	Chamber of Commerce	Public Policy Coordinator			
Jon & Judy	Klatt	kayak enthusiast				
Kristi	Klomp	WMEAC				X
Paul J.	Knoerr	canoeing enthusiast	Internet community for kayakers			
Dan	Koschtial					X
Kathy	Kremer	Aquinas College				X
Art	Kroon					X
Steve	Kunnath	Ada Village Bike Shop	Manager			
Susan	Kunnath	kayak enthusiast				
Doug	Lawrence	kayak enthusiast		X		
Dave	Lemberg	Michigan Heritage Water Trails	Associate Professor, Dept. of Geology, WMU			
Kathleen	Lett	City of Grand Rapids				X
Laurie	Levknecht	WMCKA				X
Jane	Lovett					X

Larri	Luthy					X
Neil	MacDonald	Paddler				X
Justin	Mast	kayak enthusiast			X	
Shawn	McKenney	Allegan Conservation District	Project Manager			
Matt	Meersma	Van Buren CD/kayaker				
Tony	Mourand	FTCH				X
Tim	Nelson	GR/Kent County Convention & Visitors Bureau	Convention Services Manager			
Wayne L.	Norlin	kayak enthusiast	Senior Project Manager			X
Dave	Nowicki	West Michigan Steelheaders				X
Jon	Nunn	Grand Action				
Wendy	Ogilvie	FTC&H	Senior Environmental Specialist	X	X	X
Jim	Oosting	Coldwater River Watershed Council				
Amy	Overeiner	kayak enthusiast		X		X
Courtland "Corky"	Overmyer	City of Grand Rapids	Director of Environmental Protection			
Grant T.	Pecor	Nantz, Litowich, Smith, Girard & Hamilton, P.C.				X
Steve	Plaistad	Steelcase				X
Joe	Platte	FTC&H	Senior Engineer			
W.F.	Potts	GR Steelheaders				X
Chip	Richards	Grand Rapids White Water				
Kate	Rieger	GVSU				X
Dale	Robertson	Public Museum of Grand Rapids	President & CEO			
Steve	Rousseay					X
Dan	Schulz	Steelcase				X
Suzanne	Shultz	City of Grand Rapids	Planning Director			
David	Smith	West Michigan Trout Unlimited	President			
Sarah	Stacilauskas					X
Roger	Starring	kayak enthusiast				X
Jay	Steffen	City of Grand Rapids	Director of Parks & Recreation			X
Bill	Stellema	kayak enthusiast		X		X
Bill	Stough					
Robert	Strek	GR Steelheaders				X
Andrew	Stuckey					X
Denny	Sturtevant	Dwelling Place of Grand Rapids, Inc.	Chief Executive Officer			
Ryan	Sytsma	SIGNATURE ASSOCIATES	Retail Specialist		X	
Todd	Tofferi	City of Grand Rapids	Office of Film, Music, and Special Events			
Slag	Trent	TBN Outfitters				X
Jan & John	Van Wyk	kayak enthusiast				
Doug	VanDorn	West Michigan Coastal Kayakers				X
Amy	VanElsacker	Planning Department				X
Charlie	VanRooy					X
John	VanWill					X
Clare	Wade	PR				
Greg	Wagner					X
Jay	Wesley	Michigan Department of Natural Resources	Southern Lake Michigan Unit Manager			
Rodney	Wilbur					X
Jim	Winter-Troutwine	kayak enthusiast				
Cheryl	Zuellig	JJR				
Josh	Zuiderveen	Timberland RC&D				
?		AAA Canoe and Kayak Rentals				
?		YMCA				
?		Conventions Bureau				
?		2000 Grand River Expedition				
?		2010 Grand River Expedition				
?		American White Water				
?		Chamber of Commerce				
?		Urban Adventure				
Jake		Powers Outdoors	Manager			